Proceedings of a Conference

PRODUCTIVITY AND GROWTH

Economic Group
Reserve Bank of Australia

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Introduction

Jacqueline Dwyer

The economics profession was born of Adam Smith's inquiry into the nature and causes of the wealth of nations, and the issues he addressed remain as important today as they were when he raised them. Although economic progress does not follow a simple pattern to be explained with any certainty, an understanding of the environment conducive to growth is central to the achievement of continuing advances in the standard of living.

While Adam Smith had great instinct about the forces that enrich a nation, formal analysis of growth had to wait until the conceptual tools of the Keynesian revolution, particularly national-income accounting, were assimilated and yielded the neoclassical growth model. Further analysis awaited the new growth theory of the past decade. These analyses, however, have not led to a clear operational guide for policy makers but, instead, suggest a range of possible causes of growth and policy prescriptions. Ultimately, though, the policy prescriptions in different economies reflect what is acceptable to each society.

In the Australian context, there has been a growing acceptance that productivity and growth are enhanced by the liberalisation of markets. This acceptance has arisen partly from dissatisfaction with the performance of the economy under insular policies of industry protection, excessive regulation, and centralised industrial relations which failed to deliver adequate improvements in living standards – an issue reinforced by rapidly-rising living standards in other economies, especially those in neighbouring East Asia. In fact, concern about Australia's economic performance relative to other countries has often been dramatised by our slide down the 'totem pole' of comparative per capita income levels.

In response, over the past two decades, there has been a program of market liberalisation. Whilst a gradualist and mainly consensual approach has been adopted, the program has been extensive. Financial markets have been deregulated, industry protection has been largely dismantled and a range of activities targeted for microeconomic reform. Liberalisation has also extended to labour markets, which are now moving from a centralised system of industrial relations to one that embraces enterprise agreements. The extent of reform marks a clear regime change, one that endorses competitive markets as the means of securing the most productive use of the nation's resources. Furthermore, official inquiries into the competitiveness of Australian industry, such as the Hilmer Report, form the basis of an agenda to continue the reform process.

This change in approach to economic management has been embraced in the belief that it will deliver a growth dividend and improve living standards. With this process of reform underway for some years, it is appropriate to take stock of Australia's growth performance and prospects. The papers in this Volume were commissioned by the Bank to improve our understanding of productivity and growth. In particular, the papers seek to address four main questions:

- How bad, or good, is Australia's growth and productivity performance?
- What developments in productivity and growth have occurred at the sectoral and enterprise levels?
- What lessons can be learned from the extraordinary East-Asian growth experience?
- What is the role for policy in the achievement of Australia's growth potential?

Australia's Comparative Growth and Productivity Performance

There is a widespread view that Australia's growth and productivity performance has long been inadequate. This view is supported, for example, by data published by official international agencies indicating that productivity growth has been slower in Australia than in other comparable countries for an extended period.

Table 1, drawn from a new comparative database recently published by the OECD, summarises the conventional evidence. It shows that while total output growth in Australia was in line with that of other OECD countries over the period 1970-89, both labour and total-factor productivity were well below. In fact, Australia had the lowest total-factor productivity growth of the 14 OECD countries for which data were available.

An additional OECD study for the period 1989-94 gives a more favourable impression of Australia's recent economic performance. It suggests that, over the past five years, both labour productivity and total-factor productivity have slightly surpassed the OECD

Table 1: Australia's Comparative Growth and Productivity Performance
(Per cent per annum)

	Australia	Canada	Germany	Japan	UK	US	OECD
1970 to 1989							
Real GDP	3.2	3.7	2.5	4.6	2.1	3.0	3.1
Labour productivity	1.0	1.4	2.3	3.7	1.7	1.0	2.0
Total-factor productivity	0.6	0.8	1.5	2.1	1.1	0.7	1.4
1989 to 1994							
Real GDP	2.2	1.0	2.9	2.1	0.8	2.0	1.9
Labour productivity	1.8	0.7	2.7	1.0	1.9	1.0	1.5
Total-factor productivity	1.1	-0.4	1.8	-0.5	1.2	0.6	0.5

Note: Database confined to: Australia, Belgium, Canada, Denmark, Germany, Finland, France and Italy, Japan, Sweden, the United Kingdom and the United States. These countries account for over 90 per cent of GDP in all OECD countries.

Sources: For the period 1970-89, data are from OECD Working Paper No. 145, and for the period 1989-94, they are from OECD, *Economic Outlook*, June, 1995.

average. The difference is not, however, great and may be affected by cyclical influences. Over a longer run of years, productivity growth has been less than in other industrialised economies.

There is, as well, evidence of a progressive decline in Australia's level of real per capita income relative to other countries. In 1938, Australia was ranked 4th in conventional league tables of per capita income. By 1960, its ranking was 11th; by 1993 it was 15th, equal with Belgium. According to estimates by the World Bank, Australia's real per capita income is now less than the high-performing East-Asian economies of Hong Kong and Singapore. Thus we are presented with two stylised facts, suggesting that Australia's productivity and growth performance has been relatively poor.

However, as the papers in this Volume show, while such summary measures of economic progress are valuable in certain contexts, they can be naive and lead to inappropriate conclusions about comparative performance. Three main problems give the flavour of the issues involved.

First, Australia began its economic development as a 'frontier' economy with a rich endowment of natural resources and a small population; it is to be expected that its initial levels of real per capita income were very high. However, a comparative advantage in the production of primary commodities, with low income elasticities of demand and secular price falls, does not lend itself to the maintenance of such relative affluence.

Second, meaningful comparisons of per capita income levels are difficult to perform. They require each country's income to be denominated in the price of a set of representative goods. For conventional league tables, the choice of this set of goods is most appropriate for a 'core' group of countries in Europe, but less so for other countries, like Australia, that are outside this core. When attempts are made to address this problem, or when account is taken of differences in the living conditions and preferences of communities, Australia's ranking improves, often considerably.

Third, even if accurate relativities can be established, comparisons of growth performance made at the same point in time, as opposed to the same stage of development, are misleading. Economies tend to follow a development path in which growth takes off, accelerates and subsequently slows down, as the economy matures. Less-developed economies can enjoy rapid growth through technological catch-up and by encouraging factors to accumulate faster than is sustainable for an advanced economy. Once allowance is made for each country's position on its development path, Australia's per capita growth has proceeded at a rate to be expected of a mature, industrialised economy. In this respect, our growth performance has been remarkably average.

Of course, achieving average performance amongst economies of our type implies there is room for improvement. Analysis of productivity, in particular differences at the sectoral and enterprise level, provides some guidance here.

Sectoral and Enterprise Developments

Trend improvements in productivity are necessary to sustain a desirable pace of economic growth. Indeed, much of the program of market liberalisation has been designed to secure continuing improvements in productivity. Consequently, it has been both a puzzle and a source of concern, that during much of the 1980s in Australia, labour-productivity growth was unusually slow.

Many argue that poor labour-productivity growth in the second half of the 1980s was a consequence of wage moderation. The wage pause and the Prices and Incomes Accord restrained real wages, encouraging a shift in the capital/labour ratio. While this resulted in increased employment, it lowered labour-productivity growth. But we can also throw light on this issue by decomposing the aggregate outcomes. Examination of sectors reveals substantial differences in productivity performance.

Over the course of the last business cycle, *the level* of labour productivity declined in four main industries – construction, wholesale and retail trade, finance, and recreation. These declines were offset by improvements elsewhere in the economy to generate an overall slowdown in productivity, at least in measured productivity.

While part of the slowdown is real, part can be attributed to measurement problems. Indeed, it would be surprising if falls in actual productivity levels have occurred. There are inherent difficulties in identifying the productivity of non-market industries where it is hard to obtain the market value of output, and also of service industries where it is hard to measure the quality of output. And yet these industries comprise a large and increasing share of the economy.

Measurement problems are epitomised by the deregulation of shopping hours that occurred progressively throughout the 1980s and early 1990s. Opening shops for longer hours should hardly affect aggregate sales and hence, *measured* output. It does, however, require more staff, so measured labour and total-factor productivity growth are lower while shopping hours are being lengthened. In the meantime, though, shops have provided a new and improved service, called 'convenience', that is difficult to value. In a number of industries, these types of measurement difficulties appear to have become especially pronounced in the second half of the 1980s.

In some areas, at least, we expect measurement problems to be reduced. Consequently, measured productivity should recover. This, combined with the positive influences of market liberalisation and outward orientation, already evidenced in some sectors, gives cause for optimism that Australia's trend rate of productivity growth will be higher in future than it was in the 1980s. In fact, productivity performance at the enterprise level provides strong evidence in support of this view.

At the enterprise level there have been important changes in both attitude and the organisation of work that have delivered, and will continue to deliver, productivity improvements. Case studies indicate that the program of market liberalisation, in particular the increased exposure to international competition, has encouraged firms to focus on a range of aspects of performance. Of these, productivity is central to the ability of firms to maintain competitiveness in both domestic and foreign markets. These developments have been complemented by the new focus of organised labour on the objectives of enterprises. Returns to labour are increasingly benchmarked against indicators of performance at the enterprise level, encouraging wage outcomes in line with productivity – a prerequisite for achieving the objectives of competitiveness and maintenance of low inflation.

Given our pursuit of sustainable growth through market-induced improvements in productivity, what lessons can be learned from the extraordinary growth achievements of East Asia?

The East-Asian Miracle

East-Asian economies have enjoyed remarkably rapid economic growth for a generation – a performance that has attracted the attention of policy makers hoping to emulate this success. For economists, the East-Asian experience presents the intellectual challenge of providing an explanation in terms of economic conditions and policies, rather than simply characterising it as 'miraculous'.

For OECD countries, growth-accounting exercises suggest that technology usually plays a larger role in the growth process than factor accumulation. This result is not so clear-cut for East-Asian countries where some have argued that growth may be 'extensive', in the sense that it reflects massive factor accumulation as resources are mobilised in a newly-industrialising society. This conclusion appears, however, to be a fragile one. The more widely-endorsed view accepts that factor accumulation has been important for East-Asian growth, but argues that technological progress has also played a key role.

Of course, forces other than factor accumulation and technology have contributed to East-Asian growth. Macroeconomic management has been generally good and has been complemented by policies that have enhanced the integrity of the financial system. There has also been an extensive array of selective interventions designed to promote growth by encouraging certain types of economic activity, in particular investment and exports – the so-called 'engines of growth'. Identifying the role played by policy has, however, proven difficult. To what extent would strong growth have been achieved anyway, through the 'natural' forces of factor accumulation, catch-up and convergence? Has economic success permitted particular policies to be pursued (e.g. with respect to saving) or did the policies generate economic success?

One way to address this issue of reverse causality is to examine the conditions prevailing at the beginning of the growth period. For example, had high rates of investment or exports preceded economic growth, it might confidently be argued that they helped cause it. In fact, high rates of investment and exports evolved only gradually, making their role in the growth process harder to interpret. Nevertheless, there are other attributes of these economies that did precede their rapid growth. As well as low initial-income levels, predisposing them to technological catch-up, East-Asian countries had less inequality of income and land distribution, and more primary education than comparable countries that were subsequently less successful. Perhaps these were important ingredients in the transition to rapid growth and technological catch-up.

The Role for Policy

It is of vital interest to economists to identify public policies that promote growth, or certainly do not inhibit it. In the Australian context, the principal focus has been on 'getting the basics right'. With regard to microeconomics, this has entailed a program of liberalisation in both goods and factor markets designed to encourage greater efficiency in resource use. This has already had demonstrable effects on productivity in many sectors of the economy, with tentative signs that higher aggregate productivity growth is in prospect.

While economic theories of growth offer guidance for microeconomic-policy design, they do not assign a specific role to macroeconomic policy. Nevertheless, it is hard to believe that macroeconomic policies have no influence on growth. Indeed, there is by now considerable agreement about the features of a macroeconomic environment conducive to growth: a stable and sustainable fiscal policy; an appropriate real interest rate; a competitive and predictable real exchange rate; a balance of payments that is regarded as viable; and a low and predictable inflation rate. Several of these conditions have figured prominently in public-policy debate in Australia.

A country's fiscal position, the viability of its balance of payments and its level of national saving are all inextricably linked. In Australia's case, national saving has fallen, both as a result of public dissaving associated with budget deficits, but also as a consequence of a decline in private saving – one that is unusual by OECD standards. If international capital flows were highly mobile, national saving would not be a constraint on investment and growth, as capital would flow from countries with excess saving to those where profitable investment opportunities exceed domestic saving. But this appears not to be the case. Owners and managers of each nation's saving act to keep most of it at home. Consequently, if domestic saving is deficient, investment and growth are lower than they would be if capital were perfectly mobile. This suggests a need for both fiscal restraint and incentives to boost private saving.

The final ingredient of a macroeconomic environment conducive to growth is a low and predictable inflation rate. Indeed, satisfying this condition is of key concern to central banks. Higher inflation interacts with the tax system to affect saving and investment. It generates greater uncertainty about future inflation, discouraging long-term contracting and raising risk premia on interest rates, thereby inhibiting investment. Higher inflation is also associated with more relative price variability so that price signals become more difficult to interpret and the sectoral allocation of resources is adversely affected.

In principle, each of these factors can have a causal effect on growth. The benefits of price stability accrue only gradually, however, so that empirical estimation of the growth dividend from low inflation is confounded by a myriad of other influences. Nevertheless, the widespread concern that inflation is costly has led to endorsement of a low-inflation objective in Australia. This reflects a belief that, in the long run, the growth benefits of low inflation are worthwhile.

The Determinants of Long-Run Growth

Steve Dowrick

1. Introduction

Discussions of economic growth usually focus on differences in growth performance. The rapid growth of the 1960s is typically contrasted with the slowdown of the 1970s and 1980s. We contrast the super growth of Asia with the sluggish growth of the European and North-American economies and the economic regression of Africa. In Australian policy discussions, it is particularly common to contrast our comparatively modest rate of economic growth over the past 20 years with the dynamic performance of the leading East-Asian economies. From this perspective, it is natural to examine the institutional and policy differences between countries in order to isolate those features that mark the successful growth economies. From there it is typically a short, albeit courageous step, to advocating adoption of those policies and institutions that appear to be stamped with the hallmark of success.

I want to suggest that it is also possible to view the post-war evidence in a rather different light, one that emphasises similarities rather than differences. It is possible to view a substantial part of the development record over the past 40 years, in particular the growth experience of the Asian, European and OECD economies, as following a common development path of take-off, acceleration and subsequent maturation and slowdown. Of course, at any one time, countries and regions are at different stages of development, but there are strong similarities in the rate of progress along the path of industrialisation and technical progress.

From this perspective, many of the growth differentials between countries and between periods are seen to be what I loosely term semi-exogenous. Part of observed growth rates are exogenous inasmuch as they are influenced by the initial conditions, particularly the level of productivity from which the economy is starting. Of course, the initial conditions do not fully determine subsequent growth. There are many policy choices and economic decisions (as well as truly exogenous acts of nature and fortune) that will influence growth. These endogenous elements will then influence the starting point for the subsequent period. It is in this sense that I refer to the initial conditions as semi-exogenous.

The past decade has been the occasion of substantial development in the theorising and testing of explanations for economic growth. We have progressed far enough to be able to roughly allocate the observed variation in growth rates into three camps. Approximately one third of the variation is attributable to the initial conditions, or the position on the development path: this is the *semi-exogenous* element of growth. Another third of the variation, perhaps a little more, is explicable in terms of economic decisions, policies and institutions: this is the *endogenous* element of growth which is capable of theoretical and empirical explanation. It is the terrain over which both theoreticians and applied economists dispute with their rival models and explanations. Occasionally these disputes lead to provisional claims on some part of the previously unchartered territory, but the final third of the variation in growth remains largely *unexplained*. This miracle or disaster element constitutes the area of ignorance to the national accountant; it is the residual in the regression of the econometrician. Unexplained growth is of course grist to the mill of the politician or public commentator who can claim that the key to economic performance lies in their pet love or hate, whether it be the breakdown of the family or the culture of Confucionism or the cure-all properties of microeconomic reform.

Indeed, many commentators attempt to stake out additional territory for their pet claims by ignoring the first of these fields of explanation – the extent to which growth is semi-exogenous and dependent on the stage of development of the economy. This can lead to potentially misleading and harmful conclusions. For example, naive comparisons of Australia's current rate of economic growth with that of the fast-growing economies can lead to suggestions that we should be aiming at macroeconomic policies consistent with Australia growing at a similar rate, ignoring the evidence that a substantial part of the super-growth rates (in the region of 5-10 per cent per annum) of the newly-industrialising economies is attributable to catch-up in technology and factor accumulation which no developed industrial economy can hope to emulate. Such naive comparisons can also be used to argue for inappropriate policies and institutions, mistaking association with periods of high growth for causes of growth. Moreover, these naive comparisons can lead to unduly alarmist conclusions from commentators in the advanced industrial countries. If we project current growth rates forward over 30 years or more, it is easy to conclude that the newly-industrialising economies will both dominate world output and also outstrip the current leaders in productivity and living standards. Such analyses ignore the evidence of slowdown in both population growth and productivity growth as industrialised economies mature. The historical evidence suggests that whilst leadership in productivity and living standards does indeed change hands, the time-scale for such change is typically centuries rather than decades.

In Australia this type of inappropriately naive comparison is frequently made with respect to the neighbouring economies of East Asia, currently the most dynamic growth area in the world economy. Accordingly, I focus a substantial part of my introductory analysis on the thesis that a large part of the current development phase in Asia mirrors the previous growth experience of countries which embarked earlier on the path of industrialisation. In focusing on these common elements I am seeking to identify the strength of the semi-exogenous elements of growth, so that we can more clearly and accurately identify the endogenous contributions to growth in both the developed and fast-developing economies. Having identified the semi-exogenous and endogenous determinants of successful growth paths, we can attempt both to make realistic predictions about future development paths and also draw some policy conclusions.

The empirical analysis presented and surveyed here is related principally to post-1950 growth in Europe, Asia, North America and Australasia. Analysis of this comparatively successful experience of industrialisation and growth sheds some light on the relatively poor performance of the African and Latin American economies, but I do not attempt to tackle the thorny issues of severe underdevelopment and economic mismanagement.

2. Some Stylised Facts on Economic Growth

Before presenting evidence of a common development path, I will first set out some of the evidence as it is usually displayed to emphasise differences amongst regions and differences across time. For instance, a dominating feature of world economic growth over the last half century has been the acceleration of growth in the 1960s and the subsequent slowdown. An equally prominent feature of post-war development has been the existence of consistent and substantial differentials in rates of growth by region and by development grouping. Both of these patterns are evident from Figure 1, which displays decade average rates of growth for major geographic and development groupings. The data, by decade and regional grouping, are set out in Table 1. Although the Europe/OECD grouping is somewhat arbitrary, it can be thought of as the group of relatively advanced, 'Western', market economies.[1] In some of the diagrams to be shown, this group is labelled 'Europe', sacrificing geographic accuracy to save space.

The upper panel in Figure 1 refers to the growth of real output per head of population, the most commonly used measure of development in recent studies of economic growth. The data are taken from the most recent version (PWT5.6a) of the Penn World Tables, as described by Summers and Heston (1991). The principal feature of these data is that cross-country comparisons of GDP levels are evaluated at a common set of international prices, avoiding the well-documented phenomenon by which exchange rate comparisons of less-developed economies consistently under-value the non-traded goods sector, especially labour-intensive and relatively cheap services. This relative price effect can be very significant. For example, an exchange rate conversion in 1985 would have placed Indian GDP around US$300 per capita, less than 2 per cent of US income. The purchasing power parity comparison, measuring GDP at international prices, gives a measure over int$900, more than 6 per cent of US GDP levels.[2]

International price measures of *growth rates*, on the other hand, are typically fairly close to the national accounting measures of real growth, based on domestic prices (see Nuxoll (1994) for a detailed discussion). The PWT growth rates differ from domestic measures of real growth principally because they attach different weights to the growth components of private consumption, government consumption and total investment. In most cases, however, there is relatively little difference between PWT growth rates and domestic constant price measures.

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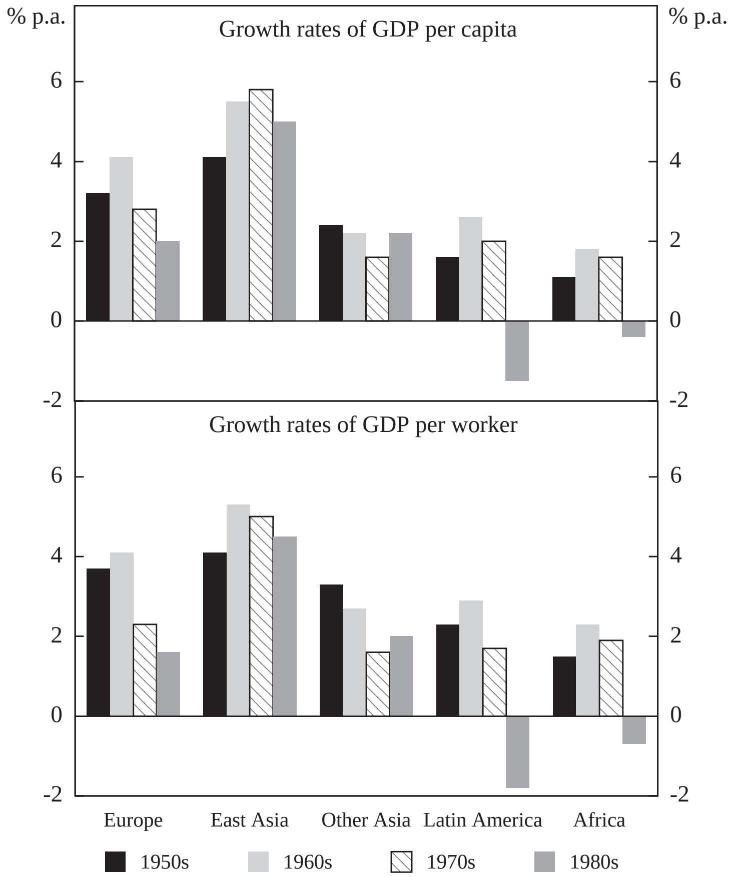
1. The regional groupings of Africa, Asia and Latin America are self-explanatory. They are also groupings which have been found in a range of econometric studies to have distinctive post-war growth patterns. The African grouping is often broken down into sub- and super-Saharan, countries. However, since I have little to say about development in either of these groupings the distinction is not important for this paper. I have omitted the oil-exporting economies of the Middle East, since most of their growth performance over the past 20 years needs to be explained in terms of the OPEC cartel. I have also omitted the centrally-planned economies of Eastern Europe. There is a residual group of 27 countries for which consistent data on productivity are available. This group consists of 22 countries from Europe, two from North America, two from Australasia plus Israel. I refer to this grouping as 'Europe/OECD'. A strict geographic grouping would drop out the last five. Current or past membership of the OECD would eliminate three (Malta, Cyprus and Israel). But all countries can claim some homogeneity as market economies with historical, political and cultural links to 'the West' and also through a level of development by 1950 represented by real per capita incomes of at least one thousand dollars (1985 US$).

2. Where int$ are values measured at international prices, normalised to the 1985 US$ value of US GDP.

Figure 1: Post-War Growth by Region



One case where PWT growth rates do differ very substantially from national accounts is the case of China. The PWT estimate of the real annual growth rate of GDP over the 1980s is 4.5 per cent whereas the IMF report a real growth rate of over 8 per cent. The difference here is less to do with relative price weights than with the PWT authors' disbelief in the system whereby '... production units often report their own estimates of real output. These estimates usually begin with the current price increase in output and then decide on how much of this is due to output growth including quality improvements and new products. It is thought that this reporting system leads to overstatement of output growth ...'. They have accordingly reduced reported investment growth rates by 40 per cent and consumption growth by 30 per cent, leaving growth rates in exports and imports unchanged.

The lower panel in Figure 1 refers to labour productivity, measured here as real output per member of the labour force. The latter measure is more relevant to economic explanations of growth which are largely based on supply-side theories of productivity

Table 1: Real Output Per Capita and Per Worker (1950-1990)

	Initial levels of output per capita and per worker		Growth rates over decade			Investment		Residual growth
	RGDP	RGDPW	Pop. %	RGDP %	RGDPW %	Expenditure/ GDP	Relative prices	
Europe and other OECD (27 countries)								
1950	4,249	9,775	1.1	3.2	3.7	21.4	0.93	-0.1
1960	5,251	12,694	1.0	4.1	4.1	24.7	0.92	0.0
1970	7,599	18,251	0.8	2.8	2.3	25.8	0.96	0.0
1980	9,820	22,213	0.6	2.0	1.6	23.0	0.96	0.0
1990	11,904	25,829						
1950-90	**7,764**	**17,753**	**0.9**	**3.0**	**2.9**	**23.7**	**0.90**	**0.0**
High-performing East Asia (8 countries)								
1950	1,144	2,099	1.8	4.1	4.1	20.3	1.44	0.0
1960	1,503	3,486	2.5	5.5	5.3	21.0	1.20	1.0
1970	2,886	6,286	2.0	5.8	5.0	28.8	1.19	1.0
1980	5,082	10,242	1.5	5.0	4.5	30.1	1.16	-0.8
1990	8,288	16,070						
1950-90	**3,780**	**7,636**	**1.9**	**5.1**	**4.7**	**25.1**	**1.30**	**0.7**
Rest of Asia (7 countries)								
1950	651	1,587	2.1	2.4	3.3	13.2	1.68	0.3
1960	804	2,114	2.4	2.2	2.7	16.8	1.71	-1.1
1970	982	2,764	2.3	1.6	1.6	18.9	1.82	-1.2
1980	1,153	3,196	2.1	2.2	2.0	22.6	2.08	-1.2
1990	1,391	3,786						
1950-90	**996**	**2,689**	**2.2**	**2.1**	**2.4**	**17.9**	**1.80**	**-0.8**
Latin America (19 countries)								
1950	1,906	5,380	2.8	1.6	2.3			
1960	2,239	6,743	2.6	2.6	2.9			
1970	2,876	8,999	2.3	2.0	1.7			
1980	3,484	10,410	2.1	-1.5	-1.8			
1990	3,066	8,839						
1950-90	**2,714**	**8,074**	**2.5**	**1.2**	**1.3**	**20.1**	**1.30**	**-1.2**
Africa (42 countries)								
1950	876	2,125	2.6	1.1	1.5			
1960	913	2,162	2.4	1.8	2.3			
1970	1,139	2,877	2.6	1.6	1.9			
1980	1,410	3,657	2.8	-0.4	-0.7			
1990	1,428	3,577						
1950-90	**1,153**	**2,880**	**2.6**	**1.0**	**1.2**	**19.8**	**2.42**	**-1.2**
World (103 countries)								
1950	1,765	4,193	2.1	2.5	3.0	18.3	1.40	0.1
1960	2,142	5,440	2.2	3.2	3.4	20.8	1.30	0.0
1970	3,096	7,836	2.0	2.8	2.5	24.5	1.30	-0.1
1980	4,190	9,944	1.8	1.5	1.1	25.2	1.40	-0.1
1990	5,215	11,620						
1950-90	**3,282**	**7,806**	**2.0**	**2.5**	**2.5**	**22.2**	**1.30**	**0.0**

Note: RGDP is real GDP per capita in 1985 int$; RGDPW is real GDP per member of the labour force; Pop. is population; investment shares are in local current prices; relative prices refer to the implicit price deflator for investment relative to that for GDP. The centrally-planned economies and the middle-eastern oil exporters have been excluded. All measures are unweighted country averages.

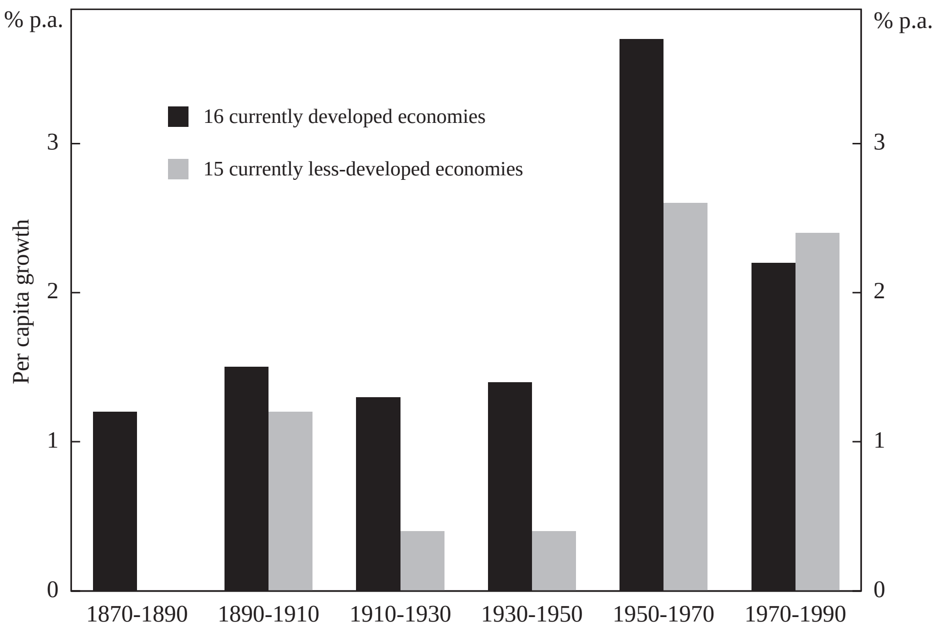
growth. The analysis that follows will concentrate on the productivity measures. In most cases, the growth of per capita GDP is very close to the growth of labour productivity. The principal exceptions occur in those countries undergoing a demographic transition whereby falling birth rates lead to lower dependency rates and increased rates of labour-force participation. In these cases, productivity measures are a better measure of technological development than *per capita* incomes. Unfortunately, data on hours of work are not available for this spread of countries and years, so labour productivity is measured on a per capita rather than per hour basis.

The productivity data display a consistent pattern of acceleration followed by deceleration over the four post-war decades. Nearly all countries experienced a surge in productivity growth in the 1950s and, especially, the 1960s. Having experienced *per capita* growth rates of around 4 per cent per annum for the two post-war decades, the industrialised nations were typically dismayed to find that growth slowed down to 2 per cent or less in the 1970s and 1980s.

At the time, the productivity slowdown was variously blamed on the OPEC oil exporters who had succeeded in raising the real price of oil tenfold and also, in Europe and Australia especially, on trade unions and a range of government policies. In retrospect, however, it is apparent that post-1974 growth is still somewhat above historically normal rates. Maddison's (1992) data on long-run growth trends over the past 120 years suggest that growth of just over 1 per cent per year is the norm rather than the exception. His data are summarised in Figure 2. Whilst the current rates of growth

Figure 2: Long-Run Growth Rates of GDP Per Capita

(Long-run growth trends)



Source: Maddison (1992), adapted from Barro and Sala-i-Martin (1995, p. 6).

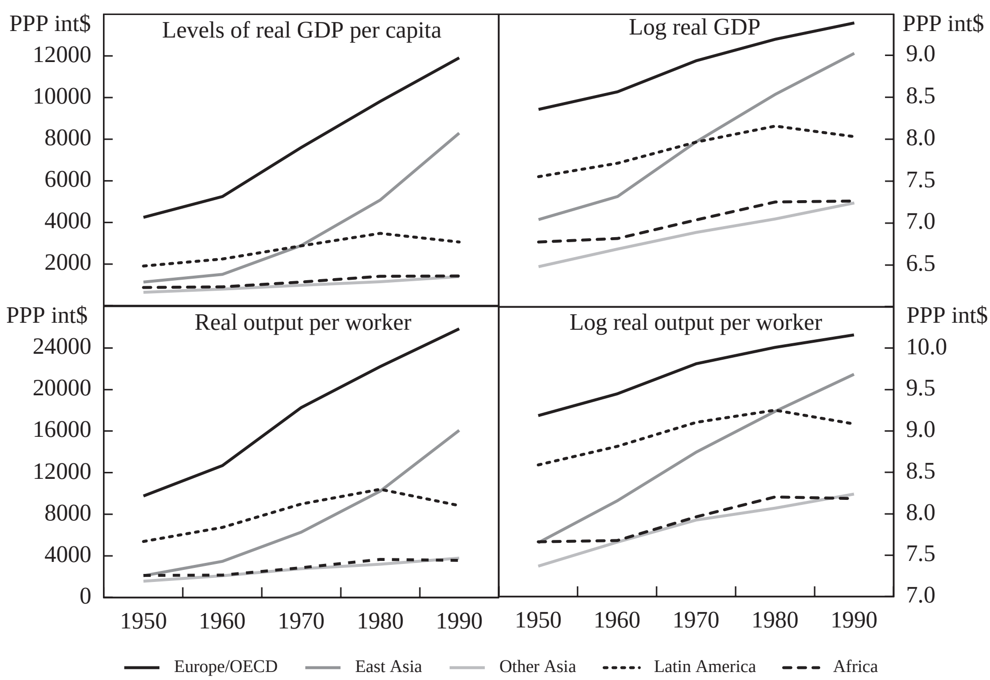
in the industrialised economies seem slow both in relation to the 1960s, and in relation to the much vaunted growth rates of 6-8 per cent of some newly-industrialised economies, it should be borne in mind that 2 per cent growth still leads to a doubling of real output and income over a generation of 35 years.

The post-war acceleration and subsequent slowdown were very noticeable, and subject to much anguished analysis, in the advanced economies of Europe, North America and Australasia. The slowdown has also been pronounced in the less-developed economies of Asia, Latin America and Africa. Even the high-growth economies of East Asia have experienced a levelling off or slight diminution in growth rates in the 1980s, and a substantial slowdown in the case of Japan.

Whilst patterns of accelerating and then decelerating growth have been common trends amongst almost all geographic and development groupings, Figure 1 shows that the East-Asian economies have consistently grown faster than the industrialised economies of Europe and the OECD, and Latin America and Africa have consistently grown slower. This means that the income gap between the richest and poorest groups of nations – Europe and Africa – has increased over the past 40 years, whilst the Asian economies have overtaken Latin America and have started to close the gap with Europe and North America, very dramatically in the case of the most successful East-Asian economies.

Figure 3 displays *per capita* income and productivity in real dollars for the major regional groupings. The most pronounced feature of these figures is the dramatic rise of the successful East-Asian economies. Average East-Asian income levels have reached

Figure 3: Levels of Real GDP Per Capita and Productivity



those typical of Europe in the mid 1970s, whilst productivity levels are now typical of Europe in the mid 1960s (the difference reflecting higher labour-force participation in these Asian economies). Income and productivity are also shown on a logarithmic scale to give an indication of proportional differences (and proportional rates of growth).

The picture with respect to the distribution of world income has been one of disparate development. The overall dispersion of world income has increased as the world's poorest economies, predominantly in Africa, have fallen even further behind the industrialised nations and the middle-income Latin American economies struggled to grow even in the boom-time of the 1960s and collapsed into negative growth in the 1980s. On the other hand, at the upper end of the world income distribution, particularly amongst the relatively advanced economies of Europe and North America (and Oceania), convergence has been the predominant trend.

This pattern of divergence at the lower end of the income distribution, and convergence at the upper end of the distribution, is evident in the relationship between the starting level of productivity and the subsequent rate of growth. A positive relationship indicates that the poorer countries are falling behind and that income levels are diverging. A negative relationship indicates that the poorer countries are catching up and that, *ceteris paribus*, levels of productivity and income are converging.[3]

Figure 4 displays the levels/growth relationship for the four major regional groupings of Africa, Asia, Latin America and Europe/OECD. Growth in Africa and Latin America is highly variable, with many episodes of negative growth, but displays no evidence of any systematic relationship with starting levels of productivity. A consistent pattern of within-group catching-up is clearly evident only amongst the advanced industrialised economies. Given this strong trend of catching-up, it is apparent from Figure 4 that Australia's modest rate of productivity growth, averaging 1.6 per cent per year since 1950, is in fact fairly typical for a high-productivity economy.[4]

It is likely that some part of the measured productivity slowdown as economies mature is due to problems of national accounting measurement. For instance, people may take the benefits of higher productivity and living standards in the form of early retirements, shorter working weeks, longer holidays, and a more pleasant working environment. None of these changes will typically show up in standard national accounting measures of economic output. Moreover, as output of the advanced economies becomes more and more concentrated in the service sector, problems of measuring improvements in the quality of output typically become more severe. We can expect these biases to understate the rate of growth of the more advanced economies, and hence to overstate the true rate of convergence. (For a detailed discussion of these issues, see Castles in this Volume.)

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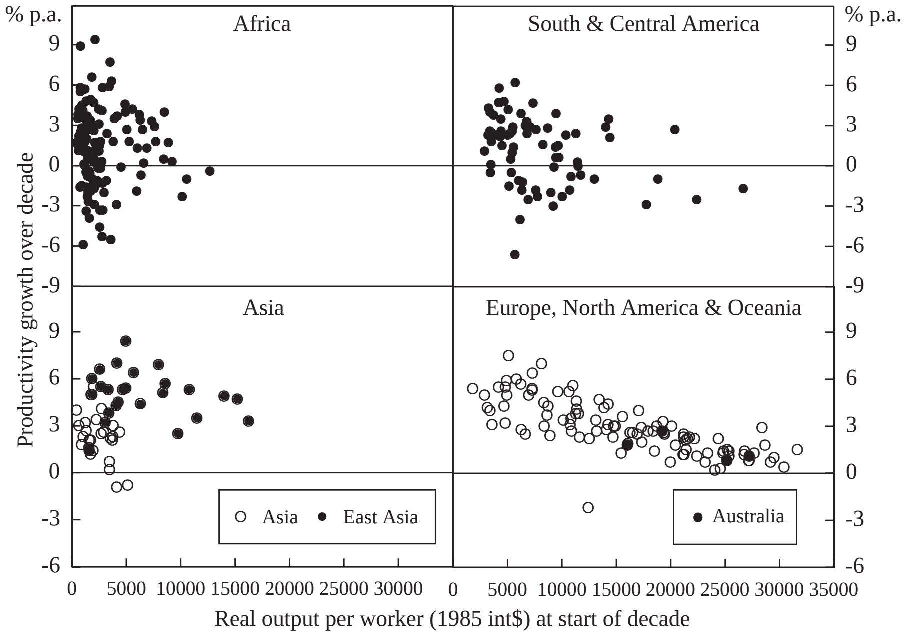
3. Quah (1993) has explained Galton's 'fallacy', pointing out that regression to the mean, in this context a tendency for poorer countries to grow faster than richer countries, is a necessary condition for convergence – but it is not sufficient. If random disturbances to growth are sufficiently high, dispersion measured by the variance of log GDP per capita may increase even though individuals tend on average to move towards the mean.

4. This is a well-established result. See, for instance, Dowrick and Nguyen (1989).

Figure 4: Catching-Up and Falling Behind by Region



However, the magnitude of the understatement of true growth is not likely to exceed one percentage point in annual growth. Furthermore, any such bias is also likely to affect developing economies. So it seems unlikely that the bias is of sufficient magnitude as to undermine the evidence that catch-up growth is highly significant for the Europe/OECD group.

Figure 4 also shows an interesting relationship between productivity levels and growth for the Asian economies. There appears to be some falling-behind at the lower end of the distribution and catching-up at the higher end, with the fastest rates of growth occurring at annual productivity levels around int$5,000 per worker. But as the high-performing Asian economies achieve higher productivity levels there is evidence, strongest in the case of the development leader, Japan, that growth rates are slowing towards rates more typical of the advanced industrial economies of the OECD. Indeed, over the past five years, which are not included in the data set used here, Japanese productivity growth has slowed to under 2 per cent.

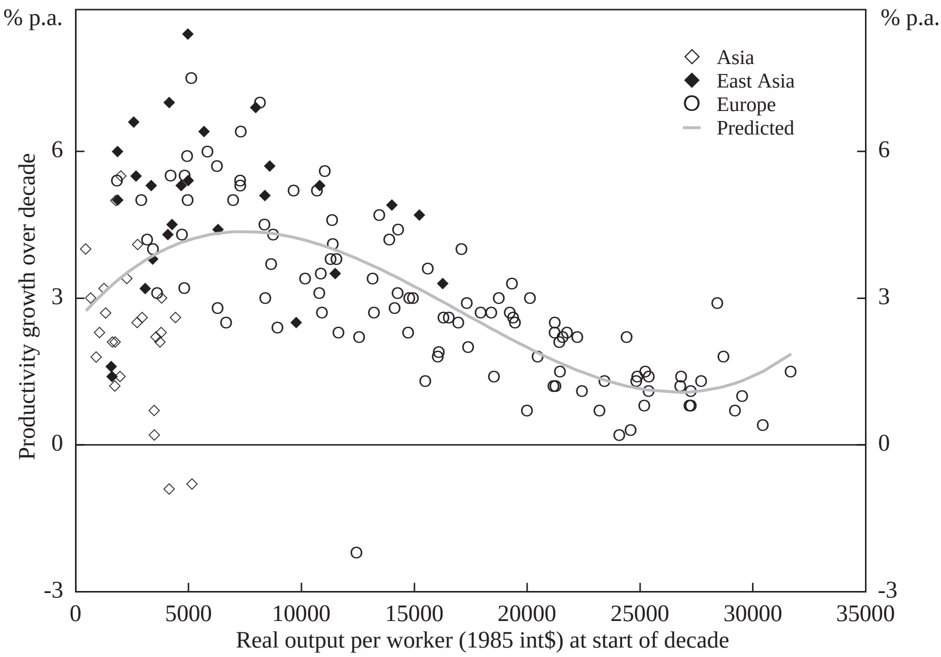
This raises the important question of whether the current super-growth of the East-Asian economies is bound to slow. It is instructive to compare the performance of the Asian economies with Europe’s experience of economic development. All of the Asian economies are now at a level of development similar to that achieved by European/OECD economies one or more decades ago. For instance, Thailand has by now reached a level of development, as measured by real labour productivity of around int$16,000 per worker, similar to that of Ireland and Spain in the 1950s, Greece and

Yugoslavia in the 1960s, and Turkey in the 1970s. Aggregate productivity levels in Japan and Singapore at the beginning of the 1980s were around int$16,000 per worker, comparable to those experienced in Italy in 1970 and Germany some ten years earlier.

How does the impressive growth performance of the East-Asian economies compare with that of the European/OECD economies at a similar stage of development? Figure 5 combines the growth data of the Asian economies with that of the European/OECD group, again relating growth over a decade to the starting level of productivity. There is a fairly strong pattern of moderate growth for the low-productivity economies, those starting below int$4,000 per worker typically growing around 3 per cent per year. Rapid acceleration is common when annual output per worker reaches somewhere between int$4,000 and int$10,000, with growth rates typically around 5 per cent. Then a slowdown occurs at higher levels of development, tailing off towards growth rates of between 1-2 per cent.

This pattern is consistent with the notion of a take-off stage of economic development. Arguments from a wide range of authors including Abramovitz (1986) and Lucas (1988) suggest that, at some point in economic development, the advantages of backwardness are outweighed by the disadvantages. The advantages consist primarily of the availability of a pool of advanced technological knowledge that has been researched, trialed and developed in the advanced economies and is available to the laggard economies either as free public knowledge or else as technology embodied in capital goods. The disadvantages of backwardness, on the other hand, consist of the fact that modern technologies are strongly complementary with local capital stocks, both physical and human. Physical infrastructure such as communications networks, equipment repair

Figure 5: Asian and European Productivity Growth
(1950s-1980s)



facilities and reliable power supplies are essential prerequisites. So too may be the existence of a well-educated and trained labour force. But the high fixed costs of providing this basic physical and human infrastructure renders the advantages of technology transfer inaccessible to the poorest economies.

This notion of a development threshold and subsequent slowdown is related also to stages of industrialisation, particularly the transfer of labour and capital from agriculture into industrial production and then increasingly into the services sector. Those developing economies which are able to invest in the pre-conditions for rapid industrialisation are enabled to grow very rapidly. But as they continue to siphon the pool of technology transfer and begin to operate on the leading edge, they have to increasingly look to their own research and development and growth must inevitably slow down.

The hypothesised pattern of development can be modelled very simplistically by expressing growth as a cubic function of the level of productivity. Using pooled data for 15 Asian economies and 27 European/OECD economies, a cubic regression is estimated in which real labour productivity at the beginning of the decade, y_0, is regressed on average annual growth in the subsequent decade, $\hat{y}$. The results are reported in Table 2.

This relationship is also plotted in Figure 5. It is of course a highly stylised description of the post-war pattern of development. In particular, the turning-up of the regression line above productivity levels of int$30,000 per worker is a spurious artifact of the cubic functional form. The actual data show a levelling off of growth rather than any turning-up. This description also ignores many important influences on growth such as differences in savings rates, education, openness to trade, changes across decades in the underlying rate of technical progress, etc. These important influences on growth will be discussed in subsequent sections. For the moment, however, it demonstrates that the simple notion of a non-monotonic development path is capable of explaining approximately one-third of the observed variance in rates of growth. Moreover, it helps a preliminary assessment of the extent to which the 'East-Asian miracle' of the past few decades has in fact been exceptional.

Table 2: Stages of Development
(Dependent variable: $\hat{y}$)

Estimation method	OLS	
n	155	
Regression coefficient (t-statistics):		
y_0	5.5	(4)
y_0^2	-4.7	(-5)
y_0^3	-0.9	(5)
Constant	2.5	(6)
Summary statistics:		
$\overline{R}^2$	0.35	
s.e.	1.48	

Note: t-statistics are corrected for heteroscedasticity.

It is certainly the case that most of the East-Asian observations displayed in Figure 5 lie above the regression line. But so do many of the observations for European economies at a similar level of development. For every fast-growing East-Asian economy, there is a European/OECD counterpart which exhibited equally rapid growth at a comparable level of development, a decade or two earlier. Moreover, as the East-Asian economies have matured, particularly in the case of Japan, there is evidence that their rates of growth have begun to tail off.[5]

A possible conclusion is that the recent growth of the high-performance East-Asian economies simply parallels that of the more successful European economies during the period of post-war reconstruction and catch-up. On the other hand, this 'parallel development' might be overly influenced by changes in exogenous rates of technical progress, with the rapid European growth of the 1950s and 1960 owing more to exogenous technical progress than to any consistent pattern of development. We can attempt to test for this possibility by extending the simple regression analysis to include fixed-decade effects, capturing common exogenous shifts in technical progress, as well as regional dummies. The decade dummy variables are defined as D50=1 for the 1950s, etc. and the regional dummies are also set to unity. The results of the growth relationship are reported in Table 3.

The suggested relationship between growth and level of development is actually quite similar to that previously estimated, with growth predicted to peak at 4.1 per cent per annum for a European/OECD country with productivity around int$4,000 per worker, tailing off to growth of 1.1 per cent per annum at productivity levels around int$20,000. Although the individual t-statistics are lower than in the previous regression, the productivity variables are jointly highly significant ($F_{3,146}$=22; $p<0.00000$).

It is surprising to find that only one of the period dummies is statistically significant. This implies that exogenous technical progress, unrelated to the level of development, was roughly the same in the 1950s as in the 1970s and 1980s. Furthermore, the magnitude of the acceleration and subsequent slowdown in exogenous technical growth in the 1960s is estimated to be substantially smaller than the raw data suggest, the purely exogenous part of the slowdown being less than one percentage point on annual rates of growth. The suggestion here is that most of the slowdown in world economic growth since the 1960s, in particular the slowdown amongst OECD economies of the order of magnitude of over 2 percentage points per annum, can be explained by diminishing opportunities for technological catch-up. As more and more economies slide down the technology-gap curve in Figure 5, average rates of growth have inevitably declined.

Much of the difference between Asian and European growth rates can also be explained as the consequence of being at different stages of development. Taking all Asian economies together, there is little discernible difference in Figure 5 between their pattern of development and that of the post-war economies of Europe and the OECD. Indeed a dummy intercept term for Asia is completely insignificant, with a point estimate of 0.08 and a t-statistic of 0.2.

5. In fact, Sarel, in this Volume, challenges the view that East-Asian growth performance has been miraculous.

Table 3: Stages of Development Allowing for Fixed Effects
(Dependent variable: $\hat{y}$)

Estimation method	OLS
n	155
Regression coefficient (t-statistics):	
y_0	1.6 (1.0)
y_0^2	-2.4 (-2.1)
y_0^3	0.5 (2.4)
D50	0.4 (0.9)
D60	0.9 (2.5)
D70	0.1 (0.2)
East Asia	0.7 (1.8)
Other Asia	-2.1 (-3.8)
Constant	3.8 (5.0)
Summary statistics:	
$\bar{R}^2$	0.54
s.e.	1.25

Note: t-statistics are corrected for heteroscedasticity.

We can get significant regional differences if we divide the Asian economies into two groups, the high-performing East-Asian economies which have attracted so much attention of late, and the sample of other Asian economies for which productivity data were available. The latter group was a consistently poor performer through the 1960s and 1970s, whilst the former group has exhibited strong growth for 40 years. That these sub-regional dummy variables are significant in the results reported above is not surprising, since the groupings have been made *ex post* in terms of observed differences in performance. What is perhaps surprising is that even when we bias the groupings to emphasise regional differences, the estimated unique component of East-Asian miracle growth is less than one percentage point of annual growth. More than half of the difference between European and East-Asian growth (a gap of nearly 2 percentage points over the past four decades) is explicable in terms of the far greater opportunities for the Asian economies in relation to technological transfer.

Although the ‘other’ Asian economies experienced much slower growth in the 1960s and 1970s, there was evidence of the beginnings of acceleration in the 1980s, particularly in India, Sri Lanka and Bangladesh. This increase in growth occurred as productivity levels in these countries approached the development threshold of int$3,000-4,000 per worker. More recently of course, and not included in the data used here, have been reports of take-off growth in China over the past few years.

Much of the variation in growth rates in Asia and the OECD can be explained by the simple model of technology transfer and threshold levels of development outlined above. The real puzzle of post-war development is, from this perspective, not one of why the

East-Asian economies have been performing so well, since they have to a large extent been following the well-established technological footsteps of the more advanced industrial economies. Nor is the poor economic performance of Africa so inexplicable, given that few of their economies appear to have reached the threshold level of development, although there are many important issues about severe underdevelopment with which this simple analysis does not attempt to grapple.

Rather the major puzzle is why the Latin-American economies failed to capitalise on the opportunities given them by the relatively privileged start they had in the post-war race for development. They started in 1950 with annual income levels more than double those of East Asia. Moreover, their productivity starting point was exactly in the income range which has proved to provide the potential for rapid growth in both Europe and Asia. But there have been only a few sporadic success stories such as Brazil and Ecuador, and even there the successful growth only lasted up until 1980 and has been followed by negative growth. After four decades of mis-managed development, Latin America finds its position in relation to East Asia reversed – it is now the Asian worker who produces twice the annual output of her Latin-American counterpart.

3. Economic Explanations of Growth: Old Theories in New Models

The past ten years have seen an eruption of models of the growth process. These were sparked off by Romer's (1986) demonstration that it was possible to devise mathematical models where the spillover benefits of investment were sufficient to stop growth grinding to a halt against the boulder of diminishing returns without sacrificing the general equilibrium properties of models based on neoclassical technologies and individual optimising behaviour. This technical breakthrough in economic modelling has revived academic interest in the analysis of growth as the product of deliberate investment (with or without spillover benefits) rather than viewing long-run growth as the technological equivalent of manna from heaven.

Romer has turned more of late to emphasise the public good nature of knowledge, rather than spillovers from physical investment, as the primary source of growth. His 1990 paper presents a vivid image, particularly appealing to academic researchers, of investment in knowledge not only generating useful ideas for current production, but also aiding the generation of further knowledge. Knowledge stocks increase through a continuous feedback loop which provides the economy with an ever increasing supply of blueprints for new products and processes.

Many other models of endogenous growth have been proposed. Lucas (1988) and others have emphasised the role of human capital as a complementary input into production alongside physical capital. Rebelo (1991) has proposed a two-sector model where increasing returns in the production of capital goods are sufficient to overcome the growth-inhibiting effects of decreasing returns in the production of final output. Jones and Manuelli (1990) have generalised the idea, due to Pitchford (1960), that decreasing returns may be asymptotically equivalent to constant returns and hence capable of sustaining long-run growth, if there is sufficient substitutability between reproducible capital and fixed factors of production. Yang has proposed, in a series of papers, that growth is driven by increasing returns to specialisation, limited only by the costs of transactions and by opportunities to trade.[6]

Hammond and Rodriguez-Clare (1993) have proposed an encompassing mathematical model of growth. I will borrow a presentation from Dowrick (1994b), but stick to their notation whereby two types of capital are involved: *H* and *K* denote capital stocks which can be interpreted as human and physical capital, respectively. However, it is important to bear in mind that these notations are essentially arbitrary. What is important from the point of view of modelling is that *K* is associated with spillovers and *H* is associated with feedback. Endogenous growth occurs in three distinct situations.

Case 1: Capital flexibility generates long-run growth

A general production technology with constant returns to scale is capable of generating long-run growth without either feedback or spillover as long as the elasticity of substitution between factors is greater than unity. This case is, for instance, analysed by Pitchford (1960) and more recently by Jones and Manuelli (1990).

Output, *Y*, is a function of *H*, *K* and the amount of labour time devoted to production of final output, *L*, which is multiplied by a labour efficiency factor, *E*, to give *EL* efficiency units of labour. Lower case letters denote *per capita* values. The output of a representative agent is given by a CES production function with the elasticity of substitution σ:

$$y = A\left[\alpha h^{1-\sigma/\sigma} + \beta k^{1-\sigma/\sigma} + [1-\alpha-\beta]\,[El]^{1-\sigma/\sigma}\right]^{\sigma/1-\sigma} \tag{1}$$

In order to concentrate on the capital flexibility argument, for this case I ignore the feedback and spillover mechanisms, assuming that *h* and *E* are fixed. Physical capital, *k*, grows according to the amount of consumption foregone. The question is whether it is possible (and desirable) to accumulate capital sufficiently quickly to generate long-run growth despite the fixity of the other factors of production.

Long-run growth is not feasible if increasing capital intensity drives the marginal product of capital to zero (the Inada condition). This occurs if capital is not readily substituted for labour ($\sigma \leq 1$), for example in the case of a Cobb-Douglas production function where $\sigma = 1$. Labour is 'essential' in production, in the sense that the marginal product of capital approaches zero as the ratio of capital to labour rises. In the absence of feedback or spillover the long run growth of output is constrained by the growth of the labour supply and by the growth of the exogenous technology parameter *A*. Agents can accumulate human capital and physical capital as much as they like, but they will always run aground on the rock of diminishing returns in the long run; hence the 'investment pessimism' traditionally associated with the Solow-Swan model.

If, on the other hand, the elasticity of substitution, σ, exceeds unity, then the marginal product of investment no longer declines to zero; labour is no longer 'essential'. In effect, robots can replace humans on the production line; they can even replace humans in the production of further robots. Of course, labour is still required to organise and direct the

6. See, for example, Yang and Borland (1991).

production process; but the essential point is that if there is sufficient substitutability between capital and labour, then investment will always contribute to growth.

As long as the return on investment is above the inter-temporal discount rate, then rational agents should choose to invest and the economy will keep on growing. Specifically, let agents' instantaneous utility depend on current consumption, c, such that:

$$v(c) = \frac{c^{1-\varepsilon}}{1-\varepsilon} \tag{2}$$

where ε is a constant rate of relative risk aversion, capturing the extent to which agents are prepared to pay to smooth out consumption. Each agent seeks to maximise lifetime utility, discounted at rate ρ. The choice for the agent is between current and future consumption. A rational agent will allocate labour time and investment in such a way that output, consumption and capital grow at a steady rate, g, given by:

$$g = \frac{A\beta^{\sigma/\sigma-1} - \rho}{\varepsilon} \tag{3}$$

There are two requirements, then, for conventional investment models to generate long-run growth. The first is that capital should be sufficiently flexible that it can be substituted for other factors, in particular that it can replace those non-reproducible factors which would otherwise constrain growth. This is the technical condition that $\sigma > 1$. The second is the economic condition that agents should perceive the benefits of increased future consumption as worth the sacrifice of current consumption, i.e. that the long-run marginal productivity of capital, $A\beta^{\sigma/\sigma-1}$, should exceed the discount rate, ρ.

Case 2: Investment feedback generates long-run growth

Feedback might occur where the representative agent chooses to devote a proportion, r, of their labour time to research/education. This research activity increases the individual's stock of knowledge or human capital, h. Crucially, the larger the stock of knowledge, the easier it is to increase it. Better educated and more knowledgeable people learn faster and develop new ideas more easily. The underlying idea is appealing – existing knowledge and understanding, combined with further education and research, generate further knowledge. This is an example of the feedback effect. Mathematically, this relationship is represented as:

$$\dot{h} = \theta r h^{\gamma} \tag{4}$$

where $\dot{h}$ represents the rate of change of knowledge/human capital which depends on both the labour time spent on research and on the existing stock of human capital. The proportional rate of growth of knowledge is given by:

$$\hat{h} = \theta r h^{\gamma-1} \tag{5}$$

If there are decreasing returns to the stock of knowledge, $\gamma < 1$, then although knowledge may continually increase, its rate of growth must decline. But if γ is exactly equal to unity, then the rate of growth of knowledge is θr.

It is, then, possible that the stock of knowledge, *h*, may exhibit constant positive growth. But under what circumstances will this translate into long-run growth of output and consumption? To answer this question, we need to specify the production technology. To simplify matters, consider the case where the production function is Cobb-Douglas. Conventional investment is not sufficiently flexible to augment the fixed factors such as labour, so the long-run growth of Case 1 is not possible.

$$y = Ah^{\alpha}k^{\beta}[El]^{1-\alpha-\beta} \qquad (6)$$

With consumer preferences between current and future consumption as defined in the previous section, the optimal allocation of resources to research/education will yield a balanced growth rate of output and consumption given by:

$$g = \frac{\theta - \rho \dfrac{1-\alpha-\beta-}{\alpha}}{1+\varepsilon \dfrac{1-\alpha-\beta}{\alpha}} \cong \frac{\theta-\rho}{1+\varepsilon} \qquad (7)$$

where the production shares of human capital/knowledge and labour are assumed to be approximately equal. This simply tells us that long-run growth will occur if the feedback mechanism is sufficiently strong (γ=1 in equation 4), and if the return to investment in research/education exceeds the discount rate ($\theta>\rho$).[7]

Case 3: Investment spillovers generate long-run growth

The idea here is that the productivity of fixed factors, such as labour, may be enhanced by spillover benefits from the capital accumulation of other agents. There are several features of investment which may produce such spillovers. The public good qualities of knowledge are a prime example, suggesting spillovers from R&D or from learning-by-doing. A simple mathematical formulation has the efficiency of labour enhanced by the aggregate capital accumulation of other agents, represented by upper case *K*:

$$E = K^{\phi} \qquad (8)$$

The solution for the growth of this economy is typically complex. But there is a simple steady state growth rate in the special case where ε=1 and the externality parameter $\phi = \frac{1-\beta}{1-\alpha-\beta}$. With equal factor shares in output this would imply ϕ=2. Normalising the labour input to unity and writing the aggregate capital stock as $K=nk$, the Cobb-Douglas production function is $y = Ah^{\alpha}k^{\beta}(nk)^{1-\beta}$ which exhibits constant returns to *k*. The market determined growth rate is :

$$g = A\beta h^{\alpha} - \rho \qquad (9)$$

7. The result is worryingly sensitive to the assumed parameters. If γ is only slightly less than unity, then the feedback mechanism is not strong enough on its own to generate long-run growth; diminishing returns will set in. If γ exceeds unity, even slightly, then growth may become explosive. Romer (1994) suggests that this is more a problem for mathematical modelling than for economic analysis.

In this case, growth is generated by private investment where agents ignore the spillovers which benefit others. Only if the positive externalities of private capital accumulation are sufficiently strong, and if agents are sufficiently patient (ρ not too high), is it possible for decentralised investment decisions to generate long-run growth.[8]

Not surprisingly, private investment decisions which ignore spillover benefits generate a sub-optimal rate of growth. A social planner facing a representative production function $y = Ah^{\alpha}k^{\beta}k^{1-\beta} = Ah^{\alpha}k$ would choose higher investment to generate a steady state rate of growth $g = Ah^{\alpha} - \rho$.

It is still debatable as to whether these new models of endogenous growth are actually better at explaining the observed patterns of economic development, in comparison with the older Solow-Swan model. One of the motives for developing the new theories has been the observation that the world's poorest economies are not catching-up to the leading economies, whereas a simple version of the traditional growth model suggests that all economies should be converging on a unique steady state. The more backward economies with lower capital intensity should face a higher return to capital and should therefore be growing faster for a given rate of investment. Moreover, given a capital share in income of about one-third, the marginal product of capital should fall rapidly as capital intensity rises, causing rapid convergence. Indeed, conventional parameterisation of the Solow-Swan dynamics suggests that the gap between current and steady-state output should shrink at a rate of about 5 per cent per year, giving convergence a half-life of about 14 years. In fact, though, even where we do observe convergence – amongst the OECD countries since 1950 – the estimated half-life is over 30 years.

By way of contrast, models of endogenous growth do not typically predict that convergence need occur at all, since they are based on returns to investment failing to diminish. Indeed, the new models are capable of predicting virtuous cycles of cumulative growth as well as low-growth traps, so divergence of income and productivity is a possible outcome. So the evidence of the previous section that world productivity levels have been diverging over the past four decades is *prima facie* evidence in favour of the endogenous growth models.

An influential paper by Mankiw, Romer and Weil (1992) has suggested, however, that this is too simplistic a test of the traditional model. First, we should allow for different rates of savings which imply that each country has its own, unique steady-state level of output per capita on which it is converging – allowing a rich country to grow faster than a poor country if the rich country is relatively further behind its own target steady state. In other words, convergence between countries should be measured conditional on their savings rate. Second, allowing for heterogeneous capital stocks, in particular distinguishing between physical capital and human capital, yields substantially larger empirical estimates of the share of capital. In their estimation, raw labour, human capital and physical capital contribute equally to production so, when broadly defined, capital's share is around two-thirds and the predicted rate of convergence is much closer to that we observe. Moreover, allowing for the importance of human capital implies that the savings rate in the conditional convergence regression should be defined to include

8. Once again, however, we have a situation where the model generates steady-state growth only with a very precise combination of parameter settings.

investments in schooling. When they so specify their model, they find support for conditional convergence across a much wider group of countries than the OECD.

The evidence on conditional convergence can also be interpreted in terms of the simple technology transfer/threshold model discussed in the previous section. Given a threshold level of complementary physical infrastructure and human capital, the observation that economies with relatively low initial levels of productivity grow relatively fast, might reflect opportunities for advancing towards the frontier of the advanced production technology rather than a move along the frontier driven by capital deepening. Unfortunately, to distinguish between these two explanations, or to establish their relative contributions to growth if they are both significant, we need to have reliable capital stock data. Such data are typically unreliable even within one country, let alone in the context of international comparisons. So, for the moment, the relative explanatory power of diminishing returns and technology transfer are difficult to disentangle.

The debate between exogenous and endogenous growth models is far from over. Mankiw *et al.* (1992) have shown that some of the principal facts of recent growth can be interpreted in terms of the dynamics of the traditional model a long way off its steady state. But if the steady state is so far off, and presumably technological shocks will be continually moving it yet further away, then it is probably going to prove very difficult to distinguish empirically between the traditional model and the new theories in which there exists steady-state growth but no steady-state level. Indeed, from a practical and policy point of view, such distinctions may be rather unimportant. In both classes of models, policy intervention is justified in terms of efficiency criteria only to the extent that market failure can be demonstrated. Moreover, both sets of theories point to the importance of investment – whether in physical or human or knowledge capital – for growth in the short and medium run. If we are all dead in the long run, that is probably good enough for us!

Probably the most important attribute of the new theories is that they have refocused the attention of many economists on the importance of long-run growth and its potential for rational economic explanation.

4. Evidence on the Determinants of Growth

A substantial body of evidence on the determinants of growth has been accumulating over the past decade. Most studies have relied on cross-country comparisons, essentially examining a cross-section of countries for correlations between their medium-term growth performance, over say 1960-85, and a range of measures of policies and institutional features. The relatively neglected dimension of empirical research has been the time-series analysis of the causes of growth. Some attempts have been made to recognise time variation by treating the data as a panel of short to medium-run observations on (typically five or ten year averages). The big advantage of this approach is that it not only gives many more observations of time-varying variables, but also it allows control for non-observed and time-invariant country effects, perhaps related to each country's history and culture and institutional setup, which might otherwise induce spurious correlation between growth and other endogenous variables. It also allows consideration of the possibility that the growth relationship is not the same at different stages of development.

There are two major challenges for empirical work on growth over the next few years. One challenge is to attempt a reconciliation between, on the one hand, the traditional time-series analysis of macroeconomic variables and the business cycle and, on the other hand, the cross-sectional analysis of growth. The second challenge is to develop the theoretical modelling in order to come up with precisely specified tests between the range of competing models. For the moment, however, we have to treat the current range of econometric analysis as suggestive rather than definitive.

It is well established that post-war economic growth shows strong partial correlations with initial levels of income (*vis-à-vis* the convergence/divergence discussion of the previous section) and also with rates of investment. Additional correlates which have been put forward include measures of schooling or stocks of human capital, distinguishing between different forms of physical investment, openness to trade, intervention in capital markets, R&D policy, population growth and fertility, monetary policy, government consumption and investment expenditures, and the occurrence of wars and revolutions.

A rather unhelpful paper by Levine and Renelt (1992) dismisses most of these potential explanators as 'fragile' to extreme bounds analysis. In other words, they found it possible to construct an OLS regression of growth in a single cross-section of countries where inclusion of some sub-set of these explanatory variables could render statistically insignificant the partial correlation between growth and any one of these variables. This approach seems to amount to data *under*mining. Given that many of these potential explanatory variables are endogenous and/or in turn related to other missing variables, it is hardly surprising that the variables are not all orthogonal and that it is therefore sometimes difficult to precisely identify their individual contributions to growth.

A more positive approach to the modelling problems is to try to identify structural relationships between the various explanators and estimate the growth relationship accordingly. It is certainly a weakness of much of the recent empirical literature that problems of endogenity and simultaneous causation have often been ignored. Nevertheless, at least some of the studies discussed here have attempted to deal with these problems, usually by estimating suspected endogenous relationships by instrumental variable methods or, what amounts to much the same thing, using lagged values of the variables to predict subsequent growth.

Here I will summarise my view of the recent empirical literature. I will concentrate on those areas where the most compelling or interesting evidence has been assembled: the initial conditions; the growth of capital and labour inputs; fertility and labour supply; education and human capital; government expenditures; and research and development.

4.1 Initial Conditions: Catching-Up and Falling Behind

Almost all cross-country studies have found that initial conditions – represented by various measures of the level of development such as output per capita, labour productivity, stocks of physical capital or stocks of human and knowledge capital – have very significant predictive power over subsequent growth.[9] The most common finding

9. Sarel, in this Volume, also assigns a major role to initial conditions.

is one of conditional catch-up – low initial stocks or productivity levels predict relatively rapid growth. However, for some variables (such as human capital) and for some samples (such as the least developed economies) the opposite is the case – a low starting point inhibits subsequent growth, implying that relatively poor economies fall behind or are caught in a low-development trap.

In the previous section I have demonstrated that a simple quadratic or cubic function of a single development variable, real labour productivity, can predict approximately one-third of the variation in subsequent rates of growth. There is a clear pattern of threshold development levels, growth take-off and subsequent slowdown as development matures. This is akin to Rostow's (1971) description of stages of development. I have interpreted this evidence principally in terms of opportunities for technology transfer and capabilities to exploit such opportunities. Alternative explanations can be found in variations on the standard neo-classical growth model, in terms of a systematic relationship between the level of development and both returns to capital and the desire to save (Sarel 1994), or in terms of endogenous growth models with market failures and investment coordination problems (Gans 1995; Murphy *et al.* 1989) which imply the existence of multiple equilibria and low-growth traps.

There are many other explanations for growth, some complements and some substitutes for the level of development explanations. I will go through some of the principal explanators in turn.

4.2 The Contributions of Capital and Labour Growth

Traditional explanations for growth have centred on the growth of physical capital and the growth of the labour force. If we augment the earlier regression of Table 2 with measures of population growth, *GP*, and per capita investment rates, *Inv/GDP*, we can interpret the results either in terms of a traditional growth accounting exercise – augmented by our non-monotonic technology transfer function – or else in terms of the dynamics of a Solow-Swan model in the way that Mankiw *et al.* (1992) have done. The results for our sample of Asian and European/OECD economies are shown in Table 4.

The negative coefficient on population growth implies diminishing returns to labour input, holding investment rates constant. The size of the coefficient, -0.33, is exactly what we would predict in a growth-accounting model with labour having a two-thirds share in national income. The coefficient on the share of investment in GDP is plausible, if somewhat high, in that it implies a gross rate of return on investment of 12 per cent per year. Barro and Lee (1993) suggest that somewhat lower estimates in the range of 5-8 per cent are obtained if instrumental variables are used and if other control variables such as life expectancy are included in the regression. Nevertheless, it is of interest to examine the contribution of capital deepening to growth using these perhaps overestimates of returns to investment.

From the data given in Table 1, we can deduce the extent to which investment has contributed to the rapid growth of the high-performing Asian economies compared with Europe/OECD. In the 1980s, for example, East Asia invested some 30 per cent of national income, whereas Europe/OECD invested only 23 per cent. This difference is predicted to add 7 x 0.12 = 0.8 percentage points to growth. At the same time, slightly

Table 4: Stages of Development Allowing for Population and Investment
(Dependent variable: $\hat{y}$)

Estimation method	OLS
n	155
Regression coefficient (t-statistics):	
y_0	2.2 (1.3)
y_0^2	-2.8 (-2.6)
y_0^3	0.6 (3.0)
D50	1.1 (2.8)
D60	1.4 (3.6)
D70	0.1 (0.3)
Inv/GDP	0.12 (3.6)
GP	-0.33 (-2.3)
Asia	0.2 (0.4)
Constant	0.6 (0.9)
Summary statistics:	
$\overline{R}^2$	0.48
s.e.	1.32

Note: t-statistics are corrected for heteroscedasticity.

higher population growth in East Asia is predicted to have lowered productivity growth by 0.9 x- 0.3 = -0.3. So overall capital deepening explains 0.5 points of the 2.9 percentage points difference. Another 1.6 points difference is attributable to the East-Asian ‘advantages of backwardness’, or opportunities for technology transfer. The residual or ‘miracle’ element of annual East-Asian growth is estimated to be significant but, at 0.7 of a percentage point, substantially less than the much publicised raw growth differential in total GDP which is more than 3 percentage points.

Indeed, country breakdowns suggest that much of this ‘miracle’ effect, or unexplained increase in technical productive efficiency, has been displayed over the past 20 years only by three countries: Hong Kong, Korea and Taiwan. High growth rates in Japan and, especially, in Singapore have been the product largely of very high rates of investment. Japan has invested over 30 per cent of national income, and Singapore over 40 per cent.

I do not go so far as Krugman (1994) who cites evidence from Young (1992) that technical efficiency in Singapore has not increased at all. That evidence depends crucially on the estimation of notoriously unreliable capital stock figures. Rather, the evidence presented here uses the much more reliable data on investment flows. Of course, the interpretation of the resultant regression residual as a measure of technical efficiency relies on the appropriateness of the imposed functional form, which here implies a locally flat marginal return to investment. If we can accept this assumption, the regression results suggest that efficiency in Singapore has benefited from technological diffusion at just the rate to be expected of economies at intermediate levels of development, taking the European/OECD experience as our benchmark. There has been little productivity miracle beyond that. As Krugman concludes:

> 'The newly industrialising countries of the Pacific Rim have received a reward for their extraordinary mobilisation of resources that is no more than what the most boringly conventional economic theory would lead us to expect. If there is a secret to Asian growth, it is simply deferred gratification, the willingness to sacrifice current satisfaction for future gain' (Krugman 1994, pp. 78).

Whilst I judge Krugman's analysis to be broadly correct for most of East Asia, there is still a substantial unexplained 'miracle' evident in the residuals the regression for Hong Kong, Taiwan and Korea. The element of their growth which is unexplained by conventional factor accumulation and technology transfer is about 2 per cent per year. Some part of this unexplained growth is probably due to human capital accumulation and other factors which are discussed later, but it is still important to recognise the existence of these unexpectedly high rates of growth in these three countries whilst keeping a realistic assessment of the order of magnitude of 'the miracle'. It is also worth noting that Germany, Italy, Greece, Spain, Turkey and Japan enjoyed periods of equivalent 'miracle' growth in earlier decades.

Both the econometric and historical evidence suggest that we can expect growth rates of productivity in East Asia to subside, in the same way as European and Japanese growth has done, as opportunities to take advantage of technological diffusion dwindle. High growth of *per capita* incomes will depend on continued rapid growth in human and physical capital, as potential for increased labour force participation is probably limited. Indeed, as countries approach the living standards of the advanced OECD economies we may expect to see – as is happening now in Japan – moves to enjoy the fruits of economic success through more leisure and shorter working hours or working years.

For the rest of Asia, relatively low investment rates go a long way to explaining why they grew so much slower than their East-Asian counterparts over the first three decades of post-war growth. A substantial pick-up in investment (particularly in India and Sri Lanka) in the 1980s has been accompanied by a decline in rates of population growth. Together, the consequent capital deepening seems to explain a mild recovery in growth in these economies. This recovery has been sufficient to push most of these economies (with the exception of Myanmar) to the threshold level where rapid-take-off growth is at least a possibility.

This simple accounting exercise can also be applied to the Latin American and African economies. Over the four decades from 1950 to 1990, Latin American economies have displayed low rates of investment and high rates of population growth. Accordingly, capital intensity has failed to grow at the rate experienced in the European/OECD group. This relative capital dilution is estimated, using the coefficients reported in Table 4, to have reduced Latin-American annual growth by one percentage point. Their failure to increase technical efficiency at the rate of the European and Asian economies at a similar stage of development accounts for another 1.2 percentage points shortfall over their potential growth rate.

Low rates of investment against a background of high, and increasing, population growth also account for about half of the growth shortfall in Africa. As with Latin America, however, their failure to improve technical efficiency at the rate observed in Asian economies at a similar level of development suggests that other important influences must be at play. Equally important is to explain why investment rates have been so much lower than in the East-Asian economies.

4.2.1 Explaining variations in rates of investment

The World Bank's (1993) report on *The East-Asian Miracle* contains valuable, if controversial, insights into the factors that have contributed to high savings rates and high investment rates in East Asia. A consistent theme in their analysis is that market forces alone are often not sufficient to produce the institutions which will generate confidence in savings, nor to overcome the coordination problems in directing investment, especially when major development pushes require complementary investments across varied sectors of the economy. Moreover, they recognise that is feasible (though they do not take it as fully established) that myopic household behaviour which ignores positive investment externalities may lead to sub-optimal savings rates even when financial institutions are well developed. It is worth quoting part of their conclusion (p. 242):

> '... Efforts to improve the institutional framework for capital market development came later in the process and were not responsible for takeoff. In some cases well-functioning development banks were a positive but not a determining factor. More selective interventions – forced savings, tax policies to promote (sometimes very specific) investments, sharing risk, restricting capital outflow, and repressing interest rates also appear to have succeeded in some HPAEs, especially Japan, Korea, Singapore and Taiwan and China.'

and to take note of their warning:

> 'But the potential costs of these more selective interventions if misapplied can be very high in terms of consumer welfare, and strong institutional capability is necessary. They would not have succeeded without the important monitoring and disciplinary roles performed by the banks and public institutions of these economies.'

Another very important factor in explaining high rates of investment in East Asia relative to Latin America and Africa is that the price of investment goods, relative to the overall price level, has been substantially lower. Brander and Dowrick (1994) have established that the price of investment goods relative to consumption goods is indeed highly significant in explaining real levels of investment. Average price levels (relative to the price of GDP) for the regions are shown in Table 1. There is a consistent tendency for the relative price of investment goods to rise as income levels fall, reflecting in part the need for less developed economies to import their capital goods at exchange rates which are undervalued relative to purchasing power parity for GDP. Nevertheless, a point emphasised by De Long and Summers (1991) is that part of the success of the East-Asian economies has been their ability to manage relative prices so as to keep the price of capital goods relatively low.

4.2.2 Investment in equipment rather than structures

De Long and Summers (1991, 1992) have examined the mix of investment across a sample of OECD and developing economies over the period 1960-85. They suggest that the gross annual rate of return on investment in machinery and equipment is much higher than that on investment in dwellings and structures. Taking account of the faster rate of depreciation of equipment, they find that the net social return is still about twice as high as the net return on structures. They suggest that there may be significant beneficial spillovers from equipment investment which result from the transfer of ideas and experience gained by workers who learn new techniques and ideas as a result of implementing and adapting the technologies embodied in new equipment.

Critics such as Auerbach *et al.* (1993) have questioned both the empirical robustness of the De Long and Summers results and also their economic interpretation. There is some suggestion that their sample of countries may not be representative. Some have argued that their results may simply reflect differences in the timing of investments or the fact that rapid economic growth induces high rates of investment in equipment.

Part of the evidence that investment in equipment causes faster economic growth is derived from econometric testing for endogeneity of both quantities and prices. This approach is illustrated by comparative case studies of Argentina and Japan. Peronist policies in the 1950s, continued through later decades by successor governments, had the effect of over-valuing the Argentine exchange rate and raising the relative price of machinery and equipment. De Long and Summers argue that Japanese policies had the effect of lowering the relative price of investment goods. Monopolistic high prices in the consumer goods sectors have been encouraged by Japan's Liberal Democratic Party and LDP-client bureaucracies. On the other hand, the Ministry of International Trade and Industry has focused on achieving value for the purchasers of capital goods – blocking the effects of 'politics as usual' in the investment goods markets. Hence, Japan's relative price structure favours equipment investment.

4.3 The Contribution of Fertility, Population Growth and Labour Supply

An often virulent debate has raged concerning the arguments of the neo-Malthusians (or anti-natalists as their opponents like to label them) who suggest that high rates of population growth are likely to reduce living standards through capital and resource dilution. Opponents of this position have pointed to the lack of a significant negative correlation between growth rates of GDP per capita and of population. This was the position of Kelley (1988) in an influential survey based on available data up to 1980. Using data up to 1990, and controlling for level of development, however, we do find a significant capital dilution effect, as reported above.

More recent work of Kelley's supports this position. It is amplified by Brander and Dowrick (1994) who suggest that it is not only the rate of population growth that matters but also the rate of acceleration or deceleration. In particular, those countries such as Japan, Hong Kong and Taiwan which reduced fertility sharply have experienced a substantial drop in dependency rates and a consequent sharp increase in labour-force participation. This has contributed in turn to higher incomes per head of population.

The magnitude of these labour-supply effects has been estimated by Dowrick (1995a) for a selection of Asian economies. The estimated contributions to *per capita* growth are listed in Table 5. Increasing the working age share of the population has a direct impact through a proportional increase in labour-force participation augmented by reduced dependency rates and increased participation of women. This has had the effect of raising annual per capita income growth by around one per cent in Hong Kong, Singapore and South Korea, which have undergone a radical demographic transition. In those countries where the demographic transition is less advanced, the labour-supply effect has been less strong but can be expected to increase in the future.

One of the major factors causing fertility to fall is rising living standards. So fertility reduction and the growth of GDP per capita can exert positive feedback effects. These have been an important part of the rapid economic and demographic transition of East Asia. Also significant has been the sharp rise in education in Asia, as shown in Table 6. In particular, Barro and Lee (1993) have provided strong evidence that female education reduces fertility. So the virtuous growth cycle has been reinforced where additional resources have been channelled into female education, as has been the case in East Asia.

Table 5: Contribution of Demographic Factors to Growth of GDP Per Capita in the Asia-Pacific Region (1960-1985)

	Growth of working age proportion of the population % points	Population growth % points	Net demographic impact on growth % points
Advanced demographic structure			
Australia	0.4	0.0	0.4
Japan	0.3	0.2	0.5
Full demographic transition			
Hong Kong	1.1	-0.2	0.9
Singapore	1.3	0.0	1.3
Korea	0.9	-0.1	0.9
Early demographic transition			
China	0.7	-0.1	0.7
Thailand	0.7	-0.3	0.4
Indonesia	0.1	-0.1	0.0
PNG	-0.1	-0.2	-0.2
Philippines	0.3	-0.3	0.0
Malaysia	0.6	-0.2	0.4
Fiji	0.9	-0.2	0.7

Note: Using coefficient estimates from Dowrick (1995a). The impact of population growth is measured relative to Australia’s growth rate. The net impact is the sum of the first two columns.

Table 6: Average Educational Attainment of the Working Age Population

	Latin America		East Asia	
	Average years of schooling			
	Male	Female	Male	Female
1960	3.3	2.7	4.7	2.4
1970	3.7	3.1	5.6	3.4
1980	4.6	4.1	6.7	4.5

Source: Barro and Lee (1994).

4.4 The Contribution of Education

Barro and Sala-i-Martin (1995) summarise extensive testing of the impact of investment in human capital on growth. They find that educational expenditures by governments have a very strong positive impact. Using instrumental variable techniques to control for simultaneous causation, their regressions suggest that the annual rate of return on public education is of the order of 20 per cent.

They also use data from Barro and Lee (1993) on the educational attainment of the adult population and appear to find increasing returns to levels of education – the marginal effect on growth of increasing years of primary schooling is small, the effect of an additional year of secondary schooling is substantial, whilst the largest effect appears to come from increasing higher education. Surprisingly, these effects seem to be confined to male education. The estimated impact of increasing female education is negative in their regression model. This is perhaps a result of collinearity between female education and other measures of development, such as life expectancy and fertility, which are included in the regression. Also, where many women are involved in domestic rather than market economic activity, the educational enhancement of their contribution to economic welfare may not be picked up directly by standard measures of GDP.

I find the Barro and Sala-i-Martin evidence on disaggregated educational attainment unconvincing. There are strong arguments and evidence for instance that primary education is vital for economic development. The World Bank's (1993) study suggests that high levels of public support for universal primary education in particular have been vital for East-Asian success. The apparent relatively low rate of return in the cross-country studies on primary education, relative to higher levels of education, may reflect the fact that there is relatively little variation across the successfully developing and developed economies in rates of primary education. A safe conclusion seems to be that investment in education does indeed create the pre-conditions for successful growth, but data and modelling problems do not yet allow any clear conclusion concerning the allocation of educational investment between different sectors.

4.5 The Contribution of Government Expenditures

Barro has consistently claimed to find strong empirical evidence that government consumption expenditures, excluding the education component, are negatively correlated with growth. His empirical modelling is at odds, however, with the theoretical modelling of his 1990 paper which suggests a non-linear relationship.

His simple model of endogenous growth has government size contributing to growth in a double-edged manner. Government activity is taken to be a productive input into private sector production, albeit with a decreasing effect on private sector marginal productivity. In other words, *ceteris paribus* an increase in government activity will increase the marginal product of capital, providing the incentive for increased private investment which produces higher long-run growth. Everything else is not, however, equal. In particular, government has to finance its activities. In Barro's model, financing requires distortionary taxation. Tax drives a wedge between private returns to investment and social returns, reducing the incentive for private agents to invest and thus reducing the long-run growth rate of the economy. A country will find that it faces a hump-shaped relationship between government size and economic growth. If government is very small, the positive effect of government on private-sector productivity dominates the distortionary tax effect, so the marginal net effect of government is positive. Beyond a certain point, however, the tax effect dominates and the net marginal effect of government is negative. Choice of government size to maximise the discounted utility of the representative consumer does not necessarily coincide with the size of government which maximises growth, but optimal government size is certainly positive.

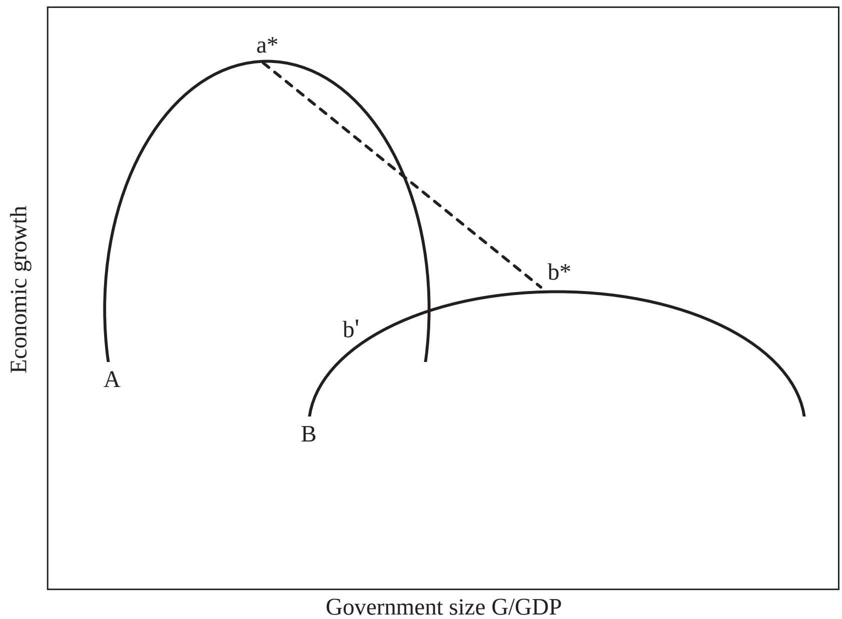
The Barro argument continues by noting that if government size were the result of a random draw, then we should expect to observe this hump-shaped relationship between government and growth. In practice, however, we observe a monotonic negative relationship. Rather than rejecting the Barro model, this evidence may be taken to suggest that government size is not chosen randomly, rather that it at least approximates the optimal size for each country. We expect countries to have different needs for government services, reflecting perhaps inter-country variation in the problems of public goods and externalities due to geographical, climatic and cultural factors. A country with, say, a high population density and an individualistic culture may need relatively more government intervention to overcome problems of externalities in interactions between individual consumers and producers. If so, it will have to rely more heavily on distortionary taxation which reduces incentives for private investment. A country which faces substantial market failure will exhibit both a large government sector and a slow growth rate relative to some other country with less need for public intervention.

In the Barro model, then, if all countries choose their level of government optimally, cross-section observation will find a negative correlation between government size and growth. But this will reflect an equilibrium relationship, not a direct causal relationship. The equilibrium relationship is driven by underlying and probably unobserved variation in the extent of market failure.

This argument is illustrated in Figure 6 where it is assumed for simplicity that welfare optimisation equates with growth maximisation. Country *A* faces a government/growth trade-off represented by the solid line *A*, and it chooses a level of government represented by the point a^*. Similarly for country *B*. The negative cross-section relationship, illustrated by the dotted line a^*b^*, should not be interpreted to imply that government in *B* is too large. Indeed, a reduction in government to the level found in country *A*, moving to the point b', would actually reduce growth and welfare in country *B*.

In some recent work, Dowrick (1995b), I have attempted to test this model of the relationship between government and growth. I note that the price of government services relative to GDP varies considerably over time and across countries, so it is possible to distinguish empirically between the real level of government activity and the size of the financing requirement. I also use panel data to control for fixed-country effects, allowing for unobserved differences in the underlying extent of market failure. The results give support for the Barro model, at least amongst the more advanced capitalist economies, finding that *ceteris paribus* government activity does indeed stimulate growth, whilst *ceteris paribus* taxation reduces growth. The marginal impact of government consumption expenditures on growth is at first positive, up to a level around 12 per cent of GDP, but negative thereafter. This evidence should be regarded as preliminary in terms of its point estimates of growth-maximising government

Figure 6: Economic Growth and Government Size in the Barro Model



expenditures, but strongly supportive of the position that at least some portion of current government expenditures are indeed growth enhancing.

Another important consideration is the distinction between public and private investment. The investment data typically used in empirical studies combine both public and private sectors. There are reasons to suppose, however, that public investment might be less productive at the margin if it is mis-directed according to political, rent-seeking objectives; on the other hand, to the extent that market investment is sub-optimal due to coordination problems or free-rider problems, public investment might be more productive.

Recent time series analysis of data from the US (Aschauer 1989; Munnell 1992; Lynde and Richmond 1992), the UK (Lynde and Richmond 1993) and Australia (Otto and Voss 1994) suggests that public investment is indeed complementary to private investment and attracts a higher marginal rate of return, particularly since the widespread cuts to public investment programs in the US and elsewhere over the past 20 years. This evidence is still rather controversial, and has not been accepted by, for example, the recent EPAC report on infrastructure provision in Australia. Nevertheless, there is independent support from the cross-country regression analysis of Easterly and Rebelo (1993) which finds that public investments in transport and communication networks are indeed important ingredients in promoting growth. Moreover, they find that such public investment does not crowd out private investment (whereas public investment in agriculture, for example, does tend both to crowd out private investment and have a net negative effect on growth).

This conclusion is broadly supported by the World Bank's (1993) analysis of East-Asian growth which they suggest has been strongly supported by public investment in infrastructure. Overall, the cumulation of evidence from different sources – time-series, cross-country and case studies – presents a convincing case for the value of public investment in a core infrastructure of modern transport and communication.

4.6 The Contribution of Research and Development

R&D expenditures typically constitute, for advanced economies, only around 2 per cent of GDP (around 1.5 per cent in Australia) – approximately one-tenth of the expenditure devoted to traditional investment in physical equipment and structures. In a standard growth accounting framework, it may then seem that variations in research effort should explain very little of the differences in growth rates between countries.

Of course, knowledge creation can occur outside the research laboratory, and so will not always be fully captured by conventional measures of R&D. For instance, Young (1993) and De Long and Summers (1992) argue that there is likely to be substantial learning and innovation involved in the implementation of new ideas, especially when new technology is embedded in capital equipment.

But we do not necessarily have to rely on non-measured research and learning to highlight the importance of knowledge in growth. The point of much of the new growth theory is precisely that if the hypothesised channels of knowledge spilling over to other productive activities are found to be substantial,[10] then even relatively small resources devoted to the production of knowledge may result in substantial economic growth. For instance, Grossman and Helpman (1991) calibrate their model to roughly match the US growth experience. They predict that business investment should be around 10 per cent of GDP whilst R&D – the engine of growth in their model – need comprise as little as 1.6 per cent to generate annual GDP growth of 2.5 per cent.

Lichtenberg (1992) has produced one of the first attempts at studying the cross-country evidence on the impact of R&D expenditures on both the level and the rate of growth of real GDP. Using a sample of 74 countries, and treating the observed GDP levels of 1985 as a steady-state outcome, he finds the national rate of return on private R&D investment to be seven times as large as the return to investment in equipment and structures. He does, however, recognise that this interpretation of the steady-state relationship requires that investment rates are determined independently of productivity – a highly questionable assumption. The cross-country correlation between levels of GDP per capita and R&D expenditures is indeed very strong, the less-developed countries typically devote less than half of one per cent of GDP to R&D compared with over two per cent for developed countries, but this may reflect nothing more than 'ability to pay'. Evidence of a causal link requires more detailed examination.

Lichtenberg's estimation of the relationship between R&D and the growth of GDP is probably less liable to endogeneity bias. Here the rate of return on R&D is still higher than that on physical capital, but by a margin of two rather than seven. I am still concerned

10. Especially if knowledge has a substantial feedback effect so that the larger the stock of knowledge, the easier it is to expand that stock.

that he does not take account of the likelihood that the relationship between research and growth may be substantially different for developed economies compared with the less developed economies, so his results must be treated with caution. Nevertheless, his estimate of returns to R&D being approximately double the returns to physical investment are broadly consistent with the estimates from microeconomic studies.

Nadiri (1993) summarises evidence on international technology flows. He concludes that:

> 'The transfer of technology is taking place much faster than before and the multinational firms are the main propagators of technology diffusion ... in most cases, it is the R&D intensive multinational corporations that are the main actors in the technology transfer market ... and are likely to be increasing sources of new spillovers' (Nadiri 1993, pp. 32-33).

A working paper by Coe and Helpman (1993) tries to quantify the magnitude of international R&D spillovers. They seek to explain variation in the annual growth of total-factor productivity for 21 OECD countries plus Israel over the period 1970-90. They find that the stock of knowledge in one country, proxied by cumulated R&D expenditures, raises productivity in foreign countries as well as in the own country. For the large G7 economies, the international spillover is approximately one quarter of the domestic rate of return.

Coe and Helpman produce unrealistically large estimates of the domestic rate of return on R&D – over 100 per cent in the G7 economies and 85 per cent in the smaller economies. These estimates are so much larger than those produced by microeconomic studies that one must question whether they have taken adequate account of reversed causation, whereby increases in income in a country allow it to increase its expenditure on R&D.[11] This problem is less likely to apply, however, to estimation of the spillover effects – so it may well be the case that international spillovers constitute more than one-quarter of the domestic returns.

A further interesting result is that spillover benefits are larger for countries with a high ratio of trade to GDP. Since trade shares are strongly correlated (inversely) with population, it is not clear whether it is really trade which enhances technology transfer or whether simply reflects the fact that a country with a small population and a small domestic R&D stock will rely disproportionately on spillover from the international stock of knowledge.

These macro studies of aggregate R&D, technology transfer and growth necessarily miss out on the fine detail of policies and institutions. A comprehensive survey of recent microeconomic studies into returns to R&D is provided by Nadiri (1993) who encompasses an earlier survey by Griliches (1991). For firms, own rates of return on R&D in the US, Canada, Japan and Europe are typically found to be between 20 per cent and 30 per cent. Such high rates of return incorporate, presumably, a premium to compensate for the inherently risky nature of research. Direct own rates of return tend to be higher for firms and industries where research is financed privately rather than publicly; own rates of return also tend to be higher for process rather than product R&D. Lower direct returns

11. Coe and Helpman claim to have dealt with such endogeneity by using the stock of R&D knowledge at the beginning of the year to predict the subsequent year's level of productivity. But the very strong persistence of both series makes such a procedure of doubtful use.

on public funds could be taken to imply that firms are better equipped than government to identify productive lines of research, but it could also reflect government choice of projects where most of the benefits do not accrue to the innovating firm.

There is consistent evidence from a wide range of studies to suggest that knowledge transfers are important. Nadiri concludes that the indirect or spillover rate of return is often at least as high as the direct own return, implying social rates of return to R&D of around 50 per cent. This evidence creates a strong presumption that R&D is under provided by the private sector. In particular, spillover benefits are strong in industries which are themselves active in R&D. This latter result supports the view that the diffusion of technological spillover is not a passive process, but requires own research activity if a firm is to benefit from the activities of others.

There is evidence from the technology flow studies that spillover is stronger between firms which are technologically close and geographically close, explaining clustering of high-tech industries. Spillovers are also found to be strong from university research to industry, but not *vice versa*. This supports the argument by Feldman (1993) that location matters because of a combination of the uncertainty and complexity of the innovation process, its reliance on university research, the importance of learning by doing and the cumulative character of knowledge. There is some suggestion that small firms are more innovative than larger firms. Acs and Audretsch (1993) suggest that small mobile firms are more adept than large firms at exploiting the spillover benefits from both the research of other firms and, especially, from university-based research. Geroski (1991) reports that in Britain technology spillovers are strongest with inventions emanating in the engineering sector flowing through to the user industries. This finding, that technology flows are stronger between firms in vertical rather than horizontal relationships, is mirrored in some of the cost function studies reported below.

An interesting recent study by Suzuki (1993) investigates R&D spillovers within and between the Japanese keiretsu – the groups of sub-contracting firms arranged around a core manufacturer. The study looks at the Japanese electrical machinery industry. It concludes that there are substantial spillovers within the keiretsu groups. Interestingly, it also finds that there are also significant spillovers to the core firms of other keiretsu. The results are summarised here as Table 7.

Not only are privately appropriated returns to R&D half as high again as for physical capital, but spillovers to other firms, particularly within the keiretsu, are substantial. (Note that because Suzuki is dealing with rates of return net of capital depreciation his estimates are lower than those of other researchers who report gross rates of return.)

The large spillovers within the industrial groupings are, presumably, one of the prime reasons for the existence of the keiretsu. Although US trade negotiators have attacked such industrial arrangements as anti-competitive, Suzuki's evidence supports the argument that such long-term institutional arrangements may in fact be desirable in order to internalise knowledge spillovers and to promote innovation.

Weder and Grubel (1993) expand this point in their discussion of 'Coasean' institutions which operate in various countries to internalise knowledge spillovers and promote technical progress. In particular, they cite the occurrence of three sorts of institutions:

- industry associations such as the Japanese Keiretsu or Swiss Verbande;
- conglomerate corporations, including multi-national enterprises; and

- geographic clustering of industries, such as Silicon Valley or the Northern Italian networks.

They point particularly to the Swiss and Japanese examples, where voluntary associations, supported by public policy, encourage long-run relationships between vertically related firms and encourage joint ventures and cooperation including joint research and training schemes.

Table 7: Net Rates of Return to R&D Expenditures in Japanese Industrial Groupings (Keiretsu)

	Private returns		R&D spillovers	
	Physical capital %	R&D capital %	Accruing to other keiretsu %	Accruing to sub-contractors within keiretsu %
Investment by:				
Core firms	13	20	3.6	8
Subcontracting firms	12	15		

Source: Suzuki (1993, Table 3).

4.7 Other Contributions to Growth

Many other theories have been put forward to explain variations in rates of growth, although the empirical evidence put forward in their favour has tended to be partial, not tested against competing hypotheses. So much of this evidence should be regarded as tentative and suggestive.

For instance, there is substantial, but not universal, evidence that barriers to trade tend to impede growth (Lee 1993), perhaps through limiting opportunities to exploit economies of specialisation in manufacturing (Backus, Kehoe and Kehoe 1992). In a paper written for last year's Conference (Dowrick 1994a), I quantified the potential gains from trade liberalisation for Australia as of the order of magnitude of half of one percentage point per year. At the same time, I warned that trade liberalisation also increases the risk of inappropriate specialisation compounded by market failures in the accumulation of complementary factors of production such as human and knowledge capital.

Economic and social institutions also affect growth. There is some evidence that inequality in income distribution tends to reduce growth through social divisiveness (Persson and Tabellini 1994) whilst sophisticated financial institutions (King and Levine 1993) and either competitive or inclusive systems of industrial relations (Dowrick 1993; Dowrick and Spencer 1994) and cooperative industrial organisation (Weder and Grubel 1993) have also been put forward as conducive to productivity growth. Not surprisingly, civil disturbances and wars are found to be disruptive to growth, at least in the short to medium term, although Olson (1971) has argued that by breaking up narrow distributional coalitions such disturbances may have a beneficial impact on longer-run growth.

Barro and Sala-i-Martin (1995) test some, though not all, of these theories in their regression model. Whilst they have not produced definitive tests between the various theories, an important finding is that various combinations of these variables are capable of explaining the very substantial differences in rates of growth between continents and between development groupings. In their full model, dummy variables for East Asia, Africa and Latin America are individually and jointly insignificant. The dramatic variations in rates of growth with which we introduced this paper are largely capable of economic explanation through both the semi-exogenous 'initial conditions' and the endogenous policy and behavioural choices, even if we are not yet in a position to clearly disentangle all the individual explanations.

5. Concluding Comments: Some Implications for Australia

Most of the analysis of this paper has been positive in the sense that it has tried to establish the determinants of growth without normative judgment. Estimation of a simple catch-up and factor-accumulation model supports the previous conclusions of Dowrick and Nguyen (1989), following the work of Gruen (1986), that productivity growth in Australia, at least since 1960, has proceeded at very much the rate to be expected of a mature, industrialised economy – levelling off at a rate of about one per cent per annum.

Whilst investment rates in the 1980s were slightly higher (by 1.7 percentage points) than average for European/OECD economies, so too was the rate of increase in population and labour force (by about 1 percentage point), partly through natural increase and partly through a major immigration program. The net effect on simple factor accumulation is probably that population and labour force growth have outweighed the investment factor, so capital intensity in Australia has probably grown slightly less rapidly than in other advanced economies. The growth accounting relationships of the final regression suggest that this capital dilution effect has probably reduced Australian labour-productivity growth over the 1980s by around 0.1 percentage points. Residual productivity growth has, however, increased slightly since the 1970s. It is probable that the large increases in educational attainment over the past 15 years, especially amongst females, have contributed to this mild pick-up in productivity growth.

Of course, to say that Australian growth performance has been average suggests that there is plenty of room for improvement – as well as plenty of opportunity for deterioration. Most obviously, we would expect an increase in savings and investment to increase growth. Current moves to achieve this through compulsory superannuation might well be successful, following the example of other compulsory savings schemes in Asia, if they are not offset by reductions in public saving and in voluntary private saving.

Even if compulsory superannuation does increase saving, investment and growth there remains the question of whether such strategies are necessarily welfare improving. A higher rate of growth does not necessarily mean that we are better off if we have to sacrifice current consumption and if we discount the future. Of course, there are arguments about myopia and about growth externalities and imperfect capital markets which can be used to justify compulsory savings schemes. But it is simply not sufficient to justify policies solely in terms of their impact on growth.

The savings/superannuation debate also raises important questions about the direction of investment. If savings are extracted compulsorily one can argue that there is additional obligation on government, reinforcing its standard public interest duties, to ensure that the institutional and taxation framework are set up to maximise social returns.

The De Long and Summers' findings on above average returns to investment in equipment, rather than investment in buildings and structures, confirm popular prejudice against the apparent predilection of the financial system for 'speculative' investment in property. There are important implications for Australian policy. Not only do Australian producers face relatively high prices for equipment investment compared to other OECD producers, but also the tax system strongly favours investment in housing and offices. There is a strong case that tax and tariff policies should be amended to prevent the diversion of resources away from investment in equipment and machinery.

Pender and Ross (1993) found that despite major reforms to the Australian tax system over the last decade, there remain substantial distortions. For instance, with an annual inflation rate of three per cent, the effective tax rate for a local corporation investing in equipment is nearly double that on investment in buildings and nearly four times the effective tax rate for investment in owner-occupied housing. These rates are listed in Table 8.

Another important argument about the direction of investment concerns the provision of infrastructure of modern communications and transport. There is compelling evidence from a wide range of studies that such investments typically attract high rates of social return and are important in promoting growth. This makes the picture of declining public investment, as illustrated in Figure 7, a matter for concern.

Of course it can be argued that private investment in infrastructure can substitute for public provision. But the economics of public good provision militate against that, and international evidence suggests that on average public infrastructure is complementary to rather than a substitute for private investment. Moreover, to the extent that network externalities are important in industrial development – *vis-à-vis* the high growth areas of Silicon Valley, Northern Italy and the growth poles of East Asia – it can be argued that the tyranny of distance and scale in Australia call for better than average infrastructure. So it is of particular concern that current levels of government investment are well below those of most OECD countries, as illustrated in Figure 8.

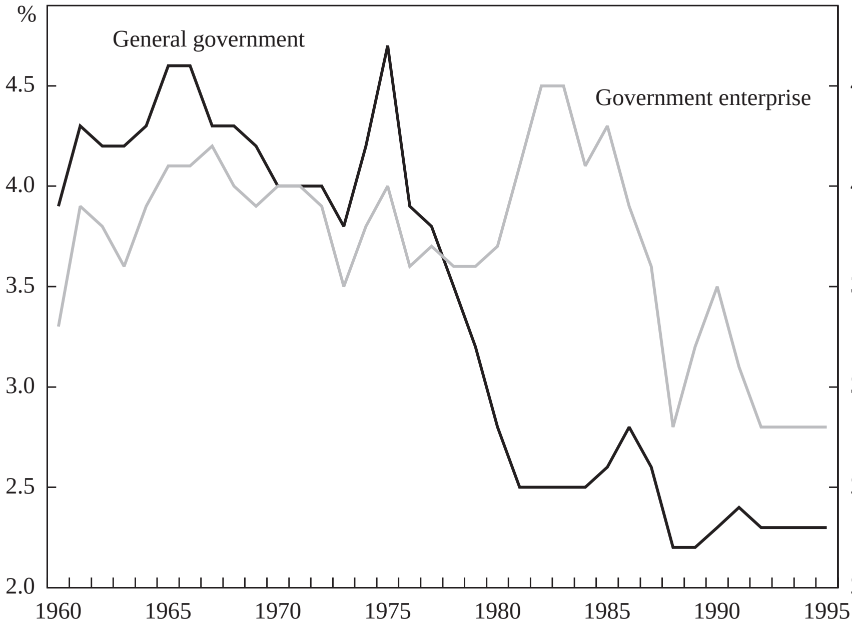
Table 8: Effective Tax Rates for Investment

(Statutory tax rate = 39%, inflation = 3%)

Ownership	Asset	Real effective tax rates %
Owner-occupier	housing	11.4
Negatively geared rental	housing	-0.8
Locally-owned company listed on the ASX	machinery	42.5
Locally-owned company listed on the ASX	buildings	27.6

Source: Pender and Ross (1993, Tables 5 and 6).

Figure 7: Real Public Investment as a Per Cent of GDP
(Real investment by general government and government enterprise)



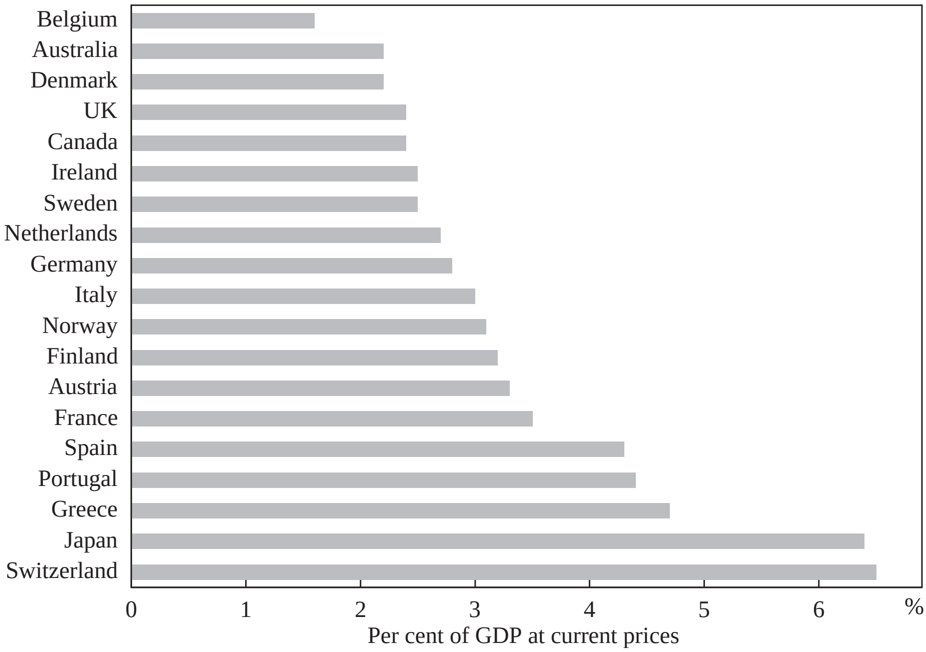
Source: ABS via DX database. Public investment is the sum of government investment and government enterprise investment.

Arguments about the growth potential of public infrastructure also support the need for efficient operation of that infrastructure, implying that there may be a growth dividend to microeconomic reform in the infrastructure sector, over and above the short-term efficiency gains. EPAC's (1995) recent call for better planning and selection of infrastructure projects is certainly to be applauded, but this does not weaken the case for increasing aggregate spending on public investment.

It seems likely that one of the constraints on government which has contributed to the decrease in public investment has been a perceived imperative for fiscal restraint and balanced budgets. This imperative is debateable for areas of public consumption expenditures. There appears to be a trade-off between current tax-financed consumption and future growth, at least at the relatively high levels of public consumption current in Australia (about 19 per cent of GDP). Although there is no presumption that growth maximisation should dominate current benefits from public consumption, there is certainly a reasonable case in terms of inter-generational equity that current consumption should be financed out of current taxation.

When it comes to public investment, however, there is no such evidence that current public expenditures are at the expense of growth prospects, rather the opposite. Since many of the direct and indirect benefits are likely to be long-lived, nor is there any presumption that public investments should be financed out of current receipts any more than private investment should be financed out of current income.

Figure 8: Government Investment Levels Across the OECD in 1993
(Government investment/GDP)



Source: ABS via DX database.

One important and potentially very beneficial policy move would be to separate out the current consumption and public investment components of the government budget in order to promote separate debates on appropriate levels of expenditure and sources of funding, and to move away from the economically vacuous obsession of commentators and markets alike with the composite 'bottom line' of current cash flow. Such a move could create the conditions for an informed and rational debate about the level and direction of public investment and borrowing. Such a debate would be greatly helped if at least some of the current macro-modelling of fiscal policy would recognise the widespread evidence of private-sector productivity gains arising out of public-sector investment.

An important part of this debate should concern the extent to which public expenditure on education should be seen as contributing to private benefits as opposed to external effects and social returns. The econometric and case study evidence suggests high social returns to investment in human capital, and important demographic and social consequences resulting from women catching up on male educational attainment. There is as yet insufficient evidence from the aggregate growth studies to distinguish clearly between the different levels and types of educational investment. Nevertheless, it seems clear that continued improvement in the educational attainment of Australians is a vital ingredient in both current welfare and future growth prospects.

When it comes to research policy, it is much less clear what should be appropriate public policies for a relatively small population in a resource rich country. Whilst feedback loops in the development of the world's knowledge stock may well be the driving force behind much of what we loosely term technological progress, it is less evident that a country like Australia need be at the forefront of this knowledge creation. A free-riding strategy might well be optimal. On the other hand, there is substantial microeconomic evidence that the ability to absorb appropriate knowledge does depend to some extent on maintaining one's own research capability and research networks. There appear to be compelling arguments that one important way of maintaining such a research capability is to facilitate cooperative research ventures and industry-wide research boards.

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Discussion

1. Bharat Trehan

Steve Dowrick has done an excellent job in mapping the formidable and complex terrain of long-term growth. I found his paper to be a cogent and useful perspective on the determinants of growth, and I am sure that you did as well. In a relatively short span, he has given us some of the stylised facts on growth, surveyed some of the new growth models and has presented a critical overview of the empirical evidence on the determinants of growth. In addition, the paper contains some interesting and unexpected results. For instance, I would not have guessed that initial conditions would explain such a large proportion of the variance in post-war growth rates of countries in Asia and the OECD. Another example is his discussion of the relationship between government expenditures and growth, which I found quite illuminating.

This paper covers a great deal of ground, and it would be hard for me to respond to all the issues that have been raised. My own comments, therefore, will be more limited; they can be divided into two parts. First, I want to comment on a couple of interrelated issues that the paper focuses on – specifically, the recent rapid growth in East Asia and what it tells us about catching up and convergence. Second, I want to talk about the role of policy in growth, and cover some aspects that Dowrick has not discussed as much. (Since Andersen and Gruen, in this Volume, talk about the role of macroeconomic policies and growth, I will stay away from those questions.)

Convergence

One of the important themes in the paper is that the rapid growth in East Asia over the past three or four decades represents the process of catching up with developed economies. In other words, a substantial part of the difference in growth rates between the members of the OECD and countries in East Asia can be explained by differences in initial income levels. This view implies that one should not read too much into the fact that the OECD economies have not grown as fast as the East-Asian economies over this period, and that the discrepancy in growth rates between the two groups will be eliminated as the rate of growth of the East-Asian economies slows down towards that of the more mature economies.

This argument appeals to me, and indeed, it is one that I would make myself. However, I am not quite sure that I would be willing to take the next step that Dowrick takes, which is to suggest that the growth experience of the East-Asian economies over the past three or four decades may not be that unusual. Specifically, while it is not difficult to find some members of the OECD that have grown as fast as the countries in East Asia over a ten year period – controlling for initial income, of course – it is much harder to do so once the post-war period is taken as a whole. Thus, an important reason why the East-Asian experience is unusual is that the high growth rates have been sustained for several decades.

Another way to put the East-Asian experience in perspective is to compare it with the behaviour of other countries that also had low levels of income (or of labour productivity) at the beginning of this period. In other words, if these sustained, high growth rates are not that unusual for low-income countries, why didn't other low-income countries grow at the same pace? Dowrick's answer is that for a large number of countries the problem was a productivity level that was too low. Specifically, the level of productivity in these countries was so low that they did not have the capability – in terms of education levels, infrastructure, etc. – to absorb foreign technology and grow. The consequence is the emergence of 'convergence clubs,' with low-productivity economies converging to an equilibrium with little or no growth.

I find the idea that one needs a minimum level of skills to absorb foreign technology to be a reasonable one. And certainly the concept of convergence clubs enjoys widespread support. For instance, in recent work using very different techniques, both Baumol (1994) and Quah (1995) find support for this concept. However, it is worth pointing out that even if one accepts that sustained growth occurs once productivity levels of four to five thousand (1985 US) dollars per worker are attained, one still has to explain why most less-developed economies have failed to attain these productivity levels over the post-war period.

Note also that not all countries fit neatly into this scheme. Dowrick points to the case of Latin America as an exception, and labels it a 'puzzle'. I suspect that it will not be the only puzzle for long. Labor productivity in the old Soviet Union, for instance, exceeded ten thousand (1985 US) dollars per worker in 1989 (according to the Heston-Summers data). It is not obvious to me, at least, that their growth path over the next couple of decades will look more like the recent performance of East Asia rather than that of Latin America. Of course, this is not a problem for the convergence-club model alone; the more general point is that the growth rate of an economy depends on a large number of factors, so that no simple model or scheme can satisfactorily account for the growth experience of every country.

The Role of Policy

I want to turn to the second factor that I had mentioned before – that is, the role of policy in growth. In his paper, Dowrick talks about certain kinds of policies such as expenditures on education. Here I want to talk about other policies that also might be important for growth.

Let me begin by describing some recent work by Sachs and Warner (1995), according to whom convergence clubs are better defined by the policy choices made by countries. 'Appropriate policies' can be divided into two subsets: those relating to property rights and those relating to how open the economy is. Under the property rights test, a country fails to qualify if it has either a socialist structure, or extreme domestic unrest (revolutions, strikes, war) or extreme deprivation of civil or political rights. (Note that Dowrick's exclusion of the former Soviet Union and the eastern bloc countries from his regressions is consistent with this criterion.) A country fails the openness test if either a high proportion of imports or exports are subject to quotas or if it has a black-market premium that exceeds the official exchange rate by 20 per cent. They show that about 35 countries qualify on these two criteria. It turns out that low-income qualifiers have grown faster than non-qualifiers, and faster than high-income qualifiers as well. (China, with close to two decades of extremely rapid growth, is an obvious exception here.) Finally, the group of qualifying countries are shown to converge unconditionally.

The kinds of policies Sachs and Warner are recommending are not very controversial; basically, they are stressing the need for good institutions. To borrow a phrase from Michael Sarel's paper, most economists would put them in their list of 'good' policies. Things get more controversial once one gets beyond this point. However, since my priors are that other kinds of government policies can make a positive contribution to economic growth, I will briefly discuss some of the recent work that supports such a conclusion. An important example is a recent paper by Page (1994) of the World Bank, who (in a discussion based on the World Bank report) assigns a central place to government policies that help firms become more export oriented. More specifically, he states that the promotion of manufactured exports was a significant source of measured total-factor productivity change in East Asia.

Since enough has been said on the issue of policies that encourage exports, I will not pursue it further here. What is interesting to me is that a lot of these policies look like industrial policies, in that East-Asian governments were targeting specific industries. South Korea, to take one example, used selective credit subsidies and export targets for individual firms. As you probably already know, not everybody agrees with such a statement. John Page (for example) draws a sharp distinction between the two kinds of policies, and does not believe that industrial policies contributed very much to the rapid growth in East Asia.

Since there are a number of ways to interpret evidence such as the South Korean experience, it is useful to ask if there is more formal support for this position. It turns out that a number of recent models – some of which Dowrick cites in his paper – can be used to support such a position; specifically, these are models that feature increasing returns and exhibit (demand or technological) complementarities across sectors. According to these models, policies that subsidise groups of industries which exhibit strong complementarities could lead to a permanently higher level of output. I am not claiming that such models provide us with a clear-cut case for large scale intervention; for example, in practice it may be hard to identify sectors whose growth would lead to large positive externalities for other sectors.

For most countries in the world, however, the problem may not be one of having to identify the sectors with such complementarities; they could simply get by looking at the experience of the 'leader' country (or at the experience of a small group of leaders). Indeed, one important reason why industrial policy may have made a positive contribution in East Asia may be that the course to be followed had already been chartered by the developed nations over the last century or so. Thus, government policy may have a somewhat different role to play in 'follower' countries. It is worth noting out that this distinction between the role of policy in leader and follower countries echoes Dowrick's prescription for research policy in Australia.

Let me conclude by reiterating that I am not claiming that government policies will have unambiguously positive payoffs, or that such policies will be easy to implement. However, I believe that government policies potentially have a significant role to play in determining an economy's growth rate, and that the recent experience in East Asia, in particular, suggests that this potential can be quite large.

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2. General Discussion

While there have been highly disparate growth performances in the post-war period, it was observed that groups of countries exhibit similar growth patterns so that they form convergence clubs. Initial levels of income appear to be a major determinant of this. However, a more important question than the process of convergence is what *causes* initial conditions to differ across countries. For this reason it was argued that it may be more useful to define convergence clubs in terms of policy choices. For example, policy choices with respect to institutional arrangements (such as systems of property rights) or macroeconomic objectives (such as inflation performance or trade exposure), can be expected to influence growth performance.

Given that initial conditions vary across regions, another theme for discussion was why some countries, such as those in Latin America, failed to exploit their promising initial conditions. This raised a debate about the role for policy.

Policy was considered by some to be of fundamental importance. Others considered it to be less important than the 'natural' growth dynamic, although it was generally agreed that some role for policy existed in 'getting the basics right' in terms of macroeconomic stability, a good system of property rights and integrity of the financial system. Disagreement related to the efficacy of specific growth-promoting policies, such as strategic industry policy and whether it had played a role in East Asia's success. Even where this was believed to be the case, it was acknowledged that there is great difficulty in identifying the causal effect of policy.

Some argued that attention should not be confined to post-war patterns of convergence. Taking a more historical perspective, growth performance since the 1850s indicates that the post-1950 era marks superior growth performance for *all* countries, not just East Asia. Understanding this feature of the data is crucial to predicting whether per capita income levels in East Asia will eventually be constrained to those levels possessed by leading OECD nations, or whether they will surpass the income levels of the first world.

However, East-Asian growth has already been sustained for longer than in European countries in their hey day, leading some to claim that East Asia *is different* and does not fit the convergence club story because it continues to grow at extraordinary rates. But perhaps comparisons of the performance of cities such as Hong Kong and Singapore with other countries is unreasonable; typically the performance of cities leads that of the hinterland. As one discussant put it, we need only be impressed when per capita income in Hong Kong exceeds that of Manhattan.

Discussion of economic performance in cities and the hinterland raised debate about other influences of geography on economic performance. Were there ‘coat-tail effects’ of living next door to a high performing economic region? Was there the possibility of catch-up and convergence between regions within a country?

The issue of why we have a new era of highly disparate growth performance remained unresolved. The surge of productivity that permitted the advanced economies to ‘take off’ in the 1950s may have reflected the arrival of a wave of invention and ideas. It may have also reflected the focus of business on maximising market share and a tendency to be geared for upswings. Now it could be argued that firms are focussed on surviving downswings, and that there has been a depletion of ideas and innovation that awaits a new wave. The reality, though, is that the leadership of economic performance changes hands only infrequently. Despite the acceleration of per capita income growth in the newly industrialising countries, for most, income levels still remain significantly behind those of the post-war leaders.

Measuring Economic Progress

Ian Castles*

1. The Evolution of the International League Table

Economists have been inquiring into the nature and causes of the wealth of nations for centuries,[1] but the regular and systematic construction of official quantitative measures of relative economic progress is a phenomenon of recent decades. A key role in this transformation was played by Colin Clark, who held that '[c]omparisons of economic welfare between one community and another, one economic group and another, and between one time and another, are the very framework of economic science' (Clark 1951, p. 16).

Clark's Joseph Fisher Lecture in Commerce at the University of Adelaide in 1938 was a milestone, because it was in this lecture that the idea of using the national accounts framework to express the average incomes of countries at a common price level was first developed and applied. Drawing upon material from what was his forthcoming book, *Conditions of Economic Progress*,[2] Clark attempted to quantify 'the absolute levels of economic progress so far achieved in different countries'. He explained that this was a difficult statistical task consisting 'in essence ... of measuring the real national income of the countries concerned, which amounts to the same thing as the actual equivalent of goods and services produced ... *measured at an international price level*' (Clark 1938, p. 9, emphasis added).

In the course of the lecture, Clark presented estimates of the average income per occupied person at work in various countries in 1936 or 1937, measured in international units of purchasing power (IUs). One IU equalled the average amount of goods and services purchasable with one American dollar, over the period 1925-1934. According to these calculations, the highest average real income per occupied person at that time was in New Zealand (2,040 IUs), followed in order by the United States (1,948 IUs), Great Britain (1,402 IUs) and Australia (1,363 IUs).[3]

The significance of Clark's pioneering work in comparing average income levels in different countries at international price levels has now been recognised.[4] In the 1990s,

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1. In fact, the full title of the most famous economics text, published in 1776, was *An Inquiry Into the Nature and Causes of the Wealth of Nations*, by Adam Smith.

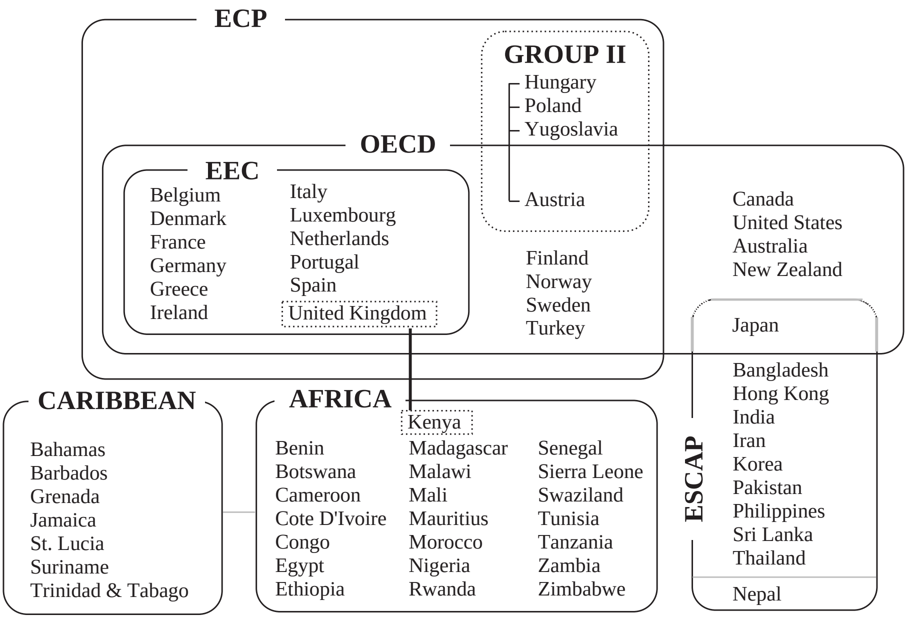
2. The first edition of *Conditions of Economic Progress* was published in 1940, and was dedicated to 'W. Forgan Smith, LL.D. ..., Premier of Queensland, A Far-Seeing Patron of Economic Science'.

3. See Clark (1938, p. 9) for further details.

4. See Arndt (1979, pp. 121-124) and references cited therein.

however, inter-country comparisons of real product and incomes are no longer the province of individual scholars. The United Nations International Comparison Programme (ICP), which began in 1967, has developed into a world-wide statistical enterprise which aims at obtaining internationally comparable data on total and per capita gross national product (GNP), by taking account of the purchasing power differences of the currencies in which national estimates were originally compiled.[5] In 1985, the ICP conducted a benchmark exercise, the results of which were published in 1994 (UN 1994).[6] For this Phase of the ICP (Phase V), comparisons were initially made within six regions or country groups: Africa, the Caribbean, Asia and the Western Pacific, the EEC, a broader European grouping comprising the European Comparison Programme (ECP), and the OECD. Since each study employed the same technique, regional results could be linked to form a global comparison if a country was represented in more than one of the regions, or through bilateral comparisons between two countries belonging to different regions. The global framework of this exercise is illustrated in Figure 1.[7]

Figure 1: Global Framework of the 1985 ICP



5. See United Nations and Commission of the European Communities (1994), hereafter referred to as UN (1994).

6. Organisations participating in various aspects of the benchmarking exercise included the World Bank, the University of Pennsylvania, the Statistical Division of the United Nations Secretariat (UNSTAT), the Statistical Office of the European Communities (EUROSTAT), the Organisation for Economic Co-operation and Development (OECD), the Economic Commission for Europe (ECE), the Economic and Social Commission for Asia and the Pacific (ESCAP) and the Austrian Central Statistical Office.

7. For a detailed exposition see UN (1994, pp. 9-19).

In the *World Bank Atlas 1995*, ICP results were extended to non-participating countries, and extrapolated to 1993 for participating countries, in order to present, for around 130 countries, a new measure of GNP per capita converted at purchasing power parity (PPP). This PPP-based measure was designed to offer '... an alternative view of a country's income level relative to others *by using international prices to value domestic production*' (World Bank 1995, p. 2, emphasis added).[8] According to the World Bank's rankings (the current official 'league table'), the relative average income levels of the 25 richest countries in 1993 were as shown in Table 1: the bracketed figures show the rankings in the late 1930s, according to the estimates given by Clark in his Joseph Fisher Lecture.

As was to be expected, the aspect of the new comparisons that attracted most attention in the Australian media was the indicated relationship between Australia's income level and those of the most successful economies to its north. Under the heading 'Aust slides below HK and Singapore', the *Australian Financial Review* noted that 'Australia ... lags well behind Singapore and Hong Kong in the World Bank's alternative new purchasing power parity measure of material living standards, which adjusts individual country's per capita [GNP] for their price levels'.[9] This was a correct interpretation of the reported estimates but, as we shall see, it is questionable whether the reported estimates for the relevant countries reflect the reality.

Another aspect of the reported comparisons deserves emphasis. The current official league table shows most of the rich countries as having quite similar levels of average income. Australia, with an indicated average per capita income in 1993 of int$18,490, was one of ten countries with average incomes of between int$17,500 and int$19,500. And Australia stood in the middle of 20 countries whose average incomes were within a range of $\pm$20 per cent of the Australian average. Only the United States and four small and atypical countries were above this range. This concentration of the average income levels of the richer countries in a relatively narrow range suggests that the oft-used league table analogy is inapposite, and the associated concentration of attention on precise rankings is misplaced.

A league table of teams in a sporting competition records unambiguously the precise outcome of a series of contests, according to pre-determined rules. If the purpose of the rankings is to separate the teams which reach the finals from those that failed to do so, it is irrelevant that the margin between the lowest ranked of the former and the highest ranked of the latter may be a fraction of a percentage point on a countback.

For a number of reasons, the rankings in Table 1 have no such significance. First, they have been determined following the application of PPPs rather than actual exchange rate

8. However, readers are asked to note that '... because of differing statistical systems and methods of collection among economies, the indicators are *not always strictly comparable* in coverage and definition' (World Bank 1995, p. 2, emphasis added). It was not made clear, however, that the range of error involved in the PPP estimates is far greater, and the conceptual issues raised are far more formidable, than in the case of other country indicators published by the Bank (such as the demographic characteristics of countries, their exports and imports, or the industrial origin of their GNPs). Nor was it mentioned that the responsibility for PPP estimates does not rest with national statistical authorities (with the single exception of the Austrian Central Statistical Office), but with the international organisations and other coordinating bodies listed in footnote 6 above.

9. *Australian Financial Review*, 3 January 1995, p. 5.

Table 1: GNP Per Capita at Purchasing Power Parities in 1993 International Dollars

Rank	Country	int$
1	Luxembourg	29,510
2	**United States (2)**	**24,750**
3	Switzerland[(b)]	23,620
4	United Arab Emirates[(b)]	23,390
5	Qatar[(b)]	22,910
6	Hong Kong	21,670
7	Japan	21,090
8	Germany[(a)]	20,980
9	Singapore[(b)]	20,470
10	Canada	20,410
11	France	19,440
12	Norway	19,130
13	Denmark	18,940
14	Austria	18,800
=15	**Australia (4)**	**18,490**
=15	Belgium	18,490
17	Italy	18,070
18	Netherlands, the	18,050
19	**United Kingdom (3)**	**17,750**
20	Sweden	17,560
21	Iceland	17,160
22	Bahamas, the[(b)]	16,820
23	Cyprus[(b)]	15,470
24	**New Zealand (1)**	**15,390**
25	Finland	15,230
34	Korea[(c)]	9,810
35	Argentina	8,630
:		
37	Malaysia	8,630
:		
45	Thailand	6,390
:		
75	Indonesia	3,140
:		
80	Philippines	2,660

Notes: (a) Former Federal Republic of Germany.
(b) Obtained from regression estimates.
(c) Republic of Korea.
Figures in parentheses are the rankings of relative average income levels from Clark (1938).
int$ are international prices denominated in 1993 US dollars.

parities, so they do not report the output of a competition (even in the sense of 'competition for markets'). Second, the numbers summarise the outcome of a myriad of transactions and are, therefore, inevitably subject to large errors of measurement. Third, even if the terms of every transaction were known and were included in the calculations, there would be no 'correct' way of aggregating those transactions in order to establish, without ambiguity, the average real income of one country compared with another. Finally, and most importantly, there is no agreement, and there is no prospect of agreement, about the concept of 'income' of which it is always better to have more rather than less.

Depending on the context, our interest might be in the measure of output that is aggregated in the system of national accounts or in alternative measures. For example, our interest might be in measures of output that take account of items not identified in the national accounts; such as unpaid and voluntary work, changes in stocks of natural resources, or in measures which seek to comprehend less tangible aspects of well-being or the quality of life. Our interest might be in a measure of income per some unit; such as per hour worked, per capita, per employed person, or some augmented measure of labour,[10] or per unit of some composite of factor inputs. Alternatively, our interest might be in the income of individuals in particular circumstances; for example, the median wage and salary earner, the retired or the unemployed, or the income of particular types of households (such as single income or single parent households).

In short, the measurement of income levels at PPPs raises formidable conceptual and practical difficulties which are not properly recognised in bland explanations that 'international prices' have been used to value domestic production, or that the estimates are 'not always directly comparable'. Even if all of these difficulties could be overcome, there would be marked shifts in the rankings of the high-income countries of the 1990s depending on which concept of income or output was seen as most relevant for the purpose at hand.

The dangers of the league table approach to the assessment of economic performance were encapsulated by Stein (1990, p. A16):

> '... a moment's reflection will show that [our] standard of living, or ... personal welfare, .. does not depend on our being ahead of anyone else ... Our real problem ... is not to get richer than someone else or to get richer faster than someone else but to be as good as we can be, and better than we have been, in the areas of our serious deficiencies, such as homelessness, poverty, ignorance and crime.'

Stein (1990) was actually speaking of the American experience. However, in the Australian context, similar concerns about league tables have been expressed. The Vernon Committee (1965), in its assessment of Australia's post-war development and prospects for future growth, was reluctant to compare economies and claimed that Australia's performance could not be judged by '... its place in any simple ranking of so called advanced countries ...' (para 2.21). More recently, Gruen (1986) has been critical of such rankings, arguing that Australia's slide down the 'totem pole' of per capita income has given rise to somewhat exaggerated concerns about the nation's economic performance. He has maintained that non-economic factors probably 'loom large' in any adequate explanation of why some countries achieve faster growth than others.

10. Such as one that allows for differences in education, skills and/or experience.

It is not the purpose of this paper to deny that summary measures of average per capita incomes, arranged in the form of league tables, may be a useful analytical tool. It will be argued, however, that there is a need for greater circumspection in the use of such comparisons, and for a more informed understanding of their limitations. In particular, it needs to be recognised that aggregates of values cannot meaningfully be compared ‘at international prices’ if there are large differences in the price *and* quantity relativities applicable to many of the components.

The paper is organised as follows. Section 2 presents estimates of relative real GNP per capita over this century. Sections 3 to 5 deal with a range of conceptual and practical difficulties associated with the identification of these relativities. Alternative approaches are then considered in Sections 6 to 8. They are shown to yield rankings of economic performance that differ significantly from those in conventional tables. Section 9 then reflects upon the way in which measures of Australia’s relative economic performance reflect social choices. Section 10 places these choices in an historical context, and some impressions of earlier relativities are offered. Finally, conclusions are drawn.

2. Indicative Estimates of ‘Real’ GNP Per Capita: 1900-1993

The ‘official’ World Bank (1995) estimates of relative contemporary income levels in Australia and in 16 other countries are exhibited in a long-term context in Figure 2. The 1993 official estimate of Australia’s real GNP per capita is backcast to 1900, using IMF estimates of annual growth rates in recent years and those reported by Maddison (1989) for earlier years to construct the time series. (For a detailed data description see the Appendix.) Comparable time series for six groups of other countries have been constructed and plotted against the estimates for Australia.

The vertical scale in each panel of Figure 2 is logarithmic, so that equal vertical distances represent equal *proportional* differences in estimated levels of GNP per capita at purchasing power parities (in international prices denominated in 1993 US dollars). According to these estimates, the bunching of the average real incomes of a large number of countries at about the same level is a relatively recent phenomenon: before World War I, the indicated average real income levels in the United States and Australia were around twice those of most countries of continental Europe, which in turn were about twice those of the highest income countries in Asia (the Philippines and Japan).

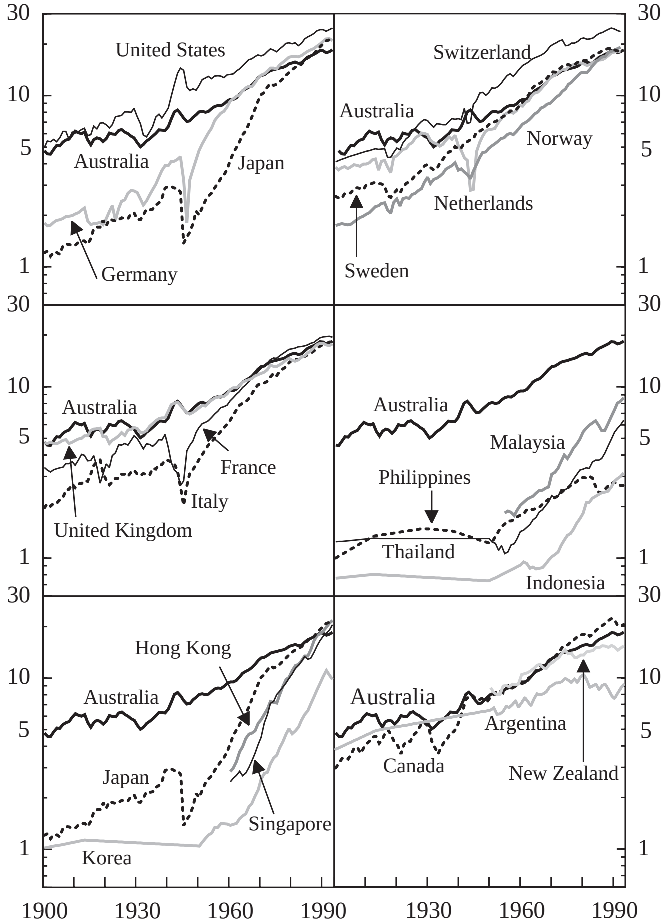
Figure 2 presents the picture of Australia’s relative position over time which has come to be generally accepted. On the one hand, the per capita growth rates of most countries in Europe, and of several countries in East Asia, have been much faster than that for Australia. In fact, the estimates suggest that many of these countries have now achieved an indicated average income level that is at least comparable to, and in several cases is higher than, Australia’s. On the other hand, however, the country’s per capita growth rate has been substantial in an absolute sense (for example, at a rate sufficient to provide each generation with a standard of living notably superior to its predecessor).

Much concern has been expressed in Australia in recent times about the decline in the country’s relative position on the real income scale.[11] This loss of relativity has arisen

11. This debate has been well articulated by Gruen (1986), and more recently by Dowrick and Nguyen (1989) and Dowrick and Quiggin (1993).

Figure 2: Real GNP Per Capita in Selected Economies (1900-1993)

PPP int$'000 (log scale)



because the *growth rate* of Australia's real GDP has been lower than that of most other high-income countries; it does not depend on the reliability or otherwise of the results of PPP studies. Most of the countries whose average real incomes were formerly much lower than Australia's have now 'caught up'.[12] However, for the reasons advanced by Stein (1990), and because of fundamental questions about whether meaningful relativities can be established in the first place, this should not of itself be cause for concern.

A final general point is that the focus of attention on the countries at the top of the league table introduces selectivity: the countries on this list are those that have always been near the top, or have had the fastest growth in average real incomes, in the modern era. We are, therefore, comparing ourselves with the countries that have been most

12. For a detailed discussion of the phenomenon of catch-up and convergence see Dowrick and Nguyen (1989) and Dowrick in this Volume.

successful. Whilst Australia is not among the leaders of this elite, we are clearly ahead of most of the pack.

But what precisely do measures of real income levels indicate about relative economic performance? There are many conceptual and practical difficulties associated with benchmarking these measures to form international comparisons. Backcasting data to form an historical profile of relativities poses even further challenges. The strategy adopted in this paper is to demonstrate the limitations of real income levels as indicators of relative economic performance, and then to provide alternative evidence of relativities, both for the benchmark period and for specific episodes.

3. Methodological Problems of the ICP Approach

Although indicative estimates of real GNP per capita are expressed in 'international prices denominated in 1993 US dollars' the observations charted in these figures should not be seen as estimates of value, but as *index numbers of relative economic quantities*.[13] The essence of ICP comparisons lies in the *relativities* of average magnitudes between countries and over time, and the expression of those relativities in terms of international prices denominated in US dollars is purely a matter of convenience. The results could be expressed in any other currency: for example, those for the 20 countries participating in the ECP 1985 (see Figure 1) were initially reported in terms of international prices denominated in Austrian schilling.

The real GNP per capita estimates published by the World Bank for 1993 were derived from estimates initially relating to other years in a variety of ways. Those for the countries of the European Union were extrapolated from benchmark EUROSTAT estimates for 1990; those for other OECD countries were also extrapolated from 1990, from an extension of the EUROSTAT study by the OECD;[14] those for other countries participating in the ICP were extrapolated from the 1985 reference year of that Programme; and those for countries not participating in the ICP (including Singapore) were estimated from the results for participating countries by regression analysis.[15]

In brief, the best-performing regression models utilise capital city price surveys conducted as part of a programme designed to equalise the real incomes of public servants and business executives assigned to countries around the world. While the price indices designed for this group do not properly reflect the prices or relative quantities of goods consumed by nationals of these countries, a structural relationship was found between the measures of purchasing power derived from these price surveys and those derived from the prices ordinarily used in the ICP. This relationship was then used to form PPP comparisons with non-ICP countries.

The accuracy of these regression estimates, in terms of a 95 per cent confidence interval, is guessed to range from ±60 per cent for low-income countries, to ±15 per cent for countries with per capita incomes up to seven tenths of that of the United States

13. For a discussion of the concept of economic quantity, see Wilson (1946), especially pp. 6-8.
14. This study relied to a substantial extent on product specifications developed for the purpose of making PPP and real product comparisons between European countries.
15. A description and assessment of the methods used to extend PPP comparisons to non-ICP countries is provided by Kravis and Lipsey (1990, pp. 21-26, 43-48).

(Summers and Heston 1991, pp. 341-342). Given the similarity of the PPP-adjusted per capita estimates reported in Table 1, these wide confidence intervals suggest that the reported rankings are of particularly low significance for countries (such as Singapore) that did not participate in the ICP. In addition to this basic qualification about the interpretation of league table rankings, there are several specific difficulties which affect the reliability of ICP comparisons.

Summers and Heston (1991) present the outcome of the ICP in its most extensive form and outline the methodological approach of the ICP benchmark studies in the following terms:

> 'Basically, an ICP benchmark study is a pricing exercise. Prices of hundreds of identically specified goods and services prevailing in each participating country are collected and processed. The price comparisons that emerge are estimates of price parities for each country's currency at a number of aggregation levels, including an overall purchasing power parity... The price parities and PPPs are used to convert the countries' national currency expenditures to a common currency unit, thus making real quantity comparisons across countries possible.
>
> The ICP divides up ... GDP into about 150 detailed categories (approximately 110 consumption, 35 investment and 5 government). All of a country's individual final output items are assigned to one or another of the categories. The ICP central office works with national data of two sorts from each participating country: national prices for between 400 and 700 particular items; and national expenditures for each of the 150 detailed categories.
>
> For the prices to provide a meaningful basis for determining relative quantities, *it is of the utmost importance that they refer to the same items,* that is, of the same quantity and quality, *from country to country*. ... To this end, specification manuals giving closely detailed technical descriptions of over 1,500 commodities, services and labour inputs have been developed that cover the universe of all items priced in any country' (Summers and Heston 1991, p. 329, emphasis added).[16]

The emphasised statement may appear to be the obvious expression of an essential requirement of a programme that seeks to provide reliable estimates of real quantities. In fact, it conceals a fundamental problem. The practical situation is that the items which are identical in quantity and quality *between* countries are often *not* the items which are most typical or representative of the relevant area of expenditure *within* every country. In the countries in which the items priced are less typical of the purchases made, it would usually be the case that the more typical items provide the buyer with better value for money than the items priced in the ICP. Indeed, it is the 'value for money' consideration that has, in many cases, made a particular product 'typical' of spending. The resulting economies of scale may well make that product progressively cheaper than the more internationally comparable alternatives. The point is best illustrated by some examples.

The list of passenger cars in EUROSTAT's 1985 PPP study, for which the OECD sought prices from its non-EEC members, included 10 diesel engine and 81 petrol-engine vehicles. Of the latter, only five had an engine capacity exceeding 2 litres. But no cars representative of the bulk of the Australian market (locally-produced models with an engine capacity of 3 litres or more) were included in the OECD comparison. In the outcome, therefore, nominal expenditure on passenger vehicles in Australia was revalued

16. See also Kravis, Heston and Summers (1978) for a discussion of these measurement issues.

for PPP purposes using a price parity relating to vehicles that were not typical of the Australian market.

For refrigerators, the OECD 1985 list taken over from EUROSTAT's comparison included five single-door models which had an average capacity of 170 litres; and 11 two-door models with an average capacity of 290 litres. At this time, the Australian consumer magazine *Choice* reported that 50 per cent of the Australian refrigerator market was held by two-door cyclic-defrost models, and tested 13 such models (9 of which were of Australian or New Zealand manufacture) which had an average capacity exceeding 350 litres.[17] The refrigerator in the typical Australian kitchen was grossly under-represented in the PPP comparison.

The statistical experts at the OECD have recognised this problem and, in cooperation with the statistical agencies of non-EEC member countries, have sought to take some account of it (mainly by being less rigorous about ensuring precise identity of specifications than the Summers and Heston paper suggests is necessary). There are, however, limits to the scale of the *ad hoc* improvements which can be effected in this way when the resources available for the purpose, both at the OECD and in the national statistical offices, are minuscule. There can be little doubt that the PPP estimates for Australia (and also for Canada, New Zealand and the United States) are substantially affected by the fact that the list of items for which prices are sought was initially prepared for the purpose of supporting comparisons between European countries. A programme which had recognised the need to take account of North American and Australasian conditions from the outset would probably have identified significantly higher levels of real product, relative to those of European countries, than does the ICP.

4. Conceptual Problems in Inter-Country Comparisons

Having regard to these enormous practical and conceptual difficulties, it is perhaps surprising that the ICP results have been accepted by most scholars as reliable and accurate measures of relative levels of real income, and even of living standards or economic welfare, between countries and over time. In contrast, Colin Clark's estimates of the average income in different countries in the late 1930s were greeted with considerable scepticism, largely because of the conceptual constraint known to statisticians as 'the index number problem'. The significance of the index number problem in relation to comparisons of real income was well articulated in 1939 by E. (later Sir) Ronald Walker, Professor of Economics at the University of Tasmania. In an essay published soon after Clark's Joseph Fisher Lecture, Walker suggested that, for scientific purposes, the term 'standard of living' should be abandoned; and he considered that a concept such as the average real income:

> ' ... can be calculated, and has meaning, only if we accept certain conventions, which rest on assumptions regarding similarity of culture. But ... the comparisons in which we would be most concerned are comparisons between countries ... in which these conventions cannot be accepted. Our conclusions, therefore, are somewhat negative. Not only are most international comparisons of living standards misguided in intention, but those to which approval can be

17. *Choice*, October 1984, pp. 34-39.

accorded are practically impossible; except between nations which resemble each other so closely as to rob the comparisons of much of their interest. The most useful work in this field, from the scientific viewpoint, will be found not in the reduction of highly doubtful differences in living standards to spuriously precise indexes, but in the comparative study of the actual content of typical family budgets of different classes in the relevant countries.'[18]

In raising these doubts about the possibility of making quantitative comparisons of real income levels between countries with widely differing cultures, Walker was repeating concerns that had been voiced for decades by statisticians and economists. Perhaps their most famous expression was by Keynes (1909) in an essay entitled 'The Method of Index Numbers with Special Reference to the Measurement of General Exchange Value', for which he won the Adam Smith prize for that year.

Keynes criticised official British estimates of relative levels of real wages in different districts of the United Kingdom. He reproduced from the official report a statistical table which purported to show that real wages in London were 3 per cent higher than in Ireland, and then rearranged the same information in a way which appeared to show that real wages in London were 2 per cent *lower* than in Ireland (see Great Britain (1908)). He claimed that both results were arbitrary:

'The arbitrary element enters in when we decide what standard quantity of food corresponds to a given standard quantity of house-room. ... If the standard is fixed for all districts with reference to what is actually the standard in London, we get one result; and if we fix it with reference to what is actually the standard in the Midlands or in Ireland, we get a different result. Which of these standards we choose is, from all points of view, wholly arbitrary' (Keynes 1910, p. 180).

In his more detailed exposition, Keynes distinguished between two kinds of difficulty which arose in the use of index numbers to measure economic quantities:

'In the first kind, the quantities in question are perfectly definite and capable of measurement, but the information at our disposal is incomplete. Our task consists in making as accurate a measurement as we can by using what statistics we have. In the second kind the quantity itself is not, in the strictest sense, capable of numerical measurement at all. We must adopt some conventional, but practically useful, measure and our task mainly consists in elucidating the quantitative aspect of the concept in question ...

We have in "the cost of living" a conception which is *prima facie* measurable. We should say that the comparison of the cost of living in two different places requires no more than the collection of the necessary statistics. Reflection shows, however, that this is not the case. The difficulty in comparing the cost of living of two sets of people who live under very different conditions is not a statistical one. It depends upon the intrinsic difficulty of saying what scale of living under one set of circumstances corresponds to a given scale of living under a different set. The two things may be numerically incommensurable' (Keynes 1909, pp. 53, 62-63).

The difficulty to which Keynes was alluding must be distinguished from a different issue with which it is commonly confused: that of the difficulty (or impossibility) of making inter-personal comparisons of utility. As Keynes was to argue in his final

18. See Walker (1939, pp. 61, 64). Following a distinguished diplomatic career, Sir Ronald Walker was to be appointed Australia's first Ambassador to the OECD in 1971. In 1930, when he had been a Ph.D. student at Cambridge, Walker 'had been invited ... to become a member of the famous Political Economy Club ... which met every Monday evening during term in Keynes's rooms in King's College ... . When Walker was in Cambridge ... Colin Clark regularly attended meetings' (Cornish 1991, p. 60).

exploration of the problems of comparisons of purchasing power, more than 20 years later:

> '... we do *not* mean by purchasing power the command of money over quantities of utility. If two men both spend their incomes on bread and both pay the same price for it, the purchasing power of money is not greater to the one than to the other merely because the former is hungrier or poorer than the latter. The purchasing power of money is not different to two individuals with equal incomes because one has greater powers of enjoyment than the other. A redistribution of money incomes which has the effect of increasing the aggregate of utility does not in itself affect the purchasing power of money' (Keynes 1930, p. 96).

Thus the particular problem which limited the possibility of comparing average purchasing power was that:

> '... the composite commodities representative of the actual expenditure of money incomes are not stable in their constitution as between different places, times or groups. They are unstable for three reasons – either (1) because the need which the object of expenditure is intended to satisfy ... varies, or (2) because the efficiency of the object of expenditure to attain its purpose varies, or (3) because there is a change in what distribution of income between different objects is the most economical means of attaining the purpose. The first of these reasons we may classify as a change in tastes, the second as a change in environment, and the third as a change in relative prices. For these reasons every change in the distribution of real incomes or in habits and education, every change in climate and national customs, and every change in relative prices and in the character and qualities of the goods offering for purchase, will affect in some degree the character of average expenditure' (Keynes 1930, pp. 95-96).

Keynes went on to examine a number of possible methods of arriving at approximations of the relative purchasing power of incomes, distinguishing between the direct method of comparing incomes of similar persons and various indirect methods of comparing prices of equivalent composite commodities. But there were limits to all of these methods, which Keynes explained in typically piquant illustrations:

> 'We are not in a position to weigh the satisfactions for similar persons of Pharaoh's slaves against Fifth Avenue's motor cars, or dear fuel and cheap ice to Laplanders against cheap fuel and dear ice to Hottentots ... We cannot hope to find a ratio of equivalent substitution for gladiators against cinemas, or for the conveniences of being able to buy motor cars against the conveniences of being able to buy slaves' (Keynes 1930, pp. 104-109).

It is arguable that the differences between the objects of consumption which were available to the many in 1930, and to the few in classical times, were not greater than those which are available to the many in 1995, compared with those available to the few in 1930. The problems of comparing purchasing power 'as between different places, times or groups' in the late 20th century are even greater than those that troubled Keynes, but a world which constantly demands the quantification of the unquantifiable appears to be unable to come to terms with the notion that 'two things may be numerically incommensurable'.

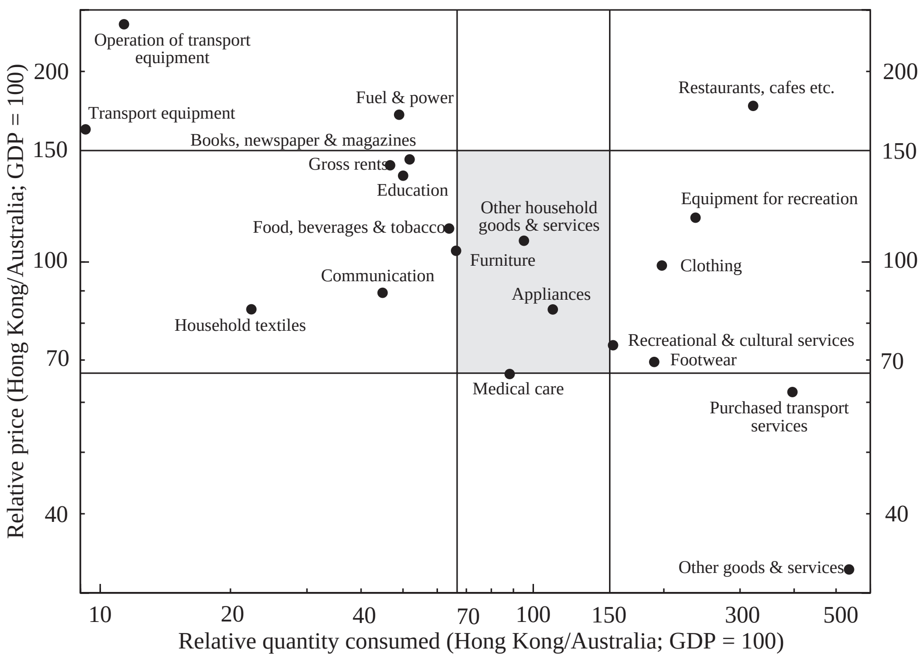
Keynes' doubts about PPP comparisons between groups with widely differing expenditure patterns were not the cautions of an insecure statistician, fearful of sacrificing detail by striking an average, but the strongly-stated verdict of one of the greatest economists after decades of serious reflection. It is remarkable that they have been so quickly set aside, in the uncritical acceptance in recent times of league table comparisons of economies between which there are massive differences in 'the character of average expenditure'.

5. The 'Index Number Problem' in Practice

An example of this uncritical acceptance has already been given: the reporting of the *World Bank Atlas*, PPP-adjusted estimates of real per capita incomes in Australia compared with Hong Kong and Singapore. Such comparisons ignore the serious logical problems identified in the preceding section. In order to demonstrate this, the relationship between the ICP 1985 price and quantity relativities for the main components of final national consumption of Australia and Hong Kong will be examined in some detail.[19]

These relationships are plotted in Figure 3 for each of 20 broad commodity groups. Each of the observations is itself an aggregation of the price and quantity relativities of each commodity within the group and, as such, has its own index number problems. Of the 20 broad commodity groups, there are only four for which the relative per capita quantity consumed in Hong Kong lies between two-thirds and one-and-a-half times that in Australia. And of the 16 commodity groups for which the quantity relative lies outside this wide range, there are six for which the bilateral price relative *also* lies outside that broad range.

Figure 3: Relative Prices and Relative Quantities Consumed in Australia and Hong Kong in 1985



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19. It is not possible to compare these relativities for components of the final national consumption expenditure of Singapore, the other country whose rise in the *World Bank Atlas* rankings was prominently reported in the Australian media. Singapore has not participated in the ICP, but other information, discussed in Section 8 below, suggests that the index number problem which is illustrated here in respect of the Hong Kong/Australia comparison, would apply with equal or greater force in the case of a Singapore/Australia comparison.

Suppose that the relative *prices* of all commodities in the two countries had been the same, so that, for example, the average price of a given quantity of medical care bore the same relationship to the average price of a given quantity of clothing in each. In that case, each of the observations in Figure 3 would lie along a horizontal line at 100, and the relative GDPs of the two countries could be calculated without ambiguity (assuming there were no measurement problems) by valuing the various different commodities, produced in differing proportions between the two countries, at that constant relative-price relationship.

Alternatively, suppose that the relative *quantities* of all commodities consumed in the two economies were the same. In that case, each observation would lie along a vertical line at 100, and an unambiguous computation of the relative price levels of the two countries could be achieved by weighting all of the various price relativities of each individual commodity between the countries by the amount of each commodity consumed.

In fact, however, the ICP results plotted in Figure 3 show that the price *and* quantity relativities of commodity groups differ greatly between Australia and Hong Kong.

In short, the conditions identified by Keynes under which an *approximate* comparison of real quantities could be made are not fulfilled. It is important to recognise that the problem of comparing the PPP and real product relationships between two countries as different as are Australia and Hong Kong would still be there, even if we had perfect knowledge of the quantity and price of every transaction in both countries in the reference period. As Keynes pointed out, the problem with which we are confronted is not a statistical one, but one that arises from 'the intrinsic difficulty of saying what scale of living under one set of circumstances corresponds to a given scale of living under a different set'.

When the World Bank authors make the seemingly simple statement that the PPP-adjusted real income estimates take into consideration the purchasing power differences of the currencies in which the national estimates were originally compiled, they are implicitly asserting that (to use Keynes' words), 'the comparison of the cost of living in two different places requires no more than the collection of the necessary statistics'. But PPP-adjusted measures cannot provide satisfactory measures of the relative real product or the relative price levels in Australia and Hong Kong, because the problem of aggregation is intrinsic. It cannot be overcome (but is, unfortunately, obscured) by multilateral comparisons in which expenditures are revalued in 'international prices' rather than in the prices of one or both of the countries which are the subject of comparison.

As it happens, the ICP revaluation of 1985 nominal expenditures in terms of international prices showed similar levels of per capita final national consumption in Australia (int\$7,946) and Hong Kong (int\$7,710). On average, per capita expenditure on the purchase and operation of transport equipment in Australia was over ten times greater than in Hong Kong, and per capita expenditure on the purchase of transport services (fares) was over three times greater in Hong Kong than in Australia. As Figure 3 shows, there were also large differences in the opposite direction in the price relativities for these groups.

A necessary implication of the existence of such large differences in price and quantity relativities is that the aggregation of the expenditures at international prices is an artificial exercise. The transactions did not take place at international prices and, if international prices *had* prevailed in each of the markets, the quantities of the various commodities consumed would have been entirely different. In the outcome, the relative real income for each country depends to an important extent upon the degree to which the price and quantity relativities for that country differs from the corresponding average relativities for the entire group of participating countries.

The extent to which ICP comparisons can be affected by the aggregation of expenditures at hypothetical rather than actual prices may be judged by a specific example from the 1985 benchmark study. According to the estimates published by the OECD (OECD 1987), the *nominal value* per head of final expenditure on gross rent in Portugal, *at national prices* converted to US dollars at the prevailing exchange rate, was US$85 (OECD Table 16). The so-called *real value* per head of the same component *at average EEC prices* was estimated at US$677 (OECD Table 6). The *real value* per head when measured *at average OECD prices* was US$855 (derived from OECD Tables 7 and 8). And the so-called *real value* per head of final expenditure *at international prices* was US$1,100 (UN 1994, Table 3).

Thus the expenditure on gross rent in Portugal in 1985 was estimated to be 13 times greater when measured at international prices than when measured at the actual values recorded by Portugal's national accountants. Other components of final expenditure in Portugal (the purchase of transport equipment, for example) were estimated to be a *smaller* total at international prices than at the prices which were actually paid.

In Table 2, the so-called real value of expenditure on gross rents in Portugal (US$1,100) is placed in a different context. The table shows the estimated 'per capita real value of final expenditure' on 'gross rents' in OECD countries in 1985. All of the information is reproduced from a table in the official report on Phase V of the ICP (UN 1994, Table 3), with the ranking presented in the form of a league table.

It is obvious from casual inspection that the comparisons in Table 2 do not indicate the relative standards of housing in the OECD countries in 1985. No study of housing conditions at that time could have concluded that Spaniards were better housed on average than Americans; or that Japanese were better housed on average than Australians; or that Portuguese were better housed on average than New Zealanders. Such comparisons are immediately recognisable as wrong by anyone familiar with the housing conditions prevailing in these countries, or with the available statistical information bearing directly on the subject. Yet the real expenditures on gross rent are a significant component of the ICP estimates of real GDP which have attracted such widespread and uncritical attention.

6. An Alternative Approach

The fact that measures of relative real product or relative price levels cannot be satisfactorily measured tends to support the view expressed by Walker that the only international comparisons of living standards to which approval can be given are 'practically impossible'. Walker did, however, suggest an alternative approach which he believed could provide more useful results: 'the comparative study of the actual content of typical family budgets of different classes in the relevant countries' (Walker 1939, p. 64).

Figure 4 provides an illustration of the approach that Walker advocated. The comparison is again between Australia and Hong Kong, with the three pie charts for each

Table 2: Per Capita Real Value of Final Expenditure on Gross Rents at International Prices in 1985 US Dollars

Rank	Country	int$
1	Spain	1,851
2	Japan	1,789
3	Denmark	1,787
4	United States	1,710
5	Sweden	1,681
6	United Kingdom	1,657
7	Italy	1,582
8	Australia	1,579
9	Canada	1,511
10	France	1,326
11	Finland	1,254
12	Luxembourg	1,233
13	Belgium	1,183
14	Austria	1,138
15	Netherlands, the	1,129
16	Germany	1,124
17	Portugal	1,100
18	New Zealand	1,067
19	Norway	890
20	Ireland	727
21	Greece	539
22	Turkey	161

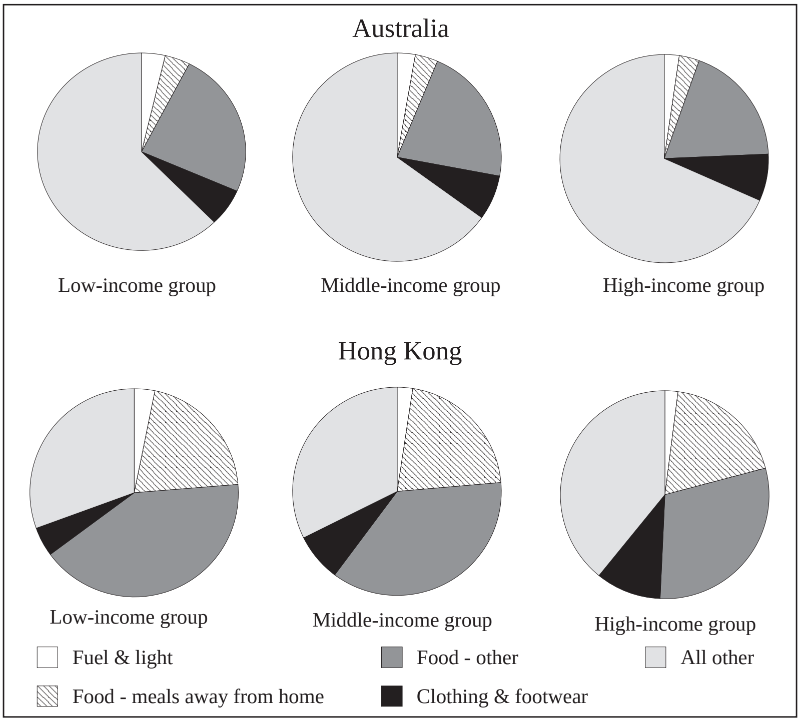
country showing the patterns of household expenditure (other than on housing) of low, middle and high-income groups in the late 1980s.[20] For the low-income group – representing the 50 per cent of households with the lowest incomes – the relevant charts show that the ‘all other’ category absorbed 65 per cent of the non-housing expenditure of Australian households, compared with only 38 per cent for the corresponding households in Hong Kong. The *ratio* of the largely discretionary ‘all other’ component to expenditure on food rises in Hong Kong from 74 per cent at the lower income level to about 130 per cent for the high-income group; in Australia, the corresponding ratio rises from 260 per cent at lower incomes to over 360 per cent at the high income level.[21]

There is thus a striking contrast between the picture shown by a bilateral comparison of the patterns of household spending of different income groups in the two countries, and that shown by a comparison of their real income levels at so-called international

20. For details of sources see the Appendix.

21. As would be expected, the ratio of ‘all other’ expenditure to expenditure on food also rises over time for any given income group. In the case of Hong Kong, this ratio increased from 66.6 per cent in 1979/80 (Hong Kong Census and Statistics Department (1981, Appendix 7)) to 74 per cent in 1989/90.

Figure 4: Expenditure Shares Excluding Housing in Australia and Hong Kong



prices. In the one case, the differences are extremely large; in the other, they are negligible. The contrast does not mean that the ICP comparison is 'wrong', in that the result could be corrected by the substitution of additional or more precise estimates of particular expenditures or prices. It is rather that the ICP type of comparison is *impossible* for the reasons carefully stated by Keynes.

The central point is really quite a simple one. The 'real' value of a money income can only be measured in terms of the goods and services which could be purchased in the markets where that income is actually spent, and cannot be affected by the structure of prices in other markets.

Although the comparative analysis of household expenditure at different income levels does not, of itself, indicate 'real' levels of income or the PPPs of different currencies, it may provide useful guidance on these matters. For example, the analysis exhibited in Figure 4 shows that the proportion of household expenditure devoted to 'fuel and light' was somewhat higher in Hong Kong than in Australia in all three of the income groups which are identified. Other sources reveal that the per capita residential use of electric power (which represents a high proportion of this expenditure component in both countries) is well over twice as great in Australia as in Hong Kong (OECD/IEA 1994a, 1994b). Taken together, these indicators reveal that the unit cost of power for domestic use is, relative to average incomes, much lower in Australia; and that the per capita quantity of power consumed was far higher in Australia.

7. 'Comparison-Resistant' Items

Of course, analyses of household expenditures cannot indicate relative real levels of spending in those areas of final demand for which the real level of consumption of individual households is not closely related to their expenditures. Important examples are the imputed rent of owner-occupied dwellings and publicly-provided or subsidised education and health services.[22] These are, however, precisely the areas in which the ICP approach to inter-country comparisons of real income also encounters its most serious difficulties.

The difficulties in estimating real levels of expenditure on gross rents have already been discussed. In this case, it can be argued that the process of revaluation of the nominal expenditures recorded in the national accounts at international prices is circular and unnecessary. As the individual national estimates for imputed rents have been built up from information about the physical stock of dwellings derived from censuses and housing surveys, the most reliable way of estimating relative real expenditures would be to utilise that information, and to use the national estimates of nominal values only for weighting purposes. In fact, the ICP attempts to make estimates of rentals for 'finely specified housing units', such as a country's rent for an apartment in a 20-year old multi-storeyed building, of 120 square metres, with central heating and one bathroom (Summers and Heston 1991, p. 330).

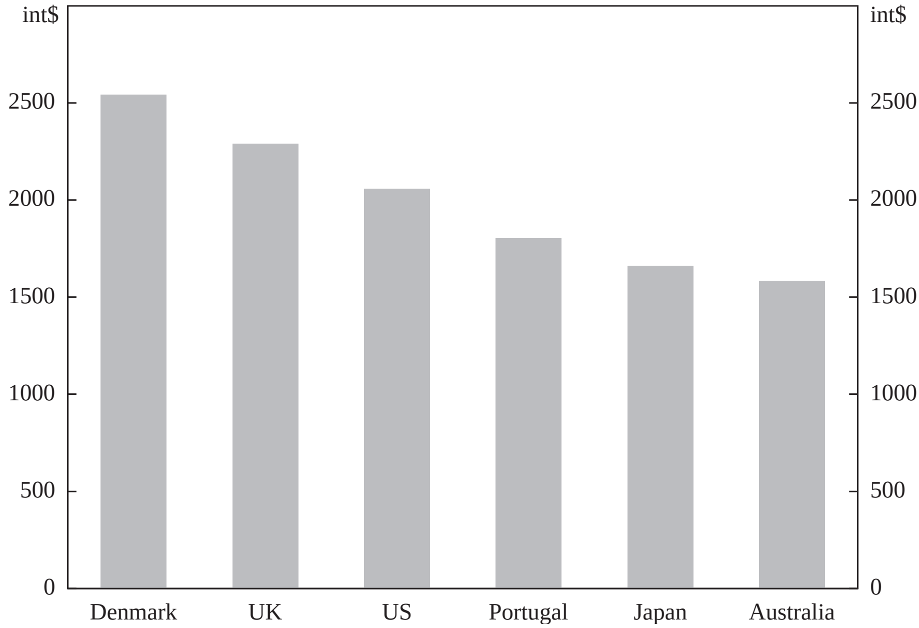
Summers and Heston recognise that an implication of this approach is that location effects on rentals are ignored, but that it is unclear how, even in principle, such an important effect should be treated. The scale of the potential errors that may result from the ICP treatment is illustrated in Figure 5, which compares the per capita 'real' expenditure on gross rents in selected OECD countries in 1990, as estimated in the OECD benchmark PPP study (OECD 1992). It is obvious that the relativities shown in the figure, like those shown for the 1985 benchmark in Table 2, are seriously awry, presumably because the rental deflators used to revalue nominal expenditures differ from the (mainly imputed) rental values which were used by the national accountants to estimate nominal expenditures in the first place.

For example, in a bilateral PPP comparison between Australia and the United Kingdom for 1958, it was estimated that real expenditure on housing was 21 per cent higher in Australia than in the United Kingdom, whether measured in British or Australian relative prices (Haig 1968, p. 45). The implication of the OECD estimates that per capita expenditure on dwellings, on a PPP-adjusted basis, was 30 per cent *lower* in Australia in 1990 is implausible, particularly in the light of the commonly-held view that investment in housing in Australia has made a disproportionately heavy call on domestic savings in recent decades.

According to the OECD estimates, per capita 'real' expenditure on dwelling rents was also higher in Japan than in Australia in 1990. This finding is at odds with general opinion in both countries, and with a mass of statistical evidence. In 1939 Colin Clark recorded, on the basis of 'the results of a recent survey', that the average floor area of houses in

22. These are not minor issues. In Australia in 1990, imputed rent was to estimated to be 12.8 per cent of household disposable income, while government expenditure on health and education was 11.5 per cent.

Figure 5: Gross Rent in Selected OECD Countries



Queensland at that time was 1,275 square feet (118.5 square metres);[23] and the average floor area of new dwellings completed in Australia increased from 160 square metres in 1983 to 185 square metres in 1993.[24] By comparison, the average floor area of houses in Japan in 1988 was 89 square metres.[25] These figures suggest that the PPP-adjusted estimates of real expenditures on gross rents in Australia would have been far higher had they correctly captured the physical characteristics of the housing services to which the ICP comparisons must necessarily be restricted.[26]

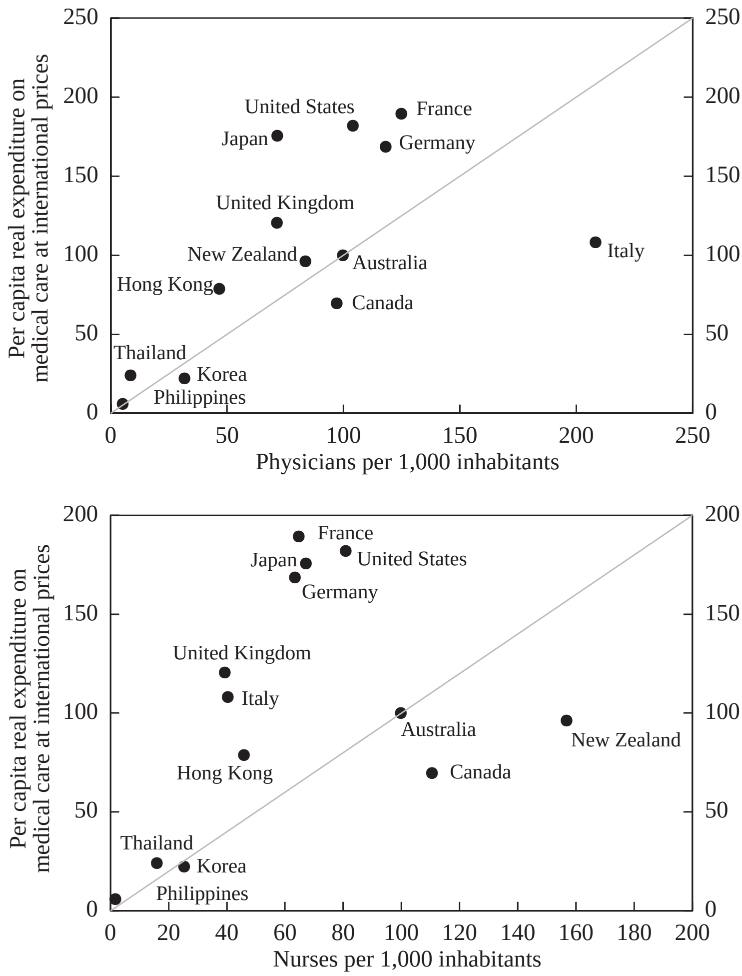
The ICP principals also acknowledge the '... particularly thorny problem of somehow valuing services that are not priced in the market ...' in areas such as general government, medical care and education (Summers and Heston 1991, p. 330). The solution that has been adopted, as in the national accounts, is to derive price parities for these categories on the basis of input comparisons. As in the dwellings case, however, this approach could be implemented more reliably by the direct use of available data on real inputs (e.g., numbers and utilisation of hospital beds, numbers of health professionals and para-professionals), rather than by attempting to deflate relevant components of expenditure by average bed-day costs or the average income of nurses.

23. From the Colin Clark papers, Fryer Library, University of Queensland.
24. As reported in the Australian Bureau of Statistics' *Australian Social Trends 1994* (ABS Cat. No. 4102.0, p. 156).
25. *Japan Statistical Year Book 1993-94*, p. 596. For a comparison of the size and equipment of housing between Sydney and Japanese cities, see Castles (1992, pp. 92-121).
26. However, it is not relevant to an evaluation of the reliability of the ICP data that physical characteristics may be an inadequate measure of the quantum of housing services consumed.

An indication of the possible effect of the ICP procedure of revaluing nominal expenditures with measures of input prices, even in 'comparison-resistant' areas such as health care, is provided in Figure 6. These figures compare World Health Organisation (WHO) data on the numbers of physicians and nurses in relation to population in selected countries in the late 1980s with the 1985 ICP estimates of 'real' per capita final national consumption expenditure on health care in the same countries. The latter estimates imply that per capita expenditures on health care, when measured in international prices, are over two and a half times greater in Japan than in Canada, and nearly twice as great in France as in Australia or New Zealand. Even in the absence of other information, these wide margins of difference would have appeared implausible; and the WHO data on the numbers of health professionals suggest that any differences may, in fact, be in the opposite direction to that indicated by the ICP estimates.

Figure 6: Real Expenditure on Medical Care in 1985 v. Numbers of Physicians and Nurses

(Australia = 100)



8. The Evidence from Non-Official Surveys

In the two preceding sections, it has been shown that the estimate of Australia's relative real per capita product emerging from official PPP studies appears to be improbably low when compared with indications from other sources of information – from household expenditure patterns in relation to comparisons with Hong Kong, and from various quantity measures in relation to comparisons with a number of countries for components of expenditure which have been identified as 'comparison resistant'.

In this section, the ICP results are tested against those of three non-official studies – the celebrated 'Big Mac' index published annually by *The Economist* since 1986; the surveys of prices and wages around the globe that have been published by the Union Bank of Switzerland (UBS) at approximately 3-year intervals since 1970; and a recent study of relative living standards using the revealed-preference principle, by Dowrick and Quiggin (1993).[27]

The Economist has explained that the Big Mac index was devised 'as a light-hearted guide to whether currencies are at a 'correct' level'.[28] But its promotion as a measure of value has not been entirely in jest. The worldwide survey of the price of a standard hamburger at McDonald's is, in a sense, at the opposite extreme to the ICP. Instead of pricing hundreds of commodities, services and labour inputs which 'cover the universe of all items priced in any country' and then weighting the resulting price relativities with the aid of detailed dissections of expenditure, the price of a single commodity is taken as representative of all final prices (though many significant intermediate prices have entered into that final price, including those of several foodstuffs, packaging, various categories of labour services, fuel and power, commercial rents and so on).

Although presented as a price parity, the Big Mac index can be used to denominate real product. In fact, it is instructive to think of a league table based on alternative units of measurement. In Table 2, each country's average per capita income is expressed as an index in relation to Australia's: first on a conventional PPP basis; and second in terms of Big Macs.[29]

In nearly all cases, Australia's 1993 GDP was relatively higher (and in some cases very substantially higher) when expressed in Big Macs rather than in international dollars according to the World Bank's PPP measure. Hong Kong was, however, a significant exception: its per capita GDP was, when expressed in Big Macs, far higher than that of any other country shown in Table 2.

Also shown in Table 2 are the results of a similar computation from the most recent Union Bank of Switzerland survey (UBS 1994). The 1993 nominal per capita GDP of each country has been divided by the nominal total cost, in the June quarter of 1994, of the basket of 111 goods and services, weighted by European consumer habits, which are included in the UBS survey. The resulting per capita GDPs, expressed in UBS basket units, have then been calculated as indices (Australia = 100). A similar procedure has

27. They used a revealed preference approach whereby observed consumption was assumed to be the preferred element in a given budget set.

28. *The Economist*, 15 April 1995, p. 78.

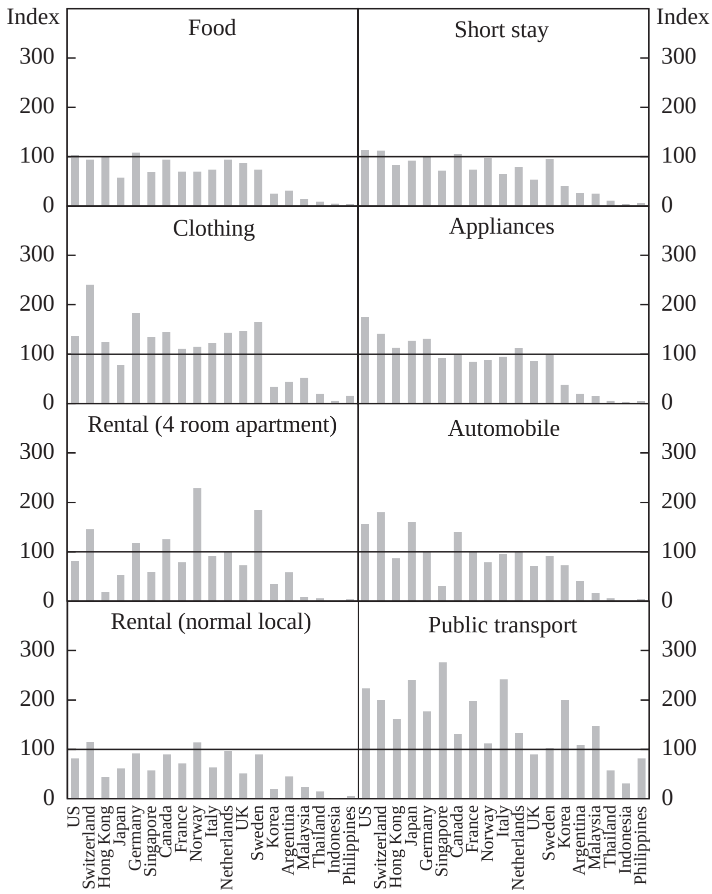
29. Using the April 1993 prices reported in *The Economist*, 17 April 1993, p. 83.

been followed to calculate component indices for other groups of items in the UBS survey. These are charted in Figure 7.

By comparison with the ICP, on which the official league table of real incomes is based, the 1994 UBS study was of modest dimensions, but it was not minuscule. More than 20,000 data items were collected by the UBS's correspondent banks and by its foreign branches and representative offices in 53 cities. In most cities the information was collected by two units working independently of one another. The entire body of data was then analysed by the Economic Research Department at the Bank's Head Office in Zurich, thus ensuring a degree of central coordination which could not be matched by the ICP (which has responsibilities for various aspects of coordination located in New York, Washington, Paris, Philadelphia, Luxembourg, Geneva, Vienna and Bangkok). The results of this substantial survey, as reported in Table 3 and Figure 7, support two significant generalisations.

Figure 7: GDP Per Capita Expressed as an Index of Selected Baskets of Goods and Services

(Australia = 100)



First, they confirm the indications from other evidence that Australia's relative real per capita income is understated in the official PPP estimates. Compared with *most* of the countries shown in the figure, the indicated level of per capita GDP is higher (and in several cases substantially higher) when measured in UBS basket units than when measured in international dollars at the PPPs revealed by the ICP. The significance of this conclusion is strengthened by the fact that the UBS basket is based specifically on European consumer habits, and would therefore be expected to be cheaper in European cities than a basket which took greater account of American, Asian or Australasian expenditure patterns for the purpose of comparisons with cities on those continents.[30]

Second, the purchasing power of per capita incomes in the various countries differs markedly between individual expenditure groups. These results, therefore, serve to reinforce the reservations that have been made in previous sections about the possibility

Table 3: Alternative League Tables

World Bank 1993			Big Macs 1993			UBS 1994		
Rank	Country	Index	Rank	Country	Index	Rank	Country	Index
1	United States	133.9	1	Hong Kong	161.0	1	Switzerland	131.2
2	Switzerland	127.7	2	United States	112.2	2	FRG	121.2
3	Hong Kong	117.2	3	Singapore	108.8	3	United States	116.9
4	Japan	114.1	**4**	**Australia**	**100.0**	4	Canada	111.2
5	FRG	113.5	5	Japan	99.8	5	Austria	108.9
6	Singapore	110.7	6	FRG	99.4	6	Denmark	107.6
7	Canada	110.4	7	Canada	93.6	7	Belgium	106.5
8	France	105.1	8	Switzerland	90.7	8	Netherlands	104.7
9	Denmark	102.4	9	Austria	81.5	**9**	**Australia**	**100.0**
10	Austria	101.7	10	Netherlands	72.0	10	Sweden	93.5
=11	**Australia**	**100.0**	11	Belgium	69.5	11	Japan	91.4
=11	Belgium	100.0	12	France	69.5	12	France	90.6
13	Italy	97.7	13	Denmark	68.3	13	Italy	89.2
14	Netherlands	97.6	14	Sweden	67.6	14	UK	82.8
15	UK	96.0	15	Italy	63.4	15	Singapore	78.0
16	Sweden	95.0	16	UK	63.1	16	Hong Kong	75.5
17	Korea	53.1	17	Malaysia	26.9	17	Argentina	35.8
18	Argentina	49.4	18	Korea	26.2	18	Korea	34.7
19	Malaysia	46.7	19	Argentina	22.0	19	Malaysia	19.0
20	Thailand	34.6	20	Thailand	10.4	20	Thailand	10.3
21	Indonesia	17.0	21	Indonesia	4.5	21	Indonesia	4.2

Note: Rankings refer to this subset of countries only.

30. New Zealand was not represented in the UBS survey.

of measuring, on a single scale, the average real incomes of communities living under very different conditions.

Given that communities do live under different conditions, one approach is to account for the revealed preference implicit in these choices. The results of the study using the revealed-preference principle are best reported in the words of one of the authors:

> '... we demonstrate that once proper account is taken of purchasing power, and also of leisure, the average standard of living in Australia is probably higher than in Japan. We base this assessment on detailed OECD data supplied by the Australian Bureau of Statistics ... which gives a breakdown of 1990 GDP by prices and quantities for forty categories of goods and services.
>
> Our judgment that Australians are, on average, better off is based on the revealed preference principle. A resident of Australia who is earning average Australian hourly wages *could* have afforded to buy the Japanese bundle of goods and services if she had worked Japanese hours. The fact that she *actually* chose the Australian bundle is taken as evidence of a higher standard of living, particularly since the average resident of Japan could not have afforded the Australian bundle of goods, services and leisure. ... On this basis we make the judgment that Australia's average living standards rank somewhere in between tenth and twelfth in the OECD, ... ahead of Japan' (Dowrick 1993, p. 3).[31]

In other words, differences in the relative structure of prices between countries can nullify conclusions based on measures of GDP 'at international prices'.

9. Australia as a 'Different' Society

The impression of Australia as a 'different' society is found not only in studies of the revealed preferences of Australians, but in the impressions of visitors and temporary residents over the years. As one external commentator observed in 1985:

> 'Australia is not a carbon copy of other modern democracies, even of those with whom it has close and continuing relations and is commonly compared. ... Australia is different today; it was different in the 19th century. It was prosperous, very prosperous, when many nations now wealthy were not so at all. Australia retains some residual memory of its earlier great affluence – an affluence based on speculation, built on hazard and greed. While international statistical comparisons suggest that the very rich are now to be found elsewhere in the world, Australians are concerned ... with what some see as a growing cupidity and materialism at home. A more fundamental concern, certainly, is whether Australia will continue to do well in the fiercely competitive economic world of the future, whether so easygoing a society will be able to accommodate itself to the demands of a new kind of industrial order ...' (Graubard 1985, pp. v, viii).

There is evidence that, from the earliest days of the nation's great era of relative affluence, the Australian 'bundle of goods, services and leisure' was weighted more towards leisure than the bundles of other countries. In January 1857, Stanley Jevons, later to become one of the great economists, attended 'a very grand cricket match between Sydney and Melbourne ... ; it was in the Domain which from its natural beauty and splendid position and the immense number of orderly people in it presented one of the

31. As Dowrick (1993) acknowledges, an alternative explanation of observed differences in consumption and leisure is simply that Australians and Japanese might have fundamentally different tastes. However, he finds that variations in OECD consumption patterns are explicable as responses to the different price structures in each country.

most beautiful spectacles I ever saw'. Writing to his brother in England, the 21 year old Jevons went on to describe the huge attendances at the match, calculating that 'nearly one quarter of the population was at the match at one time and the business of the town was quite interrupted'. And then he concluded:

> 'I take this to be a sign, not of laziness, but that the people are so well today as to be able to spare more holidays and really to enjoy themselves more than the people of other countries' (Jevons 1856).[32]

A similar conclusion was expressed more than a century later by the OECD (1972) in its first annual review of the Australian economy:

> 'No one can doubt that there are differences in social attitudes among countries – in the relative value placed on work and leisure, on money-making, on duty and discipline – *which cannot help but affect the rate of economic growth.* Australians, though no more consistent in their demands on life than other people, have for long leaned towards the view ... that economic growth is not everything' (OECD 1972, p. 28, emphasis added).

Jevons and the OECD reviewers clearly approved of the priority which Australians accorded to leisure and to the pursuit of 'non-economic' goals. But there has been another strand in the Australian national culture with which economists have been less comfortable, the manifestations of which may provide the key to the relatively slow apparent growth in real incomes during the 20th century which is exhibited in Figure 2. It was identified by W.K. (later Sir Keith) Hancock in his remarkable book *Australia*, published in 1930:

> 'The Australians have always disliked scientific economics and (still more) scientific economists. They are fond of ideals and impatient of technique. Their sentiments quickly find phrases and their phrases find prompt expression in policies. What the economists call 'law' they call anarchy. The law which they understand is the positive law of the State ... the democratic State which seeks social justice by the path of individual rights. The mechanism of international prices, which signals the world's need from one country to another and invites the nations to produce more of this commodity and less of that, belongs to an entirely different order. It knows no rights, but only necessities. The Australians have never felt disposed to submit to these necessities. They have insisted that their Governments must struggle to soften them or elude them or master them ...' (Hancock 1930, p. 86).

The characteristic Australian distrust of market signals and dislike of what Hancock called 'scientific economics' (now known as 'economic rationalism') had its most lasting and influential expression in the celebrated Harvester Judgment in 1907 – just a few months before Keynes' public questioning of the validity of the official estimates of relative real wages in London, the Midlands and Ireland.

H.V. McKay, the dominant figure in the Australian agricultural implements industry had applied to Mr Justice Higgins, the new President of the Commonwealth Arbitration Court, for a declaration that the wages he paid were 'fair and reasonable', and that therefore his machines should be exempt from the excise duty on harvesters. Higgins rejected the application, on the grounds that the wages paid at the Sunshine Harvester plant did not, in his opinion, provide for an unskilled labourer 'the normal needs of an average employee, regarded as a human being living in a civilised community'. Higgins

32. Jevons' observation is confirmed by the historian G. Blainey: 'Sydney and Melbourne led the world in having Saturday afternoons off for working men and that meant they were free to attend sporting events' (*The Weekend Australian,* 17-18 June 1995, p. 26).

was later to explain the reasoning which led him to this decision in the following terms:

> 'Many household budgets were stated in evidence, principally by house-keeping women of the labouring class; and, after selecting such of the budgets as were suitable for working out an average, I found that in Melbourne, the average necessary expenditure in 1907 on rent, food and fuel, in a labourer's household of about five persons was one pound twelve shillings and five pence, but that as these figures did not cover light, clothes, boots, furniture, utensils, rates, life insurance, savings, accident or benefit societies, loss of employment, union pay, books and newspapers, tram or train fares, sewing machine, mangle, school requisites, amusements and holidays, liquor, tobacco, sickness or death, religion or charity, I could not certify that any wages less than 42 shillings per week for an unskilled labourer would be fair and reasonable' (Higgins 1915, p. 15).

As it happens, the information which provided the British Board of Trade with the capacity to calculate relative real wages in different districts of the United Kingdom can also be used, in conjunction with contemporary Australian data on prices in Melbourne, to estimate the relative level of the wage which Higgins believed was necessary to meet the minimum needs of an unskilled labourer and his family.

In Figure 8, the purchasing power over British and Australian food baskets of the wage rate specified in the Harvester Judgment of 10.5 pence per hour (42 shillings for a standard 48 hour working week) is compared with the purchasing power of the hourly wage of an engineering labourer at that time in London, Leicester in the English Midlands and Dublin. As the figure shows, the Harvester rate was, in real terms, *twice* the London rate and *three times* the prevailing rate in Dublin.

The scale of the 'average necessary expenditure ... on rent, food and fuel' for a family of five in Melbourne in 1907 was a matter of opinion, and the level which was judged by Higgins to be necessary was austere by the standards of the 1990s. But it was certainly

Figure 8: Purchasing Power of Unskilled Labour

(Melbourne, Harvester Judgment = 100)

not austere by the British standards at that time, and it was far above the standards which prevailed in the leading cities on the continent of Europe.

The real quantities of housing, food and fuel which could have been bought in Melbourne in 1907 with a weekly sum of 'one pound twelve shillings and five pence' were considerably greater than the quantities in the basket used by the British officials to judge the relative costs of living in different cities in the United Kingdom in 1908; and it would in any case have been impossible at that time for unskilled labourers in Britain (or anywhere in Europe) to earn a wage sufficient for the assessed needs of a family of five.

In Higgins' view – and it was a view which had the support of most Australian politicians at the time – an industry which could not afford to pay the level of wages that the Arbitration Court judged to be 'fair and reasonable' should not receive protection. The practical consequence of this view was that many Australian industries had to be supported by high and increasing levels of protection in order to survive and to pay the wage rates decreed by the Arbitration Court.

10. The League Table Before the Wars

According to the estimates charted in Figure 2, Australia's level of real GNP per capita was only slightly higher than that of the United Kingdom in the years preceding World War I. Acknowledging that there are significant differences between the concepts being measured, this does not appear to be consistent with the large differences in real wage rates which were discussed in the preceding section and illustrated in Figure 8.[33]

The probable reason for the apparent inconsistency is that the relativities shown in Figure 2 are not correct. In previous sections of this paper, it was shown that average real incomes in Australia in the 1990s are probably substantially higher, relative to those in many other countries including the United Kingdom, than the conventional estimates on a PPP basis show. If this is the case, the relativities in the estimates which would be backcast to 1900 are equally astray.

And differences in the end-point relativities are only one of the possible sources of error in the long-period estimates. There would be serious hazards in the backward projection of national estimates of real product over long periods, even if the underlying information was of high quality and the changes in economic structure were modest.[34]

It follows that estimates of relative average real income levels in past periods can only be relied upon if they are built up from contemporary data, and that the use of year-by-

33. Williamson (1991) puts the real wage rate for manufacturing workers in Australia 15 per cent above the UK real wage rate and 40-60 per cent above real wage rates in other European countries, but well below those of the United States and Canada. Williamson's comparative real wage data are based on national data for nominal wages and retail prices but then converted into comparable figures using PPPs for four benchmark years. They are thus subject to the problems discussed earlier.

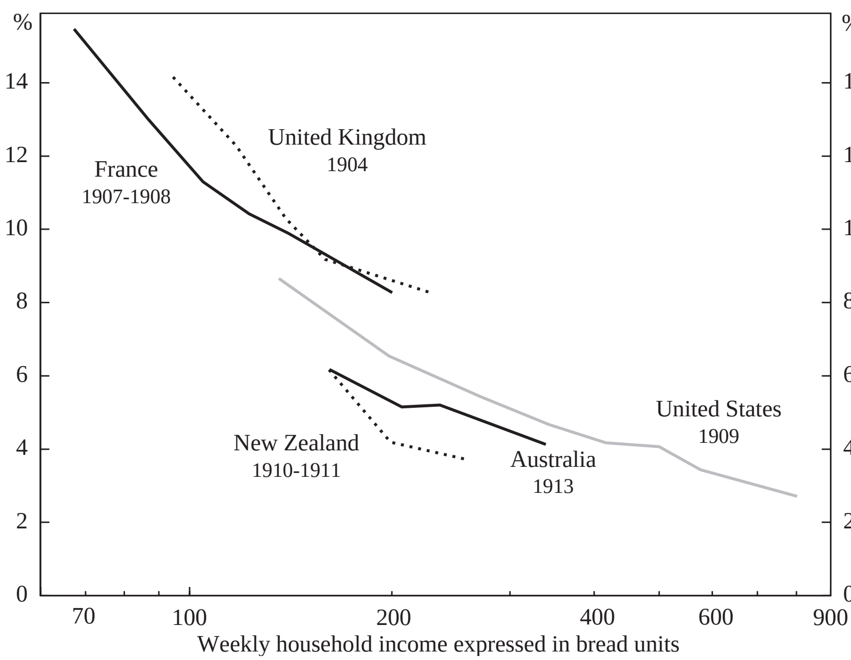
34. For the period before the commencement of the official estimates, the Australian estimates of real product are derived from Butlin (1962). In that monograph Butlin states that 'any attempt to deflate series of gross domestic product and gross capital formation over long periods must be regarded with the greatest suspicion; our attempt is no exception' (p. 31). Despite Butlin's emphatic disclaimer, Australian and international scholars have relied upon his estimates to assess the level of average Australian incomes, relative to those in other countries, in the relevant period.

year estimates of GDP at constant prices should be restricted to the identification of the profile of short-run changes. Over long periods, economic growth rates should be seen as summary measures of the apparent rate of movement which has been observed between successive ‘snapshots’, not as the means by which the scale of change between two distant years can be determined.

There is, however, an important advantage of the ‘snapshot’ approach to the measurement of relative real average incomes between countries and over time. The approach does not require that estimates be made of every individual expenditure component and every individual price parity – a procedure which, as we have seen, is difficult enough to achieve contemporaneously. Instead, it can rely on the approach which Ronald Walker suggested would prove to be more useful in any case: ‘the comparative study of the actual content of typical family budgets of different classes in the relevant countries’ (Butlin 1962, p. 10).[35]

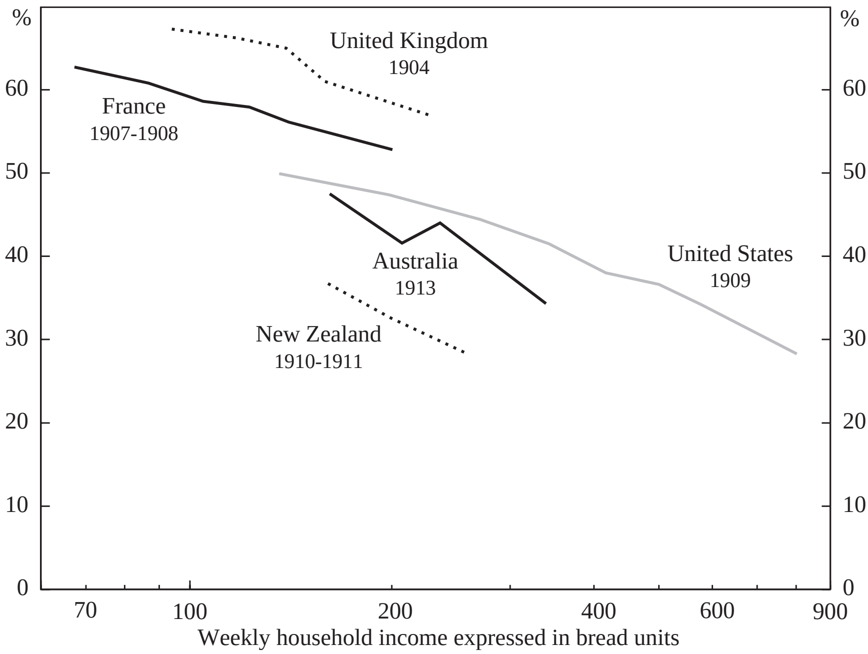
Some preliminary estimates based on this approach were made for five countries in the pre-World War I period, using official family budget studies, and are exhibited in

Figure 9: Expenditure on Bread and Flour as a Percentage of Income (1904-1913)



35. In June 1995, the Australian Bureau of Statistics published *A Provisional Framework for Household Income, Consumption, Saving and Wealth* (ABS Cat. No. 6549.0) which defined a conceptual map relating data in these fields, so as to lay the foundation for the further development of statistics concerning the economic well-being of households. It is in this area that the more cohesive development of consistent and relevant definitions and concepts, nationally and internationally, is most necessary in order to support the information needs of policy makers.

Figure 10: Expenditure on Food as a Percentage of Income (1904-1913)



Figures 9 and 10. The results bring out very marked differences between the patterns of expenditure in, on the one hand, the United Kingdom and France and, on the other, the United States, Australia and New Zealand. The estimates also provide pertinent information on the relative positions and average levels between countries. These clearly suggest that the differences in real average incomes between the countries of the Old World and the 'NIEs' of those days were much larger than the presently accepted estimates, which have been derived as an outcome of the backward projection of modern PPP calculations.

11. Conclusion

Our review of the available evidence about relative living standards and real incomes in the Australia of the 1990s reveals a need for great caution. Nonetheless, economists and national-accounting statisticians of the late 20th century have become comfortable with expressing diverse observations as averages, and then adjusting and manipulating those averages according to hypothetical assumptions – such as that prices are constant or that prices are the same as somewhere else or everywhere else. Although these simplifications are necessary if inter-country and inter-temporal comparisons of real incomes are to be made at all, it should not be forgotten that they not only involve summarisation (i.e. the loss of some part of the truth), but also the making of assumptions which do not hold in (and may often differ markedly from the facts of) the real world.

This need for caution combined with the results of the review makes it reasonable to conclude that the concerns that have their origin in Australia's position in the conventional league table are misplaced. The statistics are subject to measurement errors which are potentially large enough to invalidate the conclusions commonly drawn from them. Even if the measurement problems could be resolved there are important conceptual issues which would remain. The representation of the outcome of macroeconomic performance by a single measure involves an excessive degree of summarisation and loss of detail. Consequently, the policy issues surrounding Australia's comparative position and performance must be addressed within a multi-dimensional framework that acknowledges the serious and possibly fatal weaknesses of conventional statistical measures in capturing the scale and the subtlety of economic change. In particular, it must recognise the features which distinguish Australia from other modern societies.

Our review also shows that league tables for the early part of this century (often produced by backcasting current figures) are equally misleading. Australia, at that time, was a country with a small population and labour force relative to its abundant natural resources. Moreover, a distinctive feature of Australia was the setting of comparatively high real wages. Indeed, this was the mechanism by which the high real incomes generated in the resource-based industries were transferred to provide the owners and workers in many other industries with higher incomes than the PPP-adjusted value of what they had produced.

We have emphasised the statistical and conceptual problems in measuring the comparative position of Australia, but we would not seek to deny that there has been some considerable 'sliding down the international league scale' during this century. Yet again, however, the concerns expressed in reactions to the World Bank's league table seem, at least in part, to be misplaced. To start with the part where there are genuine reasons for concern, there is little doubt that attempts to protect economic factors from foreign competition and the cost of change has been a principal constraint on economic growth. To quote Gruen, growth was sacrificed because '... our social organisation tended to produce that outcome' (Gruen 1986, p. 193). However, two other factors have also been at work and do not give cause for concern because they are the direct outcomes of Australia's unique position early this century and of the responses of Australian institutions to that position. First, to the extent that Australians place different values on work and leisure than other countries and give a relatively high priority to those aspects of life which are not included in the conventional national accounts, *measured* growth rates will be relatively low. Second, Australia provided its contribution to the international process of convergence of per capita income by choosing to distribute the resource wealth through relatively high real wages and encouraging a wider dispersion of resources through fast population and labour force growth. In fact, this, more than any other factor, may explain the relatively slow growth in average per capita real incomes in Australia through this century.

Appendix: Data Sources for Figures and Tables

Figure 2: Real GNP Per Capita in Selected Economies (1900-1993)

Estimates of 1993 real GNP per capita are PPP estimates sourced from the *World Bank Atlas 1995*, pp. 18-19. For recent years these estimates are backcast for Australia, Canada, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, UK and US using growth rates in GDP per capita calculated using estimates of population and constant price GDP reported in IMF (1995). The estimates were then backcast from 1989 using movements in GDP reported in Tables A6, A7 and A8 of Maddison (1991) and movements in population reported in Tables B2, B3 and B4 of Maddison (1991). For the remaining countries, comparable series were produced using the sources reported in the list below.

Country	Dates	Data sources
Argentina	1900-50	Data for 1890, 1913, 1950 are available from Maddison (1993); exponential interpolation is used to produce an annual series
	1950-90	Penn World Table (Mark 5.6a)
	1990-93	IMF(1995)
Korea	1900-53	Interpolated series using data for 1890, 1913, 1950, 1973 from Maddison (1993)
	1953-90	Penn World Table (Mark 5.6a)
	1990-93	IMF(1995)
Thailand	1900-50	Interpolated series using data for 1890, 1913, 1950 from Maddison (1993)
	1950-91	Penn World Table (Mark 5.6a)
	1991-93	Asian Development Bank, Asian Development Outlook
Indonesia	1900-60	Interpolated series using data for 1890, 1913, 1950, 1973 from Maddison (1993)
	1960-92	Penn World Table (Mark 5.6a)
	1992-93	IMF(1995)
Hong Kong	1960-92	Penn World Table (Mark 5.6a)
	1992-93	Asian Development Bank, Asian Development Outlook
Malaysia	1955-92	Penn World Table (Mark 5.6a)
	1992-93	IMF(1995)
Philippines	1900-50	Interpolated series using data for 1900, 1913, 1929, 1938, 1950 from Maddison (1989)
	1950-92	Penn World Table (Mark 5.6a)
	1992-93	IMF(1995)
Singapore	1960-92	Penn World Table (Mark 5.6a)
	1992-93	IMF(1995)
New Zealand	1951-92	Penn World Table (Mark 5.6a)
	1992-93	IMF(1995)

Figure 3: Relative Prices and Relative Quantities Consumed in Australia and Hong Kong, 1985

Relative quantities consumed were derived from Table 1 of UN (1994), setting relative GDP in each country to 100. Relative prices were derived from Tables 10 and 1 of the same publication, by dividing the nominal expenditures in Table 10 by the quantities reported in Table 1, setting the relative price of GDP to 100.

Figure 4: Expenditure Shares Excluding Housing in Australia and Hong Kong

Australia: ABS Household Expenditure Survey 1988-89 (ABS Catalogue Nos 6530.0 and 6535.0).

Hong Kong: *Hong Kong Year Book 1989-90*, Expenditure Weights.

Figure 5: Gross Rent in Selected OECD Countries 1990

Gross rent and water charges item of OECD (1992, Table 1.3).

Figure 6: Real Expenditure on Medical Care 1985 v. Numbers of Physicians and Nurses

Data on per capita real expenditure on medical care at international prices were obtained from UN (1994, Table 3).

Data on physicians and nurses per 1,000 inhabitants were obtained from the World Health Organisation.

Figure 7: GDP Per Capita Expressed as an Index of Selected Baskets of Goods and Services

Nominal GDP estimates in national currencies for second quarter 1994 were obtained from IMF (1995). Latest IMF (1995) nominal GDP estimates were for Singapore, Argentina, Indonesia and Malaysia were for 1993; and 1992 for Luxembourg and Thailand. Estimates for 1992 and 1993 were converted to 1994 prices using consumer price indices published in IMF (1995). These estimates were divided by population estimates for each country, obtained by extrapolating 1993 mid-year population estimates by the average population growth rate for the period 1988 to 1993, with population statistics sourced from IMF (1995). For Hong Kong, 1993 GNP per capita in US$ was obtained from World Bank (1995), converted to local currency, and converted into 1994 prices using consumer price index data sourced from *Hong Kong Monthly Digest of Statistics*, March 1995 (Census and Statistics Department, Hong Kong).

Prices of commodity baskets were obtained from Union Bank of Switzerland (1994). Nominal GDP per capita was then divided by the cost of each of these baskets, with the resultant index set to 100 for Australia. The clothing index is a weighted average of the separate indices for women's clothing (60 per cent weight) and men's clothing (40 per cent weight). Automobile cost includes taxes and the cost of a 15,000 kilometre service. The short stay basket is made up of an overnight stay for two in a hotel, two evening meals with a bottle of red house wine, a taxi ride within the city centre, a rental car for half a day, cinema tickets for two, two 'Big Macs' and two public transport tickets.

Figure 8: Purchasing Power of Unskilled Labour

Australia: Commonwealth Bureau of Census and Statistics, Labour and Industrial Branch Report No. 2, p. 47.

UK: *Report of an Enquiry by the Board of Trade into Working-class Rents, Housing and Retail Prices, Together with the Standard Rates of Wages Prevailing in Certain Occupations in the Principal Towns of the United Kingdom*, Great Britain Parliament, Accounts and Papers (1908).

Derived as a geometric mean of indices of purchasing power over Australian and UK consumption baskets, with Melbourne set to 100.

Figure 9: Expenditure on Bread and Flour as a Percentage of Income (1904-1913) and

Figure 10: Expenditure on Food as a Percentage of Income (1904-1913)

Australia: Commonwealth Bureau of Census and Statistics, Labour and Industrial Branch Report No. 4, pp. 13, 19, 26.

France: *Report of an Enquiry by the Board of Trade into Working Class Rents, Housing and Retail Prices, together with the Rates of Wages in Certain Occupations in the Principal Industrial Towns of France*, Cd. 4512 (1909).

New Zealand: New Zealand Government Department of Labour, *Inquiry into the Cost of Living in New Zealand, 1910-11* (1912), pp. 10, 13, 22. Flour consumption was estimated to be 30 per cent of bread consumption.

United Kingdom: *Report of an Enquiry by the Board of Trade into Working-class Rents, Housing and Retail Prices, Together with the Standard Rates of Wages Prevailing in Certain Occupations in the Principal Towns of the United Kingdom*, Great Britain Parliament, Accounts and Papers (1908).

United States: *Report of an Enquiry by the Board of Trade into Working-class Rents, Housing and Retail Prices, Together with the Standard Rates of Wages Prevailing in Certain Occupations in the Principal Towns of the United States of America 1909* (1911).

Table 1: GNP Per Capita at Purchasing Power Parities in 1993 International Dollars

World Bank (1995).

Table 2: Per Capita Real Value of Final Expenditure on Gross Rents at International Prices in 1985 US Dollars

UN (1994).

Table 3: Alternative League Tables

The World Bank 1993 ranking is sourced from World Bank (1995).

For the Big Macs 1993 ranking, nominal GDP per capita in 1993 was calculated employing the same methods and sources used for Figure 7. These estimates were then divided by the local currency price of a Big Mac in 1993, sourced from *The Economist*, 17 April 1993, p. 83. 1994 Big Mac prices were used for Singapore and Austria from *The Economist*, 9 April 1994, p. 92. 1995 Big Mac prices were used for Indonesia and Thailand from *The Economist*, 15 April 1995, p. 78. An index was then constructed with Australia set to 100.

The UBS 1994 ranking was calculated in the same manner and using the same sources that were employed in constructing the indices plotted in Figure 7. The relative cost of the UBS basket of 108 goods and services (excluding rents) in the different countries was adjusted to reflect rents by multiplying the cost of that basket by the UBS index of prices including rent and dividing by the UBS index of prices excluding rents.

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Discussion

1. John Quiggin

One of the strongest motives in life is the desire to 'keep up with the Joneses'. In economic debate, this tendency is reflected in a concern with international rankings of various kinds. These rankings are frequently used to bolster a variety of spurious arguments. A typical form of the argument is 'Australia has declined relative to country *X* on scale *Y*, and we should therefore adopt policy *Z* (claimed to be practised in *X*)'. With an appropriate choice of criterion, almost any country can be used as the model. For example, New Zealand's per capita income has declined by 20 per cent relative to that of Australia over the past decade or so – hardly a promising basis for an argument based on relative performance. However, if attention is focused instead on the current account deficit, New Zealand can be made to appear as a model worthy of emulation. Ian Castles has made a number of useful contributions pointing out this kind of argument, and this paper is no exception.

First, Castles makes a number of judicious points about the general notion of 'league tables', and the idea that Australia's supposed slide from the top of the international table last century to a mediocre position today justifies some or other program of radical reform. In the 1980s, this idea was combined with observation of the performance of the 'tiger economies' to justify the prediction that Australians would soon become 'the poor white trash of Australia' in the absence of free-market reforms. (The same claim was occasionally used to justify interventionist policy as well.) In fact, the notion that Australia was exceptionally wealthy in the late 19th century is a statistical artifact arising from peculiar features of a frontier economy (Quiggin 1987). It is, in any case, entirely irrelevant to our current situation: with what possible policy decisions could a comparative advantage in wool production and the existence of some modest gold deposits have been made an engine of world-beating economic growth?

As Castles observes, on the current standard league table, all the major industrial countries (except the US) have per capita incomes within 20 per cent of that estimated for Australia. Given the wide range of uncertainty associated with the construction of such tables, this fact alone ought to be enough to dispel the idea that maintenance or improvement of our relative ranking is a justification for any particular policy agenda. Of course, there is nothing new about this observation. Castles made many of the same points nearly ten years ago at a conference in honour of Fred Gruen, who had himself made similar observations in Gruen (1986). But the myth that our relative growth performance is so poor as to justify radical reform refuses to die. For example, Clark (1995), presents the myth in its full glory, from our alleged world-beating status in the late 19th century to the rise of the Asian tigers as a reason 'why microeconomic reform is unavoidable'. The only sign of progress is the absence of any reference to 'poor white trash'.

In other work on this topic, Steve Dowrick and I have looked at a number of factors which make the standard World Bank league table an inappropriate basis for comparison, including differences in working hours, 'quality of life' variables and the range of uncertainty inevitably involved in making revealed-preference judgments from price-quantity data. Castles, however, challenges the ICP data on its own terms.

Castles' first point relates to the construction of the price indices. Because the world's consumption basket contains millions of different items, it is necessary to choose some representative subset to derive the index. If the items omitted are cheaper in some countries than in others, the relative price level in the first group of countries will be overstated relatively to that in the second. Obviously this is likely to happen if the items used in the index are chosen because they are heavily consumed in the second group of countries (e.g. small cars and small fridges in Europe). Hence, Castles argues, the PPP indices overstate the real income of European countries relative to that of Australia, US, Canada and New Zealand.

Castles next discusses the index number problem – that is, the irreducible degree of ambiguity associated with comparing consumption bundles at different sets of relative prices. In Dowrick and Quiggin (1993), we found that this problem led to the existence of several sets of ten countries, within which pairwise comparisons were generally ambiguous.

Can the idea of examining 'the actual content of typical family budgets' can tell us anything that the revealed-preference concept cannot? In principal I doubt it, but with imperfect data, it is possible that careful inspection of the household budget can give an indication of the standard of living. Certainly, in the Australian context, a food expenditure share of 50 per cent would be indicative of severe poverty (or highly idiosyncratic tastes). However, in a country with a higher relative food price, the food expenditure share will be higher, even for expenditure bundles that pass a revealed-preference test relative to some given Australian consumption bundle. I would conclude that we need to proceed with care.

The issue of 'comparison-resistant' items is a critical one. More precisely, it is a set of critical problems, one or more for each of the different comparison-resistant items. Castles focuses on housing, and the difficulties associated with valuing locations. The ICP data show Australia (and also the US) as having low levels of housing consumption relative to the OECD average, and, in particular, relative to Japan. Castles begins by considering the possibility that this is due to the failure to take account of location effects. However, as Castles finally concludes the ICP data appear quite simply, to be erroneous in its own terms. It is worth looking at the example of a representative housing unit cited by Castles 'an apartment in a 20-year old multi-storeyed building, of 120 square metres, with central heating and one bathroom'.[1] This would hardly be appealing to the average middle-class Australian family, who would expect a separate house with a floor area of 150 to 200 m^2 on a block of 800 m^2 or more, and would regard 'living in a flat' as a serious come-down. On the other hand, for a flat, the stated specifications are relatively luxurious, particularly the requirement for central heating. I surmise that very few apartments meeting the ICP specifications could be found in Australia and that those few would be mostly up-market inner-city residences. Thus the problems with cars and fridges reappear, writ large, in the case of housing.

1. This is one of many examples of housing, but it appears that the ICP rental price measures are dominated by apartments.

This still leaves unresolved the question of location and the closely related issue of 'defensive expenditures'. Do we, for example, regard high levels of expenditure on heating fuel as evidence of a high level of comfort or as partial compensation for a bitterly cold climate. In this case, to paraphrase Lenin, households everywhere are voting with their feet.[2] Once defensive expenditures relating to a relatively severe climate and high crime levels are taken into account, the unambiguously superior measured performance of the US is likely to be replaced by a set of ambiguous comparisons with other wealthy countries.

Another set of problems arises with health care. Castles observes the measurement problems associated with public provision. A more fundamental difficulty is that the ICP measures inputs. It would seem preferable to measure outcomes, such as longevity and health status. The conceptual difficulties associated with incorporating outcome measures into an index compatible with revealed preference are substantial, but they can be overcome (Dowrick, Dunlop and Quiggin 1994).

Finally, a considerable part of the debate about high-growth economies, such as Hong Kong, Singapore and (until recently) Japan, concerns the role of factor inputs. One aspect of this is relatively long working hours. Castles stresses the Australian preference for leisure. On the available evidence (Dowrick and Quiggin 1993), taking account of leisure yields a slight improvement in Australia's standard of living relative to that of other OECD countries. However, in the OECD context, it is the apparent East-Asian appetite for work that is unusual. When account is taken of leisure, Hong Kong and Japan drop sharply, both in league table measures and in terms of revealed preference.

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2. A counter claim is that the mass migration towards the equator observed in the residential choices of Americans and Australians, and in the holiday destinations of other OECD citizens, is a lagged response to the invention of air conditioning, another form of defensive expenditure.

2. General Discussion

Discussion centred on two main questions about the use of international league tables:

- What do relative real income levels imply about economic progress and standards of living?
- What are the implications of changes in relative real income for policy makers?

There was general agreement that the relative levels of real income reported in conventional league tables did not adequately capture economic progress or relative living standards. In contrast, there was considerable disagreement about the role of such summary measures of economic progress as devices for gauging the benefits of alternative policy regimes.

One reason why relative real income levels may not adequately capture standards of living is that some societies make greater 'defensive expenditures'. It was noted that such expenditures account for about 15 per cent of GDP in the United States. Examples of defensive expenditure include: spending to make up for a miserable climate (air conditioning in summer, heating in winter); spending to make up for a dispersed metropolitan area (automobiles); spending related to crime (police, prisons, private security), and so on. If one peels all this away, most of the difference in relative real per capita income levels between the US and Europe is removed.

In addition to the types of expenditure made, issues about the way in which these expenditures are denominated were raised. In particular, the possibility of measurement techniques creating a systematic bias against particular types of countries was discussed. The prices used to convert national income levels to a common unit were described as 'Eurocentric', and to the disadvantage of non-European countries.

Given the difficulties involved in identifying a comprehensive price set of representative goods, the merit of choosing a small basket of representative goods was debated. After all, in principle, only one price is necessary to denominate real product, as shown by the Big Mac league table of relative real income. Choosing a small representative basket would have the advantage of transparency. It was mentioned that one reason for doing this is that whatever the shortcomings of attempts to measure relative real income, there must be some 'grain of truth' in major changes in relativities between countries that are sustained over time.

Alternatively, it was argued that if one's basic concern is with relative living standards, 'social indicators' could be given greater attention. Social indicators were considered to be very important, especially in areas such as health where no policy specialist could glean relevant information from the ranking of real per capita income. The main disadvantage of such an approach, though, is that these indicators must be prepared for each social issue in question. In contrast, the appeal of the conventional league table is that it provides a single summary measure.

Nonetheless, the fact remains that what is left out of measures of living standards matters. For this reason, we must be circumspect about the meaning of the relativities reported. As one discussant put it, there is a greater need to develop a theory of how to raise growth and welfare than to explain existing relativities in measured real income.

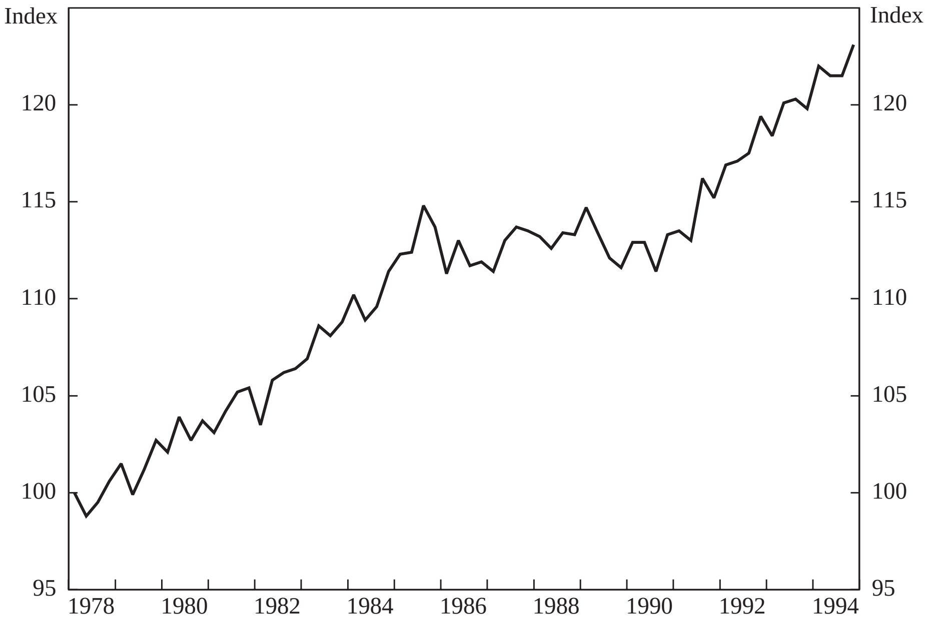
Labour-Productivity Growth and Relative Wages: 1978-1994

Philip Lowe*

1. Introduction

During much of the 1980s, labour-productivity growth in Australia was unusually slow (see Figure 1). Between March 1983 and June 1991 (which are equivalent points in the business cycle), output per hour worked in the non-farm economy increased at an annual rate of just 0.68 per cent per year. This compares with average annual labour-productivity growth of 1.34 per cent over the previous five years, and 2.51 per cent growth over the subsequent three years. This period of slow labour-productivity growth occurred at the same time that employment was growing rapidly. The most frequently offered explanation for this combination of favourable labour-market outcomes but low productivity growth is that the Prices and Incomes Accord held down real wages and led

Figure 1: Labour Productivity in the Non-Farm Sector
(March quarter 1978 = 100)



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to a substitution of labour for capital.[1] The growth of the service sector and measurement problems are also sometimes cited as explanations for the 1980's productivity slowdown.

This paper uses industry-level productivity and wages data in an attempt to improve our understanding of labour-productivity outcomes over the period since 1978. It does not contradict the explanation based on changes in the relative price of labour, but argues that the story is richer than that suggested by the simple factor-substitution explanation. The paper pays particular attention to the slowdown in labour-productivity growth over the second half of the 1980s. Over that period, four industries – construction, wholesale and retail trade, finance, property and business services and recreation, personal and other services – experienced declines in the *level* of labour productivity. The paper examines possible reasons for these declines and examines the contribution of these industries to the aggregate productivity slowdown.

The industry data raise a number of interesting issues. Foremost amongst these is the issue of how to measure output in the service industries. This problem is graphically illustrated by the wholesale and retail trade industry. Despite the adoption of new technologies and rationalisation within the industry, the measured level of labour productivity fell over the second half of the 1980s. To a significant extent this fall was the result of the deregulation of shopping hours, which led to an increase in opening hours and employment. While deregulation is unlikely to have led to more goods being processed through the checkout (the standard measure of output), it certainly made shopping more convenient. While statisticians attempt to make adjustments for improvements in the quality of goods, no adjustments are made for improvements in the quality of services. The result of this is that deregulation of shopping hours led to a reduction in measured output per hour worked, but to an increase in many people's living standards. As the service sector continues to expand, contradictions of this sort will become more frequent.

While measurement problems in other service industries adversely affect the measured level of real output, they can only explain the productivity slowdown if the service sector's share of total employment increased substantially or, somehow, the measurement problems became worse in the 1980s. There is some evidence that measurement problems did in fact become more severe in the finance, property and business services sector and, in particular, in the wholesale and retail trade industry. Measurement problems appear to have played a much smaller role in explaining the slowdown in productivity growth in the recreation, personal and other services sector. In this sector, compositional shifts appear to have been important. In addition, declines in real product wages allowed rapid employment growth, despite the fact that the average level of labour productivity of the new workers was less than the average level of the existing workers.

Outside the service sector, the construction industry, and to a lesser extent the manufacturing industry, also made significant contributions to the 1980s slowdown. Working in the other direction, faster rates of productivity growth in electricity, gas and water, communications and transport and storage acted to push up productivity growth. These favourable effects were, however, more than offset by developments in other sectors.

1. See EPAC (1989), Dowrick (1990), Dixon and McDonald (1992) and Phipps, Sheen and Wilkins (1992).

The industry data also provide some insight into the relationships between relative productivity performance and wage outcomes. Under enterprise bargaining arrangements, wage increases for individual enterprises and industries are increasingly justified in terms of the individual firm's or industry's productivity performance. Such a relationship between productivity growth and wages has an obvious appeal. Ultimately, however, differential rates of productivity growth between industries do not appear to lead to substantially different rates of increases in wages across industries. Instead, differences in productivity growth affect relative prices; slow productivity growth in hairdressing does not lead to stagnant real wages for hairdressers, but instead to an increase in the relative price of a haircut. The examination of the wage data also suggests that real output growth in the finance, property and business services sector has been significantly underestimated.

The remainder of the paper is structured as follows. Section 2 examines trends in labour-productivity growth over the period from March 1978 to June 1994 and the contribution of various industries to changes in labour-productivity growth.[2] Section 3 then analyses productivity trends in the wholesale and retail trade, recreation, personal and other services and construction sectors. Section 4 follows with an examination of the interactions among wages, productivity and prices using industry-level data. Finally, Section 5 provides a summary and concluding remarks.

2. Trends in Labour-Productivity Growth

In analysing trends in labour-productivity growth, the traditional measure of labour input is hours worked. While this is the appropriate measure for assessing the average output produced per hour worked, it ignores the fact that unemployed workers are producing no measured output. If these unemployed workers find jobs, this is likely to slow productivity growth as, on average, the new workers will be producing less output than the existing workers. In contrast, output per potential worker may be growing quite strongly. This appears to have been the case in the second half of the 1980s. Figure 2 shows an index of output per *potential* worker (where the potential workforce is equal to the labour supply). This labour-productivity series is more volatile than the one presented in Figure 1 as it does not adjust for the decline in labour input in recessions. More importantly, this series also shows a much better productivity performance between 1982 and 1989. While declining unemployment contributed to the slowdown in growth in the standard measure of labour productivity, the slowdown does not necessarily imply a decline in the rate at which average living standards were improving.

While swings in the business cycle have a pronounced effect on output per potential worker, they also affect the standard measure of output per hour worked. In recessions, labour productivity tends to decline as firms are reluctant to lose workers who have firm-specific knowledge. In the recovery, this 'labour hoarding' means that labour productivity can increase quite quickly. The existence of increasing returns to scale may accentuate this cyclical influence. While taking account of these cyclical influences is important, there is no standard method by which this is done. The approach adopted here is to use

2. The choice of time period is governed by the availability of data on hours worked by industry.

Figure 2: Output Per Potential Worker
(March quarter 1978 = 100)

Note: Labour supply defined as labour force plus those not in the labour force seeking work.

the recession troughs as the break dates for splitting the sample into three sub-periods. At best, this is only a partial solution as neither the starting nor end points of the entire sample are recession troughs. Even if they were, differences in the nature of recessions may lead to differences in productivity performance over different business cycles.

Table 1 presents labour-productivity *growth rates* for each industry over the various sub-periods and Figure 3 shows the *level* of labour productivity in the March quarter of 1978 and the June quarter of 1994. The ASIC industry classifications are used.[3]

Data on hours worked by industry are obtained from the Labour Force Survey.[4] This is a survey of individuals and provides industry-level hours worked data from 1978 onwards. Data from a similar survey of firms (the Survey of Employment and Earnings)

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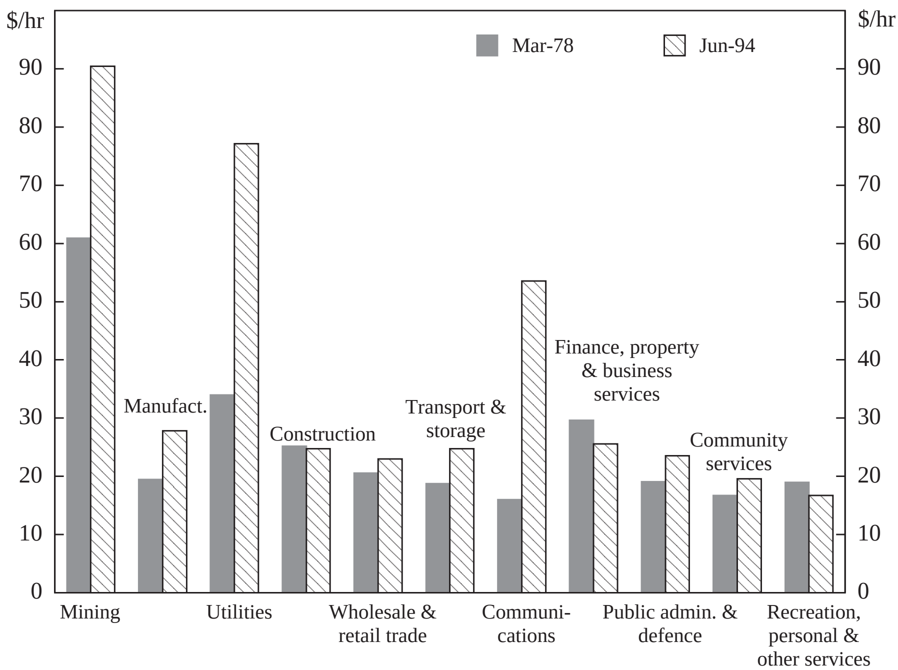
3. In August 1994, the Australian Bureau of Statistics (ABS) switched from the Australian Standard Industrial Classification (ASIC) to the Australian and New Zealand Standard Industrial Classification (ANZSIC) system. This change has led to some alterations in the definition of industries. Since at the time of writing, historical data under the ANZSIC definitions are only available from December 1984, this paper predominantly uses data based on the ASIC industry definitions. In some cases in the industry studies, ASIC data are used in conjunction with ANZSIC data. Attempts have been made to ensure that the data are as comparable as possible.

4. Hours-worked data are calculated by multiplying employment by average hours worked. The employment data are seasonally adjusted by the ABS. The hours-worked data are seasonally adjusted using the X11 procedure and then a centred (Henderson) moving average is applied to the seasonally-adjusted data.

Table 1: Labour-Productivity Growth Rates by Industry
(Per cent per annum)

	1978:1-1983:1	1983:1-1991:2	1991:2-1994:2	1978:1-1994:2
Mining	-3.01	6.44	1.42	2.52
Manufacturing	2.41	1.89	2.53	2.16
Utilities	1.00	7.68	5.19	5.13
Construction	2.70	-1.45	-0.98	-0.10
Wholesale and retail trade	1.01	-0.10	2.31	0.68
Transport and storage	-0.55	1.81	5.63	1.77
Communications	6.07	6.96	12.89	7.76
Finance, property and business services	0.02	-1.37	-0.97	-0.87
Public administration and defence	0.70	1.31	2.17	1.28
Community services	0.64	0.45	2.89	0.96
Recreation, personal and other services	-0.50	-1.83	1.49	-0.81
Non-farm sector	**1.34**	**0.68**	**2.51**	**1.21**

Figure 3: Labour Productivity by Industry
(Output per hour worked)



Note: Output at average 1989/90 prices.

were first published in September 1983. At least for data on total employment, the Labour Force Survey is preferred by the ABS.[5] While the general trends in the two surveys are similar, the Survey of Employment and Earnings has shown weaker employment growth over recent years. At the industry level, differences between the two surveys can help explain some of the anomalies in the industry labour-productivity data (see below).

There are clearly large differences across industries in both *growth rates* and *levels* of labour productivity. In the communications sector, labour productivity increased at nearly 8 per cent per year between 1978 and 1994, while labour productivity fell at almost 1 per cent per year in the finance, property and business services and the recreation, personal and other services sectors. In terms of levels, in the June quarter of 1994, labour productivity in the mining industry (the sector with the highest level of labour productivity) was almost 5.5 times that in the recreation, personal and other services industry (the sector with the lowest level of labour productivity).

In a number of industries there is an important issue concerning the measurement of output and thus productivity. The most frequently cited measurement problems are in the non-market sectors – public administration and defence, finance, property and business services and community services – where it is difficult to obtain the direct market value of output. In public administration and defence, annual estimates are derived by extrapolating base year output by the sum of deflated estimates of wages, salaries and supplements and constant price estimates of consumption of fixed capital.[6] With public service average wages rising more quickly than public service pay rates (due to an increase in the average classification level of public servants) measured labour-productivity growth has been positive. To the extent that a higher average classification represents a higher average skill level, it is consistent with rising labour productivity. More problematic is the notion that an increase in the pay rate of a particular classification represents an increase in the 'price' of the output, rather than an increase in output produced per hour worked. Similar issues arise in the community services industry.

In the finance, property and business services sector, output in the base year is extrapolated using data on hours worked.[7] This is based on the assumption that there is zero labour-productivity growth. Despite this, on the measure presented above, labour productivity does change in these industries. While compositional effects play some role in explaining this change, differences in the Labour Force Survey (LFS) and the Survey of Employment and Earnings (SEE) are also important.

Since September 1983, the ABS have used the SEE to extrapolate output in this sector. Figure 4 shows the ratio of finance, property and business services sector employment, as measured by the SEE, to employment as measured by the LFS.[8] It shows that changes

5. See ABS Cat. No. 6248.0.

6. Quarterly estimates are derived by interpolating the annual estimates with estimates of hours worked (see ABS Cat. No. 5243.0).

7. This procedure was also used for the 1984/85 base-year estimate for public administration and defence.

8. The ratio has been rebased to 100 in March 1985. The ABS state that 'if the incidence of multiple job-holding, labour turnover and part-time working remains fixed over time, the estimates of movement in employment provided by the two series are, in concept, the same.' (ABS Cat. No. 5211.0, 1989/90, p. 18:33).

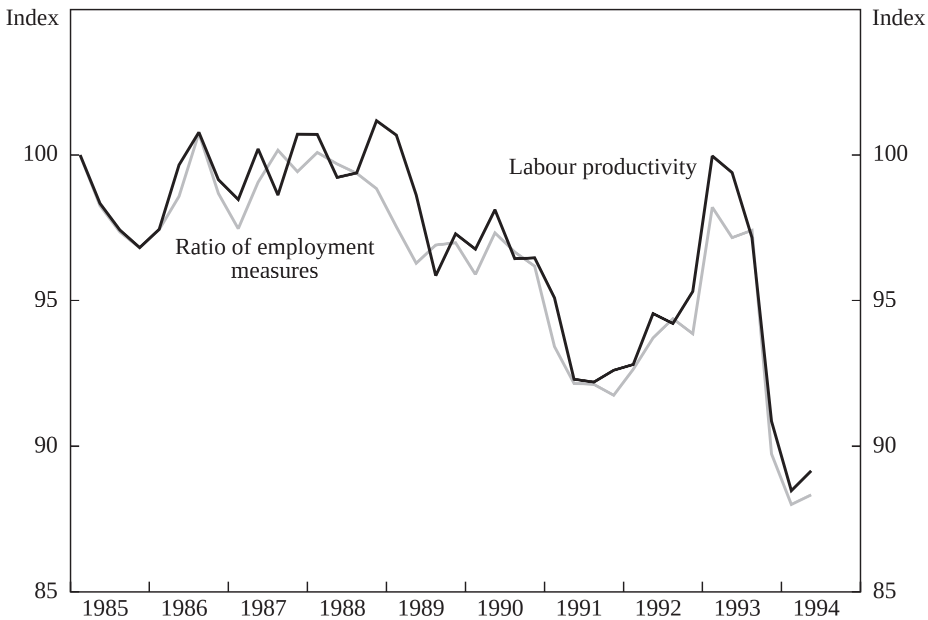
in labour productivity, as measured in this paper, are almost entirely explained by changes in this ratio. Thus if the SEE measure of labour input is used in the productivity calculations, there is no decline in productivity. While in the medium term, the two measures of labour input might be expected to behave similarly, substantial deviations appear to persist for some time. In analysing the differences in the two measures, the ABS states that in the upswing of the employment cycle the (aggregate) SEE series will lag the LFS series due to delays in updating the business register. The increasing use of contract labour in the finance, property and business services sector may also be contributing to the differences.

Other measurement problems, particularly in service industries, arise due to the difficulty in measuring the quality of output. While the statistician makes adjustments to price indices for the improvement in the quality of goods, such adjustments are typically not made for improvements in the quality of services. Whether or not such adjustments should be made is a matter for debate. For example, if shops are open longer hours, providing an increased level of convenience, should some adjustment be made to the price deflator for the retail industry? Should adjustments be made for improvements in quality of service in hotels and restaurants? There are no clear, easily implementable answers to these questions. However, these issues do suggest a deal of caution in concluding that a slowdown in measured labour-productivity growth necessarily implies a slowdown in the march forward of living standards.

Notwithstanding these measurement problems, we now turn to examining the role that particular industries play in driving the aggregate productivity numbers. The

Figure 4: Labour Productivity and Measures of Labour Input for Finance, Property and Business Services

(March quarter 1985 = 100)



aggregate level of labour productivity can be expressed as a weighted average of productivity in each industry, where the weight for a particular industry is that industry's share of total employment. That is:

$$\frac{Y}{L}=\sum_{i=1}^{n}\frac{L_i}{L}\frac{Y_i}{L_i} \tag{1}$$

where Y is aggregate output, L is aggregate labour input and Y_i and L_i are output and labour input in industry i.

Given equation (1), the change in aggregate labour productivity can be expressed as:

$$\Delta\left[\frac{Y}{L}\right]=\sum_{i=1}^{n}\left\{\Delta\left[\frac{Y_i}{L_i}\right]\frac{L_i}{L} + \Delta\left[\frac{L_i}{L}\right]\left[\frac{Y_i}{L_i}-\frac{Y}{L}\right]\right\} \tag{2}$$

The first component measures the contribution to the change in aggregate labour productivity made by productivity improvements *within* each industry. The second component measures the contribution made by workers shifting *between* industries. One weakness of this accounting approach is that the two components may not be independent. A sector that has a higher than average level of labour productivity may further increase labour productivity by firing any workers with low marginal product. This would be recorded as an increase in within-sector productivity, as well as a decrease caused by the movement of labour out of an industry with a high average level of productivity. The problem arises because the marginal product of the average and marginal workers may be quite different. This hints at a second and related problem – while average labour-productivity levels differ considerably across sectors, the differences in labour productivity of the marginal worker are likely to be much smaller. Thus, the relatively small compositional effects identified below are likely to be upper estimates of the true size of compositional effects at least at this level of aggregation.

We now turn to the decomposition suggested by equation (2), and examine the contributions to aggregate labour-productivity growth made by various industries in each of the three periods defined in Table 1. For each period, Figure 5 shows the annual change in labour productivity in each sector, multiplied by the sector's share in total employment – the first component of equation (2). Figure 6 shows the second component of equation (2) – the contribution to productivity growth from the movement of labour between sectors. Figure 7 shows the share of total hours worked in each of the industries in March 1978 and June 1994. The biggest changes have been an increase in the employment shares of finance, property and business services and community services and a decline in manufacturing's share.

2.1 The Slowdown in Labour-Productivity Growth From 1983

After growing at an annual rate of 1.34 per cent between March 1978 and March 1983, labour productivity in the non-farm sector grew at just 0.68 per cent per annum between March 1983 and June 1991. Figure 5 and Table 1 show that this slowdown did not occur in all industries, with a number of industries increasing their contribution to aggregate labour-productivity growth. Most notable amongst these was the mining sector, with labour-productivity growth increasing from -3 per cent per annum, to around $6^{1}/_{2}$ per cent per annum; this added 0.16 of a percentage point to annual aggregate productivity growth.

Of the industries contributing to the slowdown, the construction industry made the largest contribution. Had productivity growth in this industry been maintained at the rate that was achieved between March 1978 and March 1983, annual aggregate labour-productivity growth would have been 0.35 of a percentage point faster in the 1983-91 period. The slowdown in labour-productivity growth in manufacturing contributed a further 0.18 of a percentage point to the aggregate slowdown. In total, the slowdown in measured productivity growth in the five service sectors contributed 0.45 of a percentage point.

Within the service sector, wholesale and retail trade made the largest contribution. The slowdown in this sector, from an already slow growth rate, took around one-quarter of a percentage point off aggregate labour-productivity growth, relative to the 1978-83 period. After experiencing average labour-productivity growth of around 1 per cent per annum between March 1978 and March 1983, the wholesale and retail trade sector actually recorded negative productivity growth over the following eight years. By March 1991, the level of labour productivity in the sector had fallen nearly 11 per cent from its peak reached in March 1984.

Figure 5: Contributions from Within Sectors

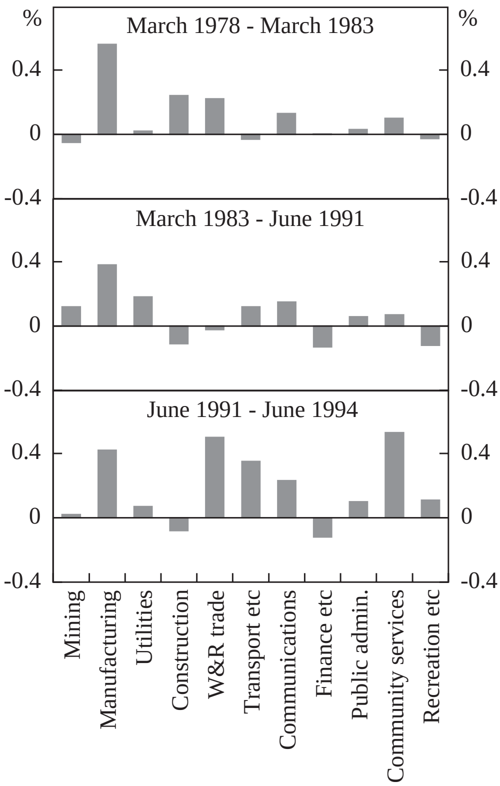


Figure 6: Contributions from Movements Between Sectors

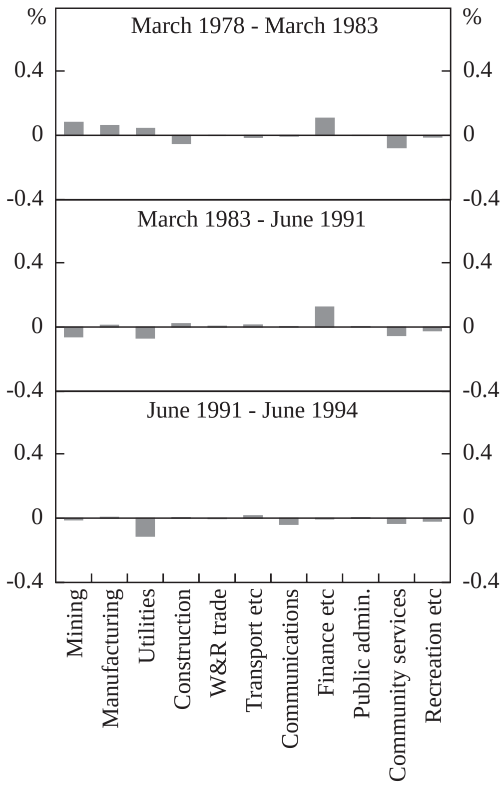
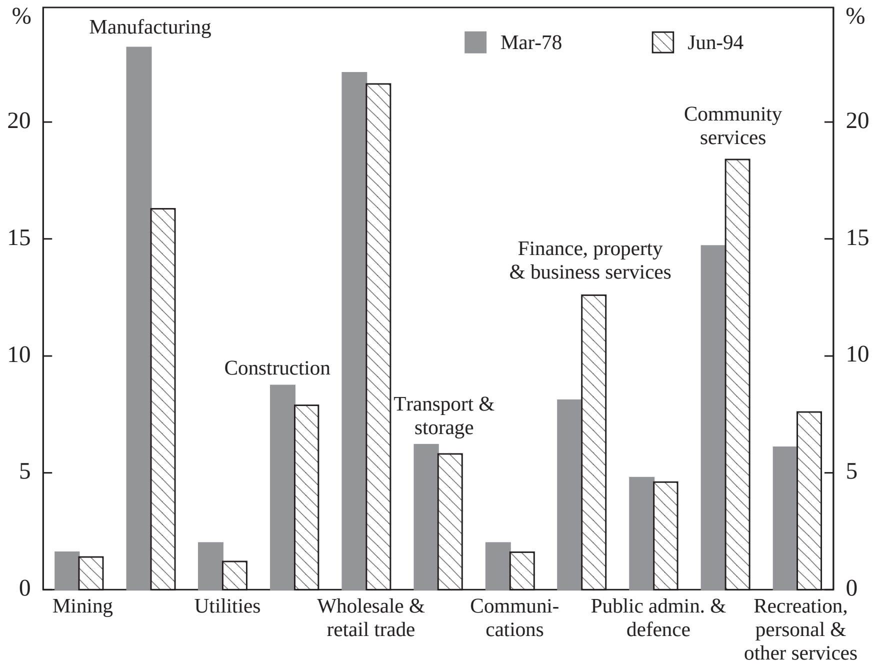


Figure 7: Shares of Total Hours Worked
(Percentage of aggregate hours worked)



The finance, property and business services sector contributed around 0.13 of a percentage point to the aggregate slowdown. As discussed above, the negative productivity growth in this sector reflects differences in the Labour Force Survey and the Survey of Employment and Earnings. Between 1983 and 1991, the level of labour productivity also fell in the recreation, personal and other services sector. In fact, this sector experienced the largest fall of any industry; the level of labour productivity falling over 14 per cent between March 1983 and June 1991. The deterioration in the productivity performance in this sector contributed almost 0.1 of a percentage point per annum to the overall slowdown.

As noted above, the slowdown in productivity growth in the mid 1980s did not occur in all industries – in addition to the mining sector, the utilities, transport and storage and communications industries all made larger contributions to aggregate labour-productivity growth in the 1983-91 period than they had done in the 1978-83 period. Labour-productivity growth in utilities was 7.7 per cent per year between March 1983 and June 1991 (1.0 per cent in the earlier period), while labour-productivity growth in communications was 7.0 per cent (6.1 per cent), and in transport and storage it was 1.8 per cent (-0.6 per cent).

In part, the faster productivity growth in these industries reflected the microeconomic reforms that were taking place.[9] To some degree, the low productivity growth in the

9. For a discussion of the impact of recent microeconomic reforms on productivity see Filmer and Dao (1994).

manufacturing, construction and wholesale and retail trade industries has hidden the macroeconomic benefits of these microeconomic reforms. Not only has the improved performance of sectors that provide important inputs made an indirect impact on the competitiveness of Australian business, but it has also made a significant direct contribution to aggregate labour-productivity growth. Had the productivity growth of these sectors (utilities, communications and transport and storage) been unchanged from the rate that was achieved between March 1978 and March 1983, aggregate labour-productivity growth between 1983 and 1991 would have been at least 0.3 of a percentage point slower than the already low level that was actually experienced.

Finally, an examination of Figure 6 suggests that at the level of aggregation used in this section of the paper, the movement of labour between sectors played only a very small role in explaining the productivity growth slowdown. In the period between March 1978 and March 1983, the movement of labour between sectors added just over 0.1 of a percentage point to annual labour-productivity growth. This compares with a zero contribution over the period from March 1983 to June 1991. In both periods, the growth of employment in the relatively low-productivity community services industry acted to retard aggregate labour-productivity growth. This was offset by the employment growth in the relatively high-productivity finance, property and business service sector. The impact of these effects was, however, quite small. The major difference between the two periods is the decline in the latter period in the employment shares of the mining and utilities industries which have relatively high labour productivity.

2.2 The Pick-up in Labour-Productivity Growth Since 1991

Since mid 1991, the growth rate of labour productivity has increased considerably – averaging 2.5 per cent per annum between June 1991 and June 1994. This improvement has been widespread, with most industries experiencing a pick-up in productivity growth. While in the construction and the finance, property and business services sectors, labour productivity has continued to decline, it has done so at a slower pace. In contrast, the levels of labour productivity in wholesale and retail trade and recreation, personal and other services industries have risen over recent years.

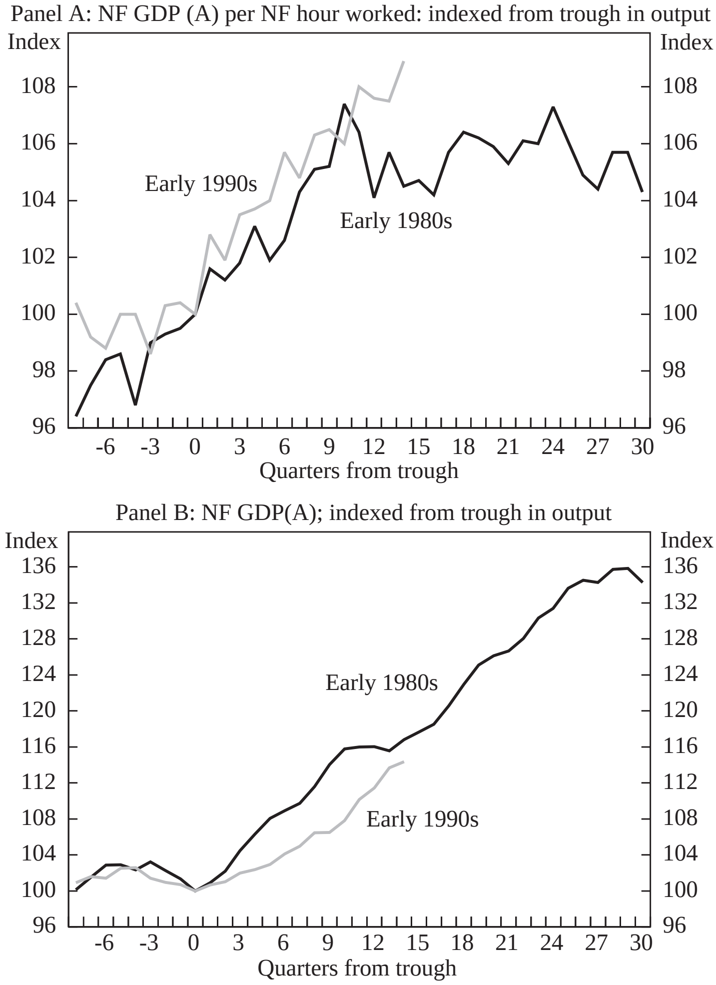
The sector that has made the largest contribution to the turn-around in aggregate productivity performance is the wholesale and retail trade sector – it accounts for around half of a percentage point of the increase in the growth rate. Together, the transport and storage and communications industries have contributed a further 0.3 of a percentage point to the pick-up in aggregate labour-productivity growth. A considerable contribution has also been made by the community services industry (0.45 of a percentage point).

While the movement of labour between sectors has had a larger impact on productivity growth than was previously the case, the role remains relatively small (see Figure 6). The declines in employment shares of the high-productivity utilities and communications industries have contributed negatively to aggregate labour-productivity growth. In total, the effect of the movement of labour between sectors has been to subtract nearly 0.2 of a percentage point per annum from aggregate labour-productivity growth (compared with zero, in the previous period). However, as mentioned earlier, the within-sector productivity contributions may not be independent of the contribution made by movements of labour between sectors. In particular, while in an accounting sense, the fall in relative employment in the high-productivity utilities industry has resulted in a direct decline in overall productivity, the fall in employment was probably important in generating the rapid increases in labour productivity *within* the sector.

Does the increase in labour-productivity growth represent a fundamental change from the 1980s experience or is it just a one-time adjustment in productivity levels and/or the result of a cyclical upswing?

The top panel of Figure 8 presents indices of labour productivity for the non-farm sector around the time of the recessions of the early 1980s and early 1990s.[10] The zero point on the time line represents the trough of the recession. The bottom panel shows analogous indices for real non-farm GDP. For the first two years of recovery, labour-productivity growth is similar in the two episodes – increasing at nearly 3 per cent

Figure 8: Productivity and Output Out of Recessions



10. The GDP(A) series is used here. The data period has been extended to include the December quarter 1994.

per year. This is despite the fact that in the most recent episode, output growth was considerably slower. In terms of productivity growth, the real difference appears in the third year. In the episode of the early 1980s, labour productivity reached its peak ten quarters after the trough of the recession and then was basically flat for seven years. In the current recovery, labour productivity has continued to increase and, in relative terms, is now considerably above where it was at the same time in the previous cycle. In contrast, non-farm output has not yet increased to the same extent as was the case in the early 1980s.

It is tempting to cite this recent difference in productivity growth as the first sign of a structural change in the underlying rate of productivity growth. However, it is clearly too early to make a definitive judgment on whether such a change has occurred. Explaining, let alone predicting, changes in productivity trends is notoriously difficult. There are, however, a number of factors that give cause for optimism. First, ongoing microeconomic reform and the competitive pressures induced by the increased internationalisation of the economy should help deliver continuing productivity improvements.[11] The implementation of the Hilmer reforms, which the Industry Commission estimate will add around $5^1/_2$ per cent per annum to real GDP, is also a positive factor for future productivity growth.

Second, real wages should not need to fall as they did after the wages push of the early 1980s. To some extent, the early-1980s recession was the result of an unsustainably large increase in real wages – this was not the case in the early-1990s recession. An implication of this is that as demand increases, real wages, productivity and employment should *all* increase. As the cycle progresses, declining unemployment rates may well be associated with declining productivity growth, but with real wages growing, a repeat of the stagnant productivity of the second half of the 1980s experience is unlikely.

Third, as the following discussion argues, the measured performance of the wholesale and retail trade industry should be considerably better than in the 1980s. Most of the adjustment to the deregulation of shopping hours has been completed, so that the adoption of new technologies and more efficient forms of retailing should contribute to aggregate productivity growth.

Fourth, as Baily (1993) argues, the electronics revolution of the past decade has soaked up a lot of resources, as companies have computerised their workplaces and come to grips with the new technology. We may now be on the verge of reaping more fully the gains from this investment. David (1990) argues that the small productivity gains that western countries have so far seen from computerisation are analogous to the small initial gains from the invention of the electric dynamo at the end of the previous century. In that case, large productivity gains were not realised until new industrial facilities, organisational structures and complementary technologies were developed. In the current context, it is difficult to predict exactly when, and to what extent, the benefits of the recent investment in computers and information technology will show up in the productivity numbers. Nevertheless, it is probable that in the next five years substantial benefits will accrue.

While the magnitude and timing of these various factors is uncertain, collectively they provide a basis for believing that labour productivity growth will continue at a reasonable pace for the remainder of the current decade. As growth in GDP slows, some slowing of

11. See Ergas and Wright (1994) for evidence that internationalisation has affected the performance of firms in the manufacturing industry.

productivity growth is inevitable, but a return to the stagnant levels of labour-productivity experienced in the second half of the 1980s seems unlikely.

3. Labour-Productivity Growth in Specific Industries

Over the business cycle that ran from March 1983 to June 1991, four industries experienced a decline in the measured *level* of labour productivity. In the finance, property and business services sector this decline can largely be explained by problems with the measurement of labour input (see previous section). This section analyses productivity outcomes in the other three sectors: two service industries – wholesale and retail trade and recreation, personal and other services – and the construction industry.

3.1 The Wholesale and Retail Trade Industry

The wholesale and retail trade industry is the largest industry in Australia. In 1994, it accounted for nearly 18 per cent of total output in the non-farm economy (nearly 20 per cent if the ownership of dwellings, import duties and imported bank service charges are excluded) and for about 22 per cent of total hours worked.

Figure 9 shows output per hour worked in the industry over the period from March 1978 to June 1994. Labour productivity is clearly pro-cyclical; falling in recessions and increasing in booms. Perhaps more importantly, the trend rate of productivity growth appeared to change in the mid 1980s. After output per hour worked increased by around 1 per cent a year from 1978 to 1983, it fell, on average, by around 0.1 per cent a year over the following eight years.[12] More recently, labour-productivity growth has again been positive. Despite the recent rise, labour productivity in June 1994 had still not reached its previous peak in March 1984.

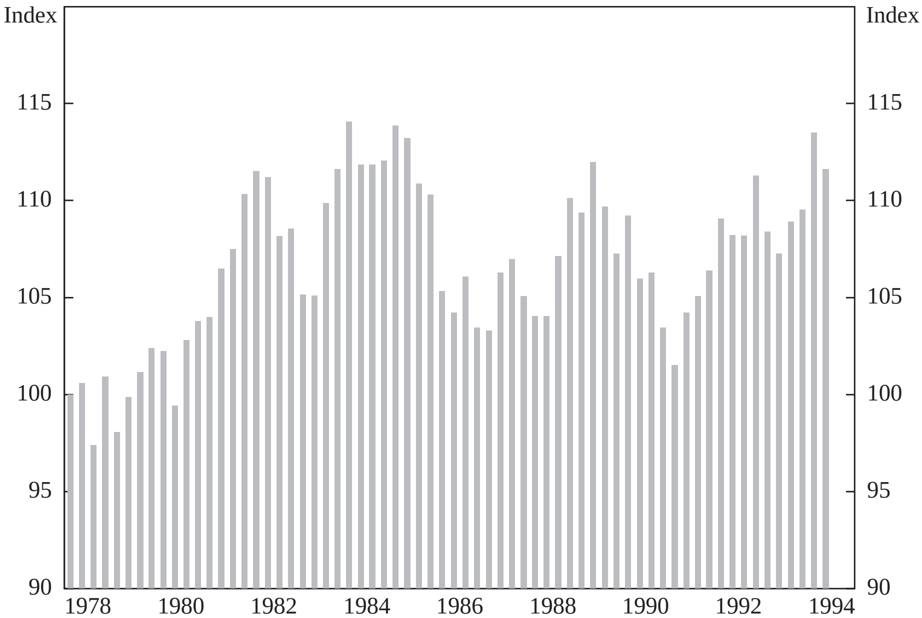
While comparable data for other countries are scarce, the low productivity growth in the wholesale and retail trade industry appears to be unusual by international standards.[13] The OECD publishes data on total-factor productivity for different sectors for member countries (Meyer Zu Schlochtern and Meyer Zu Schlochtern 1994). Unfortunately, the data for wholesale and retail trade also include the output of the hotels and restaurants sector (which under the ASIC classification system is included in the recreation, personal and other services sector). The data show that between 1970 and 1989, total-factor-productivity growth in this sector in Australia was -0.34 per cent per annum. This performance was worse than that in any other country for which data are published – on average, across the 13 countries, total productivity growth in the sector was 0.8 per cent per annum.[14]

12. Between 1966/67 and 1978/79 output per person employed in the industry increased at around 1.6 per cent per year.

13. One source is OECD (1992). This report examines the change in the structure of the distribution industry in seven OECD countries (Australia is not included).

14. A series of reports published by the OECD suggest that, in a range of countries, labour-productivity growth in the distributive trades was between 1 and 2 per cent in the 1980s (see Betancourt (1993), Dawson (1993), Lachner, Tager and Weitzel (1993), Maruyama (1993), Messerlin (1993), Pellegrini and Cardani (1993) and Wibe(1993)). For the United States, both the Bureau of Labour Studies and the Bureau of Economic Activity estimate that output per hour worked in retailing increased by more than 1 per cent per year between 1977 and 1986. However, over this period labour productivity in food stores fell by 7 per cent (see Baily and Gordon (1988)).

Figure 9: Labour Productivity in the Wholesale and Retail Trade Industry
(March quarter 1978 = 100)



In light of the international experience, and given the perception that there has been substantial technological innovation in the distributive trades over the past decade, the fall in labour productivity is surprising. The use of scanning devices and computer-operated stock control systems have become common place. Stores have become larger and many firms have rationalised their operations. Despite these changes, the average worker in June 1994 was processing slightly fewer goods per working hour than a worker ten years ago. We now examine why this is so.

3.1.1 Measurement issues

Firms in the distribution industry provide three core outputs: (i) distribution of goods; (ii) product information; and (iii) convenience or the minimising of transaction costs. (Some might argue that they also provide entertainment.)[15] In obtaining an estimate of the growth rate of output for the industry, statistical agencies typically only consider the first of these outputs. In Australia, in the wholesale industry, base-year output for six industry groups is extrapolated by constant price estimates of wholesalers' sales in each industry group. In the retail industry, base-year output for 16 industry groups is extrapolated by constant price estimates of industry retail turnover. This methodology assumes that output is a fixed proportion of turnover for each industry group. As such, it only takes account of the 'distribution' output of the sector, ignoring the supply of product information and the provision of convenience. Given current measurement

15. Oi (1992) argues that retail firms also engage in repackaging and supply ancillary services such as delivery and credit.

practices, changes in the quality of service, opening hours, the extent of product information and the quality of the shopping environment do not lead to changes in output.

There are two principal sources of data on measured output and labour input for the wholesale and retail trade industries. The first is the periodic censuses of the retail industry and surveys of the wholesale industry carried out by the ABS. For retail trade, a census has been conducted every five or so years since 1948.[16] For wholesale trade, the most recent surveys were conducted in 1981/82 and 1991/92. The second source is that used above for the calculation of industry labour-productivity indices – that is, quarterly output data from the national accounts and labour input from the Labour Force Survey. The census/survey data provide comprehensive snap-shots at particular points in time, while the national accounts provide time-series data.

Unfortunately, the two sources present quite different pictures. The quarterly data show that in the second half of the 1980s, labour productivity fell in both the wholesale and retail industries, with the fall being more pronounced in the wholesale industry (see Figure 10). This is at odds with the results from the Wholesale Industry Surveys and the Retail Censuses. Data from the survey of wholesalers show that real turnover increased by 19 per cent between 1981/82 and 1991/92, while employment fell by 4 per cent; implying an *increase* in turnover per person of some 23 per cent. Over the same time period, the national accounts data show an increase in output in the wholesale sector of around 8 per cent, and the Labour Force Survey shows an increase in employment of 19 per cent (and an increase in hours worked of 23 per cent). This implies a *fall* in output per person of 15 per cent between 1981/82 and 1991/92.[17] In retailing the contrast is less marked. The census data appear to show slightly slower productivity growth than do the national accounts/labour force survey data, although a complete assessment is made difficult due to changes in industry definitions brought about by the switch from ASIC to ANZSIC classifications.

3.1.2 The wholesale industry

If the survey data are correct, then labour-productivity growth in wholesaling was considerably higher than that suggested by Figure 10. Table 2 presents employment and turnover data from the Wholesale Industry Survey for various sub-categories of wholesale trade. It shows that in 1991/92, almost two-thirds of total employment in wholesaling was in sub-sectors that supply investment goods (the first four categories). This explains much of the cyclicality of the industry. In all sub-sectors, with the exception of machinery and equipment, employment actually fell over the ten years to June 1992. Perhaps more importantly, the data show that in all but one sub-sector, real turnover per person increased between 1981/82 and 1991/92. The increase was particularly large in minerals, metals and chemicals, where labour productivity increased by 70 per cent over the ten year period. Given the widespread gains in labour productivity throughout the industry, it seems unlikely that labour productivity in the industry as a whole could have declined.

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16. The 1991/92 census, which is known as the Retail and Services Census, also included certain service industries. In the present paper, this census is simply referred to as the Retail Census.

17. In part, this difference may reflect the fact that the 1991/92 Wholesale Industry Survey sought data on ‘management units’, while the earlier survey sought data on ‘establishments’. In the latter survey, businesses whose primary activity was not wholesaling were excluded.

Figure 10: Labour Productivity Indices for Retail Trade and Wholesale Trade
(March quarter 1978 = 100)

Table 2: The Wholesale Industry (1991/92)

Type of wholesaler	Employment	Turnover $m	% change in employment 1981/82-1991/92	% change in turnover per person 1981/82-1991/92
Builders hardware dealers	44,155	6,408	-19.7	20.8
Machinery and equipment	102,677	17,616	4.9	23.5
Minerals, metals and chemicals	31,012	24,438	-20.7	70.7
Farm properties and produce	19,565	7,954	-14.9	-6.1
Food, drink and tobacco	43,466	14,516	-14.8	3.1
Textile and clothing	14,875	3,076	-9.3	6.7
Household goods	12,977	3,235	-26.3	28.6
Other specialists	39,524	7,874	-0.1	34.2

Notes: (a) Nominal turnover data have been deflated by the implicit price deflator for the wholesale industry.

(b) ASIC and ANZSIC data have been used to construct the percentage changes. The differences in the definitions are relatively minor with a couple of exceptions. In the builders hardware dealers category, building completion services are not included in the data for 1991/92 (in 1991/92 this sector accounted for around 7 per cent of sub-sector employment). The machinery and equipment category excludes motor vehicles wholesalers in both periods.

Source: ABS Cat. No. 8638.0, 1981/82 and 1991/92.

3.1.3 The retail industry

Stores selling food account for the largest share of employment in the retail industry (see Table 3). Food stores have also been the source of the fastest jobs growth within retailing, with the number of jobs increasing by 22 per cent between 1986 and 1992. Employment in stores selling bread and cakes grew particularly strongly, increasing nearly 140 per cent over the six year period, while the number of establishments increased by nearly 90 per cent.[18] Employment growth was also very rapid in takeaway food retailing (up 41 per cent). Outside the food industry, employment grew quickly in stores selling domestic hardware and housewares (up 43 per cent) and in stores selling newspapers, books and stationary (up 28 per cent) (see Appendix A).

Value added per employee tends to be highest in those sub-sectors selling high-value goods such as furniture and motor vehicles. According to data published from the 1985/86 Retail Census, value added per employee in these sub-sectors is about three times that in the sub-sector with the lowest value added per employee (milk bars and take away stores). While large differences exist in the level of labour productivity between sectors, international evidence suggests that large differences also exist within sub-sectors.

In general, one of the most significant determinants of the level of labour productivity for a given class of store is the size of the store. In a comprehensive comparison of retailing productivity in Britain, the United States and Germany, Smith and Hitchens (1985) conclude that, in all three countries, labour productivity increases with shop size, where size is measured by turnover. They attribute much of the superiority of retail productivity in the US to the larger size of shops in that country. A similar conclusion is reached by Baily (1993) who attributes the large size of shops in the United States to relatively weak zoning regulation, few restrictions on shopping hours and a well-developed private transport system. An OECD study into the distribution systems of a variety of countries (OECD 1992) concludes that average sales per employee tend to be 50 to 80 per cent higher in the largest class of stores than the smallest, with value added per employee being as much as 100 per cent higher. The study also reports work by Noyelle (1990) which concludes that in France, the shift to larger stores between 1980 and 1986 contributed over 1 per cent per annum to labour-productivity growth in retailing (out of a total labour-productivity growth in the sector of 2.4 per cent per annum).

As Table 3 shows, this shift to larger stores has also occurred in Australia. The increases have been particularly pronounced for supermarkets and stores selling furniture, housewares and appliances. In both cases, the average sizes of stores increased by over 20 per cent between 1986 and 1992. In most cases, real turnover has not increased as quickly, so that turnover per square metre has fallen.

Not only has the physical size of stores increased, but so too has the number of employees per store. In 1980, on average, 5.5 people worked at each retail location. By 1992, this had increased to 6.2 people. In part, this increase is due to the growth of part-time employment, with the number of full-time employees per location actually falling. The increase in the size of businesses can also be seen in the number of ‘small’ and ‘large’ businesses (small businesses are those that employ fewer than 20 people);

18. In part, this growth stems from the deregulation of baking hours in the mid 1980s.

Table 3: The Retail Industry

Type of store	Employment 1991/92	Employment % change from 1985/86	Square metres per location 1991/92	Square metres per location % change from 1985/86	Turnover per square metre 1991/92 $	Turnover per square metre % change from 1985/86	Turnover per employee 1991/92 $	Turnover per employee % change from 1985/86
Supermarket and grocery	179,619	6.6	560	23.3	4,918	5.4	145,269	8.9
Specialised food	238,028	37.0	105	11.2	3,294	-5.0	63,581	-18.7
Total food	*417,647*	*22.0*	*186*	*10.9*	*4,164*	*1.0*	*98,713*	*-6.2*
Department stores	86,576	-9.7	9,084	3.1	2,508	-10.5	113,172	3.5
Clothing and soft goods	91,653	8.9	152	12.0	2,597	-5.0	94,891	-1.3
Furniture, housewares appliances	72,503	23.7	401	20.2	2,072	-8.8	163,869	0.2
Recreational goods	56,297	17.8	155	4.6	3,323	1.6	113,168	-6.0
Other personal and household goods	111,026	39.4	169	8.8	1,955	1.5	82,909	4.1
Total personal and household goods	*427,688*	*14.2*	*248*	*8.4*	*2,331*	*-7.1*	*108,626*	*-0.1*
Motor vehicle retailing and services	215,198	n.a.	n.a.	n.a.	n.a.	n.a.	203,040	n.a.

Note: Turnover is in average 1989/90 prices.
Source: ABS Cat. No. 8623.1.

between 1980 and 1992 the number of small businesses increased by 18 per cent, while the number of large businesses rose by 32 per cent (Kiel and Haberkern 1994).

Despite the increase in store size and the adoption of new technologies, measured labour productivity in the retail industry has fallen.[19] As is the case for the economy as a whole, changes in labour productivity within a particular sector can, theoretically, be decomposed into changes due to compositional shifts and changes due to increases in labour productivity within sub-sectors. Unfortunately, detailed data on output and hours worked by sub-sector of retailing are not published. In their place, data from the 1985/86 and 1991/92 Retail Census can be used to obtain a rough estimate of the effect of compositional shifts. These data suggest that had the employment structure that existed at the time of the 1991/92 Census existed in 1985/86, value added per employee in 1985/86 would have been up to 2 percentage points lower.

19. The fall is less pronounced when data from the 1984/85 base-year national accounts are used. The ABS attributes the difference in the 1984/85 and 1989/90 base-year accounts to a change in the method used to calculate value added of truck retailers (see ABS Cat. No. 5243.0).

The single most important contributor to this negative compositional effect is the expansion of the fast food industry (milk bars and take-away stores); over the six years between the Retail Censuses, the share of total hours (in food and personal and household good retailing) worked in this sub-sector increased by about 5 percentage points to around 17 per cent. With value added per hour worked in this sub-sector (in 1985/86) being roughly 60 per cent of the average, this change of 5 percentage points in employment shares contributed almost 2 percentage points to the decline in retail industry productivity. An additional 1 percentage point was contributed by the contraction of hours worked in department stores, as these stores tend to have higher than average levels of labour productivity. The rapid expansion of relatively low-productivity bread stores also contributed to the slowdown.

While compositional effects may explain part of the poor productivity outcomes, they can provide no more than a partial explanation, as labour productivity appears to have fallen in a wide range of different types of stores. A comparison of the 1985/86 and 1991/92 Retail Censuses, shows that in 15 out of the 25 sub-sectors for which comparative data are available, turnover per employee fell; the largest falls being recorded in retail stores selling marine equipment, takeaway food, bread and cakes, liquor and floor coverings (see Appendix 1). A similar picture emerges when disaggregated quarterly retail trade turnover data are examined.

Why did turnover per employee fall in such a wide range of retail stores in the second half of the 1980s? One possible answer is the spread of part-time employment – workers who work fewer hours process fewer goods through the check-out. Certainly, the share of part-time employment did increase more quickly in the second half of the 1980s than it did over the first half of the decade. Over the 1980s as a whole, the ratio of employment to hours worked in the industry increased by about 4 per cent. This suggests that even if an adjustment is made to take account of a reduction in average hours, labour productivity in a variety of stores would still have fallen.

The strongest candidate for explaining the slow labour-productivity growth in retailing is the deregulation of trading hours. While deregulation has occurred at different rates in different States, stores in all states are now open for longer hours than was the case in 1980. For the 30 years following World War II, shopping hours were heavily regulated with most shops opening for around 48 hours per week. By the end of the 1970s, all States had introduced late night shopping on one or two nights per week. This had the effect of increasing average opening hours a little, to just over 50 hours per week in 1980. Nevertheless, opening hours still remained heavily regulated.

In New South Wales, the regulations began to be eroded in late 1984 when shops were permitted to trade on Friday nights and Saturday afternoons. The success of these longer hours saw increasing pressure for further deregulation, which finally came in 1989 when unrestricted trading hours on Monday to Saturday were introduced. While regulations concerning Sunday trading remain, they are in large part ineffective. Deregulation has also occurred in other states, but in most cases the process has been slower. For example, in Victoria and South Australia, the extension of Saturday trading to 5:00 p.m. took place in 1987.

Kiel and Haberkern (1994) estimate that deregulation has led to an increase in average opening hours in Australia from 52 hours per week in the early 1980s, to 56 hours in 1986 and to 61 in 1992. In New South Wales and the ACT, where deregulation has been more extensive, they estimate that shops were open for an average of 66 hours in 1992 – 15 hours a week more than in 1980. These changes represent an increase of almost 30 per cent in the hours that the average retail store is open in NSW, and an increase of almost 20 per cent Australia wide.

While unpublished data from the ABS show a slightly smaller increase in average shopping hours, the increase is nevertheless significant; the data show that in 1992, the average retail store was open 57 hours. On average, supermarkets were open 75 hours per week; a 12 per cent increase since 1986. Since 1992, hours of operation of many supermarkets have been extended further with a number of supermarkets now open 24 hours a day. With the exception of household appliance stores, all categories of stores recorded longer shopping hours in the 1991/92 Retail Census than in the 1985/86 Retail Census.

Longer shopping hours have increased shopper convenience and thus have led to an increase in the broad concept of output of the retail sector. However, it is unlikely that they have had any substantial effect on the standard measure of output, as opening stores for longer hours is unlikely to change savings-consumption decisions. On the other hand, it would be surprising if an increase of nearly 20 per cent in average opening hours did not require an increase in the number of hours worked. As a result, longer shopping hours imply a reduction in the average level of labour productivity. Longer hours may have also contributed to the negative compositional effects. A good example is bread shops where deregulation of baking hours has led to a proliferation of specialist bread shops which tend to have low levels of labour productivity. Working in the opposite direction is the idea that deregulation of shopping hours has encouraged the move to larger stores with higher levels of labour productivity.[20]

The ‘shopping-hours’ explanation is supported by state-based data on turnover per person employed in food stores. The data suggest that labour-productivity growth was slower in those states that undertook the most extensive deregulation of shopping hours. The shopping hours explanation is further supported by the fact that the largest declines in labour productivity in the retail sector took place at the same time that employment was expanding rapidly. Further support is suggested by the work of Baily and Gordon (1988) who provide a ‘back-of-the-envelope calculation’ of the effect of regulation of shopping hours on labour productivity. They estimate that if German shopping-hours regulations were applied to the United States, total GDP might be 5 per cent higher (assuming that the workers ‘released’ from the retail sector are employed elsewhere in the economy). While this estimate is almost surely on the high side, Baily and Gordon argue that, at least conceptually, making a reasonable adjustment for the output of ‘convenience’ might offset all of the productivity slowdown in US retailing. In reality, however, the extension of shopping hours in the US considerably predates the productivity slowdown. This is not the case in Australia.

If this interpretation of events is correct, then measured productivity in the sector would be increased by re-regulation of shopping hours. This would, however, be an

20. See Morrison and Newman (1983) for Canadian evidence that shopping hours regulation favours small stores.

absurd reaction. Once shopping hours were deregulated, many retailers moved quickly to extend their hours of operation. Such a move was in response to a clear public demand for greater flexibility in the timing of shopping.[21] This raises an important issue. Normally slower productivity growth is associated with a slower rate of increase in conventionally measured living standards. However in this case, the link between growth and welfare has been weakened. While an evaluation of the benefits that households received from longer shopping hours is beyond the scope of this paper, revealed preference says that these benefits may be quite significant. By not making an adjustment to the quality of the output of the retail sector, the statistician may have underestimated output and overestimated the price of that output. On the positive side, given that hours deregulation has already occurred on a widespread scale, the magnitude of this measurement problem should not grow any further.

3.2 The Recreation, Personal and Other Services Industry

The recreation, personal and other services sector plays only a small role in explaining changes in aggregate labour-productivity growth, but the large fall in the level of labour productivity makes it an interesting case for study. In 1992, the level of labour productivity in the industry was only about 80 per cent of the level in 1978. As can be seen from Figure 11, the bulk of this fall occurred between 1984 and 1991. This was also a period of very rapid employment growth. Over this seven year period, total hours worked in the sector increased by 40 per cent.

Using the ASIC data, the industry has three main sub-sectors:

- entertainment and recreation services;
- restaurants, hotels and accommodation services (the 'hospitality' sub-sector); and
- personal and other services.

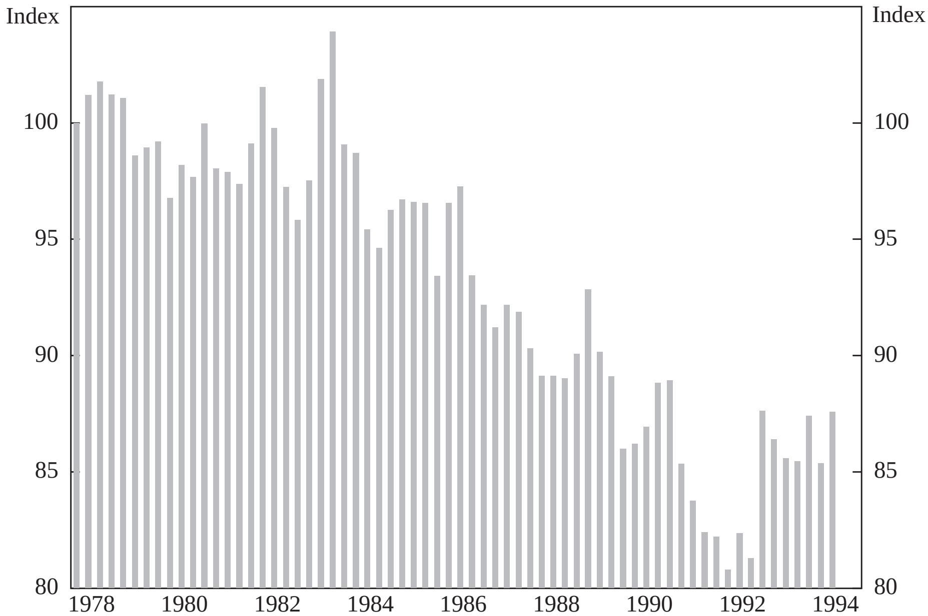
In 1993, the hospitality industry accounted for 54.8 per cent of total industry employment (up 3 percentage points over the past ten years) while entertainment and recreation services and personal and other services accounted for 23.4 and 21.9 per cent respectively (up 0.2 and down 3.1 percentage points respectively). Separate output data are not published for all three sub-sectors, but output and hours worked data are available for similar ANZSIC categories since the mid 1980s. Figure 12 shows indices of labour productivity for the relevant categories. In both cultural and recreational services and accommodation, cafes and restaurants, the level of labour productivity fell significantly through the second half of the 1980s.

In assessing the industry's overall performance, developments in the hospitality sector are particularly important, as this sector accounts for over half of the industry's employment. The hospitality sector (using the ASIC classification) has four principal components: accommodation; pubs, bars and taverns; cafes and restaurants; and licensed clubs. An indication of the importance of these various sub-sectors and the relative levels

21. Not everybody perceived this public demand. In 1983, in one of many reports into the regulation of shopping hours, Justice Macken wrote: 'It is blind fantasy to assume that in the Sydney Metropolitan area there are a significant number of people eager to shop on Saturday afternoons or on Sundays with respect to goods available to them through the week' (Macken 1983, p. 53 as cited in Kiel and Haberkern (1994)).

Figure 11: Labour Productivity in Recreation, Personal and Other Services

(Output per hour worked, March quarter 1978 = 100)



of labour productivity can be obtained from the ABS's 1991/92 Survey of Hospitality Industries. Similar surveys were also conducted in 1979/80 and 1986/87.

Table 4 shows the share of part-time and full-time hospitality employment accounted for by each of these sub-sectors in 1986/87 and 1991/92. It also shows nominal gross industry product per full-time equivalent worker. Unfortunately, deflators for the different sub-sectors are not published.

In terms of employment, the accommodation and restaurant sub-sectors have clearly been the fastest growing. Cafes and restaurants have increased their share of part-time employment in the hospitality industry from 31.7 per cent to 39.8 per cent and their share of full-time employment by two percentage points to 32.7 per cent. Between 1980 and 1992, the number of businesses operating cafes and restaurants increased by 73 per cent to 8,741 while employment rose by 202 per cent. The accommodation sector also enjoyed strong employment growth, with the number of jobs increasing 92 per cent over this 12-year period. Table 4 suggests that many of these jobs were full-time jobs, with accommodation's share of total full-time employment in the hospitality sector increasing from 25.6 to 30.8 per cent over the period from June 1987 to June 1992.

There are quite large differences in the level of productivity between the various parts of the hospitality sub-sector. Licensed clubs have the highest level of labour productivity, with cafes and restaurants having the lowest level. Using the data for 1991/92, the level of labour productivity in restaurants and cafes is equal to three-quarters of the level of

Figure 12: Labour Productivity in the Recreation Sector
(March quarter 1985 = 100)

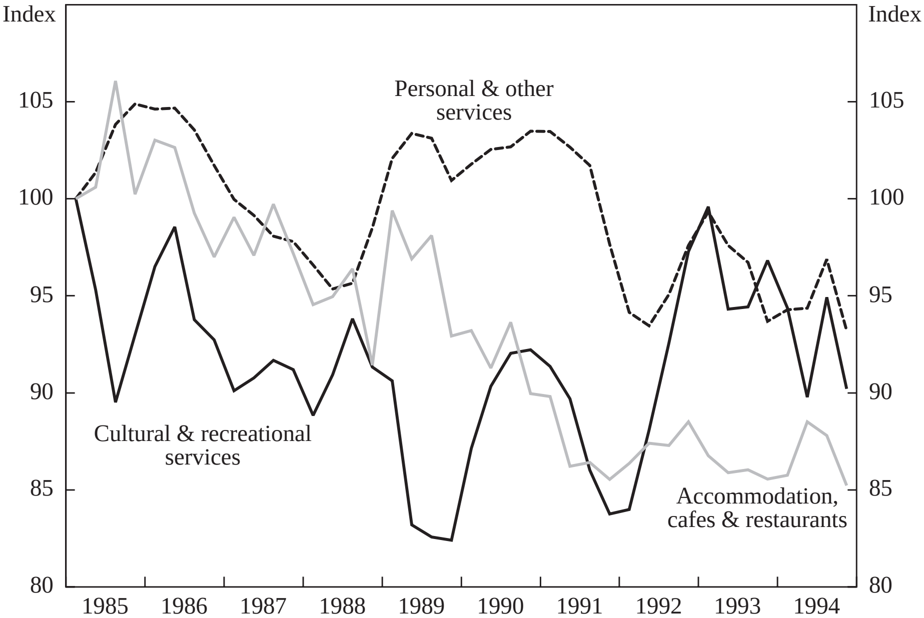


Table 4: The Hospitality Industry

	Share of full-time employment		Share of part-time employment		Productivity level ($ per full-time equivalent worker)	
	1986/87	1991/92	1986/87	1991/92	1986/87	1991/92
Accommodation	25.6	30.8	15.8	16.2	24,882	28,412
Pubs, bars and taverns	26.0	18.7	32.0	25.2	22,543	29,146
Cafes and restaurants	30.7	32.7	31.6	39.8	15,616	20,108
Licensed clubs	17.7	17.9	20.7	18.8	29,284	35,081
Total	**100.0**	**100.0**	**100.0**	**100.0**	**22,440**	**26,830**

Notes: (a) Full-time equivalent employment is calculated as full-time employment plus half of part-time employment.
(b) The measure of output is Gross Industry Product.

Source: ABS Cat. No. 8674.0.

labour productivity for the hospitality industry and 57 per cent of the level of labour productivity in licensed clubs. As a whole, the level of labour productivity in the hospitality sector is lower than the average for the entire recreation, personal and other services sector.

At this level of aggregation, differences in productivity levels, together with changes in the structure of employment appear to have led to relatively large compositional effects on the sector's productivity performance. Within the hospitality industry, the sub-sector with the fastest employment growth has been the lowest labour productivity sector. If the employment shares that existed in 1991/92 had applied in 1986/87, then the level of labour productivity in the hospitality industry in 1986/87 would have been around $2^1/_2$ per cent lower than was actually the case. While this calculation only provides a rough estimate of the impact of compositional effects, it does suggest that, at least in this component of the industry, these effects may be important.

While the growth of relatively low-labour-productivity industries may have contributed to low productivity growth for the industry as a whole, it is again unlikely that compositional effects provide the full explanation. In a number of the industry's sub-sectors, the available data suggest that there has been relatively limited productivity growth. The data in Table 4 suggest that nominal labour productivity in cafes and restaurants increased by 28.8 per cent over the period 1986/87 to 1991/92. Over this same time period the 'meals-out' component of the CPI increased by 30.2 per cent. Similarly, nominal productivity in pubs, bars and taverns increased by 29.3 per cent, while the prices of alcoholic beverages increased by 34.1 per cent.

Low productivity growth of these sectors is also suggested by a comparison of the results from the 1986/87 Services Industry Survey and the 1979/80 Census of Retail and Selected Services Industry. These surveys provide estimates of real turnover (in 1986/87 prices) per employee. These estimates are shown in Table 5 as a percentage of turnover-per-employee in the cafes and restaurant sub-sector in 1979/80.

In cafes and restaurants, real turnover per employee fell by 8.2 per cent over the seven years to 1987. This fall is partly due to an increase in part-time employment, but turnover per full-time equivalent worker has also declined. A similar picture emerges for hotels and licensed clubs. Productivity improvements in hairdressing also appear to be extremely small, with real turnover per employee barely increasing over the seven years. Laundries and drycleaners, and especially movie theatres, appear to have done considerably better.

Table 5: Turnover Per Employee

	1979/80	1986/87
Accommodation	116.2	123.8
Hotels (drinking places)	190.8	178.4
Cafes and restaurants	100.0	91.8
Licensed clubs	163.1	154.3
Hairdressers and beauty salons	60.6	61.0
Laundries and dry cleaners	91.8	97.9
Motion picture theatres	148.8	175.7

Note: Real turnover (in 1986/87 prices) per employee is given as a percentage of real turnover per employee in cafes and restaurants in 1979/80.

Source: ABS Cat. No. 8650.0.

The evidence suggests that many of the sub-sectors of the industry have not experienced significant improvements in productivity. In large part, this reflects the highly labour-intensive and service-oriented nature of these sub-sectors – it is difficult to make hairdressing a more capital-intensive activity and it is difficult to substitute capital equipment for waiters in a restaurant. Perhaps, the greatest scope for 'technical progress' in many of these industries is the provision of better quality service with the same labour input. As in the case of retailing, such improvements are difficult to capture in the measure of output used in the national accounts.

While the above data do not provide a complete picture, they do suggest that the declining level of labour productivity in the recreation, personal and other services sector is the result of both compositional effects and stagnant or declining average productivity levels in a number of important sub-sectors. This has occurred at the same time that employment in the sector has grown rapidly – in fact, the periods of most rapid decline in labour productivity have coincided with the periods of most rapid employment growth. One explanation for this combination of low productivity growth and strong employment growth is a decline in the sector's real product wage; this allowed firms to employ more workers even though the new workers were reducing the average level of labour productivity in the industry. We return to this issue in Section 4.

3.3 The Construction Industry

Between March 1983 and June 1991, output per hour worked in the construction industry declined at a rate of almost 1½ per cent per year. This deterioration followed a long period of relatively solid productivity growth and occurred at the same time that employment and output were growing particularly rapidly (see Figure 13). While the decline in productivity is apparent for both private and public construction, it is more pronounced in public construction; between March 1983 and June 1991, output per person in private sector construction fell by 5.4 per cent, while in the public sector, labour productivity fell by 17.7 per cent.

The fall in productivity in public sector construction can be explained, in part, by compositional effects. After 1984/85 there was a sharp decline in public sector gross fixed capital expenditure, with the fall in State government expenditure in the electricity sector being particularly pronounced (see Australian Treasury (1994)). While we know of no data that provide estimates of value-added for various sub-sectors of government construction, it is reasonable to assume that value-added in electricity construction was relatively high, so that the decline in this type of construction made a direct negative contribution to productivity growth (this is, of course, not a bad thing). While compositional effects are important for government construction, they are not the complete answer to the declining productivity in the construction sector, as the level of productivity in the private sector also fell.

The extent of the deterioration in private sector construction is surprising and is at odds with data obtained from the Construction Industry Surveys. A comparison of results from the 1984/85 and 1988/89 surveys shows that over this period, value added per employee in the private sector increased by around 16 per cent, with increases experienced in most sub-sectors (see Table 6). The survey data also suggest that compositional effects within the private sector play only a small role in explaining the

Figure 13: The Construction Industry: Output, Employment and Labour Productivity
(March quarter 1978 = 100)

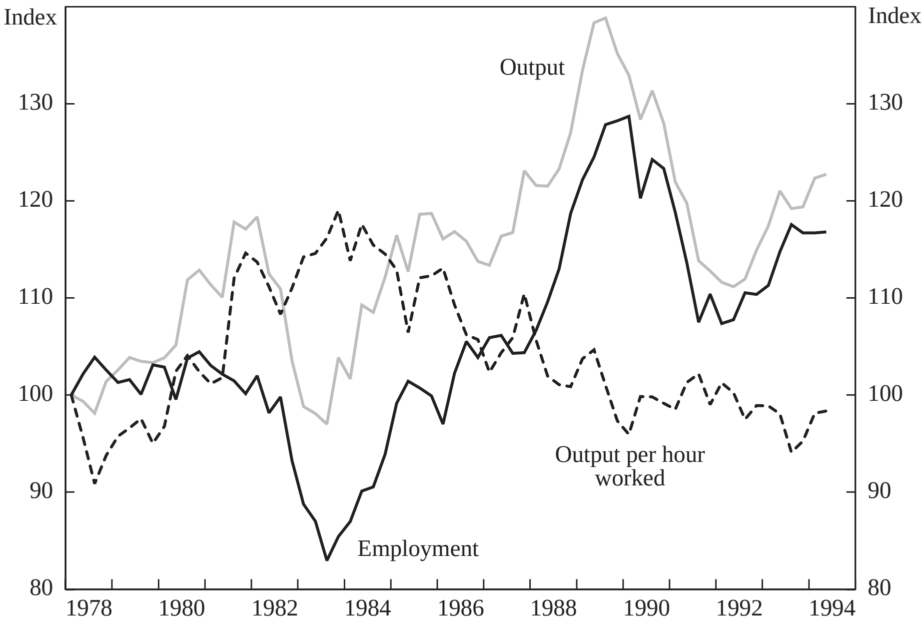


Table 6: Private Sector Construction

Type of construction	Share of value added		Share of employment		Value added/ employment		
					$'000		% change
	1984/85	1988/89	1984/85	1988/89	1984/85	1988/89	
Residential	15.8	13.8	16.1	12.9	29.3	30.0	2.4
Non-residential	15.3	19.2	9.8	12.0	37.9	45.2	19.3
Total building	*31.1*	*33.0*	*25.9*	*24.9*	*29.2*	*37.3*	*27.9*
Road and bridge	6.5	5.8	3.7	3.0	42.8	53.7	25.5
Other non-building	10.1	7.5	7.0	6.3	35.2	33.5	-4.8
Total non-building	*16.7*	*13.3*	*10.7*	*9.4*	*37.9*	*40.1*	*5.8*
Trades	52.2	53.7	63.4	65.9	20.0	23.0	15.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**24.3**	**28.2**	**16.0**

Note: Value added is at average 1984/85 prices.
Source: ABS Cat. No. 8771.0.

outcomes. While the share of the non-building construction sector in total employment fell, the share in another high productivity sub-sector – non-residential building – rose. The biggest fall was in the employment share of residential building construction which has a relatively low level of productivity. In summary, if the 1984/85 employment weights are applied to the 1988/89 productivity data, the level of labour productivity in 1988/89 would have been higher by slightly more than 1 per cent.

In contrast to the survey data, the national accounts shows a decline in private sector labour productivity of 2.3 per cent between 1984/85 and 1988/89. This difference stems largely from different rates of increase in output, rather than labour input. To obtain quarterly estimates of private-sector construction output, the statistician extrapolates base-year output by various components of gross fixed capital expenditure on construction by the private sector. This approach assumes that input prices increase at the same rate as output prices. This approach also means that any biases in the deflators for gross fixed capital expenditure on construction will also affect the measurement of output of the construction sector. It is difficult to determine to what extent biases exist. Certainly studies in the United States suggest that the deflators for residential construction are biased upwards due to the inadequate measurement of improvement of building quality. Baily and Gordon (1988) estimate that in the US, the residential construction deflator has been upward biased by at least 1 per cent per year for the past 30 years. This is reflected in a pronounced trend decline in productivity in the construction sector. However, it is unlikely that this provides an explanation for the Australian data, since it would require that the systematic mismeasurement of quality became worse in the mid 1980s. There is no obvious reason to believe that this was the case.

There is nevertheless, a question mark over the residential construction deflator, especially in the second half of the 1980s. Historically, this deflator has increased at roughly the same rate as the price index for materials used in housing construction; over the 16 years to September 1986, the dwelling deflator increased at an average rate of 9.6 per cent per year, while the input price index increased at an average rate of 9.5 per cent. In contrast, over the three years to September 1989, the output deflator increased more rapidly than the input price index; 11.3 per cent compared with 8.7 per cent. The rise in the dwelling deflator also exceeded the rise in the non-residential building deflator and the engineering construction deflator (7.5 per cent and 6.1 per cent per annum respectively) and the rise in the household repairs and maintenance component of the CPI (6.0 per cent per annum).

Why did the dwelling deflator increase so quickly? One clue lies in the close correspondence between the dwelling deflator and the Australia-wide price series for new project homes. This series is available from June 1986, and over that period it tracks movements in the deflator quite closely. The project home series is derived from surveys of project home builders, with the ABS asking respondents to exclude land costs. Despite this, there is some circumstantial evidence that the price series may be capturing something other than construction costs. The State-based data show unusually large differences in price increases across States; over the five years following June 1986, the price of a project home rose by more than 60 per cent in Sydney and Brisbane, but only by a little more than 20 per cent in Adelaide and by just over 30 per cent in Perth and Hobart. Such differences are striking, especially when the inputs that go into a house are traded in an essentially national market, and their prices increased at very similar rates in all states. In Sydney – which experienced the country's fastest increases in project home prices in the late 1980s – the pattern of prices changes corresponds quite closely to the general increase in established house prices.

While the builders of project homes may have substantial pricing power in individual markets, the size of the increase in prices, and the variation across States, at least raises the possibility that the dwelling deflator may have been overestimated in the late 1980s. A more comprehensive analysis, however, awaits further research. In any case, even if the dwelling deflator had increased at the same rate as input prices, this would still not fully explain the decline in labour productivity in private-sector construction. A further possible explanation for the slowdown is that the rapid employment and output growth in the construction industry was associated with a reduction in the average skill levels of workers in the industry and to less efficient construction practices. This explanation, however, still has to confront the evidence from the Construction Industry Survey which shows solid productivity growth.

4. Wages and Productivity

One of the most frequently given explanations for the slowdown in aggregate productivity growth in the second half of the 1980s is that wages fell relative to the cost of capital and that this led firms to substitute labour for capital. Certainly after 1982/83, there was a significant decline in the share of GDP going to labour as real wages and real unit labour costs fell. Over recent times, analysis of the links between productivity and wages has often stopped with the observation that aggregate wage restraint led to a slower rate of increase in the capital-labour ratio and thus to slower labour-productivity growth. However, just as changes in output at the industry level can offer insights into the productivity issue, so too can sectoral changes in prices and wages.

The form of the links between wages, prices and productivity growth have long been debated in Australia. Discussion of the wage decisions made by the Commonwealth Conciliation and Arbitration Commission in the 1950s and 1960s was often centred on the relationship between average productivity growth and the increase in the aggregate nominal wage.[22] At the industry level, analysis of the various linkages is made difficult by the fact that there is no dominant model in which to analyse outcomes. In general equilibrium, nominal wages (adjusted for skill differentials) should be the same in each industry. An increase in productivity, even if just in one industry, should lead to an increase in wages throughout the *entire* economy and, as a result, a change in relative prices and a reallocation of labour and capital. In practice, the labour market is rarely in equilibrium and changes in the level of productivity in one sector may influence both the sector's relative wage and the ability of the sector to attract resources from other parts of the economy.

The long time taken to re-establish equilibrium makes it difficult to formulate strong testable propositions. This difficulty is compounded by Australia's historically relatively

22. See the debate between Russell (1965) and Whitehead (1963, 1966). I am indebted to Glenn Withers for this historical perspective.

centralised wage-fixation system, which created the possibility that, at least for a period of time, real wage increases were not directly tied to labour-productivity growth. This was particularly important in the 1980s. Over this period, real wages fell in a number of industries. This was not solely an outcome of the productivity performance of those sectors, but also reflected a decision by policy makers to achieve employment growth by reducing real wages; using the industry data, there is quite a strong negative correlation between productivity growth and growth in hours worked.

Even if the labour market was always in equilibrium, there are still no definitive predictions about changes in the sectoral allocation of labour and capital in response to productivity improvements in a particular sector. If one sector has an improvement in its technology, it may attract more workers and more capital, but it is also possible for that sector to lose both capital and labour. The loss of jobs in an industry undergoing relatively rapid productivity improvements is more likely if the underlying technical change is biased against labour, demand growth is weak and there are limited opportunities to substitute labour for capital. However, in general equilibrium, any labour made redundant by technological change is re-employed elsewhere in the economy in response to a change in relative factor costs. As discussed above, this equilibrium might be a long time in coming. A more difficult issue is what happens when technological change reduces the demand for a certain type of worker. If real wages for these workers fall, the level of employment in general equilibrium may well be lower if the new wage is below the workers' reservation wage.

In the following discussion an eclectic view is taken and it is argued that the evidence suggests that the links between wages and productivity have worked in both directions. Relatively high labour-productivity growth in some sectors has resulted in nominal wage increases in those sectors greater than average wage increases. In contrast, in other industries, the real wage restraint of the 1980s substantially reduced real product wages, and this allowed firms to take on more workers than would have otherwise been the case. On average, these workers produced less output than the existing workers and this reduced labour-productivity growth. This is particularly important in the recreation, personal and other services sector, and to a lesser extent in the wholesale and retail trade and construction sectors.

4.1 Productivity, Wages, Prices and the Mismeasurement of Output Growth

To discuss the relationship between measured productivity growth, wages and prices we start with a simple economy-wide production function. Real output, *Y*, is produced with capital, *K*, and labour, *L*, using the following constant returns to scale technology:

$$Y = AK^{\alpha}L^{1-\alpha} \tag{3}$$

With fixed capital and labour, the rate of increase in real output equals the rate of technological progress:

$$\hat{Y} = \hat{A} \tag{4}$$

where ^ denotes percentage change.

The rate of increase in nominal output can be decomposed into the rate of increase in real output and prices. Further, if real wages increase at the same rate as real output, the following holds:

$$\hat{Y}^N = \hat{Y} + \hat{P} = \hat{A} + \hat{P} = \hat{w} + \hat{P} \tag{5}$$

where *P* represents prices and *w* represents real wages.

Given that $\hat{Y}^N$ is known, if the statistician underestimates $\hat{Y}$, then the rate of price increase is overstated. In the extreme case, if technological progress is occurring but is assumed to be zero, the increase in nominal output is treated as inflation. It also means that measured real wages growth is zero, when in fact real wages are increasing.

We now move to partial equilibrium, assuming that labour does not move, or at least moves slowly, between sectors. In this case, an industry with relatively fast productivity growth should experience an increase in its relative nominal wage (because the relative marginal product of labour has increased) and a reduction in the relative price of its output (because relative marginal cost has declined). Therefore:

$$\hat{W}_i > \hat{W} \text{ and } \hat{P}_i < \hat{P} \tag{6}$$

where *W* denotes the nominal wage and subscript *i* represents industry *i*.

This relationship implies that in the industry with relatively fast productivity growth, not only does the nominal wage increase relatively quickly, but so too does the relative product wage. Now consider what happens when the statistician incorrectly assumes that there is zero productivity growth in this industry. In this case, the increase in nominal output is interpreted as an increase in price, and thus the following relationships may apply:

$$\hat{W}_i > \hat{W} \text{ and } \hat{P}_i > \hat{P} \tag{7}$$

While the nominal wage in the high-productivity-growth industry is still likely to increase faster than in the economy as a whole, the same is now also true for prices, so that the real product wage in the industry increases by a smaller amount than when there are no measurement problems. In the extreme case, if all sectors suffered the same measurement problems, those sectors with the fastest productivity growth would experience increases, rather than decreases, in their relative prices. Thus changes in relative prices and real product wages may give misleading signals as to relative rates of productivity growth. On the other hand, changes in nominal wages are likely to be subject to fewer measurement problems and, as a result, the behaviour of nominal wages might help provide insight into productivity outcomes at the industry level.

Suppose a sector shows negative productivity growth and a relatively fast increase in its implicit price deflator, but also a relatively large increase in its relative wage and its share of the economy's resources. This suggests that productivity growth in the sector is being mismeasured – a low-productivity-growth sector should not be able to attract an increasing share of resources and at the same time, pay those resources more than they are being paid elsewhere.

This analysis assumes that wages are determined by the marginal product of labour and that marginal products are not quickly equalised across sectors. Both assumptions are subject to question. If wages are set exogenously (at least for a period of time) and the economy is at less than full employment, a decline in real product wages will generate increased employment. Unless there is an improvement in technology, this increased employment will *cause* a decline in labour-productivity growth (that is, there will be a movement *along* the demand curve as opposed to a technology-induced *shift* of the curve). The other caveat is that in general equilibrium, nominal wages (adjusted for skill) in all sectors increase at the same rate, irrespective of industry productivity performance. Despite these qualifications, data on nominal wages may be useful in interpreting the industry productivity outcomes.

4.2 Productivity and Relative Nominal Wages

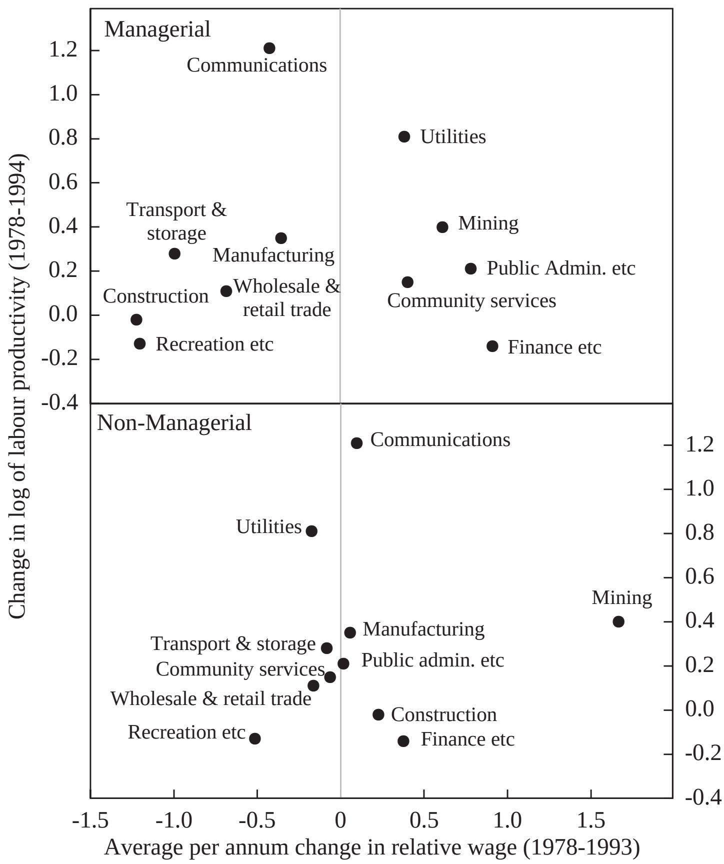
We now turn to the data on sectoral relative earnings and productivity growth. We have data on average weekly earnings of managerial and non-managerial workers in each of the 11 sectors. Figure 14 shows the relationship between labour-productivity growth and the change in relative earnings. The vertical axis shows the change in the log of labour productivity between March 1978 and June 1994; the faster an industry's productivity growth, the higher is the industry on the vertical scale. The horizontal axis shows, for the same period, the change in the ratio of average weekly earnings in the sector to economy-wide average weekly earnings; industries to the right of the vertical line at zero have experienced larger than average percentage increases in earnings. The top panel uses earnings of managerial workers and the bottom panel uses earnings of non-managerial wages.[23]

If relatively fast labour-productivity growth in one sector leads to an increase in the relative nominal earnings paid in that sector, the observations in these graphs should lie around an upward sloping line. While the relationship between relative productivity growth and relative earnings is quite weak, it does appear that in the wholesale and retail trade and recreation, personal and other services sectors, relative earnings for both managerial and non-managerial workers have declined.[24] In contrast, workers in the high-productivity-growth mining sector experienced increases in their relative earnings. The data also suggest that in the utilities industry, the high productivity growth has been reflected in the wages of managerial workers, but not in the wages of the non-managerial workers. One possible explanation of this difference is that the technological change that has taken place in this industry is biased against relatively unskilled labour. It is also possible that the rather weak relationship between relative wages and relative labour

23. For managerial workers, the 1978 observations are for private-sector, full-time male workers. The 1993, observations are for total (private and government), full-time male workers. For non-managerial workers the data for both time periods are for total (private and government) full-time workers. The data are from ABS Cat. Nos 6304.0 and 6305.0.

24. The growth of part-time employment in these industries also has a role to play in explaining relative changes in average weekly earnings. More generally, changes in the relative education and skill levels of workers in different industries may influence the relationship between productivity growth and wages as well.

Figure 14: Productivity and Relative Wages



productivity growth may reflect the fact that the 16-year time period is long enough for the general equilibrium results to establish themselves.

The finance, property and business services industry appears to be an outlier. Non-managerial workers in this industry have gained larger increases in earnings than workers in any other industry, with the exception of the mining industry. Further, the increases paid to managerial workers were the highest in any sector. At the same time that the finance sector was paying relatively large wage increases it was increasing its share of total hours worked; the share rose from 8.2 per cent in March 1978 to 12.7 per cent in June 1994.

Despite these changes, the data show a fall in the level of labour productivity in the finance sector over this 16 year period. Even if we abstract from the problems caused by the differences in the Survey of Employment and Earnings and the Labour Force Survey, measured labour-productivity growth in the industry was essentially zero. As the above discussion indicated, it is difficult to reconcile zero productivity growth with rising relative wages and a rising employment share. This suggests that the assumption of zero labour-productivity growth in the finance industry is inappropriate. In fact, the increasing relative wages in this sector is suggestive of substantial productivity improvement.

4.3 Productivity and Real Product Wages

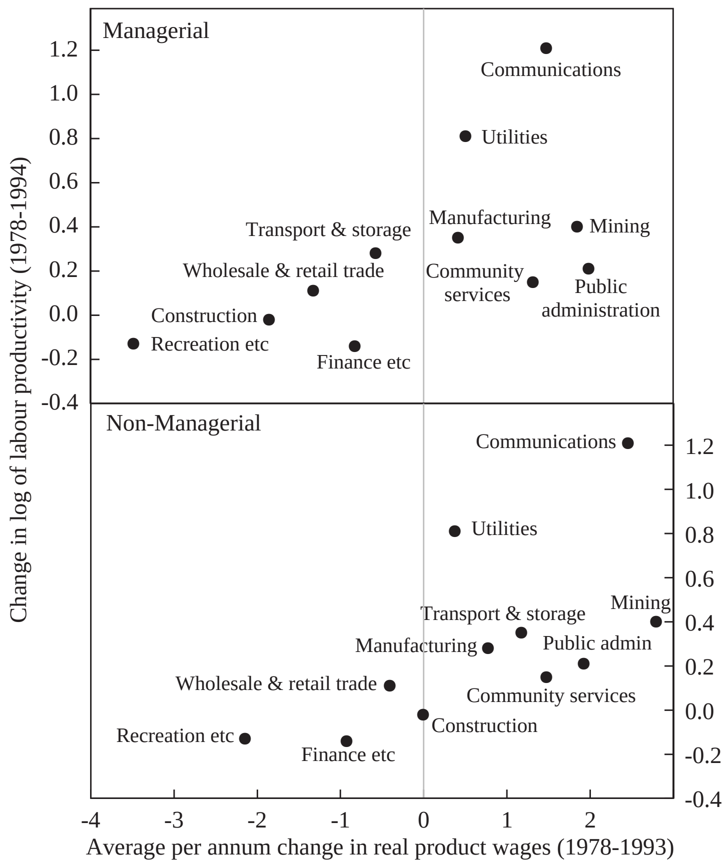
Employment decisions are made on the basis of real product wages not real consumption wages. Over long periods of time the price deflators in different industries can move quite differently. Over the period from 1978/79 to 1992/93, the average annual increase in the implicit price deflator for the mining industry was 4.2 per cent, while the deflators for the recreation, personal and other services and finance, property and business services industries increased at annual rates of over 8.5 per cent. Such differences, cumulated over a long period of time can make large differences to the real product wages paid in the various sectors of the economy. Provided there are no measurement problems, sectors that experience relatively rapid productivity growth should experience increases in their real product wages, as the productivity improvements tend to put upward pressure on the sector's nominal wage and downward pressure on the price of the sector's output. Conversely, sectors with relatively low productivity growth should have declining product wages. As discussed above, this can also occur when there is excess supply in the labour market; in this case declining product wages 'cause' a decline in productivity by allowing less productive labour to be employed.[25]

Figure 15 is similar to Figure 14 but now the horizontal axis shows the percentage change in real product wages over the period 1978 to 1993. Here, the observations tend to lie much more clearly around an upward sloping line. This implies that the faster is a sector's labour-productivity growth, relative to the economy as whole, the larger is the increase in the sector's real product wage. That is, differences in productivity growth tend to show up in relative prices, rather than relative wages. This positive (negative) correlation between productivity growth and real product wages (relative prices) is an enduring one. In examining wage and price outcomes in Australian manufacturing in the 1950s, Whitehead (1963, p. 189) found that approximately 70 per cent of changes in relative prices were associated with differential productivity movements. A similar conclusion was reached by Salter (1960) is his study of UK manufacturing.

This positive association between productivity growth and real product wages it well illustrated by the recreation, personal and other services sector; it experienced the poorest productivity performance and it has also experienced the largest decline in its product wage. This decline reflects both relatively low nominal wage increases and a relatively rapid increase in the sector's price deflator. Apart from the difficulty of capturing changes in the quality of service provided, the measurement of real output in this sector is not plagued with serious problems. The low nominal wage increases suggest that the sector's overall productivity performance has indeed been relatively poor and, as a result,

25. This discussion ignores the impact of demand-side factors on product wages. This reflects the notion that an increase in demand should not permanently affect wages and prices, independently of its impact on the supply side; if marginal cost is constant, higher demand might drive up prices temporarily, but competition should eventually bid away any excess returns. There is, however, a role for the demand side to have a permanent effect of prices if the industry is subject to diminishing returns; if higher demand draws in more resources and reduces the marginal product then relative prices may increase.

Figure 15: Productivity and Real Product Wages



the relative price of the sector's output has increased. A similar picture emerges for the construction and the wholesale and retail trade sectors.

Together, wholesale and retail trade and recreation, personal and other services accounted for 31 per cent of the additional hours worked between March 1983 and December 1989. Workers in these industries tend, on average, to be less highly skilled than workers in the economy as a whole, and have weaker job tenure. Through holding down their real wages and allowing greater flexibility in work arrangements, firms found it profitable to take on workers, even though there was relatively little productivity growth in these sectors. Almost by definition, these new workers had lower levels of labour productivity than the existing workers, as firms were only willing to employ them at lower real product wages. In simple terms, a reduction in relative product wages was required to generate the jobs in sectors in which productivity growth was less than average; this reduction was brought about through wage restraint, but an increase in the relative price of the sectors' output also played an important role.

Measured real product wages have also fallen in finance, property and business services, but unlike the recreation sector, relative nominal wages have risen. The fall in product wages in this sector, is driven solely by the increase in the relative price of the sector's output. As discussed above, if a sector experiences productivity growth, but no growth is recorded, the measured price of the sector's output will increase. This appears to be what has happened in the finance industry, particularly in the period following the deregulation of the financial system. To a large extent, the increasing relative nominal wages in the sector reflect productivity growth, but this increase in wages is offset by an overstated increase in the price of the sector's output. The problems induced by this distortion are likely to increase through time, as the finance, property and business service sector is accounting for an increasing share of hours worked.

5. Summary and Conclusions

The past decade and half has seen considerable liberalisation of the Australian economy and extensive microeconomic reform. While these reforms promised a faster rate of labour-productivity growth, it is only over the past few years that we have any signs in the published data that this is being delivered. In fact, there was virtually no increase in the measured *level* of labour-productivity over the second half of the 1980s. In part, this reflects a number of measurement problems together with the fact that an increasing share of the work-force was finding jobs. While some of the recent pick-up in productivity growth is related to the business cycle, a number of fundamental factors, in combination with a lessening of measurement problems, gives cause for optimism that Australia's trend rate of productivity growth is now higher than that of the 1980s.

The reasons for changes in productivity growth have long presented a puzzle for economists. This paper attempts to find, and to put together, just a few pieces of the puzzle. These pieces are found in the industry-based data. These data provide insights into the industries driving the aggregate results and, combined with data on wages, raise some important measurement issues. They also provide insight into the links between industry labour-productivity growth and industry relative wages.

While measurement problems are an unfortunate fact of life in decomposing nominal output into its price and quantity components, the problems appear to have been particularly pronounced over the second half of the 1980s. In the retail industry, the extension of shopping hours increased employment and the provision of 'convenience', but this was not captured in the output statistics. In the finance, property and business services sector, the rapid employment growth over the second half of the 1980s appears to have been underestimated by the series that is used to extrapolate output growth. In the construction industry, output may have been underestimated due to the unusually rapid increase in the dwelling construction deflator.

While compositional effects also play some role in explaining the low productivity growth of the 1980s, the role is relatively minor. However, one area where they may have been important is in recreation, personal and other services industry. Within this sector, there was strong growth in employment in restaurants which, according to the published statistics, tend to have relatively low levels of labour productivity. Thus, as this sector expands, measured labour-productivity growth is retarded, although to date, this effect has been relatively small.

These compositional effects raise an important issue. As income levels continue to increase, activities that were once undertaken in the home (for example, preparing food) are increasingly being undertaken in the market sector. While such a move tends to increase people's living standards, it slows the increase in conventional measures of average living standards. As the service sector continues to grow, given current measurement practices, the relationship between improvements in actual living standards and the amount of output produced per hour worked may weaken further. Only by moving to some other broader concept of output – which includes convenience – might trends in labour productivity more closely match trends in living standards.

Not all industries experienced a slowdown in labour productivity growth over the second half of the 1980s. The utilities, mining, communications and transport and storage industries all recorded faster labour-productivity growth between March 1983 and June 1991 than in the previous five years. To some extent this improvement in performance reflected the reforms taking place in these industries. The macroeconomic benefits of these reforms, however, were masked by developments in other industries.

Notwithstanding the particulars of individual industries, the decline in real wages between 1983 and 1989 played an important role in underpinning the productivity growth slowdown in the 1980s. Falling real wages allowed firms to take on additional workers – whether it be in retail stores, community services, or in the hospitality sector – despite the fact that the extra output produced by a new worker was less than that produced, on average, by existing workers. This employment-induced decline in labour productivity should not be seen as a bad outcome, as unemployed workers went from producing no measured output, to contributing positively to measured national income. In doing so, they contributed to rising living standards, if not rising labour productivity.

In the longer term, the causation between wages and productivity clearly runs the other way, with increases in economy-wide labour productivity generating higher aggregate real wages. At the industry level, the picture is a little more complicated. In the short term, higher productivity growth in one industry may generate higher wages in that industry. Eventually, however, labour is mobile between industries, so that differences in wages across industries (adjusted for skill) cannot increase without bound. In the long run, even those sectors with no productivity growth must pay higher wages and thus differences in productivity growth tend to show up in relative prices, and not relative wages.

Looking forward, a critical question is whether the increase in labour productivity seen over the past three years represents a cyclical rebound or the start of a period of continuing strong productivity growth. If it is just cyclical, or a one-time level adjustment, and the pattern of the 1980s is to be repeated, then the level of labour productivity is unlikely to increase much before the end of the decade. This would have serious implications for the sort of wage increases that are consistent with maintaining a low-inflation environment.

While some slowing of the recent pick-up in labour productivity growth is inevitable, there are some tentative signs that productivity growth over the 1990s is going to exceed that in the 1980s. Labour productivity is still increasing solidly three and a half years after the trough of the recession. At the equivalent point in the mid-1980s recovery, labour productivity growth had ceased. In terms of the fundamentals, the increasing competition brought about by the Hilmer Reforms and the internationalisation of the economy should have positive influences on labour-productivity growth. The dividend from past and continuing investments in computerisation and information technologies should also help underpin productivity growth. While it is difficult to predict future measurement problems, it is quite possible that they will be less severe over the second half of the 1990s, than they were over the second half of the 1980s. This is clearest in the retail industry, where much of the adjustment to deregulation of hours has been completed. In coming years, continuing improvements in technology and the move to larger stores should allow this industry to contribute positively to measured aggregate labour-productivity growth.

While picking changes in the trend rate of labour-productivity growth is a difficult task and is subject to considerable uncertainty, there is little evidence to suggest that the experience of the 1980s is the right benchmark. While the evidence is still unclear, the signs appear to be emerging of a faster rate of trend labour-productivity growth. Such an outcome is essential if both employment and real wages are to increase in a sustainable way.

Appendix: The Structure of the Retail Industry

Type of store	Loca-tions	Employ-ment	Turnover $m	Square metres/location 91/92	Square metres/location % change	Turnover/square metres 91/92	Turnover/square metres % change	Turnover/employee ($; 1989/90 prices) 91/92	Turnover/employee ($; 1989/90 prices) % change
Supermarket and grocery	**9,476**	**179,619**	**26,093**	**560**	**23.3**	**4,918**	**5.4**	**145,269**	**8.9**
Meat, fish and poultry	7,337	28,324	2,772	97	-2.0	3,899	8.6	97,868	-7.8
Fruit and vegetables	3,650	18,032	1,871	170	31.6	3,008	-3.9	103,760	3.8
Liquor	1,882	8,786	2,130	213	-10.2	5,312	2.4	242,431	-13.1
Bread and cakes	4,755	29,715	1,165	108	21.1	2,267	-11.3	39,206	-16.1
Takeaway food	20,334	131,126	5,299	92	7.4	2,832	4.3	40,412	-17.2
Specialised food n.e.c.	5,773	22,045	1,898	82	23.3	3,996	5.4	86,097	8.9
Total specialised food	**43,731**	**238,028**	**15,134**	**105**	**11.2**	**3,294**	**-5.0**	**63,581**	**-18.7**
Total food retailing	**53,207**	**417,647**	**41,227**	**186**	**10.9**	**4,164**	**1.0**	**98,713**	**-6.2**
Department stores	**430**	**86,576**	**9,798**	**9,084**	**3.1**	**2,508**	**-10.5**	**113,172**	**3.5**
Clothing	15,564	64,537	6,314	150	13.6	2,696	-5.7	97,835	-1.6
Footwear	3,188	13,897	1,303	132	-6.2	3,088	3.7	93,761	-2.0
Fabrics and other soft goods	3,309	13,219	1,080	177	24.0	1,846	-12.3	81,701	-2.5
Total clothing and soft goods	**22,061**	**91,653**	**8,697**	**152**	**12.0**	**2,597**	**-5.0**	**94,891**	**-1.3**
Furniture	3,032	14,401	2,507	670	17.3	1,234	-18.8	174,085	-10.5
Floor covering	1,361	5,413	978	348	-9.8	2,063	-10.1	180,676	-14.6
Domestic hardware and housewares	5,036	28,781	3,506	393	40.8	1,771	-4.4	121,816	12.8
Domestic appliances	4,045	20,555	4,446	287	15.1	3,829	-3.3	216,298	8.8
Recorded music retailing	838	3,353	444	105	11.3	5,045	10.9	132,419	9.0
Total furniture, houseware, appliances	**14,312**	**72,503**	**11,881**	**401**	**20.2**	**2,072**	**-8.8**	**163,869**	**0.2**
Sport and camping equipment	3,356	11,568	1,186	180	16.8	1,960	-6.9	102,524	-0.2
Toys and games	989	3,884	391	190	16.8	2,080	-6.9	100,669	-0.2
Newspapers, books and stationery	6,928	35,860	4,014	138	-18.6	4,199	29.7	111,935	-6.1
Photographic equipment	428	2,225	343	110	38.8	7,298	32.5	154,157	27.0
Marine equipment retailing	644	2,760	437	186	22.0	3,642	-36.0	158,333	-22.7
Total recreational goods	**12,345**	**56,297**	**6,371**	**155**	**4.6**	**3,323**	**1.6**	**113,168**	**-6.0**

Continued

Appendix: The Structure of the Retail Industry *(Continued)*

Type of store	Loca-tions	Employ-ment	Turnover $m	Square metres/location 91/92	Square metres/location % change	Turnover/square metres 91/92	Turnover/square metres % change	Turnover/employee ($; 1989/90 prices) 91/92	Turnover/employee ($; 1989/90 prices) % change
Pharmaceutical, cosmetics and toiletries	5,646	38,932	4,084	136	9.2	5,325	15.0	104,901	7.8
Antiques and used goods	4,268	10,111	637	186	24.7	803	-16.4	63,001	-4.5
Garden supplies	2,420	9,430	626	662	17.7	391	-7.3	66,384	2.4
Flowers	2,567	7,079	341	65	17.2	2,042	-7.3	48,171	2.2
Watches and jewellery	3,512	16,073	1,451	80	-2.8	5,182	49.4	90,276	31.3
Retailing n.e.c.	9,513	29,401	2,066	116	-3.1	1,876	15.3	70,270	-7.6
Total other personal and household goods retailing	**27,926**	**111,026**	**9,205**	**169**	**8.8**	**1,955**	**1.5**	**82,909**	**4.1**
Total household equipment repair services	3,258	9,633	506	95	n.a.	1,627	n.a.	52,528	n.a.
Total personal and household goods	**80,332**	**427,688**	**46,458**	**248**	**8.4**	**2,331**	**-7.1**	**108,626**	**-1.0**

Note: Percentage changes are from 1985/86 to 1991/92.

Source: ABS Cat. No. 8623.1.

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Discussion

1. David G. Mayes

Philip Lowe's paper raises several interesting and overlapping issues which merit discussion. The experiences described for productivity in Australia have both similarities and dissimilarities with the experience of other countries.

If we look at the restructuring phases in recent years in both the United Kingdom and New Zealand, for example, they are characterised by substantial increases in labour productivity. These increases have occurred in both the downturns and the subsequent upturns. Thus, in the first phase, they were accompanied by substantial unemployment increases. The first question here, therefore, is whether the Australian case is qualitatively different with much more of the pressure of restructuring being taken in the form of a decline in real wages.

The important step offered in the paper is to consider not just the aggregate but the industry composition of the changes. Here there are some clear contrasts and similarities with the UK experience. In the first place the change in the weights, i.e. the change in the structure of industry as a whole, was not an important explanation of the Thatcher miracle. That result seems to be repeated in Australia, even though the performance of different industries varies considerably.

Secondly, in the UK case, although some industries contributed to productivity growth across the whole period, there were two distinct groups, one providing a major contribution in the recession and the other in the growth phase. In the recession several weak industries such as clothing, textiles and footwear contracted markedly. There was a considerable shake-out of labour and many firms went out of business – resulting in a loss of capital as well. These differences in relative contribution are also clear in the Australian case but without necessarily the same distribution across industries.

In our UK study we went rather further than the industry level and considered changes at the plant or establishment level (see Mayes (1995), especially Chapters 2 and 4). This helped explain some of the conundrum about performance across industry as a whole in a way which is not addressed by Lowe's paper. A very important role was played by entry and exit. The productivity performance of continuing enterprises was not, in general, particularly striking. However, what overlay this was that the productivity of exits tended to be below average. Thus their exiting itself helped raise the average. Entry also helped the average as new entrants tended to be above average and indeed, in the Canadian case, explored by John Baldwin from Statistics Canada, those new entrants themselves tended to improve their productivity quite markedly over the first few years – this reflects set-up costs and a steeply upward-sloping learning curve in the initial phase.

One of the most important questions we posed was whether the distribution of productivity across industries had changed during the period. To what extent was the increase the result of an outward movement of the frontier of most efficient performance, and to what extent was it a narrowing of the differential and elimination of the less efficient? In the UK case, it was the movement in the frontier that provided the bulk of the explanation in most industries. The tail of inefficient firms fell in the most extreme cases but the general contribution was more limited. To some extent this reflects our methodology. We estimated trans-log production functions with a residual split into stochastic and efficiency components. In an earlier book we made a detailed comparison of the UK and Australia for the common year, 1977 (Mayes , Harris and Lansbury 1994). But while we have repeated this exercise for the whole of the 1980s this has not, as far as I know, been replicated for Australia.

Lowe points to some of these differences in structure when he considers the role of changes in scale in retailing but the main emphasis in the paper is on two further compositional elements. One is the failure to capture changes in the quality of output, particularly in the service industries which contribute an important component to the slow growth of productivity in the economy as a whole, and the second is the change in the structure of employment with changes in the skill mix. I have enormous sympathy for most of these arguments as many of the aggregate results seem counter-intuitive. In the New Zealand case, many of the changes are obvious and well documented. New Zealand Rail, for example, used to employ around 20,000 people. It has reduced that to a quarter but it now runs more trains. By rescheduling shipping it is possible to move goods between Auckland and Christchurch within 24 hours. But this process of change extends beyond Air New Zealand, New Zealand Post, etc. into many other publicly-owned service enterprises where the change in quality of service and efficiency has been substantial. Nevertheless this does not come out in the figures. Local government charges have been rising in recent years but this is a function not of increased wages but increased quality and range of services. (This is, of course, a major source of frustration for a central bank changed with maintaining price stability as these quality improvements are treated as price increases and hence feature in the CPI.)

I suspect Lowe is quite correct to emphasise this source of missed productivity increase. It also seems inconceivable to me that the IT revolution has not had a dramatic impact on many service sectors. One does not have to look far afield to be aware of it. The Reserve Bank of Australia has been a beneficiary in exactly the same way as the Reserve Bank of New Zealand. The number of staff required to implement policy has fallen dramatically, the quality of advice has improved and productivity in terms of papers written, forecasts made, etc. has increased out of all proportion. The figures shown for the finance, property and business services sectors seem unbelievable and case studies, including one in this Volume, contradict it. A second facet Lowe points to is the rise of part-time employment and increase in less productive jobs alongside the more rapid increase in the productivity of existing jobs which, in part, helps to explain the discrepancy in the statistics. It is certainly the case in the New Zealand recovery of the past few years that although the recovery has been driven by exporting and major productivity growth, when we look at the economy as a whole, the productivity performance is not particularly impressive. This reflects the growth of service sector jobs, in some cases part-time employment. Unemployment has fallen faster and employment risen faster than was anticipated even with the rapid growth we have experienced. The high productivity growth has occurred, but the growth has generated a second round of more labour-intensive activities as the increased incomes are spent. It is noticeable that the current recovery has not resulted in the traditional rush of imports of consumer goods. Imports have increased, but it is imported capital equipment which has been a more important contributor.

It should, therefore, be clear that much of the apparent productivity puzzle can be unlocked by considering a more disaggregate picture both in terms of firms and employees. One needs to consider the dynamics of the market both in terms of entry and exit for firms, and the distinction between behaviour in an existing job and movement from and into jobs for the labour market.

The measurement issue is, if anything, likely to be more severe than is suggested in the paper. I have said virtually nothing about the relative wage facet of the paper as I have little in the way of new information to add to it but, assuming moderate labour-market flexibility, Lowe's view that relative wages will act as an indicator seems very reasonable.

It is much harder to decide whether Australia is embarked on a new higher-productivity trend. All one can point out from the New Zealand and UK experiences is that it is easy to talk oneself into this belief. Practice, however, seems to be much more resilient and while optimism is to be welcomed, I would expect the Reserve Bank of Australia to be pretty cautious in assessing the degree to which trend productivity has risen even allowing for changes in its sectoral composition.

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2. General Discussion

The discussion was focussed on the following practical issues and their implications:

- the proper measurement of output and productivity; and
- interpretation of the observed relationship between productivity and wages at the sectoral level in Australia.

A key measurement issue was considered to be the heterogeneous nature of intermediate industries – such as finance, property and business services – where some of their services should properly be treated as an intermediate input rather than an output. However, while changes in the measured output of sectors producing intermediate goods would change the measured productivity growth in these sectors, it may not have any effect on aggregate productivity growth since it may reduce value added in other industries.

It was also emphasised that fundamental measurement problems arise in industries where it is difficult to identify the market value of output. Again, reference was made to finance, property and business services. For this industry, output in a base year is extrapolated using data on hours worked. Consequently, labour productivity in that sector – national accounts-based output divided by hours worked – was actually one measure of output divided by another, with the resultant productivity measure being the observed inconsistency between the series.

Other important measurement issues related to the nature of the survey data from which measures of output are derived. It was noted that quite a different picture about productivity in wholesale and retail trade, for example, could be identified by reference to surveys of establishments or management units rather than the national accounts. This led to a discussion about how survey information could be better utilised to identify changes in quality, such as consumer convenience, which presently make valuation of the output of service-oriented industries so difficult.

Given these practical problems in the measurement of productivity, there was wide-ranging discussion about how the observed relationship between productivity, wages and prices should be interpreted. The main results of the paper were related to Baumol's unbalanced growth model in which, with a common equilibrium wage, divergent productivity across the economy causes a divergence in relative prices. An interesting historical perspective was provided. It was noted that, using the same type of analysis, Australian researchers in the 1950s and 1960s had found similar results, suggesting that the findings were robust to the type of wage-fixing system. The attainment of a common equilibrium wage does, however, require labour mobility. Consequently, it was argued that some comment on the extent of labour mobility was appropriate.

According to some participants, the paper implied that industries which experienced the largest increases in their relative prices (those with the poorest productivity performance) also experienced the largest increases in employment. A discussion followed on the role that the demand side played in driving this result; perhaps those industries with the least scope for productivity improvements have the highest income elasticities. It was suggested that general increases in living standards force up the price of output in these industries and this allows additional workers to be employed, even though their marginal contribution to output is relatively small. It was suggested that the paper could more fully explore these demand influences on productivity outcomes.

Finally, in discussion pertinent to a small open economy, it was argued that terms of trade shocks can play a major role in the relationship between the marginal product of labour and the real product wage. A scenario was presented in which rising commodity prices increased Australia's terms of trade so that, for some sectors, the real product wage fell, and was driven below marginal product. As a result, in the affected industry, labour input is increased and investment is reduced, causing the capital/labour ratio to fall. This was described as the optimal response to the terms of trade shock. It was emphasised that the relationships between productivity, prices and wages evident in the data are contingent upon the effect of exogenous shocks, such as the terms of trade.

Problems in the Measurement and Performance of Service-Sector Productivity in the United States

Robert J. Gordon

1. Introduction

In the past two decades, the American economy has evolved quite differently from most other advanced industrialised economies. Unlike economies which have experienced a large increase in unemployment, the US unemployment rate in 1994-95 has been little different than in other prosperous years, such as 1972, 1979, and 1987-88. Instead, there is now a general consensus that the most intractable problems of the American economy are slow growth in productivity and in real wages. Productivity growth has proceeded at barely one per cent per year since 1972, and growth in real wages for most employed persons has been less than that, due to an increase in inequality that has concentrated much of the limited payoff from productivity growth in the top 20 per cent of the income distribution.

When examined more closely, it appears that America's productivity performance is characterised by a dichotomy. Subject to several measurement caveats to be explained below, the performance of American manufacturing has been quite robust, with 1987-94 growth in output per hour of 2.9 per cent, more rapid than the 2.6 per cent rate recorded during productivity's golden age of 1950-72, and much more rapid than the 2.2 per cent rate of the dark age during the intervening period, 1972-87. It is in non-manufacturing, mainly the services, that the problem of slow productivity growth and the post-1972 growth slowdown is concentrated. The corresponding growth rates for private non-farm non-manufacturing (PNFNM) over 1950-72, 1972-87, and 1987-94 are, respectively, 2.1, 0.4 and 0.8 per cent per annum. And, as we shall see, growth for the PNFNM sector of multi-factor productivity (which differs from output per hour by factoring out the contribution of capital input) has been barely positive since 1972.

1.1 Substantive and Measurement Issues

How is slow productivity growth in the American non-manufacturing sector to be explained? A number of explanations have been proposed and several of these, like the oil price shocks of the 1970s, have been discarded as the poor productivity performance grinds on inexorably while the shock in question has disappeared. We shall review the evidence on several traditional explanations, including inadequate saving and investment, a decline in labour quality, a deteriorating infrastructure, and the depletion of resources and ideas. We shall investigate problems of particular industries that suggest pockets of difficulty rather than an economy-wide malaise. And, as a final potential cause, we shall suggest the possibility that the vaunted flexibility of the American labour market contributes to the productivity problem – weak unions, a drastic decline in the real minimum wage, and lax immigration barriers combine to foster an ample supply of low-wage labour that, in turn, encourages American employers to overstaff particular service occupations compared with their counterparts in other countries.

But before searching for explanations, we need to confront a suspicion that perhaps the phenomenon to be explained does not exist. Some writers have claimed that productivity growth has been rapid rather than slow, and that a complex set of measurement errors has prevented the true achievements of the American economy from being adequately captured by the official data. They argue that there has been an explosion of new technology over this period, especially in computers and electronics. They point to examples of industries that have transformed their operations and raised efficiency. They (especially Griliches (1994)) point to a steadily rising fraction of output produced in industries in which output is intrinsically hard to measure.

With Martin Baily, l have examined the relation between the measurement of productivity and the productivity slowdown in the United States and asked whether measurement errors could account for much or all of the post-1972 productivity slowdown (Baily and Gordon 1988). We concluded that they could not, for two basic reasons. First, a measurement error can 'explain' the slowdown only to the extent that the error became worse or had a bigger impact in the slowdown period than it did in prior periods. Thus, the failure of standard price data to capture the improvement in the quality of many outputs (leading to an understatement of real output) can only explain the slowdown to the extent that quality change has proceeded more rapidly in recent years than it did before l973. A second reason for the small impact of measurement errors in explaining the slowdown is that many of these errors occur in industries that partly or wholly produce intermediate goods. In the United States, the computation of GDP starts with aggregate data on final shipments and sales of consumption, investment and government goods and net exports. This total is then allocated down to the sectors, as GDP originating by industry. Errors in the computation of, say, GDP originating in the trucking industry will alter the fraction of total private GDP that is thought to be generated in this industry, but not the estimate of total GDP. If trucks are really producing more real output than we thought, then the industries that buy trucking services are producing less.

While measurement errors cannot explain the entire slowdown, or why PNFNM productivity growth falls short of that in most other OECD nations, nevertheless the errors are sufficiently important that a full set of corrections could easily *double* the recorded rate of PNFNM productivity growth in the United States. In this paper, I take another look at the wide variety of measurement issues that must be confronted in assessing productivity in the services, and this reassessment convinces me that Baily and Gordon (1988) understated the seriousness of measurement errors. My new verdict relies primarily on several sources of upward bias in the American consumer price index (CPI) that have been identified since 1988 by government statisticians within the Bureau of Labor Statistics (BLS) and which imply a corresponding downward bias in the growth rate of output and productivity within the US service sector.

The measurement problems discussed in this paper are relatively complex, and some of them may not apply in every other country. The United States is almost unique in using a hedonic price index for the output of electronic computers and then introducing that deflator into the national accounts and productivity statistics with a weighting scheme that is highly inappropriate. The result is that all official output and productivity data for the US for sectors or aggregates including the computer-producing industry (including manufacturing and GDP as a whole) substantially understate performance prior to 1987 (the base year in the current US national accounts) and overstate performance since 1987. Correction for this 'base-year index bias' raises the hurdle that the economy must surpass for us to conclude that the productivity-growth slowdown of the past two decades has abated.

1.2 Plan of the Paper

The paper begins with several tables that document the magnitude of the productivity-growth problem within the United States, both in the aggregate and for sub-industries, and which compare US performance with that in several other large nations. We then turn to the measurement issues, distinguishing those that involve the measurement of current-dollar output, price deflators, and hours of labour input. The last part of the paper investigates substantive causes of the weak productivity performance in the services, with special emphasis on problems experienced by particular industries.

2. US Productivity Performance in the Official Data

Our presentation of official data in this section emphasises the contrast between the performance of the manufacturing and PNFNM sectors in the US. It also examines differences among the US and other members of the G7 countries in the behaviour of productivity at the aggregate and sectoral level.

2.1 Productivity Behaviour Within the American Economy

Table 1 displays the annual average growth rates over specified intervals of output per hour (hereafter average labour productivity or ALP) and multi-factor productivity (MFP). The dividing points between the intervals are chosen to be periods when the economy was at roughly a neutral level of demand pressure, with an unemployment rate in the range of 5.5-6.0 per cent. Thus differences in performance across intervals are not influenced by cyclical movements in productivity. The right-hand column computes the overall slowdown in productivity growth between the first two intervals, covering 1950-72, and the second two intervals, covering 1972-94.

Looking first at the aggregate economy (the private non-farm or NFP sector), we note the substantial slowdown in ALP growth from 2.25 per cent in 1950-72 to just 0.99 per cent during 1972-87 and l.24 per cent for 1987-94. As we shall see, the apparent recovery after 1987 is illusory and is influenced by the base-year index bias involving computers. In manufacturing there has been an even healthier revival after 1987 and no post-1972 slowdown at all, but (since computers are a larger share of manufacturing than of the aggregate economy) the base-year index bias is larger for manufacturing than for the aggregate. In the large non-manufacturing sector (PNFNM) there has been an even sharper ALP growth slowdown than for the aggregate economy.

Table 1: United States Annual Productivity Growth Rates (1950-1994)

	1950:2-1963:3	1963:3-1972:2	1972:2-1987:3	1987:3-1994:4	Slowdown 1972-94 minus 1950-72
Output per hour					
Non-farm business	2.36	2.13	0.99	1.24	-1.13
Manufacturing	2.60	2.53	2.13	2.90	0.00
Non-farm non-manufacturing business	2.25	1.92	0.50	0.76	-1.46
Multi-factor productivity					
Non-farm business	1.42	1.09	0.32	0.90	-0.65
Manufacturing	1.70	1.37	1.29	2.51	0.37
Non-farm non-manufacturing business	1.34	0.96	-0.02	0.41	-0.96

The bottom section of Table 1 exhibits growth rates of MFP for the same sectors and time intervals. Because the growth rate of capital input slowed in the final 1987-94 period relative to earlier periods, MFP growth slowed less in absolute terms than ALP. Stated another way, a slower rate of capital accumulation explains a portion of the observed slowdown in ALP growth. And, for the same reason, in the manufacturing sector MFP growth accelerates after 1987 to the most rapid rate observed in any of the intervals shown.

2.2 International Comparisons

Does the abysmal performance of PNFNM productivity in the United States have any counterpart in the rest of the G7 countries? Is there the same dichotomy between manufacturing and PNFNM elsewhere? Table 2 arrays the G7 countries plus Australia in eight columns and separates the sample period into three intervals – 1960-73, 1973-79, and 1979-92. This table begins by covering three aggregates, all private industry, PNF and PNFNMNM (this stands for private non-farm non-manufacturing non-mining). On subsequent pages are arrayed nine sectors for which roughly comparable data are available across the G7 countries: agriculture, mining, manufacturing, construction, utilities, transport/communication, trade, finance, insurance and real estate, and services.

For the purposes of this paper, we are most interested in the magnitude of the productivity growth slowdown across countries and the extent to which there is a dichotomy in other countries between the behaviour of the manufacturing and non-manufacturing sectors. Looking first at the PNF sector, we note that every country experienced a substantial post-1973 slowdown in productivity growth, and that the slowdown in the US was actually the smallest in absolute magnitude when 1960-73 is compared with l979-92. Several countries, particularly France, Germany, and the UK, performed worse in 1979-92 than in the oil-shock period of 1973-79, in contrast to the US which performed better.

Table 2: Growth Rates of Output Per Hour by Country and Sector (1960-1992)[(a)]

	US	Australia	Canada	Japan	France	Germany	Italy	UK
Private industry								
1960-73	1.97	—	3.25	9.36	5.70	5.75	7.91	3.70
1973-79	0.42	1.88	1.30	3.29	4.27	4.59	2.99	2.23
1979-92	1.27	1.92	1.43	3.60	2.89	2.53	2.31	2.26
Private non-farm								
1960-73	1.92	—	3.02	8.27	4.90	5.32	6.58	3.53
1973-79	0.46	1.58	1.27	3.14	3.94	4.39	2.46	2.20
1979-92	1.18	1.83	1.41	3.25	2.55	2.34	1.88	2.18
Private NFNMNM[(b)]								
1960-73	1.34	—	2.38	7.50	3.85	4.80	6.01	2.77
1973-79	0.45	1.46	1.81	1.51	3.25	4.39	1.76	1.43
1979-92	0.64	1.85	1.35	2.63	2.33	2.47	0.67	1.11
Agriculture								
1960-73	2.66	—	6.03	7.66	6.70	6.96	8.89	7.06
1973-79	-1.68	5.20	0.92	0.64	5.35	5.97	4.69	2.71
1979-92	5.19	2.37	2.17	2.95	6.23	5.28	4.10	5.34
Mining[(c)]								
1960-73	3.05	—	3.50	13.92	4.20	3.81	—	5.56
1973-79	-10.22	2.64	-7.19	6.00	4.23	0.87	—	17.28
1979-92	4.46	2.88	1.73	4.20	3.02	0.14	—	7.60
Manufacturing[(c)(d)]								
1960-73	3.28 (3.27)	—	4.13	10.43	6.90	5.88	6.52	4.60
1973-79	0.90 (0.52)	2.76	1.77	6.34	4.98	4.44	3.86	1.64
1979-92	2.50 (2.17)	2.78	2.10	3.94	2.85	2.05	3.49	4.42
Construction								
1960-73	-2.37	—	2.08	7.05	3.45	4.42	4.72	2.61
1973-79	-1.53	2.67	0.01	0.08	1.78	2.76	1.00	0.48
1979-92	0.09	-0.22	2.03	2.40	2.96	1.55	1.03	1.68
Utilities								
1960-73	4.43	—	5.68	6.23	7.46	7.00	6.17	6.89
1973-79	-0.24	2.65	3.50	4.17	5.37	6.26	0.62	3.16
1979-92	0.56	5.79	0.32	4.04	4.52	2.21	1.61	4.45

Continued

Table 2: Growth Rates of Output Per Hour by Country and Sector (1960-1992)[(a)] *(Continued)*

	US	Australia	Canada	Japan	France	Germany	Italy	UK
Transportation/Communication								
1960-73	3.68	—	4.62	7.18	5.09	4.80	4.87	4.96
1973-79	2.72	4.86	2.88	2.22	3.98	6.28	3.31	2.22
1979-92	2.99	4.71	3.82	3.40	4.21	3.62	2.65	3.62
Trade								
1960-73	2.05	—	3.26	8.88	3.69	4.67	7.06	2.89
1973-79	0.64	0.77	0.85	2.24	3.21	3.64	2.05	-0.03
1979-92	2.22	0.66	1.04	3.83	1.58	1.66	0.79	1.59
Finance, insurance and real estate[(e)]								
1960-73	1.20	—	1.12	7.15	1.70	2.70	—	0.54
1973-79	0.49	-0.33	1.40	3.11	2.27	4.08	—	1.97
1979-92	0.43	-0.25	1.17	2.25	0.45	2.24	—	0.00
Services[(e)]								
1960-73	1.36	—	1.35	7.71	2.54	4.45	4.61	1.04
1973-79	0.41	0.92	2.74	-0.64	1.92	3.80	0.51	0.42
1979-92	-0.68	0.52	0.36	1.47	2.47	2.46	-1.26	-2.51

Notes: (a) Canadian data are available from 1961-92, Japanese data from 1962-92, and German data from 1962-91.
(b) NFNMNM stands for private non-farm, non-mining, non-manufacturing.
(c) Italian mining and manufacturing are aggregated and the growth rate is given in manufacturing.
(d) US manufacturing growth rates are shown with and without computers, respectively.
(e) Italian finance, insurance and real estate are included in services.

A surprising result is found when productivity growth rates are compared over the same intervals for the PNFNMNM sector. Productivity growth in this sector over 1979-92 was almost as slow in Italy and the UK as in the US, but was much more rapid in Japan, France and Germany. As is true in most of the comparisons in these tables, the absolute magnitude of the slowdown between 1960-73 and 1979-92 was least in the US and much greater in Japan and Italy.

Turning now to the manufacturing sector, the numbers in parentheses (available for the US only) provide a measure for manufacturing excluding the 2-digit industry that makes computers. This omission makes a substantial difference and drops the US performance to the bottom of the league table (tied, surprisingly, with Germany). Of particular note is the enormous revival of UK manufacturing performance after 1979 to the top of the league table, ahead even of Japan.

Several points should be emphasised about productivity in US manufacturing. First, the official data record a growth rate of 4.1 per cent for 1992-94, which pushes the 1979-94 average growth rate up from 2.5 to 2.7 per cent. While this performance is quite respectable in comparison with that registered by Canada, France and Germany, it is nonetheless tainted by base-year index bias. While no official data exist on the base-year index bias for the manufacturing sector, as we shall see below the bias is about 0.55 per cent for total GDP in 1992-94 and is doubtless larger than that for manufacturing. A second point is that, even including allowance for the base-year index bias, US manufacturing (unlike the US service sector) does not represent an outlier with extraordinarily poor performance that needs to be explained.

We now turn to the performance of the six components of the PNFNMNM portion of the US economy, representing about three-quarters of private-sector output. Two problem cases are listed in Table 2. The productivity performance of the US construction industry is a much-discussed but little-understood oddity. Productivity growth was sharply negative between the early 1960s and the late 1970s and barely positive since then. The construction sector is a prime suspect for major measurement errors; the ratio of US to Canadian productivity *level* in construction falls over the past three decades by *two-thirds,* which seems highly implausible.

Listed next is the utility sector, comprising electricity, gas and water. Here the growth rate of US productivity has been barely positive since 1973, and the post-1973 slowdown was the greatest of any sector listed in Table 2. And the performance of US productivity in the utilities sector is exceedingly poor in comparison with all the other G7 countries, with the exception of Canada after 1979. The final section of the paper suggests that the experience of the utilities sector supports the technological depletion hypothesis ('running out of ideas').

Next is the transportation and communications sector. (Data are available for these two sectors separately for the US but the two sectors must be combined for international comparisons.) The relatively favourable performance of the US combines an outstanding record for the telecommunications and railroad subsectors with mediocre performance by airlines and trucking.

Also listed are the remaining components of the non-manufacturing sector. In trade the US enjoyed a substantial recovery after 1979, and exhibits no productivity growth slowdown when l979-92 is compared with 1960-73. In fact, the US performance in trade exceeds that in any other G7 country besides Japan. As we shall see, the average performance for US trade disguises highly divergent behaviour in individual parts of the retail sector.

Finance, insurance and real estate represents one of the worst-performing US sectors and one where measurement issues are paramount. The post-1973 growth slowdown for the US is not particularly large (in contrast to utilities), because the pre-1973 growth performance was poor as well. The cross-country comparison reveals substantial heterogeneity and negative productivity growth in the UK after 1979.

The final section of Table 2 covers miscellaneous services. This large sector, representing 22 per cent of US private GDP in 1991, lies at the heart of the US productivity growth problem. The largest single subsector of services is the health service sector comprising about 7 per cent of private GDP, and this sector is subject to severe measurement problems. Nevertheless, the US is not unique in having poor productivity growth in the services sector. Italy and the UK also display virtually no growth in services productivity since 1973 and Canada virtually none since 1979.

Overall, the performance of the US economy is poor by international standards and also highly heterogeneous. The US is at or near the top of the league table only in agriculture, mining and telecommunications. Performance in manufacturing and trade is roughly average, while the major problem areas appear to be construction (4.6 per cent of 1991 GDP), utilities (3.4 per cent), finance, insurance and real estate (20.8 per cent) and services (21.8 per cent).

2.3 Productivity Performance at the Detailed Industry Level

The US statistical system provides three sets of information on productivity at the detailed industry level. First, the national income and product accounts (NIPA) contain detailed output data for about 75 industries, but hours worked data for only a small subset of these. Second, productivity defined as output per person engaged (including both employees and self-employed persons) can be calculated for the full set of 75 industries. Third, the BLS compiles a separate set of output per hour and per employee data for selected industries; however these are not aggregated in a form comparable to the NIPA data.

We turn first in Table 3 to the industries for which NIPA hours data are available. This provides additional detail beyond that available in Table 2. We note the outstanding productivity record since 1979 of the farming and communications sectors. Farming has experienced a substantial acceleration of productivity growth since 1979, as has construction (in the sense that the period of rapid productivity *decline* seems to have ended). The detail in Table 3 also indicates that the favourable performance of manufacturing is occurring in the durable goods sector, and that non-durable goods manufacturing did not perform well after 1987.

A more detailed industry breakdown is available in Table 4, where productivity is defined as output per person engaged, not per hour. Since the focus of this paper is on the service sectors, we will skip over the first page of Table 4 and focus on the second page. In the transportation sector we note the superb record of the railroad industry since its deregulation in 1980. The largest component of transportation, the trucking industry, was also deregulated in the early 1980s but did not experience a productivity revival until after 1987. The airline industry was deregulated in stages between 1978 and 1981, but its productivity steadily decelerated in each successive period in Table 4.

Considerable detail is provided for the components of the finance, insurance and real estate sector. Banking and depositary institutions experienced no productivity growth throughout the post-war period, but as we shall see that reflects a measurement issue rather than reality. There were substantial post-1987 improvements in the performance of securities and commodities brokers, of insurance carriers, and of the large real estate industry, but a poor performance by insurance agents.

Within the services sector, the weakest performances occur in personal services, business services, auto repair, health services and legal services (the latter for 1972-87). The only strong performances are in hotels (after 1987) and amusement and recreation services.

A different set of industry productivity indices is provided by the BLS. In some cases the underlying source of output data differs from that in the NIPA data summarised in Tables 3 and 4. In general, the BLS uses gross output rather than value-added as its output

Table 3: Annual Growth Rates of Output Per Hour, United States by Subsector, Various Intervals (1960-1992)

	1960-72	1972-79	1979-87	1987-92	Slowdown 1979-92 minus 1960-72
Private industries	2.04	0.53	1.32	1.19	-0.79
Agriculture, forestry and fisheries	3.30	-2.15	5.52	4.64	1.78
Farms	4.20	-1.56	7.26	6.32	2.59
Agricultural services, forestry and fisheries	-3.07	-2.81	3.44	2.99	6.28
Mining	3.55	0.53	5.36	3.01	0.64
Construction	-1.70	-2.81	-0.24	0.61	1.88
Manufacturing	3.16	1.43	2.67	1.99	-0.83
Durable goods	3.00	0.58	2.73	2.82	-0.22
Non-durable goods	3.39	2.68	2.54	0.87	-1.68
Transportation and public utilities	3.75	2.09	2.20	2.43	-1.43
Transportation	3.14	1.76	1.67	2.40	-1.10
Communication	4.77	4.27	5.28	4.09	-0.09
Electricity, gas and sanitary services	4.04	1.10	-0.05	1.54	-3.29
Wholesale trade	3.24	1.39	4.27	1.80	-0.20
Retail trade	1.55	0.37	1.69	1.38	-0.02
Finance, insurance and real estate	1.32	0.39	-0.80	2.41	-0.51
Services	1.37	0.53	-0.67	-0.68	-0.24

concept, and it relies more on measures of physical volume, whereas the NIPA output data are mainly based on double-deflated value-added (and thus more prone to error if deflators are erroneous or inconsistent). The BLS series also provide considerable detail within the retailing sector not available in the NIPA.

Table 5 provides annual growth rates of output per hour for the BLS industries outside of manufacturing. Only a single time period is presented here, 1973-92. Comparing Tables 4 and 5 for the transportation sector, we emerge with a consistent story except for trucking, where the BLS records substantially more rapid productivity growth than in the NIPA.[1] In the utility sector there is the same stark contrast in Table 5 as in Tables 3 and 4 between the telecommunications industry and the other utilities.

1. Sources of discrepancies between the NIPA and BLS are examined in detail in Gordon (1992, pp. 374-382).

Table 4: Annual Growth Rates of Output Per Person Engaged, United States by Industry, Various Intervals (1960-1992)

	1960-72	1972-79	1979-87	1987-92	Slowdown 1979-92 minus 1960-72
Total economy	**2.01**	**0.22**	**0.68**	**0.84**	**-1.25**
Private industries	**2.21**	**0.07**	**1.04**	**0.94**	**-1.22**
Agriculture, forestry & fisheries	3.43	-0.46	4.86	4.94	1.47
Farms	3.91	0.14	6.40	5.83	2.21
Agricultural services, forestry & fishery	-1.15	-2.90	1.87	3.86	4.38
Mining	4.15	-9.14	5.31	3.68	0.34
Metal mining	1.47	-3.81	16.17	18.83	16.03
Coal mining	3.57	-6.19	10.63	10.89	7.19
Oil and gas extraction	4.60	-12.24	3.28	0.96	-2.48
Nonmetallic minerals, except fuels	4.02	-0.07	2.02	1.40	-2.31
Construction	-1.93	-2.64	-0.50	0.26	1.81
Manufacturing	3.11	1.12	2.77	2.00	-0.73
Durable goods	2.97	0.31	2.82	2.76	-0.18
Lumber and wood products	4.99	0.44	4.23	-3.01	-4.38
Furniture and fixtures	2.48	0.65	3.16	0.69	-0.56
Stone, gas, and glass products	2.53	0.15	1.49	2.58	-0.49
Primary metal industries	1.96	-1.84	1.74	1.53	-0.33
Fabricated metal products	2.44	0.51	2.84	1.34	-0.36
Machinery, except electrical	2.71	-0.51	2.79	n.a.	1.33
Industrial machinery, and equipment	n.a.	n.a.	n.a.	5.28	—
Electric and electronic equipment	5.04	3.61	4.66	n.a.	0.20
Electronics and other electronic equipment	n.a.	n.a.	n.a.	5.81	—
Motor vehicles and equipment	4.13	1.13	1.56	-1.85	-4.28
Other transportation equipment	2.55	-1.14	3.92	1.49	0.15
Instruments and related products	3.47	1.77	1.49	6.39	0.47
Miscellaneous manufacturing industries	3.36	-0.68	4.56	2.25	0.05
Non-durable goods	3.31	2.32	2.64	0.95	-1.52
Food and kindred products	3.37	2.06	3.65	0.81	-1.14
Tobacco manufactures	3.47	2.64	-2.38	-7.44	-8.38
Textile mill products	5.67	5.17	4.04	3.65	-1.83
Apparel and other textile products	2.44	4.30	2.50	3.50	0.56
Paper and allied products	3.23	2.33	2.20	2.21	-1.03
Printing and publishing	2.07	0.54	-1.01	-1.51	-3.33
Chemicals and allied products	5.19	1.47	4.03	0.26	-3.05
Petroleum and coal products	4.07	0.88	5.52	0.34	-1.14
Rubber and miscellaneous plastics products	7.56	1.60	4.69	2.67	-3.88
Leather and leather products	2.11	2.08	3.21	6.19	2.59

Continued

Table 4: Annual Growth Rates of Output Per Person Engaged, United States by Industry, Various Intervals (1960-1992) *(Continued)*

	1960-72	1972-79	1979-87	1987-92	Slowdown 1979-92 minus 1960-72
Transportation and public utilities	3.81	1.70	2.06	2.38	-1.59
Transportation	3.13	1.04	1.53	2.37	-1.18
Railroad transportation	4.48	3.15	9.48	7.15	3.84
Local and interurban passenger transit	-2.45	-1 .94	-3.03	-2.10	-0.11
Trucking and warehousing	3.99	0.12	0.22	3.60	-2.08
Water transportation	2.62	2.71	0.03	-0.20	-2.71
Transportation by air	4.48	3.02	2.19	1.35	-2.71
Pipelines, except natural gas	8.70	-1.38	0.17	-2.68	-9.96
Transportation services	-1.43	0.13	0.05	-0.08	1.41
Communication	4.91	4.60	5.12	4.06	-0.32
Telephone and telegraph	5.85	5.15	6.46	4.65	-0.30
Radio and television	-1.01	1.37	-2.61	3.92	1.67
Electric, gas, and sanitary services	4.22	0.85	-0.07	1.54	-3.49
Wholesale trade	3.58	0.94	3.97	1.72	-0.74
Retail trade	1.92	-0.56	1.03	1.20	-0.81
Finance, insurance, and real estate	1.39	-0.16	-0.92	1.73	-0.99
Banking	-0.01	0.02	0.00	n.a.	0.01
Depository institutions	n.a.	n.a.	n.a.	0.00	—
Credit agencies, other than banks	0.11	0.02	0.02	n.a.	-0.13
Non-depository institutions	n.a.	n.a.	n.a.	-0.06	—
Security and commodity brokers	0.02	1.47	0.71	6.32	3.49
Insurance carriers	1.73	0.44	-3.18	5.92	-0.37
Insurance agents, brokers, and service	0.64	-4.08	6.68	-0.83	2.29
Real estate	1.74	-1.68	-2.89	1.42	-2.47
Holding and other investment offices	0.01	-0.83	-0.02	0.37	0.17
Services	1.26	0.04	-0.68	-0.89	-2.04
Hotels and other lodging places	0.76	-0.46	-0.91	4.04	0.81
Personal services	1.88	-1.47	-0.97	-1.20	-2.86
Business services	-0.22	-0.48	-0.75	-0.96	-0.63
Auto repair, services, and parking	2.67	-0.27	-2.25	-1.77	-4.68
Miscellaneous repair services	0.01	0.15	-1.07	-0.25	-0.67
Motion pictures	0.62	2.02	1.81	-4.48	-1.96
Amusement and recreation services	-1.16	0.83	2.43	2.16	3.46
Health services	0.65	-0.73	-1.26	-2.36	-2.46
Legal services	1.14	-3.75	-3.72	0.55	-2.72
Educational services	-0.04	-0.10	-0.69	1.06	0.22
Social services and membership organisations	0.17	-0.09	-0.31	-0.52	-0.58
Miscellaneous professional services	1.24	-1.98	-0.79	n.a.	-2.10
Other services	n.a.	n.a.	n.a.	-0.92	—
Private households	-0.88	1.60	0.49	0.82	1.54

Table 5: Annual Growth Rates of Output Per Hour, United States for Selected BLS Industries (1973-1992)

	1973-1992
Transportation	
Railroad transportation, revenue traffic	6.0
Railroad transportation, car miles	3.8
Bus carriers, class I	-0.7[(a)]
Trucking, except local	2.9[(a)]
Trucking, except local, general freight	3.4[(a)]
Air transportation	2.7[(b)]
Petroleum pipelines	0.3
Utilities	
Telephone communications	5.8
Gas and electric utilities	0.5
Electric utilities	1.4
Gas utilities	-2.2
Trade	
Scrap and waste materials	2.2[(c)]
Hardware stores	1.3
Department stores	2.6
Variety stores	-0.2
Food stores	-0.8
Grocery stores	-0.8
Retail bakeries	-1.7
New and used car dealers	1.2
Auto and home supply stores	2.8
Gasoline service stations	3.1
Apparel and accessory stores	2.5
Men’s and boys’ clothing stores	1.2
Women’s clothing stores	3.8
Family clothing stores	1.8
Shoe stores	1.6
Home furniture, furnishings, and equipment stores	3.4
Furniture and home furnishings stores	1.6
Appliance, radio, TV and computer stores	5.9
Household appliances stores	4.2
Radio, television and computer stores	6.2
Eating and drinking places	-0.3
Drug stores and proprietary stores	0.9
Liquor stores	1.0

Continued

Table 5: Annual Growth Rates of Output Per Hour, United States for Selected BLS Industries (1973-1992) *(Continued)*

	1973-1992
Services	
Commercial banks	2.0
Hotels and motels	-0.3
Laundry, cleaning, and garment services	-0.9
Beauty and barber shops	0.5
Beauty shops	0.1
Automotive repair shops	-0.3

Notes: (a) 1973 to 1989.
(b) 1973 to 1991.
(c) 1977 to 1992.

Most of the BLS indices in Table 5 refer to retail trade. While the array of growth rates may appear to be highly heterogeneous, there is a distinct pattern.

Retail establishments involved with food and drink have a poor productivity record. These include food and grocery stores, retail bakeries, and eating and drinking places. Most other types of retailing have respectable to excellent productivity growth rates, with the best records recorded for stores selling consumer durables like television sets and appliances.

The BLS data record the same dismal record for services as do the NIPA, except for commercial banks. Here the difference has a simple source – the NIPA make no attempt to measure productivity for banking and simply set output growth equal to the growth in input, thus assuming productivity growth of zero by definition. In contrast, the BLS makes an attempt to measure the volume of transactions for three types of banking activity: deposits, loans and trusts.

2.4 Summary of the Evidence

The productivity performance of the American economy is poor on average, but highly heterogenous at the detailed industry level. This suggests that the search for explanations must examine aspects of particular industries rather than searching for one or two general, overarching explanations. There are a surprising number of industries that are star performers, with productivity growth rates above 4 per cent for the 1979-92 period (in Table 4). These include farming, metal and coal mining, industrial machinery, electronic equipment, instruments, leather products, railroads, and telecommunications. But, as an offset, there were other industries with negative productivity growth over the same period, including printing and publishing, tobacco manufactures, pipelines, real estate, and within the services sector, business, auto repair, health, legal, and miscellaneous services.

3. A Litany of Measurement Issues

A number of measurement problems taint the legitimacy of comparisons of productivity performance across time, across industries, and across countries. This section provides an introduction to the general class of measurement issues that relates to productivity performance, particularly in the services sector. Then more detailed sections follow that highlight the major issues relevant to cross-time, cross-industry, and cross-country comparisons.

3.1 Interrelation Among Measurement Issues

Since the post-1973 productivity-growth slowdown has eluded a convincing and general explanation, an appealing goal for research would be to identify a set of measurement problems that could fully explain the slowdown. However, this is unlikely to occur, for two basic reasons. First, to contribute any explanation of the overall US productivity slowdown, a given measurement problem *must* have caused *aggregate* output growth to have been understated more (or aggregate input growth overstated more) after 1973 than before. Some of the most important types of measurement error, particularly those involving a failure to adjust price deflators adequately for quality change, may have been as important or even more important before 1973.

Second, it is not enough to demonstrate that there is a measurement problem at the industry level, because the output of many industries (e.g. railroad freight) consists of intermediate goods. An understatement of output growth in an intermediate sector results in an understatement of input growth in the sector producing final output using intermediate inputs. Thus, a demonstration that a measurement problem biases the output growth of a particular intermediate industry just reshuffles productivity growth among industries without explaining the aggregate slowdown. For instance, an understatement of output growth in the railroad freight industry would be a pure industry phenomenon, since all of railroad freight output is an intermediate good. But an understatement of real consumer purchases of air transportation would contaminate both productivity growth in the airline industry and in the economy as a whole. Many of the debates in productivity measurement concern the validity of industry measures and imply more for the industry allocation of productivity growth than for the overall magnitude of the slowdown.

To summarise this point is to establish four quadrants on a simple grid as a classification of actual or possible measurement errors.

Table 6: Summary of Possible Measurement Errors

Affects aggregate economy, contributes to post-1973 slowdown.	Affects aggregate economy, but same effect pre and post 1973.
Contributes to post-1973 slowdown for an industry, no aggregate impact.	Measurements error that applies pre and post 1973, no aggregate impact.

Only measurement issues that qualify for the north-west corner of this quadrant help to explain the productivity growth slowdown. Issues relating to the south-west corner are those that reshuffle the industry allocation of productivity change. Issues entering the quadrants in the eastern half of the table could create a secular bias in productivity at the aggregate (north-east) or industry (south-east) levels, but have no implications for the slowdown.

However, from an international perspective, the north-west quadrant is not the only interesting aspect of measurement issues. Identification of measurement errors that 'reshuffle' the industry distribution of productivity growth may change the distribution of growth rates across industries and countries. A particular substantive explanation may gain or lose plausibility if attention to measurement issues creates convergence or divergence of a particular industry viewed across countries. Similarly, measurement errors in the north-east or south-east corners of the grid that apply both before and after 1973 may still be interesting to learn about. A sufficient upward bias in the price deflator for consumer goods in the United States, for instance, could imply that real wages have grown substantially since 1973 rather than stagnating. This would be important news, even if the same error implied that growth in productivity and real wages prior to 1973 had been understated as well.

With improved methodology and larger budgets, how could measurement methods have deteriorated since 1973? Is that not a *prima facie* argument against measurement errors as a cause of the productivity slowdown? The primary reason to suspect that there may have been a measurement-related component to the slowdown is not that the official statistical agencies have become worse, but rather than the economy has become harder to measure. According to ball-park estimates by Griliches (1994, p. 11), the fraction of the American economy consisting of sectors with output that is 'hard to measure' has increased from 51 per cent in 1947 to 69 per cent in 1990.

This review of measurement problems begins with two general sets of issues that are not confined exclusively to the service sector – that is, weighting problems (particularly aggravated in the US through the influence of the hedonic deflator for computers and a single base-year weighting scheme) and sources of bias in the basic source of price data used in deflating most of the output of final goods and services, namely the US CPI. We shall then turn to specific problems that affect the validity of measurement of output and productivity in the US service sector.

3.2 Index Numbers and Additivity

The most important point about weighting schemes and index numbers is that weights should change frequently. There is a class of index numbers that Diewert (1987) has classified as 'superlative' which allow weights to change frequently but differ in minor ways, depending on the duration of the period over which weights are averaged, and how the averaging is carried out. These desirable index numbers, often referred to as 'Fisher-ideal' or 'chain-weighted' index numbers, represent a theoretical ideal that is far from the practice of the US NIPA.[2]

2. Those in charge of the NIPA are well aware of these problems and may be on the verge of changing to a superlative index number scheme for aggregate real GDP.

The US NIPA are quite unique, in comparison with other countries, in their steadfast insistence on a *single* base year that applies to all calculations of real variables – that is, real GDP, real consumption, real investment, and so on, from the dawn of the data through to the present. This leads to fallacious indices that are widely used and analysed, and yet which the producers of the data (the Bureau of Economic Analysis, or BEA) know are misleading and, for some purposes, lead to the opposite conclusions of the truth.

First, let us review the simple logic behind the error of using a single base year, and then examine some of the consequences. The official US measure of real GDP in 1987 weights sub-components of output by their relative prices in 1987. To focus on the effect, consider the different impact of government expenditures, which have an increasing relative price over the decades, and of producers' durable equipment, in which there is an important component of computing equipment, which has a (rapidly) declining relative price over the decades.

Consider first the years prior to 1987, when government expenditures were relatively cheaper than in 1987. The official 1987 weights based on 1987 relative prices will *overweight* government expenditures for years prior to 1987 and will *underweight* government expenditures for years after 1987. Since government expenditures always increase in wartime, the relative size of government (and of World War I or World War II wartime expenditures) is much larger using 1987 as a base year than, say, 1944 or 1917. Further, the size of the exaggeration of wartime expenditures is not fixed, since the base year is regularly moved to a later date, e.g. from 1972 to 1982 to 1987. To dramatise the importance of this error in weighting procedures, l have often said 'that every time the BEA moves the base year to a future year, World War I gets bigger'.

Similarly, the 1987 base year procedure *understates* the importance of computers and other high-tech equipment prior to 1987. Since these have rapidly declining relative prices, prior to 1987 any component of GDP that includes computers is understated as a share of GDP, and the growth rate of GDP itself is understated. Everything is reversed after 1987. The relative size of government (or any other sector with a rising relative price) is understated. The relative size of computer investment, or any aggregate (like producers' durable equipment (PDE) or manufacturing output) that includes computer output, is overstated.

But the size of relative shares is a small part of the overall problem. Anyone who wants to check the movement of true shares is free to use nominal magnitudes. Instead, the real damage is done to measures of the *growth rate* of real magnitudes, essential ingredients in measures of productivity and our standard of living. Oddly, while the BEA publishes both fixed 1987 base-year measures of real output magnitudes and superior magnitudes based on chain-weighting and benchmark-weighting, almost no-one pays any attention to the superior measures.[3] Yet everyone, following Diewert (1987, 1995), agrees that they dominate the conventional fixed 1987-base-year measures, so much so that the latter are invalid measures of economic performance.

3. The BEA's benchmark weighting system weights the growth rates of real sub-aggregates (e.g. real durable consumption) by the average of nominal expenditure shares in benchmark years five years apart, e.g. 1982 and l987.

Does this make any difference? Table 7 shows that important conclusions about the true behaviour of the economy can be reversed when the official fixed 1987-base-year data are used in place of the theoretically preferable chain-weighted or benchmark-weighted indices. To understand this table, note that the columns display annual rates of growth over four periods, 1972-87, 1987-90, 1990-94 and 1987-94. That is, column (4) does not provide new information but rather provides a weighted average of the information in columns (2) and (3). Much of the following will be based on a comparison of the growth rates in columns (1) and (4).

Table 7: Growth Rates of Real Output Measure with Alternative Weights and Various Time Periods (1972-1994)

	1972-87	1987-90	1990-94	1987-94
	(1)	(2)	(3)	(4)
Real GDP				
Fixed 1987 weights	2.75	2.68	2.00	2.29
Chain-type weights	3.03	2.70	1.72	2.14
Benchmark weights	3.10	2.68	1.74	2.14
Real consumption of durable goods				
Fixed 1987 weights	4.69	2.48	3.92	3.30
Chain-type weights	5.05	2.45	3.30	2.94
Benchmark weights	5.09	2.45	3.34	2.96
Producers durable equipment				
Fixed 1987 weights	4.69	3.25	7.90	5.91
Chain-type weights	5.79	3.18	6.00	4.79
Benchmark weights	6.69	3.45	6.20	5.02
Non-farm private output per hour				
Fixed 1987 weights	0.95	0.15	1.94	1.17
Chain-type weights	1.23	0.17	1.66	1.02
Benchmark weights	1.30	0.15	1.68	1.02

Note: Chain and benchmark versions of output per hour calculated by applying the differences for real GDP in the first three lines of the table.

Sources: GDP, Consumption, PDE from *Survey of Current Business*, various issues; Output per hour from *Economic Report of the President* and *Economic Indicators*, various issues.

The lines of the tables appear in four sections representing real GDP, real durable goods consumption, producers durable equipment, and non-farm private output per hour. In every case, the theoretically predicted difference appears between the indices based on fixed 1987 weights, and the indices based on chain-type weights or on benchmark weights. That is, the fixed-1987-weight measures understate the growth rate of real magnitudes prior to 1987 and overstate them after 1987.

For two key issues the change in weighting schemes, from the unsatisfactory BEA scheme based on fixed (1987) prices to one of the moving-weight schemes favoured by

Diewert, makes enough difference so that conclusions are reversed. Let's start at the bottom of Table 1, where data on the growth rates of productivity, measured as US non-farm output per hour are displayed. Comparing column (1) and column (4), we reach the conclusion – associated with such optimistic business economists as Stephen Roach of Morgan Stanley – that productivity growth has accelerated. Fixed 1987 weights indicate that between 1972-87 and 1987-94 productivity growth accelerated from 0.95 per cent per year to 1.17 per cent per year.

However, this conclusion turns out to be quite decisively wrong when recalculated with either chain-type weights or benchmark weights. Comparing 1972-87 versus 1987-94, chain-type weights indicate a productivity deceleration from 1.23 to 1.02 per cent per year. In other words, the correct moving-weight index indicates a productivity *slowdown* of the same order of magnitude as the incorrect fixed-weight index indicates a productivity *acceleration.* The difference is even greater for PDE, where the fixed-weight (official) indices indicates an acceleration from 4.69 to 5.91 per cent per year, while chain-type weights indicate a deceleration from 5.79 to 4.79 per cent per year. The difference between one measure and the other amounts to 2.2 per cent per year, a big deal when compounded out over 10 or 15 years.

Why has the BEA maintained the single-base-year approach for so long? As Diewert (1995) points out, there is a fatal theoretical contradiction between shifting weights and 'additivity'. Simply put, if we shift weights every quarter, then the sum of the components of real GDP will not add up to total real GDP for more than a single quarter. The obvious retort to the 'additivity' dilemma is, 'who cares?'. For any question involving shares of one component in the total economy, or a sub-component in a major part of the economy, the correct answer comes from shares of nominal (current dollar) spending or income, not real (constant dollar) income.

There is no additivity problem in nominal magnitudes and thus no problem in discussing shares of any component within any other component.

Perhaps we could agree that there is a 'dichotomy' in the use of national income statistics. Some people are interested in the cross-sectional relationships, i.e. relative magnitudes. For this nominal magnitudes are the correct measure. More often, we are interested in growth rates of real magnitudes, such as productivity growth (which in turn is the growth rate of output minus the growth rate of hours of labour input). Here we want the growth rates to be based on moving weights, a Fisher-ideal, Tornqvist, or chain-weighted measure. For growth rates, *additivity does not matter*.

Not only is the additivity dilemma irrelevant for nominal magnitudes but it is meaningless for real magnitudes. If we want the share of consumption in total real GDP (consisting of components C+I+G), we can measure that as C/(C+I+G). It is irrelevant whether the level total real GDP computed with a chain-weighted procedure differs from the total of C+I+G. Besides, with rapidly changing weights, shares in real GDP are unlikely to differ appreciably from shares in nominal GDP. Again, additivity does not matter.

3.3 Sources of Bias in Aggregate Price Indices

What matters for output and productivity growth is bias in the GDP deflator, not the CPI. Yet it is conceivable that the biases in the GDP deflator and CPI could go in the opposite direction, because of the base-year bias discussed above. Real GDP growth is biased upward after 1987 because of the use of fixed 1987 weights rather than a moving weight system like chain-weighting or benchmark weights. Yet the CPI is widely believed to be biased upward throughout the post-war period. This issue, for which no one has yet provided quantitative measures that balance the opposing sources of error, implies that the direction of bias in aggregate measures of output after 1987 is uncertain, since weighting bias that raises the growth rates of real magnitudes is/may be overwhelmed by CPI bias that reduces the growth rates of real magnitudes. Obviously, before 1987 both sources of bias work in the same direction and imply that the growth rate of real GDP and of productivity is understated. This is not good news for those attempting to explain the productivity-growth slowdown.

Why are we now quite certain that the CPI incorporates a substantial upward bias? There are at least four reasons.

1. *Traditional Substitution Bias*. The CPI is what is known as a 'Laspeyres' price index. That is, it measures price changes for many different products and then aggregates these thousands of separate measures of price change using weights that apply *to a base year (or years) that is prior to the period being measured.* Over much of the post-war period, these weights in the CPI have been based on consumer expenditures from *five to fifteen years* prior to the year of price measurement. In the traditional example, even if the price of chicken rises much less than the price of beef so that consumers shift their expenditures to chicken, the relative weight of chicken and beef in the CPI is based not on current spending patterns but rather on expenditures in that long-ago base year. Economists used to study this traditional substitution bias quite a lot, until they found out that it didn't amount to much. The consensus estimate for this first source of bias is 0.25 per cent per year.

2. *Quality Change*. It is widely recognised that the CPI fails to adjust adequately for the improved quality of new products and new models. To set this problem in context, students of business history have drawn attention to the 'product cycle.' New products – whether autos, air conditioners, or VCRs – are initially made in small volumes and sold at high prices. Soon, firms figure out how to increase volumes and reduce prices. Eventually products mature, sales fall off, and prices increase more rapidly than the average product. The sequence is easily visualised as a U-shaped curve – the price of any given product relative to the consumer market basket starts high, then goes down, is flat for a while, and then goes back up.

Nobody debates the reality of this product cycle, and nobody debates the fact that the CPI introduces products late, thus missing much of the price decline that typically happens in the first phase of the product cycle. This is the first aspect of quality change bias. For example room air conditioners were widely sold in 1951, available in the Sears catalogue and rated by *Consumer Reports* in 1952, but not introduced into the CPI until 1964, 12 years late! More recently, the microwave oven, VCR, and personal computer were all introduced into the CPI years after they were sold in the marketplace. In short, the CPI introduces new products too late and tracks obsolete products too long.

The second aspect of quality change bias results from a narrow definition of a commodity. Before 1970 precise multiplication and division required noisy and expensive rotary electric calculators; after 1970 electronic pocket calculators became available and are now in the pocket or dormitory of every college student. The price fell quickly from $1,000 to $10, and the new product could do exponents, logarithms, and lots of things the old product could not do. But the price decline was completely ignored by the government price indices, which treated the old and new calculators as separate products. People flock to rent videos but the declining price of seeing a movie at home, as compared to going out to a theatre, is entirely missed in the CPI. Similarly, the CPI misses the replacement of manual typewriters by electronic typewriters and then PCs with word-processing capability.

The third aspect of quality change bias results from a narrow definition of quality. Newly-improved models are often introduced with new features that are missed by the CPI. Changes occur in energy efficiency and repair frequency, but these are rarely if ever valued in compiling the CPI. Here is a brief list of some of the quality improvements that have been 'missed' by the CPI over the post-war years:[4]

- improved ability of refrigerator-freezers to hold a zero temperature;
- reduced electricity consumption of all appliances, particularly refrigerators and TV sets;
- reduced repair costs on TV sets and indeed all appliances;
- reduced vibration, noise, and discomfort in air travel as jets replaced piston planes and as air travel became safer;
- the enormous improvements in the audio quality of home and auto stereo equipment;
- the shift from metal to plastic that reduced corrosion and increased lifetimes for so many consumer products;
- the reduced weight of home power tools;
- the reduction of noise, weight, bulk, and installation cost of room air conditioners; and, to bring home the point to almost everyone in this room; and
- the immeasurable increase in picture quality of colour TV sets compared to the dim, flickering images of the mid 1960s.

How much does this second source of CPI bias amount to? For some products it is very large – 6 per cent per year for the radio-TV category over the 37 years studied in my book (Gordon 1990). For other products, it is much less. I estimated that for consumer durables the upward bias was 1.5 per cent per year for the post-war period, assuming that the half of consumer durables that I didn't study were measured perfectly (it is likely that an inquiry into that other half would turn up additional bias). Even in such traditional products as apparel, there seems to be a substantial bias – in recent unpublished historical research I have identified a 2.1 per cent per year upward bias in the CPI for apparel between 1920 and 1947. If the only quality bias was in the durables I measured in my book, the implied bias for the total CPI would be 0.3 per cent per year. Adding in plausible bias in non-durables and services (including medical care), we could easily double that to, say, 0.6 per cent per year.

3. *Outlet Substitution Bias*. Just as the CPI has a narrow definition of a product, it has a narrow definition of where a product is sold. A banana is not a banana. If a pound of

4. This list is an excerpt from Gordon (1990, pp. 38-39).

bananas initially costs $0.69 at Ace supermarket, and ‘Ultra Discount Superstores’ comes to town and starts selling bananas for $0.49 per pound, the consumer enjoys a price decline of 29 per cent. But the CPI registers a price decline of zero! Why? Each outlet is assumed to provide a separate set of services. But consumers have been leaving ma-and-pa drug stores in droves to shop at Walmart, ma-and-pa toy stores to shop at Toys ‘R’ Us, and ma-and-pa hardware stores to shop at Home Depot. So we know that individual consumers have enjoyed a price decline that is not measured at all in the CPI.

A related source of bias is that the US government price indices for drugs treat brand-name and generic drugs as separate commodities. Thus when the market shifts from brand-names to generics (which generally are introduced at about half the price), the price index does not fall while measured revenue does fall, leading to a spurious decline in output and productivity in the pharmaceutical industry.

4. *The Logarithm Bias*. The most embarrassing source of bias in the CPI was brought to light by the BLS itself. To put it bluntly, the CPI doesn’t understand logarithms. Using the methodology of the CPI, if a piece of apparel goes on sale from $100 to $75, that represents a price decline of 25 per cent. When the item goes back to the regular price of $100, that represents a price increase of 33 per cent. True change in price from beginning to end? Zero, the answer that would be obtained by using logs. The CPI measured change in price? Plus 8 per cent! Careful BLS research has shown that this contributes a bias of about 2 per cent per year for produce and female apparel in a recent period, and a bias for the total CPI of about 0.35 per cent per year.

3.4 Implications for Productivity Growth

The set of CPI measurement bias sources outlined above is by far the largest part of the productivity measurement story. Recall from our four-quadrant matrix that a particular source of measurement bias must apply to purchases of final goods and services in order to imply an alteration to official productivity growth measures for the aggregate economy (in contrast to a bias applying to intermediate goods and services that merely reallocate productivity growth among sectors). By definition, the CPI applies to final purchases of consumer goods and services, and so any bias identified in the CPI directly implies a bias in the opposite direction in measures of productivity for industries producing consumer goods and services.

Where do the individual sources of CPI bias alter the record of productivity growth recorded in Tables 1 to 5? Traditional substitution bias and outlet substitution bias imply that actual productivity growth has been more rapid than officially recorded in manufacturing and trade. Quality change bias applies in many consumer purchase sectors, from durable goods like VCRs and microwave ovens to services like banking, insurance, and health care. Finally, the ‘logarithm’ bias creates a substantial overstatement of price increases for produce and apparel, implying an understatement of productivity growth in the apparel part of manufacturing and in retail trade.

3.5 Additional Sources of CPI Bias

Even the radical estimate presented here of the CPI bias is surely an understatement of the true bias, for new products raise the standard of living in ways that go far beyond simple price changes for a single product. The price of light was reduced enormously by the invention of electricity, but until recent pioneering work by Nordhaus (1995) there was no price index that directly compared the price per lumen of a primitive 1890's electric light bulb with that for a whale-oil lamp. And even such an adventuresome price index makes no attempt to measure the value to families of extending day into night, or for firms in being able to extend the hours of production from a given set of facilities.

Whatever invention we take – whether the automobile that allowed limitless flexibility in the time and destination of rapid transportation, or the jet plane and communications satellites that tied together far-flung nations into a single international community, or the television and VCR that allowed almost any motion picture to enter the home, or the new-fangled PC with CD-ROM that promises ultimately to bring the Library of Congress into every home – these new developments have made human life better on a large scale.

The ultimate test of the change in the cost of living over the past 25 years is to ask the following question. Take the market basket of goods and services available in 1970 and labelled with 1970 prices. Take the market basket available in 1995 and labelled with today's prices. Ask the consumer, how much more income would you require to be as satisfied with the 1995 basket and prices as with the 1970 basket and prices? The CPI says 4 times as much income would be necessary, because the CPI has quadrupled since 1970. But that 1970 market basket has no VCRs, microwave ovens, or computer games; its colour TV sets break down all the time; and its refrigerators use a lot of electricity. Consumers forced to answer my question are going to miss all the benefits of modern life and are not going to say that four times as much income would be necessary – maybe 3 times, maybe 2 times, but not 4 times. That's the ultimate test of bias in the CPI. Note that if the correct answer is '3 times,' the bias in the CPI has been running at an annual rate of 1.2 per cent, while if the correct answer is '2 times,' the bias instead is 2.8 per cent.

4. Measurement Problems at the Industry Level in an International Context

In addition to the set of measurement issues outlined above, there are others related to specific industries. It helps to understand some of the issues involving particular industries if we compare measurement methods in the US with several other large countries, particularly France, Germany and the UK.

At the general level of output and price measurement, we stress one area in which US methods seem inferior to those used in the other countries – weighting methods. As we have seen above, the United States uses a single base year (which other countries like France, Germany, and the UK avoid through frequent changes in weights), and the compounding of the error of using a single base year through the introduction of a hedonic price index for computers that creates huge changes in relative prices within particular sectors of the aggregate economy, particularly durable manufacturing.

The US is apparently the only country that forces the relative price of a single base year to apply throughout the history of the national accounts, although an alternative chain-weighted index of GDP and its major components is now published for the period since 1959. The use of shifting base years in France, Germany and the UK increases the accuracy of the relative price structure used to aggregate the output and price indices.

This major advantage comes at a cost for users of the accounts: different sets of tables are provided for each base year, and the user must go to the extra work of linking when a long time series is desired. For instance, the French accounts are published for 1949-59 on a 1956 base, 1959-79 on a 1970 base, and 1970-present on a 1980 base. The need for linking extends to nominal series, not just real series, since new measurement methods are generally introduced as part of a new weighting system. Thus the nominal value of construction output in France for 1970 is different in the 1980-base accounts than in the 1970-base accounts. As the base year is updated, numerous other aspects of the accounts change, again inhibiting links. For instance, the French accounts are available at a progressively greater level of industry detail as the base year shifts from 1956 to 1970 to 1980.

The German system is similar to the French in most respects. The UK accounts rebase every five years. Historical UK data for 1978-83 use 1980 weights, 1983 to 1988 use 1985 weights, and so on. Frequent UK rebasing carries with it a cost in terms of ease of data availability; we are informed, for instance, that the UK producer price statistics are simply not available for l980 in a product breakdown comparable to the pre-1980 period.

4.1 Specific Industries

I have identified several industries in which US measurement methods differ from those used in other major nations.

Transportation. The apparently uniform reliance of France and Germany on double deflation conceals important differences across industries. Double deflation means that an attempt is made to subtract the real value of materials inputs, deflated separately. But this does not mean that gross output is obtained in all cases by the use of detailed price indices as deflators. Instead, in Germany and France, volume indicators are used in some industries. An example is rail transportation in Germany, where ton-mile indices are developed for 100 different categories of freight and aggregated using base-year value-per-ton-km weights; the substantial data requirements of this method are facilitated by the monopoly position of the Deutsche Bundesbahn. The method is similar in principle that is used in the US by the BLS productivity program (as summarised above in Table 5) to measure gross output. However, the German method is more detailed in application, adjusts for materials outputs, and presents a unified story for the different forms of transportation, in contrast to the US, where the national accounts indicate substantially slower output growth than the BLS. Interestingly, the only fact about the French treatment of transportation that we have digested so far is that the French CPI, intended to provide price information for urban workers, covers *only* the packaged tour component of air transportation.

Real Estate. Both France and Germany deflate gross output with rental price indices, as in the US. The US rental price indices are sometimes accused of a downward bias by tracking a progressively older rental housing stock and failing to correct for the declining quality that, some allege, comes with increasing age. However, maintenance and remodelling may actually lead to an improvement in quality. The fraction of the rental housing stock equipped with central air conditioning, built-in appliances, etc., has increased alongside the fraction of the owner-occupied housing stock displaying these additional quality attributes.

In both Germany and France a substantial effort is made to correct the rental price indices for quality change. In Germany new buildings are folded into the sample regularly; presently the index is based on ten quality categories of apartments. The French go further with a large sample of apartments stratified into 3,000 size/quality categories (square metres, presence of central heat, number of showers/bathrooms, etc.). In France $^1/_{12}$ of the sample of apartments is replaced each year. Comparisons of relative prices across countries are clouded by the different importance of rent controls; presently about 30 per cent of French apartments are rent-controlled.

Insurance. Baily and I (1988) complained that productivity growth in the US insurance industry was understated due to an upward bias in the price indices used for deflation. Instead of measuring the price of what the insurance industry actually does, e.g. write policies, the US accounts use the prices of the activity being insured, mainly auto repair and medical care, and both of these exhibit substantial increases in relative prices. This problem is avoided in France, where gross output is measured not by deflation but by a physical volume measure (note in Table 5 above that the BLS does not provide a productivity index for insurance, even though in principle one could be created from an output measure based on the number of policies written and claims filed). In France, not only is the number of policies counted by standard categories of insurance, but the number of 'elemental movements' is processed on these standard categories. The current system contains 11 classes of 'movements' through 11 basic categories of policies. The system allows the monitoring of both the change in the stock of policies and the change in the numbers of policies issued in each category.

For insurance the German system relies more on deflation and less on the construction of volume indices. Nominal claims paid are deflated by different price indices – 'special items' from the CPI tor health insurance, the general consumption deflator for life insurance, and a special price index for auto repairs for casualty insurance. Thus it would appear that, in a world in which computers raise the ability of insurance employees to issue additional policies per employee, the French methodology would be more likely to capture the effects of the computer revolution than the German methodology.

Banking and Finance. The US industry data for banking and finance extrapolate output with labour input and assume no productivity change.[5] The French take the nominal production of the banking sector to be based on interest earned minus interest paid (for 80 per cent of bank output, volume indices for specific services for the other 20 per cent), deflated by a weighted average price index of bank services, including service charges on checking and saving accounts as well as credit card fees. The German approach is similar, taking gross nominal output to be the sum of sales from goods, commissions, and fees, plus interest received, less interest paid. Then consumption of intermediate goods, consumption of fixed capital, and taxes linked to production are subtracted, to arrive at net value added at factor cost. Unlike the French procedure which uses prices of explicit bank services, the Germans deflate net value added obtained in this way by the aggregate price index of national expenditure, at least for banks. For other credit institutions they rely on a price index for service charges in the CPI.

5. We note in Table 4 that the NIPA measure of output per person engaged in the industry 'security and commodity brokers' grows at a substantial rate after 1987, indicating a change in measurement methods. I have not yet been able to identify the nature of this change.

4.2 Implications of Differences in Measurement Methods

There are a number of differences in measurement methods between the US and several other major industrial nations. There are enough measurement issues to suggest that the unique American discrepancy between buoyant post-1979 productivity growth in manufacturing and near-total stagnation outside of manufacturing is partly spurious. In European nations the growth rates of manufacturing and non-manufacturing productivity are much closer together, and the true rates for the US manufacturing and non-manufacturing sectors are probably closer together also.

5. Hypotheses to Explain the Productivity Slowdown

As we have seen, the US economy has not experienced a uniform slowdown in productivity growth across all industries. The problems are concentrated in particular sectors. Thus a simple way of evaluating alternative hypotheses is to ask whether they shed light on cross-industry differences in productivity performance.

5.1 Measurement

Measurement problems related to specific industries, particularly finance, insurance, and real estate, have been reviewed above. The various sources of CPI bias suggest that productivity growth has been understated in manufacturing, retail trade, and some services. While most of these measurement problems were present long before the advent of the post-1973 productivity growth slowdown, we must recognise, as Griliches (1994) emphasises, that economic activity has shifted toward sectors in which output is intrinsically hard to measure. In his dichotomy, the economy is divided into two types of sectors, ‘measurable’ and ‘hard-to-measure’.

One weakness of the Griliches ‘hard-to-measure’ hypothesis is that it should apply equally to all nations, whereas Table 8 reports that productivity growth in the hard-to-measure sectors tend to be substantially more rapid in Japan and Europe then in the US. As we have seen, part of this difference, particularly in the finance, insurance and real estate sector, may be attributed to measurement issues. A large question originally asked by Baily and myself (1988) and more recently reviewed by Griliches (1994) is why a vast

Table 8: Productivity Growth by Type of Sector

Measurable	Share of GDP in 1990 %	Hard-to-measure	Share of GDP in 1990 %
Agriculture	2.0	Construction	4.4
Mining	1.8	Wholesale trade	6.5
Manufacturing	18.4	Retail trade	9.3
Transportation	4.7	Finance, insurance and real estate	17.7
Utilities	4.0	Other services	18.9
		Government	12.2

investment in computers has, at least in the US, produced so little payoff in productivity growth? Griliches shows that three-quarters of this computer investment has gone into the hard-to-measure sectors. Visible payoffs from computer investment, like rapidly rising volumes on securities and commodities exchanges, and the convenience of 24-hour banking with automatic teller machines, are largely missed in the productivity data.

5.2 Standard Suspects

So much has been written about standard hypotheses to explain the productivity growth slowdown that we can mention them very briefly here. The inadequate US saving rate is indeed part of the problem, and that is evident in Table 1, where the slowdown in MFP growth in non-manufacturing is two-thirds of the slowdown in output per hour growth. Nevertheless, this still leaves a MFP slowdown of one per cent calling out for an explanation.

A separate aspect of inadequate investment is an alleged deterioration in infrastructure, i.e. public capital. In view of the lavish investment of the United States in interstate highways, cloverleafs, and posh airline terminals serving even medium and small-sized communities, this hypothesis seems dubious. A careful cross-country examination by Ford and Poret (1991) revealed no convincing evidence of a role for infrastructure in explaining cross-country differences in productivity performance.

The timing of the slowdown originally cast the oil price shocks of the 1970s as prime culprits, but this explanation has long since lost its credibility as the real price of oil has returned close to its pre-1973 values. Also, the cross-industry pattern of the slowdown does not lend credence to the oil price hypothesis, as such energy-intensive industries as airlines and utilities do not reveal a slowdown in the 1972-87 period followed by a compensatory revival.

A plausible culprit capable of explaining part of the slowdown is a decline in labour quality. The percentage of teenagers and adult women in the labour force rose after 1973, yet their average wages still lag behind those of adult men. Whether this represents a decline in labour quality is debatable, depending on how much of the wage difference reflects true differences in productivity, and how much represents discrimination. Baily and I (1988) suggested that about 0.3 percentage points of the slowdown might be attributed to some combination of the mix shift in labour compositions, and the decline in standardised test scores over the past two decades.

5.3 Two Plausible Explanations

My favourite list of explanations of the productivity growth slowdown include, of course, the measurement issues emphasised above, particularly in construction, finance, insurance and real estate and those sectors influenced by the CPI bias. However, there remain problem industries where measurement is not a suspect. In electric utilities and air transportation, the productivity growth slowdown is real and has a simple explanation – technological depletion or, more simply, ‘running out of ideas’. In both industries, based on the technology of large turbines, a frontier of size, speed, and pressure was reached and is unlikely to be surpassed. Poor productivity growth in US food retailing may also have a depletion aspect: ‘they could only invent the supermarket once’.

In addition to measurement and depletion, my other favourite explanation of the particular US pattern of the slowdown is that a structural shift in the operation of the US labour market has reduced real wages in the bottom half of the income distribution, and this has fed back into lower productivity (or slower growth). Simply put, the labour supply curve has shifted out, sliding down the labour demand curve. The sources of the structural shift are weak unions, a decline in the share of employment in industries where unions are strong, a substantial decline in the real minimum wage, and substantial immigration, both legal and illegal. This hypothesis is explored at length in Gordon (1995), but its role in explaining slow productivity growth in retail trade and services is evident from casual observation. US restaurants, particularly at the medium and higher price range, tend to have more serving personnel and layers of servers than their counterparts in Europe (it is standard in Chicago to have one layer taking orders, another delivering food from the kitchen, and a third ('bus boys') setting and clearing tables). In the US, at least everywhere I look, it is commonplace to have two people at each supermarket checkout lane, one tallying up the bill and the other 'bagging' each customer's order. Automated parking lots, with machines instead of cashiers, are more common in places like Sweden than in the US.

6. Conclusion

I have previously called attention to a dichotomy in macroeconomics. European economists concentrate on explaining structural unemployment and understanding impediments to labour-market flexibility (Gordon 1995). American economists are concerned with slow growth in productivity and real wages, and growing inequality of the income distribution. Too little work is done on either side of the Atlantic (or Pacific) to understand differences across countries and industries in the growth of productivity, the basic source of economic progress.

This paper has identified a number of important differences between the productivity performance of the US and other leading industrial nations. US manufacturing productivity has not experienced a slowdown when 1972-94 is compared with 1950-72, but official data overstate the post-1987 growth of manufacturing productivity. Much of the post-1972 slowdown is concentrated in particular industries outside of manufacturing, and output in many of these industries is intrinsically hard to measure. A host of measurement problems suggests that US productivity growth is substantially understated, both before and after 1972, with the fraction of economic activity taking place in 'hard-to-measure' sectors suggesting a possible increase in the seriousness of measurement difficulties.

In addition to measurement problems (some but not all of which are similar in other countries), two substantive hypotheses are proposed to explain the productivity slowdown. First, technological depletion has played a role, particularly in electric utilities, air transportation, and food retailing. Second, the weak bargaining position of labour in the United States may have contributed to slow productivity growth, particularly in the services, by leading to low wages in the bottom and consequent overstaffing.

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Discussion

1. Stephen S. Poloz

It seems that whenever Robert Gordon decides to take a romp through the data, our profession learns something of importance. The paper he has prepared for this Conference is no exception. He focuses on the well-documented slowdown in productivity growth in the mid 1970s and demonstrates that it was concentrated in sectors of the economy that are intrinsically hard to measure. The fact that these same sectors have been increasing in relative importance over time is suggestive of an important role for measurement issues in the perceived productivity slowdown. In addition, he offers two economic hypotheses: first, in some sectors there has been a degree of technological depletion, as he calls it; and second, the gradual weakening of the market power of US labour may have led to disproportionate growth of low-paying, overstaffed, low-productivity jobs in that economy.

The core of the paper deals with issues of price measurement. I do not need to remind this audience of Gordon's reputation on this topic. He has invested many years in it, and the contrast with my own level of expertise on the subject could not be more stark. I was accordingly very relieved to discover that my role as discussant would be not to critique this work specifically, but rather to draw out of it the issues I believe are worthy of further discussion.

There are, of course, several sides to every economic debate. Some will no doubt wish to argue that other economic or structural factors played a dominant role in the productivity slowdown. The digestion of the energy price shocks that took place in the 1970s is a prominent example. Others have suggested that the slowdown might be more appropriately characterised as a return to normal, after an extraordinary productivity pickup earlier on, related to the post-war period of rapid technological advance. Some will probably question Gordon's suggestion that reduced market power of labour led to lower productivity growth, simply on the grounds that more flexibility in markets is almost always associated with better economic outcomes. And, with regard to Gordon's sectoral analysis one could ask, just to cite a couple of examples, about the role of the regulatory environment in the case of utilities, or of the handling of seat-discounts in the data on air transportation, in generating his results.

Nevertheless, many of the available economic and measurement explanations probably contain some validity, as they are all correlated with the productivity slowdown. We are basically faced with a classic identification problem. Most of the variables that we have in our theory of economic growth are themselves endogenous, with the implication that one can obtain almost any empirical result just by altering the identifying assumptions that one imposes on the data.

Most of the usual economic explanations for the productivity slowdown can be described as 'real' or 'structural' in nature. But when I look at the broad stylised facts of the past 25 years, the shock that stands out for me is a nominal one. I have in mind, of course, the rise in inflation that began in the late 1960s. Perhaps this view of the world is a product of my training, or of the time I have spent as a central banker. In any case, this represents for me the largest and most significant exogenous disturbance in modern economic history.

Inflation in the United States was at levels that many would describe as negligible in the first half of the 1960s, and it went through a series of cycles along a rising trend until 1980, at which time the pattern was broken. Inflation then spent most of the 1980s in the 4-6 per cent range, again showing a slight tendency to rise, until 1991, when we appear to have experienced a downward ratcheting. But it would be fair to say that, even now, we have not yet worked off completely the effects of the surge in inflation that began some 30 years ago.

We know the origins of this shock. Excessive US monetary expansion in the late 1960s was transmitted via a fixed exchange rate system throughout the major world economies. The final outcomes were not identical in every major country, of course, because the fixed exchange rate system was one of the casualties of this shock, enabling policy responses to differ from country to country later in the 1970s.

The decline in the purchasing power of US dollars during 1965-72 was surely a factor that contributed to efforts on the part of major petroleum producers to raise their prices in the 1970s. The two oil price shocks that resulted of course represented *relative* price changes, albeit large ones, but given that general inflationary pressures were already widespread, they had more the effect of adding to those pressures at the time.

The hypothesis that I would like to advance today is an encompassing one. Thinking of the various factors that might have caused the productivity slowdown – be they structural or measurement in nature – as *competing* hypotheses seems to me to miss the point entirely. I suspect that many of these potential explanations might be related to one another, not for causal reasons, but because they represent multiple symptoms of a common exogenous disturbance, namely, the rise in inflation that, in fact, has yet to be fully reversed.

Now, I will not go into an extensive review of the literature on the link between inflation and real output, for it is well known to this audience. Suffice to say that most economists seem to believe that there are real economic costs associated with ongoing inflation; in short, they believe that non-superneutralities exist. They have in mind the resources spent managing money holdings and changing prices frequently. They have in mind interactions between inflation and distortionary features of the taxation system, such as the taxation of nominal interest income and rules for inventory and depreciation expenses. They have in mind confusion in relative price signals. And they have in mind the uncertainty that arises from the positive association between the level of inflation and its volatility. The problem, of course, is that these effects are very difficult to quantify. Many have tried, and few have succeeded, in demonstrating a statistically robust causal link between inflation and GDP or productivity growth.

Levine and Zervos (1993) have summarised quite well the weaknesses contained in cross-country regressions of real growth on inflation. Nevertheless, if one's priors are that the link exists, it is difficult to disregard research such as that reported in Cozier and Selody (1992), Motley (1994) and, of course, Barro (1995). There is some debate as to whether inflation affects the level of output, or its growth rate. But, since any effects on the level are sure to be spread over time, the two cases would be difficult to distinguish in practice. The latest estimates from this literature suggest that non-superneutralities are not large but, in a growth context in particular, they do not need to be large to be important.

In any case, it is likely to be very difficult to measure the size of such non-superneutralities using the macro data. For one thing, it can be expected that inflation will distort the labour-leisure decision, making GDP a particularly poor measure with which to compare economic welfare between low-inflation and high-inflation regimes. Second, government tax structures are likely to be endogenous to changes in inflation, as governments attempt to provide the same services in all inflation regimes. Thus, if tax revenue falls as inflation falls, governments are likely to increase the rates of taxation when inflation declines, thereby increasing the size of the tax distortions and offsetting some of the real benefits associated with the distortion-reducing drop in inflation. And third, the effects of inflation on real activity might simply be very small; although early work with endogenous growth models with tax distortions (Black, Macklem and Poloz 1994) suggests that the economic costs of inflation might eventually be very large, the predicted effects on the *growth rate* of output appear to be small enough to be difficult to detect using standard empirical methods.

Let us set this empirical debate aside, then, and proceed on the presumption that non-superneutralities are economically important, and therefore that the rise in inflation was at least a factor that contributed to the productivity slowdown. Where does this put Gordon's very convincing evidence on productivity measurement? I believe that this finding, too, can be at least partly encompassed by the hypothesis that the rise in inflation was the root cause. This is because much of Gordon's hypothesis rests on problems of price measurement. For example, it is well known that the degree of substitution bias in price indices will be greater during periods when relative prices are changing significantly which, as already noted, was certainly a feature of the 1970s (see Crawford (1993) for a discussion). In any case, there is certainly room for both the measurement error and the inflation/productivity hypotheses, and perhaps others, in explaining the productivity slowdown. I am only suggesting that the role of inflation in all this is deserving of some serious attention.

All of this matters a good deal right now, of course. For if you believe that the productivity slowdown was due to the declining market power of labour, or technological depletion, or simply a function of the difficulties of measurement, then you are unlikely to be looking for a productivity acceleration now. However, if you put any weight on the hypothesis that the slowdown was related to the rise in inflation, then you will be looking for evidence of a productivity acceleration as we move through the 1990s, particularly in countries where inflation is settling in at negligible levels.

I do not want to give you the impression that I believe that everything, and not simply inflation, is always and everywhere a monetary phenomenon. However, I suspect that inflation may have played an important role in the events that this paper is attempting to explain. A major deceleration in inflation has now occurred in many countries, so it seems that perhaps all we have to do is to await the outcome of this new experiment. In the meantime, I found Gordon's analysis of measurement issues to be very enlightening, and can only hope that statistical agencies will take it seriously.

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2. General Discussion

Discussion was centred on three main issues:

- the distinction between actual and measured productivity performance;
- the possible sources of poor service-sector productivity; and
- the implications of poor productivity performance for employment.

The importance of these issues was reinforced by the observation that an increasing share of activity is occurring in those areas of the economy that are inherently difficult to measure. But measurement issues are not confined to specific sectors. Those that relate to the estimation of computer volumes affect the capital stock and, thereby, the measurement of productivity in a range of industries. Furthermore, even in those areas where productivity can be measured more accurately, it was argued that failure to take account of the role of intermediate inputs might give a misleading indication of productivity. For example, measurement of multi-factor productivity using only labour and capital implies that there has been significantly higher productivity growth in US manufacturing than in other sectors of the economy. However, it was argued that models which also employ energy and materials generate estimates of multi-factor productivity growth that are about half that of the standard two-factor model.

A number of possible sources of the productivity slowdown in the US were proposed. Much attention was paid to the role of computers, not just in terms of the measurement problems that they introduce, but in terms of the way in which they are used. It was noted that computers are a 'general purpose' technology in which a lot of resources are invested. When first used, they may cause a negative productivity shock. Since users cannot readily measure computational power, computers tend to be employed inefficiently. An analogous example was said to be electricity: initially, it did not have an 'on/off' switch, so its use was not economised and the productivity benefits were not realised for many years. Similarly, it was argued that we are yet to witness the productivity benefits of the computer revolution. In opposition to this view, though, it was noted that the potential productivity benefits of computers may be squandered as computers become progressively cheaper and are put to less productive uses.

The role of inflation in the productivity slowdown was also debated. One hypothesis was that the inflationary surge that began 30 years ago was the largest exogenous shock to output growth and productivity of modern times. Supporters of this view argued that the present environment of low inflation should be the catalyst for an acceleration in productivity that commences now. Others queried why inflation should cause such pronounced sectoral differences in productivity performance. One possibility was said to be the different responses of countries to inflation and the way this impacted on real exchange rates. For example, for much of the 1960s and the first half of the 1980s, the US dollar was overvalued and encouraged expansion of the non-traded goods sector.

The most pressing concern, however, was the implication of the productivity slowdown for employment. Wage dispersion in the US was said to be associated with high employment growth at the low and the high end of the income distribution, with a hollowing out of middle-income jobs that have traditionally been unionised. The increased proportion of wages in the bottom half of the income distribution has encouraged excessive labour use in specific sectors, resulting in low productivity. Consequently, a pessimistic message was that in order to achieve greater productivity, one has to rationalise inputs and lose jobs. And yet, there have been great inventions in contemporary history. Why is the choice not better than it is? What can be done so that countries can have more productivity *and* more jobs? Here it was argued that one has to address a fundamental problem – the depletion of ideas.

Productivity Change in the Australian Steel Industry: BHP Steel 1982-1995

Peter Demura*

1. Introduction

Productivity improvements are important in raising the nation's standard of living over the medium term. As Krugman (1994, p. 13) notes, '... productivity isn't everything, but in the long run it is almost everything'. Empirical research on trends and sources of Australian productivity growth have almost entirely been at the macroeconomic level (Dixon and McDonald 1991, 1992; NIEIR 1991; Adams, Dixon and Parmenter 1991) or at the aggregated industry level (Bureau of Industry Economics 1985; Hughes, Burgess and Dunlop 1991; Industry Commission 1992). However, there have been relatively few studies on identifying the productivity performance of individual firms (EPAC 1989; Lansley and Stern 1992). This is surprising given that '... productivity at the national level is no more than the sum of productivity achievements at the firm level – or even the individual production unit. Therefore, company productivity improvement is as much a critical issue as national productivity' (Grossman 1984, p. 18). Moreover, accurate productivity measurement within a firm can provide management with an additional tool in analysing and correcting the efficiency of the firm beyond that provided by traditional accounting numbers (Kendrick and Creamer 1965; Cocks 1974).

In this paper, we attempt, in a small way, to extend the understanding of company productivity improvements in Australia with reference to productivity changes at BHP Steel. In particular, we examine the changes that have occurred since the early 1980s that have led to substantial improvements in labour productivity. An important driver of the improvement is the increased exposure to international markets through both exports and foreign direct investment. This extends the conclusions from earlier research (Ergas and Wright 1994) from the industry level to the firm level.

BHP Steel is a core business of Australia's largest publicly listed company, The Broken Hill Proprietary Company Limited (BHP). Other core businesses include minerals and petroleum. In 1993/94, BHP accounted for 1.4 per cent of Australia's GDP and 8.0 per cent of total merchandise exports (BHP 1994). BHP Steel is the world's 13th largest steel producer, accounting for 1.1 per cent of world production.

2. Measurement of Productivity

It is generally accepted that from a theoretical point, total-factor productivity (TFP) is a superior measure of productivity performance since it measures the efficiency of total

* The author acknowledges the considerable assistance from Ross McDonald, Geoff Shaw and other colleagues from BHP Steel. The views expressed in this paper, are those of the author and are not necessarily those of The Broken Hill Proprietary Company Limited.

resource use. In contrast, measures of partial productivity, fail to capture changes in other factors that lead to changes in productivity. For example, improvements in labour productivity may reflect changes in the capital/labour ratio as much as they reflect changes in the efficiency of labour. To produce meaningful measures of TFP, data need to be collected on the outputs produced and their respective prices, the various factor inputs and indirect taxes. As the number, complexity and geographical spread of products increases, the data requirements become onerous and the resultant measures may obscure underlying trends in productivity.

In the case of BHP Steel, measurement of TFP becomes a difficult exercise given:

- BHP Steel produces in excess of 10,000 products both in Australia and offshore (necessitating 10,000 plus deflators);
- the complexity of the cost and capital data required;
- the trend towards increased value-added production over the past decade; and
- the diversity of overseas operations.

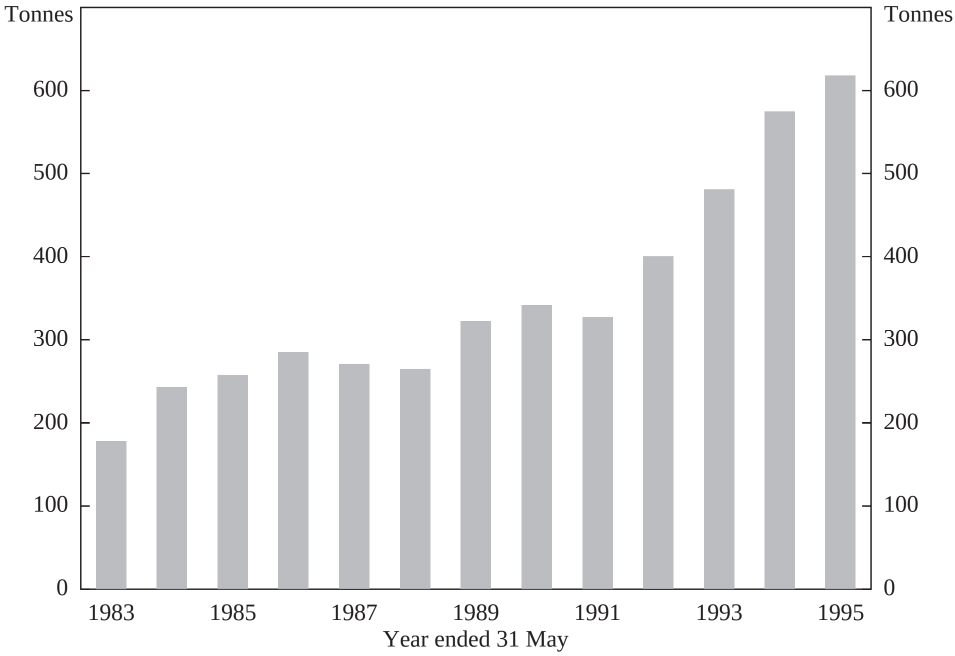
Due to the complexity of the data requirements and the possibility of obscuring what is the essence of this paper, we focus on labour productivity improvements at the three Australian integrated steelworks which account for 88 per cent of production and about 47 per cent of labour employed by BHP Steel. The traditional measure of labour productivity at BHP Steel has been the amount of raw steel produced per steelworks employee. Benefits of the labour productivity measure are ease of calculation, compatibility and, although there have been quality improvements, the numerator (raw steel produced) is relatively homogenous.

3. Productivity Performance

Labour productivity at the three major Australian steelworks has risen from around 175 tonnes per annum in 1982 to 618 tonnes per annum in the year to May 1995 (Figure 1). This reverses the downward trend in productivity evident through the 1970s which resulted from an under-utilisation of capacity, a failure of employment to fall in line with production, industrial dispute, outdated work practices and a failure to gain the full productivity benefits of new capital investment (Steel Industry Advisory Council 1983). The contribution to measured labour-productivity improvements have varied from labour reductions to increases in production (see Table 1). The increase in productivity has been more pronounced in recent years, with productivity increasing by just over 80 per cent since 1991. Although the rise corresponds to the recovery in the Australian economy, the increase in productivity in the past two years cannot be simply attributed to an improvement in capacity utilisation since, over this period, steel production has remained at or above capacity after allowance for maintenance and other downtime.

For a firm with large fixed costs, reductions in variable costs and improving productivity can have a significant impact on profitability. The increase in labour productivity, together with stronger demand and cost reductions, has made a major contribution to the improvement in BHP Steel profitability over this period, with profits increasing from a low of $189.5 million in 1991/92 to $670 million, excluding abnormal items, in 1994/95. Productivity improvements in a key sector such as steel do not only

Figure 1: BHP Steel Productivity – Major Australian Steelworks
(Raw steel – annual tonnes per employee)



Source: BHP.

Table 1: Production, Employment and Productivity

	Raw steel production % change	Employment % change	Productivity % change
1982	-8.3	-4.3	-6.2
1983	-25.9	-18.5	-9.2
1984	13.3	-17.8	36.5
1985	0.5	-4.6	6.2
1986	7.9	-2.1	10.5
1987	-6.5	0.1	-4.9
1988	-6.6	-6.0	-2.2
1989	8.6	-11.1	21.9
1990	0.5	-5.1	5.9
1991	-7.4	-3.1	-4.4
1992	8.7	-11.2	22.3
1993	6.0	-11.8	20.3
1994	14.1	-4.6	19.5
1995	3.4	-3.9	7.5

Source: BHP.

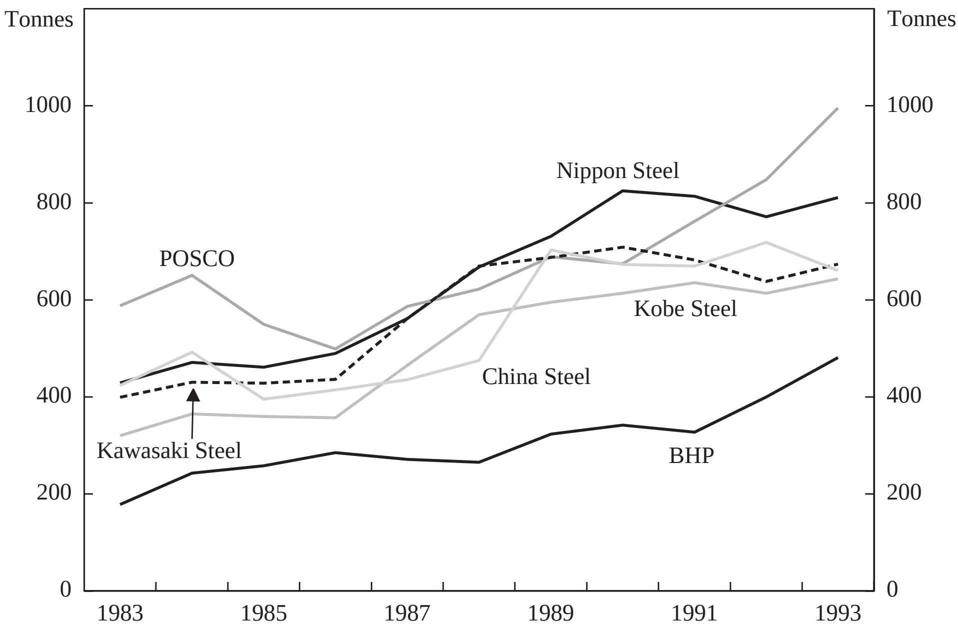
benefit the company involved, but also have positive effects on steel-using industries by lowering the cost of a key input and facilitating increases in production (Rimmer 1989).

4. International Comparisons

BHP Steel has not been alone in improving productivity performance during the 1980s and early 1990s. In Figure 2 we have plotted the labour productivity figures for the five most productive integrated steel companies in the world and BHP. This figure needs to be approached with a significant degree of caution because of the differing methods by which companies report productivity, the types of employees included (i.e. whether contractors, maintenance personnel, and non-production employees are included) and finally, differences in the degree of vertical integration and product range of the companies. All of these factors make international productivity comparisons difficult, especially between integrated steel makers and the minimills.

With the limitations in mind, we see that the South Korean steel maker (POSCO) had the highest level of productivity among the major integrated steel makers in 1993, followed closely by Japanese steel makers (Nippon Steel, Kawasaki Steel and Kobe Steel) and a Taiwanese steel maker (China Steel). However, these productivity figures pale into insignificance compared with the productivity of the minimill producers using

Figure 2: Steel Productivity
(Annual tonnes per employee)



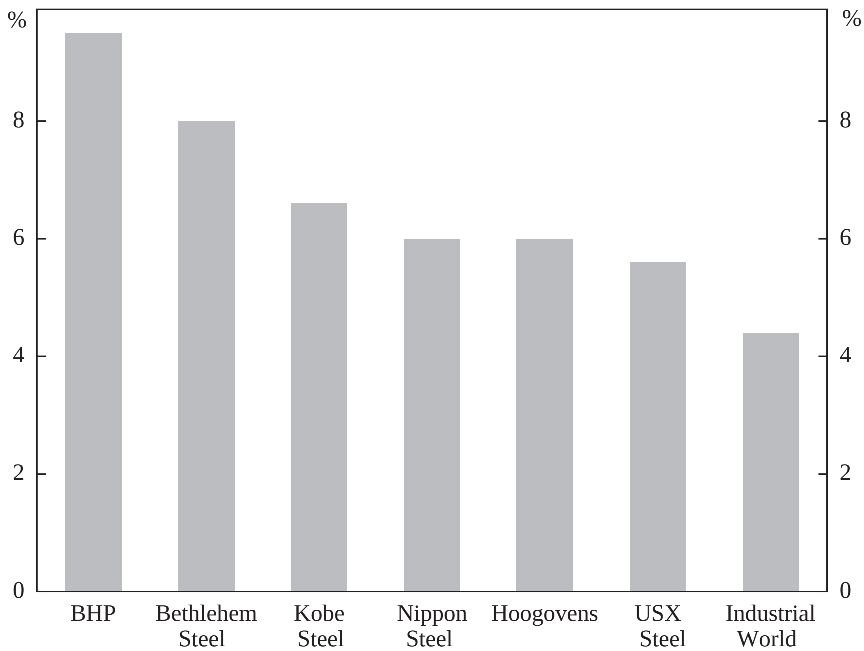
Source: Paine Webber (1995).

electric arc technology (Paine Webber 1995).[1] The distinction between integrated and minimill producers is becoming increasingly blurred as the former adopt the new technologies and the quality of the steel from the minimills improves. Even the integrated steel makers in our comparison, with the exception of China Steel, have some degree of electric arc capacity.

It is evident that, in recent years, BHP Steel has narrowed the gap between itself and the world's best which, with the exception of POSCO, is around 700-800 tonnes per employee. Over the period 1983-93, BHP Steel productivity grew at an annual compound rate of 9.5 per cent, the fastest rate of growth of any of the major steel makers and almost 50 per cent higher than the industrial world average (Figure 3). In absolute terms, productivity at BHP Steel in 1983 was only 30 per cent of the prevailing world best (POSCO) but, a decade later, this had risen to just under 50 per cent of this level. Given the significant increases in labour productivity since 1993, the gap is likely to have narrowed further. Just as developing economies approach the productivity levels of more developed economies over time, through the introduction of new technology and improved labour skills, the same pattern of convergence and catch-up may be underway in the world steel industry.

Figure 3: Productivity Growth

(Annual compound growth rate 1983-1993)



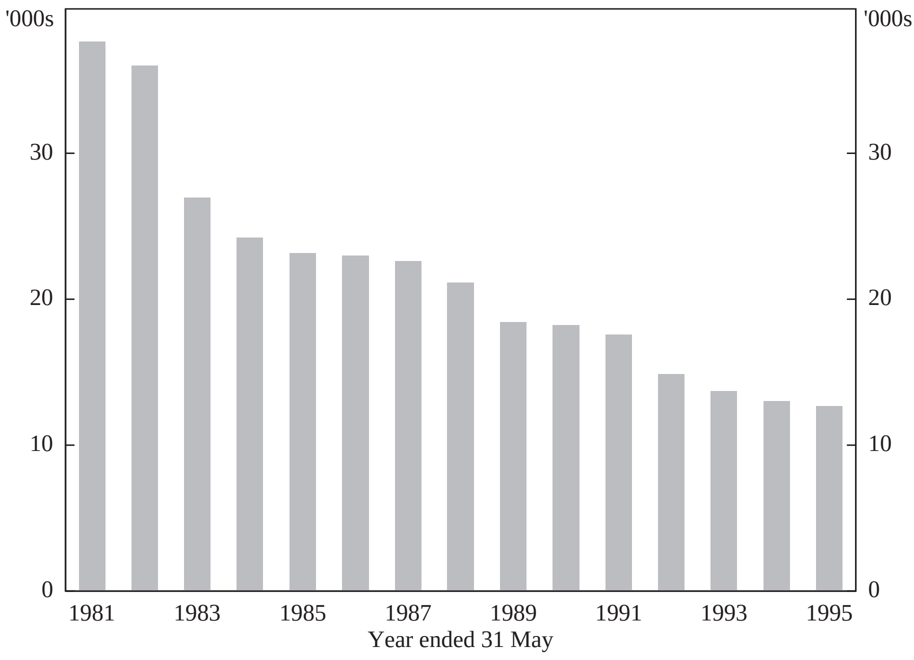
Source: Paine Webber (1995).

1. Where as much as 2,609 tonnes per annum has been produced by Tokyo Steel and 1,360 tonnes per annum by the US steel producer, Nucor.

5. Response to a Crisis

The first big push to improve productivity came in the early 1980s when a confluence of forces threatened the existence of one or more of BHP’s steelworks. During the early 1980s the world recession, falling demand and an increase of excess world steel capacity, estimated at 30 times Australian domestic consumption (Walsh 1982), resulted in a substantial increase in imports of cheap steel into the Australian domestic market. This occurred at the end of the resources boom, and BHP Steel found itself with excess capacity, both plant and labour, and a declining market share. BHP’s immediate response was a downsizing of operations. Between 1982 and early 1983 plant capacity was reduced by one third to 6.0 million tonnes (Prescott and McLeod 1990) and the workforce declined by almost 10,000 either through voluntary retirement or retrenchment (Steel Industry Advisory Council 1983) (Figure 4).

Figure 4: Total Employment in Major Australian Steelworks



Source: BHP.

The crisis in the steel industry focused BHP’s attention on the need to increase productivity and modernise its steel-making operations. After a succession of industry inquiries and a change of government, BHP together with unions and Federal and State governments agreed to the Steel Industry Plan. Under the Plan, BHP gave an undertaking to maintain its steel-making capacity, invest $800 million over five years and refrain from further compulsory retrenchments. Governments, on the other hand, promised up to $71.2 million in bounties (not required), and committed to reduce indirect taxes, speed up anti-dumping provisions and review assistance measures if required (Capling and

Galligan 1992). The unions agreed to productivity targets, to follow dispute settlement procedures and refrain from seeking increases in wages in excess of community standards (Prescott and McLeod 1990).

By 1984, productivity at the steelworks had reached 243 tonnes per year and the net operating loss was substantially reduced. There is some debate about the role of the Steel Industry Plan in turning BHP Steel around (Capling and Galligan 1992). For example, the Bureau of Industry Economics argued that the turnaround had more to do with currency depreciation, recovery from the 1982/83 recession, cost cutting and retrenchments implemented prior to the Plan, and an improved industrial relations climate under the Accord (Bureau of Industry Economics 1989). However, what the Plan *did* do was allow BHP Steel to restructure its operations, increase training and development and give it confidence to undertake substantial capital investments with the aim of improving business performance. Rather than investing $800 million, it spent almost $2 billion. This represented the '... largest capital expenditure program, on a per tonne of capacity basis, of any developed steel-making country – surpassing Japan, doubling EEC spending, and quadrupling that in the US' (Prescott and McLeod 1990, p. 2).

6. Beyond the Crisis: Focus on Growth, People and Labour – Management Relations

The Steel Plan marked the beginning of a cultural change within BHP Steel, and this carried over into the Steel Industry Development Program Agreement (SIDA) in 1989 when the Steel Industry Plan ended. Under SIDA, the focus on business improvement and productivity performance continued with management and unions agreeing to performance targets and on the processes for identifying and implementing measures to achieve the targets. Key measures for increasing productivity were job restructuring, increasing the skills of the workforce, the implementation of total quality management (TQM) and encouraging, at all levels, a more customer-oriented and productive culture than had existed previously. Consultative arrangements were put in place, career and training opportunities were developed, and award restructuring was undertaken. During this period, the emphasis was on improving the skills of employees to enable them to keep pace with the technological changes occurring in the steel-making process, and to broaden the range of tasks an employee could be asked to perform (Morrissey, Dibden and Mitchell 1992). An important element in achieving the required changes was the guarantee of continued employment, but not necessarily the *same* job, as this might have been made redundant through restructuring.

The momentum generated under SIDA has been carried forward into the new employee/management agreement, the National Steel Industry Business Improvement Agreement (SIBI). As the name suggests, the focus is on business improvement, particularly at the local work level. Using the framework developed under TQM, a system of continuous improvement is creating an environment of change where employees are encouraged to develop ways to improve the efficiency of their work areas. In addition, employees are shifting from a production-based culture to a customer focus. The emphasis is no longer on reducing the number of people, but rather on equipping the workforce with a set of common objectives, skills and flexibility to respond to change.

Improvements under SIBI have come from a better organisation of work – anecdotes abound about the type and value of the improvements made to date, but perhaps the most significant are the improvements at the slabmaking operations at the Port Kembla steelworks. For several years, the slabmaking operations were unable to lift output beyond 3.6 million tonnes per annum despite significant effort and capital investment. There was also room for improvement in both delivery times and quality. However, over a period of two years the output of steel slabs increased by 25 per cent to 4.5 million tonnes per annum while at the same time quality and delivery performance improved. In fact, as Paul Jeans, the General Manager of the Slab and Plate Products Division noted, ‘the major improvements at ... Port Kembla were achieved by and through people’ (Jeans 1995). This resulted from a process which included:

- a re-organisation of the steel-making and slabcasting departments;
- the development of shared goals and objectives;
- an involvement of all workers in the collection and analysis of data and identification of possible areas of improvement;
- training and developing the skill base through multi-skilling;
- the development and measurement of key performance indicators; and
- feedback and recognition of a job well done.

The improvements at the slabmaking operation highlight the value of learning and reducing confusion through systematic analysis in improving productivity. By being involved, workers and management gained valuable knowledge in the operations of the capital equipment but, of equal importance, they gained an appreciation of the process by which improvements were made enabling applications elsewhere in the plant. Hayes and Clark (1986) note that the rate at which managers and employees learn, and in turn gain a better understanding of the manufacturing process, is a potential source of faster productivity growth.

The gains made at Port Kembla, and elsewhere within BHP Steel, reflect a conscious attempt to involve all employees in process improvement. A number of things facilitate this policy of inclusion. First, communication between management and employees has been improved, thus avoiding some of the problems evident in the earlier restructurings (Capling and Galligan 1992). Second, there has been a de-layering of management structures which has improved communications. Third, employees remain focused through the development and implementation of business plans. Fourth, the guarantee of employment during the life of SIBI has reduced suspicions that changes will lead to widespread unemployment. Finally, there have been financial rewards by way of quarterly performance-based bonuses, while the introduction of the Employee Share Plan has given employees a direct stake in the prosperity of the steel business and the company as a whole.

7. Labour Disputes and Safety

Improvements in labour productivity have also come from the dramatic reduction in the number of employee hours lost in industrial disputes: lost employee hours as a share of total hours worked are now less than one-fifth the level that prevailed in 1983. The improvement in labour relations can be put down to better working conditions, greater employment security, the various Accords between the government and trade unions and a reduction in demarcation disputes following the restructuring of awards. An additional element has been the improvement in management/employee communications. As well as these positive developments, the recent decline in labour time lost at BHP Steel mirrors that of the Australian economy; undoubtedly the recession reduced the willingness of employees to take industrial action.

BHP Steel is looking at making large improvements in safety, with the ultimate target being zero lost time injuries (LTIs), while the interim target is a 50 per cent reduction in the number of LTIs by 1996 and a 70 per cent reduction by 1999. Apart from the obvious benefits, improvements in safety are leading to increased productivity through reductions in absenteeism and better morale among employees. BHP Steel has the objective to be a world-class performer in terms of safety and has developed a range of policies to achieve this objective.

8. The Role of Internationalisation

In a paper presented to this conference last year, Ergas and Wright (1994) discussed the positive benefits a greater involvement in international markets can have for firm performance and productivity. The conclusions reached by Ergas and Wright suggest that internationalisation begins a process of innovation where firms look to improve their work and management practices, technology, products and quality and marketing in order to prosper from the increased competition.

Increased international exposure has influenced productivity at BHP Steel through three main channels: economies of scale; the increased attention of management and employees in addressing inefficiencies; and the development of high quality export-oriented products.

However, for BHP Steel to achieve the necessary economies of scale and increase the size of the steel business at a time when Australian consumption was growing slowly, it was necessary to develop export markets for both domestic and foreign value-added products (see Figure 5). By developing markets outside Australia, BHP Steel in recent years has been able to maintain maximum capacity utilisation, thereby promoting gains in labour productivity and substantially reducing its average fixed costs. This would not have been possible if it had remained a domestic producer.

Moreover, as a result of the success of BHP Steel in overseas markets, an increasing share of capital improvements are being devoted to servicing export markets, as shown in Figure 6 (Prescott and McLeod 1990). In this instance, the causation runs from exports to productivity. To remain competitive in export markets, BHP Steel has had to make productivity improvements by addressing all the inefficient work practices, inappropriate manning levels, cost structures and labour relations practices. This has been going on for over a decade and employees are now more aware of the threats from competition both in export markets and from imports into the domestic market.

The final factor has been the improvement in quality and the increasing range of products exported. BHP Steel has always exported a large percentage of production, but what has changed is the increase in the *value added* of its exports. In effect BHP Steel has shifted from an opportunistic exporter to one which makes exports the focus of

Figure 5: Australian Domestic Consumption of Finished Steel and Real GDP
(Index 1960 = 100)

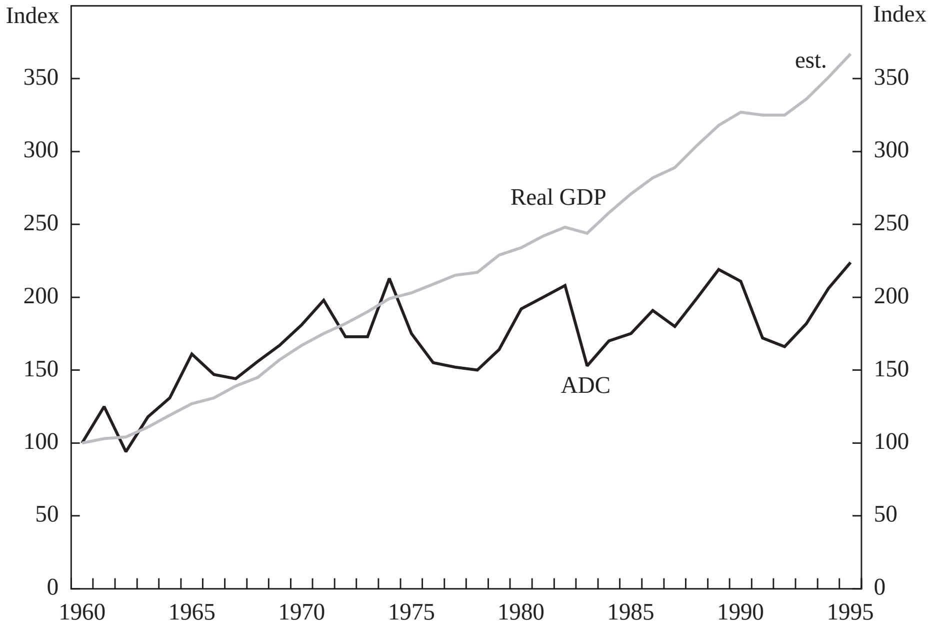
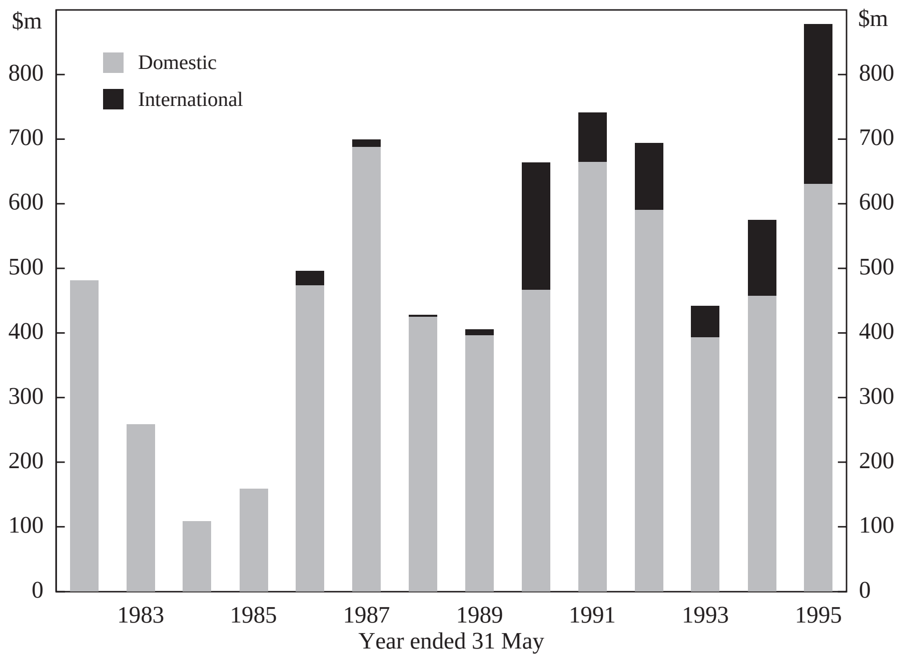


Figure 6: Capital and Investment Expenditure



Source: BHP.

attention (AMC 1990). Initially, exports were marginal and variable, capacity was primarily to serve the domestic market; and investment in downstream activities was neglected. Now, like other export-oriented firms, BHP factors exports into capacity expansion, develops export markets for the long term, invests in foreign marketing offices and distribution, gathers market intelligence, and modifies the products to suit foreign customer requirements. In fact, BHP Steel is unique in that it has one of the highest export/production shares of any major steel maker in the world. There is little doubt that the development of a viable export business has acted as a catalyst and provided BHP Steel the opportunity to restructure its operations to enhance productivity.

9. Investment in Technology

Apart from the ongoing business improvement program, the development of export markets and improved labour relations, the final major influence on productivity performance has been the introduction of new technology. Moreover, the latest developments in technology probably offer the greatest potential to further increase productivity. BHP Steel has continued to invest heavily in new technology over the past decade or so and has aimed to replace outmoded methods of steel production with technology best suited to its operations.

The continued expansion of capital and the reduction in the number of employees suggest that there has been a substantial increase in the capital/labour ratio. This trend is likely to continue and apart from the business improvement program, the next jump in productivity will probably come from technological improvements which eliminate or combine some of the steps in the steel-making process. The most well known of these is the minimill, which essentially produces steel from scrap, or alternative iron inputs, doing away with the front-end process of the steelworks.

In fact, there exist ambitious projects that aim to eliminate almost all rolling stages prior to the formation of thin sheet products. These developments, if successful, will radically change the economics of steel production. In the interim, however, conventional integrated blast furnace plants remain the choice where scale economies can be achieved and the best of these plants, including BHP’s Port Kembla steelworks, remain cost competitive with the minimill operations.

10. Conclusion

Initial attempts at improving productivity at BHP Steel were driven by a crisis which threatened the survival of some, if not all, of the business. Once the decision was made to sustain productivity improvements, labour numbers were reduced and investment increased. Both management and employees worked to improve business performance, motivated by the desire to succeed in export markets. In fact, this export orientation has been accompanied by a change of mindset, with the customer (increasingly an international customer) becoming the prime focus. Productivity improvements will continue. This will be dictated by pressure from competition, both at home and offshore. Although, the major improvements in productivity will be facilitated by the introduction of new technology, an essential element in the improvement will be, as in the past, the development of BHP’s people.

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The Performance of the NSW Electricity Supply Industry

John Pierce, Danny Price and Deirdre Rose

1. Introduction

Australian governments have placed considerable emphasis on microeconomic reform since the mid 1980s. The central aim of these reforms is to boost productivity growth by creating an environment in which resources are allocated to their most productive uses and firms use the most efficient methods of production – that is, to improve the productive and allocative efficiency of the economy. Reforms have initially focused on the finance sector and on liberalising those sectors of the economy which are involved in exporting or competing with imports (the traded goods sector).

With the policy framework for opening up the economy largely in place, policy makers are now focusing their attention on reform in those sectors of the economy which support the traded goods sector. This includes infrastructure service industries such as electricity, telecommunications, transport, and ports. In some respects this has been driven by the internationalisation process. As the economy opens up, concerns about competitiveness increase. This puts pressure on those sectors, or factors of production which provide inputs to the production of exports or import-competing goods. Industries which serve customers both here and overseas depend on top quality, least cost production inputs.

The Electricity Supply Industry (ESI), which is examined in this paper, provides a crucial input to production, and is therefore a priority sector for reform. In fact, recent work by the Industry Commission (1995) on the impact of implementing recommendations of the Hilmer Report and related reforms, indicate that electricity and gas sector reforms may account for up to 25 per cent of the total benefits of competition reform (New South Wales Government 1995).

2. Industry Reform Proposals

Over the past decade, governments both in Australia and overseas have implemented or foreshadowed sweeping reforms to their electricity industries aimed at improving economic performance. The reforms have taken the form of administrative changes (commercialisation and corporatisation), structural changes, pricing reforms, regulatory reforms, and privatisation. This section provides a brief outline of reforms in Australia to establish a national electricity market, as well as reforms to the New South Wales ESI.

2.1 The National Grid

In recent years, the Commonwealth and State governments have been cooperating to establish a national electricity market in Australia. The main aim is to operate the separate State and territory-based electricity systems in south-eastern Australia and the

Snowy Mountains Scheme as one national grid. The market will initially cover those States which are currently interconnected – namely New South Wales, Victoria, South Australia and the Australian Capital Territory – and will eventually be expanded to Queensland and Tasmania as new transmission links are established.[1] The ultimate objective is to have a market where:

- customers are able to choose their electricity supplier from a number of competing generators and retailer suppliers, removing the current restrictive arrangements whereby the market is carved up into regional monopolies;
- there is open and non-discriminatory access to the interconnected transmission and distribution network;
- there are no legislative or regulatory barriers to entry for new participants in electricity generation or retail supply; and
- there are no legislative or regulatory barriers to interstate and/or intrastate trade.

Although the starting date for the national market has been postponed several times, governments have maintained and renewed their commitment to a national market as recently as the April 1995 Council of Australian Governments meeting.

2.2 New South Wales

In the early 1990s, administrative reforms were made to the generation sector of the ESI as part of a broader commercialisation and corporatisation process that affected all government trading enterprises in the State. The result has been significant operating cost savings and efficiency gains. However, there is still considerable scope for productivity improvements, and further reforms are needed to prepare the industry for the commencement of the national market. Key features of proposed reforms include:

- *Generation*: A commitment to structural reform of the generating sector and to the establishment of effective competition between generators.
- *Distribution network and retail supply*: Amalgamation and restructuring of the 25 electricity distributors in New South Wales into a smaller number of distributors that will operate under a commercial framework.
- *Transmission*: Separation of responsibility for generation (a competitive sector) and transmission (a natural monopoly).

There are four criteria guiding the development of the new structural arrangements in New South Wales:

- the size of industry participants should be sufficient to retain or realise economies of scale;
- the organisations created should be able to earn a commercial return on assets, finance new investment and expand their operations as required;
- the number and relative size of market participants should ensure effective competition, with each participant facing pressure to improve productivity in order to remain viable (rather than being able to increase or distort prices); and

1. The transmission distances to Western Australia and the Northern Territory preclude their involvement in the national market.

- under the new market structure, non-traditional generation and end-use technologies should be able, as far as possible, to compete on an equal basis with the current stock of coal-fired thermal generation and end-use appliances.

The reforms within New South Wales do not involve the transfer of assets from public to private ownership. The government has argued that it is the *structure* of the market rather than the *ownership of assets* that drives efficiency improvements.

3. Productivity Measurement

The performance of private firms is usually assessed by looking at their profits, share price and output. However, for publicly-owned utilities, many of which have monopoly power and regulated prices, this is not appropriate. Rather, it is necessary to utilise measures of economic efficiency (Kay 1992).

The earliest approaches to productivity measurement used partial-factor measures – that is, the ratio of output to one input, often labour. However, while partial measures provide useful information, they can provide a misleading picture of overall performance if viewed in isolation. To determine the overall productivity of a firm, a measure is needed that can simultaneously take account of all the inputs to production in relation to output – that is, a measure of total-factor productivity. A wide variety of useful analytical techniques have been developed in recent decades which can be used for making comparisons of overall efficiency and productivity. The two most widely-used techniques are:

- index number methods, commonly referred to as total-factor productivity (TFP) measures; and
- the estimation of frontier production or cost functions either using a mathematical programming approach called data envelopment analysis (DEA) or an econometric approach (stochastic frontiers).

Index number methods, or TFP measures, are used to measure technical efficiency. In brief, TFP is measured by taking a ratio of output quantity to input quantity. Aggregation of the diverse inputs used and outputs produced into single measures of input and output quantity is achieved by using indexing procedures. In the aggregation process, inputs are weighted according to their share of total costs and outputs are weighted according to their share of total revenue.[2]

DEA uses information on the observed inputs and outputs of a number of productive units to calculate a production frontier which is defined by the most efficient producers in the data set. The relative efficiency of each unit is determined by its position in relation to the efficient frontier. Units on the frontier are those which are the most efficient within the data set. DEA provides more comprehensive measures of efficiency than TFP because it is able to distinguish between technical efficiency (that is, minimising the amount of inputs needed to produce a unit of output) and allocative efficiency (that is,

2. The TFP studies in this paper use the Tornqvist translog index for comparisons of a single firm over time, and the translog multilateral index advocated by Caves, Christensen and Diewert (1982) for comparisons of a number of firms over a number of time periods. The multilateral index produces a relative measure of the productivity of each organisation in the sample in relation to a sample average.

combining inputs in a way which minimises the cost of production). It can be also be used to decompose technical inefficiency into three sources – pure technical, scale inefficiency, and congestion of inputs – and provide each unit in the data set with a list of relevant role models. However, the drawback of DEA is that a much larger number of observations is needed than for TFP measurement (London Economics 1994).

4. Productivity of the New South Wales ESI

A number of empirical studies are reviewed to assess the performance of the ESI in New South Wales. These studies utilise both TFP and DEA efficiency measurement techniques. In interpreting these studies, it is important to bear in mind that the electricity industry is highly capital intensive and that capital comes in large, bulky increments which are larger than are needed to satisfy demand when first commissioned. This makes large variations in productivity in the electricity industry unavoidable in the short term. Therefore, it is best to assess performance on the basis of trends rather than year-to-year performance. We present trends in productivity performance of the generation, distribution and transmission sectors of the ESI.

4.1 Generation

Over 90 per cent of the demand for electricity in NSW is met by Pacific Power, a State government trading enterprise. The remainder is provided by the Snowy Mountains Hydro Electric Authority and a few small independent generators. Pacific Power currently has generating plant capacity of 12,150 MW.[3] This is by far the largest generation capacity of any State. The next largest is Victoria (with 7,155 MW).[4] Pacific Power accounts for almost half of the installed capacity in the south-east States of Australia that are currently interconnected.

4.1.1 Performance between 1978/79 and 1987/88

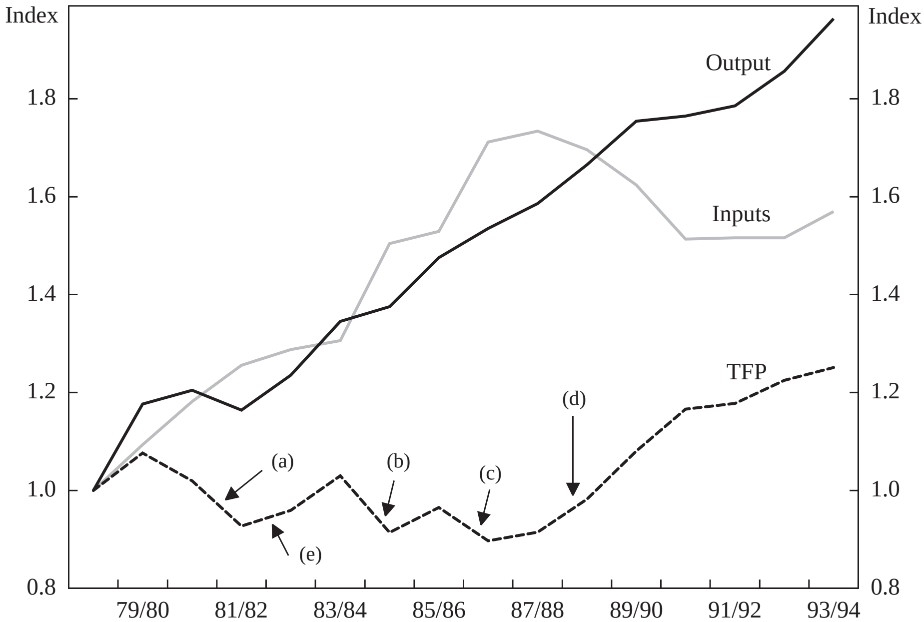
Figure 1 shows Pacific Power's TFP, input and output indices between 1978/79 and 1993/94. The results are based on unilateral TFP studies undertaken by Pacific Power. The period between 1978/79 and 1987/88 can be described as the pre-reform era. As summarised in Table 1, during this period, Pacific Power's TFP declined at an annual average rate of just under 1 per cent, resulting in a total decline for the period of 8.5 per cent. Significant additions made to generating capacity during the period, combined with lower-than-expected growth in electricity demand and a major plant failure, contributed to this decline.

Demand for electricity in NSW had been growing strongly since the 1950s; growing on average at about 9 per cent per annum in the 1950s and 1960s, and about 6 per cent per annum in the 1970s. In response to these historical growth rates, and on the expectation of the 'resources boom' during the 1980s, significant investments were made in upgrading and expanding the generation facilities in New South Wales during the 1980s. Unfortunately, contrary to these expectations, there was a general downturn

3. Excludes New South Wales' share of the Snowy Scheme and dry stored capacity.

4. Excludes its Snowy entitlement.

Figure 1: Pacific Power TFP, Inputs and Output (1978/79-1993/94)



Notes: (a) Major plant failure at Liddell, economic downturn and opening of new plant.
(b) Eraring.
(c) Bayswater.
(d) Labour reductions, improved output and plant retirement.
(e) Labour reductions and plant retirement.

Table 1: Productivity of Pacific Power (1978/79-1987/88)

	Annual average change %	Total change %	Average cost share %
TFP	-1.0	-8.5	—
Inputs	6.3	73.4	—
Outputs	5.3	58.6	—
Capital productivity	-3.2	-25.3	47
Labour productivity	3.5	36.7	20
Fuel productivity	0.6	5.6	25
Other productivity	-0.8	-7.0	8

Source: Pierce, O'Brien and Farah (1992).

in economic activity in the early 1980s, so that expected demand for electricity was not realised. In order to get full understanding of the consequent fall in productivity, it is useful to look at the productivity of the individual factors of production:

- *Capital productivity* had the largest affect on overall TFP, given that it accounted for almost half of all input costs over the period. It fell by around 25 per cent as a result of the commissioning of a substantial amount of new generating plant, combined with much lower than expected demand for electricity.
- *Labour productivity* fell between 1978/79 and 1981/82, with labour numbers increasing by 24 per cent. However, after 1981/82, it rose steadily at an average annual rate of 3.6 per cent, serving as an important offset to the declining capital productivity.
- There was a fairly substantial fall in *fuel productivity* up to 1981/82, with nominal fuel costs doubling between 1979/80 and 1981/82. A major plant failure forced Pacific Power to employ older plant which was considerably less fuel efficient. The older plant was decommissioned in 1985/86 improving both capital and fuel productivity.
- The productivity of *'other' inputs* (that is, operating and maintenance costs other than labour and fuel) fell by an average rate of almost 1 per cent per annum as a result of the substantial maintenance needed at the failed plant and the increased operating expenditure on recommissioning older plant.

4.1.2 Performance 1987/88 to 1993/94

This period has seen quite substantial changes at Pacific Power, as the NSW government has initiated reforms to the NSW ESI to improve economic efficiency. The reforms during this period focused on administrative reforms within Pacific Power.

Table 2: Productivity of Pacific Power (1987/88-1993/94)

	Annual average change %	Total change %	Average cost share %
TFP	5.4	36.8	—
Inputs	-1.6	-9.5	—
Outputs	3.6	23.8	—
Capital productivity	6.8	48.1	52
Labour productivity	15.0	131.5	13
Fuel productivity	0.2	0.9	26
Other productivity	-0.7	-4.0	9

Source: Pierce, O'Brien and Farah (1992) and Steering Committee on National Performance Monitoring of GTEs (1995).

As shown in Table 2, TFP rose rapidly at an annual average rate of 5.4 per cent for a total increase of 36.8 per cent over the period. This reflected significant cost savings which were being achieved as a result of new management policies associated with the commercialisation process. Capital, labour and fuel inputs were all substantially rationalised resulting in productivity gains in these partial factors:

- *Capital productivity* rose consistently, increasing at an annual average rate of almost 7 per cent. This improvement resulted from the decommissioning of inefficient plant, and the transferral of 132kv transmission assets to the distributors. Reflecting improved capital productivity, the reserve plant margin (RPM) fell to a low of 36.2 per cent in 1991/92.[5] However, it had risen to 48.2 per cent by 1993/94 with the commissioning of new plant.
- The dramatic rise in *labour productivity* reflected the significant labour reforms undertaken during this period. Employee numbers fell from around 10,500 in 1987/88 to below 5,900 in 1992/93 and award restructuring resulted in the introduction of more productive work practices and reduction of industrial disputes.
- *Fuel productivity* rose steadily from 1986/87 to 1992/93, increasing at an average annual rate of 1.1 per cent. This resulted from the increased utilisation of new plant and improved operating practices and was reflected in improved thermal efficiency and plant reliability during the period.
- In contrast, the productivity of *'other' inputs* fell by 4 per cent between 1987/88 and 1993/94, with major falls in the two years to 1990/91. This resulted from increased refurbishment works and preventative maintenance expenditure. However, as these expenditures had a beneficial effect on plant reliability, the decline in 'other' productivity facilitated improvements in capital productivity.

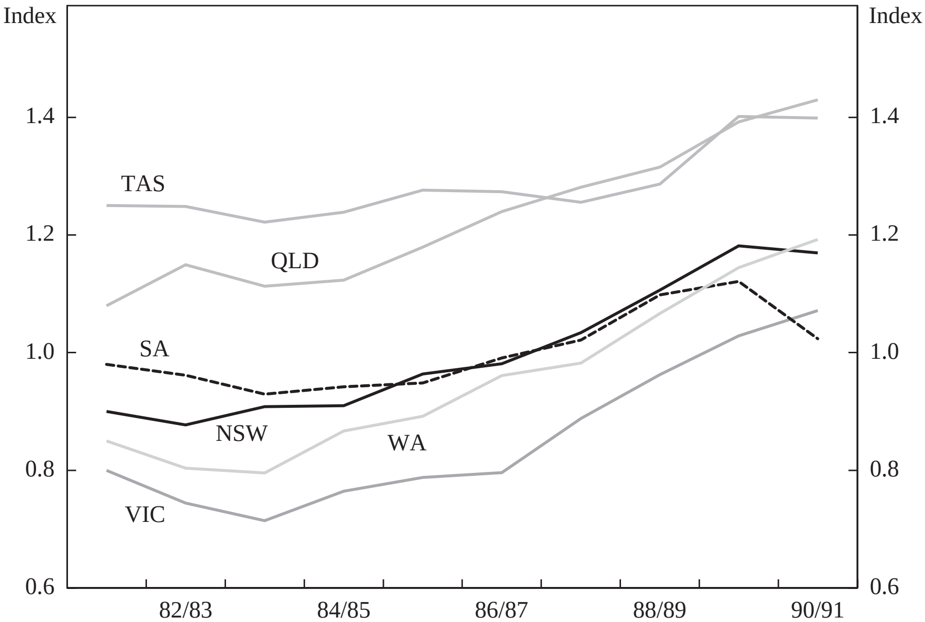
4.1.3 Comparisons and prospects

Figure 2 shows a comparison of the total-factor productivity of the New South Wales generation sector against other Australian States between 1982 and 1991. The differences in generation TFP between the States are largely due to the different fuel types used in each State. Victorian generation displays the lowest TFP as it uses brown coal (which is least efficient) and Tasmania displays the highest as it mostly uses hydro generation systems. Of the States which predominantly use black coal generation (including New South Wales), Queensland has consistently achieved the highest levels of productivity. This has been a result of strong demand growth in that State, investments made in fuel and technically-efficient power stations, significant reductions in its permanent workforce and efficient maintenance systems.

While differences in generation performance are largely due to the type of fuel usage, an important question is the role played by economies of scale. In a study commissioned by the New South Wales Treasury, London Economics (1994) has recently completed a study on economies of scale in the generation and distribution sectors. Using data for 1991/92, the study set out to determine the minimum efficient size (MES) of electricity

5. Reserve plant margin is an indicator of the level of excess capacity. It is calculated as total plant capacity less peak demand in a period, expressed as a percentage of peak demand. The RPM margin includes Pacific Power's entitlement to the Snowy Mountains Hydro Electric Scheme.

Figure 2: Generation Sector Multilateral TFP, Comparison of States (1982-1991)



Source: Derived from London Economics and ESAA (1993).

and distribution firms using two different techniques:

- a non-parametric modelling approach – using data envelopment analysis; and
- a parametric modelling approach – involving an econometric estimation of the relationship between total output and total costs using a translog cost function.

The performance of a large number of generators from 11 countries was compared. The analysis indicated that the minimum efficient unit size for generation businesses is in the region of 1,000 MW to 5,000 MW. The average size of generators displaying constant returns to scale is 3,100 MW. The generation entities in Queensland, Victoria, South Australia and West Australia are at a size most likely to exhibit constant returns to scale. While Pacific Power in New South Wales operates close to constant returns to scale, it could be separated into up to three businesses and still maintain scale efficiency.

Turning to expectations of future performance, it is unlikely, that the substantial productivity growth achieved through labour reforms will continue, even though past experience shows that overall productivity does not depend on the productivity of individual inputs in isolation, but also on the *way* in which inputs are used together. Nonetheless, it appears that excess capacity is likely to be a persistent problem in New South Wales, even with the introduction of the national electricity market.[6]

6. In modelling the effects of implementing the National Competition Policy, the Industry Commission (1995) assumed that competition is likely to lead to a reduction in excess reserve plant margins for all States from 8 per cent to 4 per cent. Within NSW, however, it is assumed that the excess capital stock will remain at around 10 per cent.

4.2 Distribution

For the moment, there are 25 distributors in New South Wales. The distribution sector is dominated by the four metropolitan electricity distributors which account for 80 per cent of electricity sales. However, as discussed earlier, the NSW government has signalled its intention to substantially reduce the number of distribution firms through amalgamations and restructuring. The productivity of the distribution sector of the New South Wales ESI has been examined on the basis of TFP and DEA studies of metropolitan distributors conducted for the New South Wales Government Pricing Tribunal by London Economics and the ESAA (1993, 1994a). The TFP results have been updated to 1993/94 by NSW Treasury.

Each metropolitan distributor in New South Wales has achieved an overall increase in TFP between 1981/82 and 1993/94 (Figure 3 and Table 3). The combined TFP of the metropolitan distribution authorities rose at an annual average rate of 3.6 per cent, resulting in total TFP growth of 53 per cent over the period. There has been some variation in TFP performance, with two distributors experiencing declining TFP in the first half of the 1980s, and the TFP growth of *all* the distributors generally slowed or fell in the early 1990s:

- *Capital productivity* has been consistently low in comparison to the productivity of other inputs. This has had a significant impact on the distributor's TFP given that capital inputs account for around 40 per cent of their costs. The sharpest declines in capital productivity occurred in the first half of the 1980s. Between 1981/82 and

Figure 3: NSW Metropolitan Distributors TFP, Inputs and Output (1981/82-1993/94)

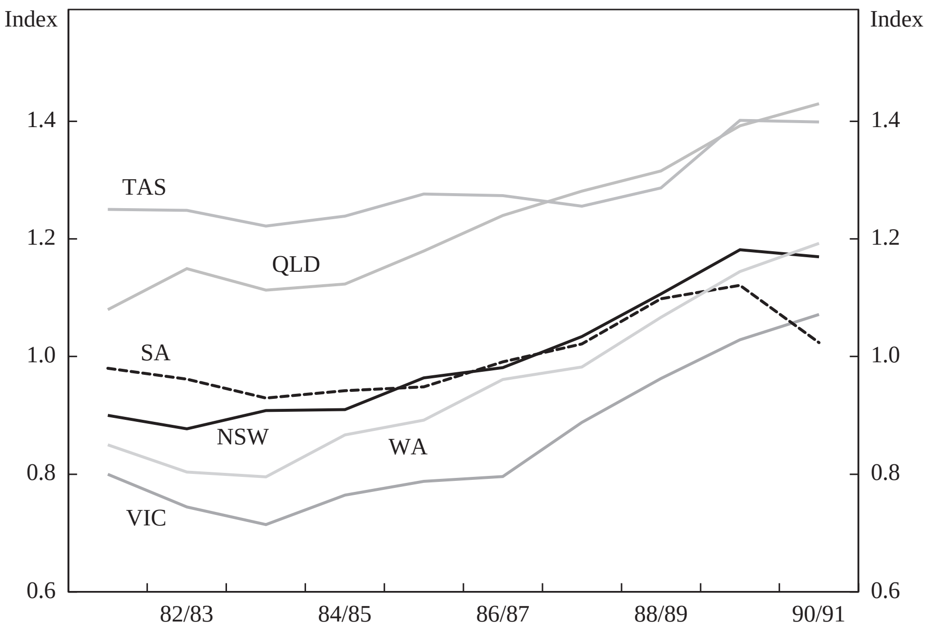


Table 3: Productivity of NSW Distributors (1981/82-1993/94)[(a)]

	Annual average change %	Total change %	Average cost share %
TFP	3.6	53.2	—
Inputs	-0.2	-2.4	—
Outputs	3.4	49.5	—
Capital productivity	0.2	2.9	40.1
Labour productivity	8.1	154.8	36.3
Other productivity	3.7	53.7	23.7

Note: (a) Excludes rural distributors.
Source: London Economics and ESAA (1993) and London Economics (1994a).

1985/86, the combined capital productivity of all the distributors fell at an average annual rate of 2.2 per cent, for a total fall of 8.3 per cent (London Economics and ESAA 1993).[7]

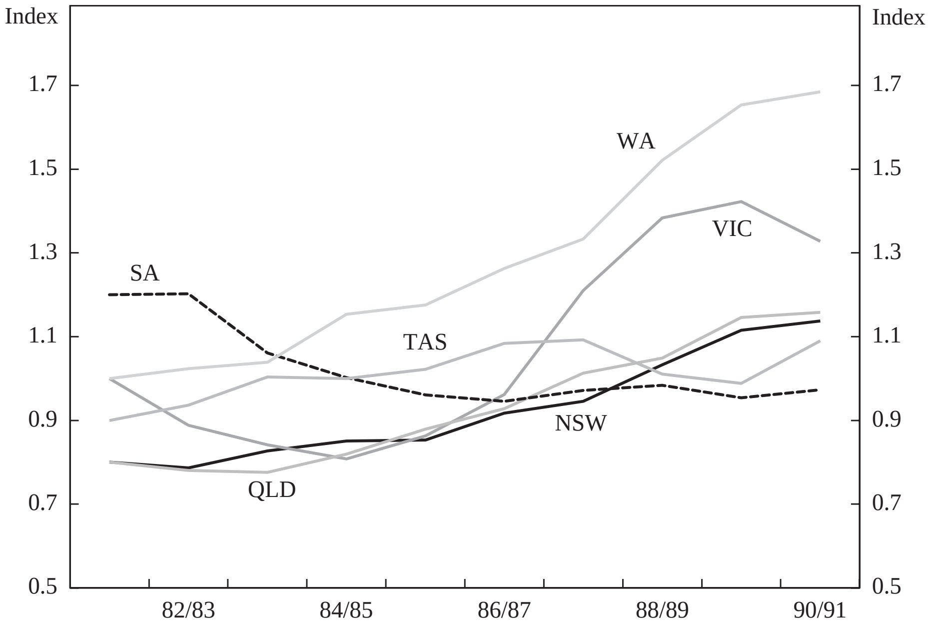
- However, distributor's *labour productivity* grew at an annual average rate of 8.1 per cent between 1981/82 and 1993/94, for a total increase over the period of almost 155 per cent. This provided a significant offset to the low capital productivity, as labour accounts for roughly the same share of input costs as capital.
- There was considerable volatility in the 'other' operating inputs, although, in aggregate, 'other' input productivity rose by almost 54 per cent between 1981/82 and 1993/94.

4.2.1 Comparisons and prospects

Figure 4 shows a comparison of the total-factor productivity of the New South Wales distribution sector against other Australian States between 1982 and 1991. The New South Wales distribution sector has consistently performed below the TFP levels of the other States. However, since 1988/89, TFP growth has risen above that of Tasmania and South Australia. A comparison of the input productivities between the States indicates that the NSW distributors clearly need to make improvements to their capital productivity. Comparisons of overall distribution costs between New South Wales, Victoria and Queensland indicate that there is a 20 to 25 per cent gap between New South Wales and the other two States (Government Pricing Tribunal 1994). For example, the Victorian distribution sector has achieved significant productivity growth due to resource rationalisation, superior distribution and higher customer density than in New South Wales and Queensland.[8]

7. Factors that have contributed to the poor capital-productivity performance include the increasing use of more expensive underground wires and the transfer of Pacific Power's 132 kv sub-transmission assets to the distributors in 1989/90.
8. Customer density (that is, customers per circuit kilometre) was 13.9 in Victoria, 10.1 in New South Wales, and 8.6 in Queensland in 1992/93.

Figure 4: Distribution Sector Multilateral TFP, Comparison of States (1982-1991)



Source: Derived from London Economics and ESAA (1993).

The New South Wales metropolitan electricity distributors have also been benchmarked against a sample of distribution utilities in the United Kingdom and United States over 1990/91 to 1992/93 (London Economics 1994b). The study found that the distributors' performance had improved over time. However, it was estimated that the distributors could achieve another 20 to 60 per cent reduction in inputs, delivering significant cost savings. The main source of the distributor's inefficiency was in relation to their labour, and operating and maintenance inputs.

Based on the economies of scale study undertaken by London Economics (1994), it appears that the minimum efficient size for distributors is between 12,000 GWh and 30,000 GWh of sales per annum (although the range for distributors displaying constant returns to scale went as low as 2,000 GWh per annum). In terms of customers, the minimum efficient size was between 0.5 million and 1.25 million (although again the range for constant returns to scale distributors went as low as 94,000 customers). In the distribution sector, customer density and output density (determined by average consumption) were found to be the major determinants of scale efficiency. The study supports a reduction in the number of rural distributors in New South Wales.

It appears that there is potential for significant productivity improvements in the NSW distribution sector. The TFP studies indicate that there is scope for at least a minimum growth rate of 5 per cent per annum in distributor's TFP. The Government Pricing Tribunal (1994) considers that NSW distributors could achieve 20 to 30 per cent reductions in their operating costs through efficiency gains.

4.3 Transmission

In February 1995, responsibility for the high voltage transmission system was removed from Pacific Grid, a subsidiary of Pacific Power, to an independent body, TransGrid. The New South Wales grid consists of 13,000 km of network including 86 substations, which link the major power stations and distribution authorities. The network is also linked to networks in other States, and is large by world standards.

TFP has grown significantly in the transmission sector between 1981/82 and 1990/91, rising at an annual average rate of almost 7 per cent, for a total increase of 81 per cent (see Table 4). TFP declined at the start of the 1980s, and productivity fell in all input categories, largely as a result of the expansions to the high voltage network being undertaken to connect new power stations.

Capital productivity also slowed between 1984/85 and 1988/89 as a result of the construction of an interstate link. However, capital productivity subsequently rose reflecting the completion of major capital works and the transferral of the majority of the 132 kv network to the New South Wales distributors. Equipment utilisation improved in the later half of the 1980s, while system losses fell.

However, the greatest input productivity improvements were associated with labour. Labour productivity rose at an annual average rate of 12 per cent, resulting in total labour-productivity growth of 178 per cent between 1981/82 and 1990/91.

Table 4: Productivity of NSW Transmission Sector (1981/82-1990/91)

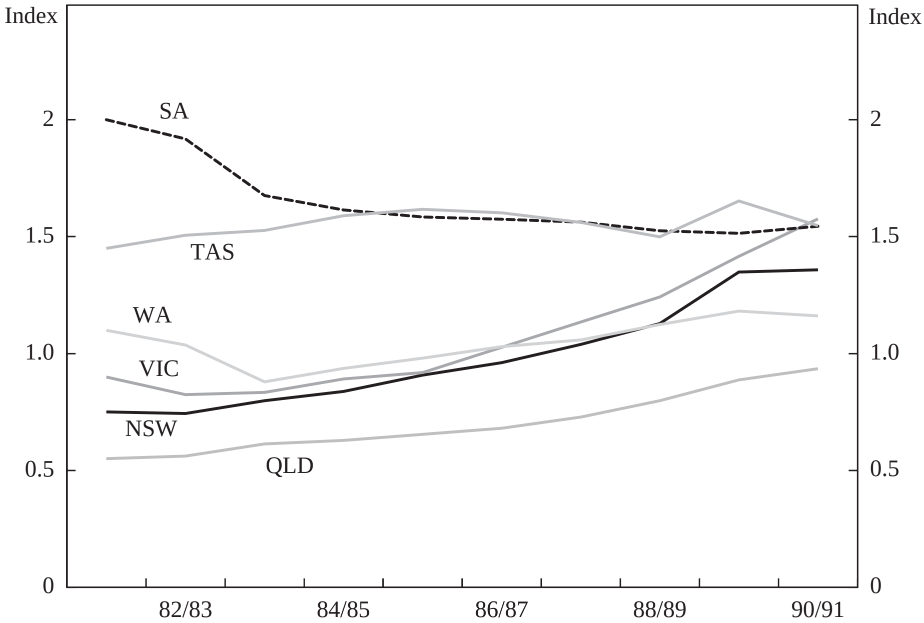
	Annual average change %	Total change %	Average cost share %
TFP	6.8	81.1	—
Inputs	-2.5	-20.1	—
Outputs	4.2	44.6	—
Capital productivity	2.3	22.7	49.8
Labour productivity	12.1	178.3	24.3
Other productivity	8.3	105.5	25.9

Source: London Economics and ESAA (1993).

4.3.1 Comparison with other States

Figure 5 shows a comparison of the total-factor productivity of the New South Wales transmission sector against other Australian States between 1982 and 1991. Its performance has been significantly worse than that of other States. However, the two main factors which effect the costs of transmitting electricity are the size of the grid relative to the number of customers and the level of voltage that can be transmitted. Customer concentration in the transmission sector is in the low range in New South Wales at 3.8 customers/sq km, compared to 8.3 in Victoria and 5.3 in South Australia. Queensland has the lowest concentration at 1.3 customers/sq km.

Figure 5: Transmission Sector Multilateral TFP, Comparison of States (1982-1991)



Source: Derived from London Economics and ESAA (1993).

5. Overview of New South Wales ESI Performance

Overall, the New South Wales ESI has enjoyed consistent and quite substantial productivity growth since the early 1980s. Multilateral TFP comparisons undertaken by Swan Consultants and extended by the Bureau of Industry Economics (1994) show that as a result of productivity improvements, the total New South Wales ESI achieved the second highest productivity level amongst the Australian states (after Queensland) by 1991/92. Further productivity improvements have also been achieved in New South Wales since 1991/92, with notable improvements in labour productivity and power plant performance. For example, Pacific Power's TFP has grown by 6.2 per cent over the two years between 1991/92 and 1993/94.

The New South Wales ESI's productivity growth has come from both rising output and reduced input usage. The amount of electricity generated and energy sales have risen by 18 per cent over the six years to 1993/94. At the same time, NSW has been one of only two States (the other being South Australia) to reduce input usage. The most substantial reductions have occurred in labour employed directly in the industry. However, despite these improvements, international benchmarking studies indicate that there is still significant scope for further improvement in the New South Wales ESI. In 1991/92, the estimated gap in overall productivity between the New South Wales ESI (the generation, distribution and transmission sectors), and US investor owned utilities, was 24 per cent (Bureau of Industry Economics 1994).

An international benchmarking study by London Economics and the ESAA (1994b) which used DEA to compare the Australian ESI against electricity utilities in the United States, the United Kingdom, Japan, Canada, New Zealand, South Africa, Ireland, Taiwan, Greece and Thailand, also provides evidence of the scope for productivity improvement. That study estimated that in 1990/91, the Australian generation sector was 8 per cent, the distribution sector was 27 per cent, and the transmission sector was 25 per cent less technically efficient than international best practice.

In particular, there appears to be considerable scope for improvement in the distribution sector. The New South Wales Government Pricing Tribunal (1994) considers that distributors could achieve productivity improvements in the range of 20 to 30 per cent. It has indicated that further savings are also achievable in the generation and transmission sectors. The magnitude of the savings actually delivered will be determined by industry reforms (in particular, opportunities for new market share within the national market), coal sourcing strategies, and the effectiveness of asset management practices.

The largest productivity gains are likely to be associated with capital inputs, given their substantial share of costs in the industry. Excess capacity in the New South Wales generation sector is still very substantial. In 1993/94, the reserve plant margin stood at 48.2 per cent, which is high by international standards. It has been conservatively estimated that the present value cost of excess generating capacity in New South Wales is more than $1 billion, despite the fact that the investment decisions that led to the excess were made over a decade ago. The structural reforms underway and the movement towards a national grid should assist in delivering efficiency improvements in New South Wales.

6. Conclusions

It is clear that there have been substantial productivity gains in the electricity sector in New South Wales that have been driven in recent years by administrative reforms. The benefits of reforms which raise productivity and efficiency include: lower prices to consumers; improved international competitiveness for industries relying on electricity as an input; reductions in GTE debt; higher dividend returns to government; and improved reliability, quality and choice of goods and services. Already, in New South Wales, some of these benefits are evident in a 28 per cent real reduction in wholesale electricity prices since 1983/84, significantly higher dividend payments to the government, and substantial reductions in the utilities' debt levels.

However, at the same time, we cannot presume that the rest of the world has been standing still. To meet world best-practice productivity levels, a significant step increase in productivity improvement is needed by the Australian electricity industry. While administrative reforms have provided some gains, to maintain and extend productivity growth further structural reform is needed. Action is now being taken within Australia to introduce competitive wholesale and retail electricity markets. The Commonwealth and State governments have agreed to establish a national market in electricity and most State governments are undertaking significant structural and regulatory reforms to their electricity industries to prepare for that market. These reforms are occurring in the context of a worldwide trend towards competitive market structures for electricity.

As with all industries, the electricity industry must adapt and evolve in response to changes in the external environment. As a provider of essential infrastructure, electricity has reached the stage of a mature industry in advanced economies like Australia. However, developments in technology affecting production choices, advanced control systems and the availability and cost of information have radically changed the basis on which electricity systems can be organised. From a centralised and highly integrated structure, the industry has progressively become more open, beginning with the separation of functions such as generation and transmission. Expanding the opportunities for customer choice is the next logical step. The major decisions that affect the level of resources used by the industry will be driven by the retail sector responding to consumer demands, rather than by centralised generation monopolies as has occurred in the past. This will improve the access afforded to more environmentally-sympathetic generation technologies and improve the incentives for demand management and energy conservation. Indeed, the technological development in these areas are making the present structure of the industry increasingly difficult to maintain.

The next leap in productivity will be obtained by establishing a commercial, highly competitive New South Wales electricity industry that can respond to the challenges of the national market to the benefit of consumers, the environment and the economic development of the State.

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Measuring Productivity in the Australian Banking Sector

Alan Oster and Lawrence Antioch*

1. Introduction

The potential benefits of increased productivity in intermediate sectors – such as banking and finance – can be substantial, given the impact of their services on resource allocation and competitiveness in the broader economy. No doubt, these considerations were high in the minds of policy makers in the 1980s when significant deregulation of the Australian financial sector was undertaken. And yet, despite more than a decade of reform, the level of measured labour productivity in the finance sector fell over the course of the last business cycle. But the specific nature of this sector, including its increasingly service-oriented focus, the non-market value of its output, and the role of rapid technological innovation, has complicated the analysis of its productivity performance.

Against that background, this paper briefly discusses some of the conceptual issues peculiar to measuring productivity in the finance sector. It examines a range of productivity indicators for the banking component of the sector, with specific reference to the National Australia Bank (NAB). An examination of these indicators at the enterprise level may thereby shed some light on actual productivity performance in the banking and finance sector since the early 1980s.

2. Measuring Productivity in the Finance Sector – The Conceptual Issues

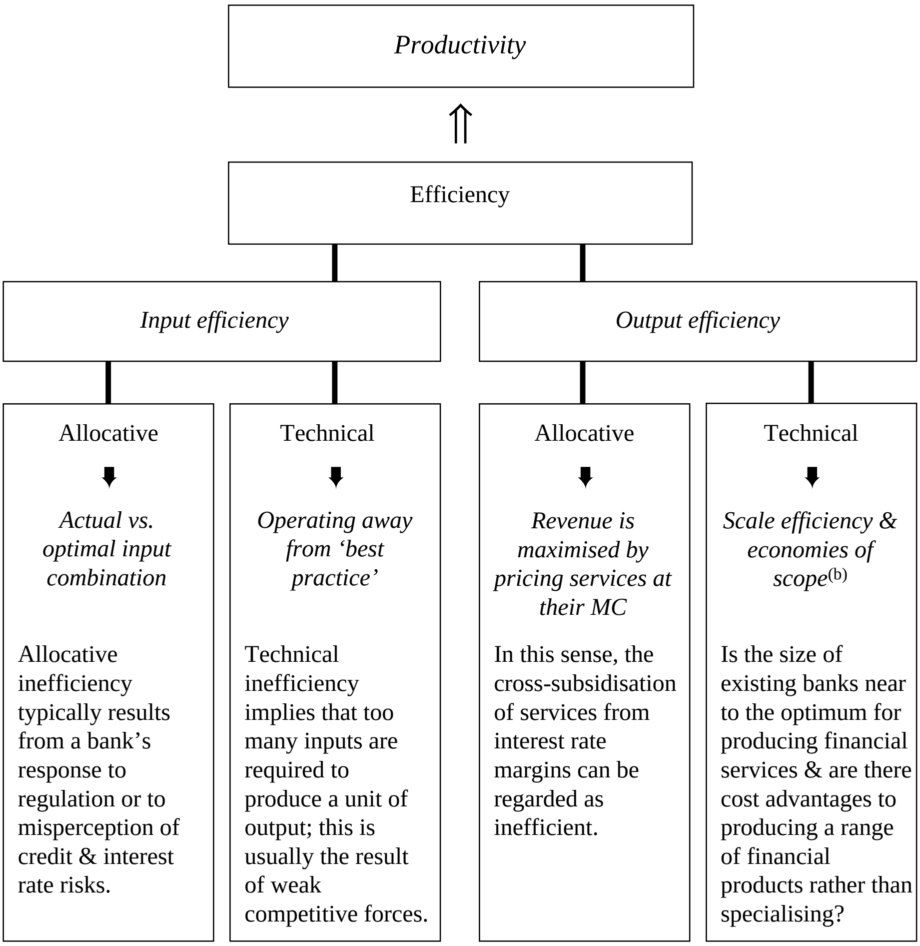
The conceptual and empirical problems that plague the measurement of physical output in most service industries are particularly acute in the banking sector, where there is no clear consensus on an appropriate definition of output (Triplett 1990). For example, since banks engage in intermediation, are their deposits to be measured as an input or an output? The most common response to this problem is to examine *indicators* of productivity in the banking sector that are generally derived from accounting data. For example, in the 1989/90 Commonwealth Government Budget Papers, the Commonwealth Treasury presented the decline in the ratio of operating costs (excluding provisions for bad debts) to average assets as evidence that productivity improvements in the banking industry had indeed occurred. Other frequently-used accounting measures include the ratios of operating income to costs or staff expenses.

The rationale for these accounting indicators is that productivity improvements, including the productivity of non-labour inputs, should mean that a lower level of costs or employment is required to manage a given level of assets, or to produce a given level

* National Australia Bank. The paper has benefited from extensive suggestions by Alison Tarditi. The views expressed are those of the authors and do not necessarily reflect those of the National Australia Bank.

of income. However, these ratios can be interpreted more correctly as measuring the banks' *efficiency* target rather than directly measuring their productivity. Nonetheless, such measures of efficiency are the most commonly-examined indicators of productivity in banking. Consequently, efficiency concepts will be used to structure the main points of analysis in this paper.

Figure 1: Aspects of Efficiency[(a)]



Notes: (a) This table is reproduced courtesy of the RBA and summarises research undertaken by Alison Tarditi (Economic Analysis Department) and Damian Brindley (Domestic Markets Department). For a more detailed discussion see also Evanoff and Israilevich (1991) and Berger, Hunter and Timme (1993).

(b) Scale efficiency refers to a firm operating on the minimum point of its average cost curve; economies of scope are achieved when the cost of jointly producing a range of outputs is less than the cost of producing them independently.

Concepts of efficiency relate to how well a bank employs its resources relative to the existing production possibilities frontier (or, in other words, relative to current 'best practice') – how an institution simultaneously minimises costs and maximises revenue, based on an existing level of production technology. The analysis of bank efficiency, therefore, relies on intra-sector comparisons, involves both technological and relative pricing aspects, and has partial indicator value for analysing productivity performance. The concept of productivity, on the other hand, refers to the performance of the sector as a whole and effectively combines changes in efficiency and technological advances in an average measure. Figure 1 organises aspects of efficiency measures in order to gain a perspective on banks' productivity. This paper will attempt to exploit some of these channels in its analysis.

3. Gauging Productivity in the Banking Sector – Some Measurement Issues

3.1 Input Efficiency

These first measures concentrate on the degree of efficiency with which banks combine their *inputs* to produce a given level of output at minimum expense. Since the mid 1980s, there has been a decline in the ratio of operating costs (excluding provisions for bad debts) to net (interest and fee) income for banks (Figure 2). This may be

Figure 2: Operating Costs to Net Income

Note: Data were obtained from the Domestic Markets Department of the RBA and measure the domestic operations of banks.

interpreted as indicating some improvement in banks' efficiency and, therefore, some possible gain in productivity. However, any such conclusions must be drawn with caution. This measure can be affected by changes in the mark-up over costs so that it reflects changes in the industry's competitive practice as much as changes in its productivity. Such a decline, far from indicating cost minimisation through input efficiency, could instead, be reflecting oligopolistic rents.

The more often-quoted measure of efficiency calculates the ratio of operating costs (excluding provisions for bad debts) to average assets. This ratio has fallen 15.2 per cent since 1986 (Figure 3).

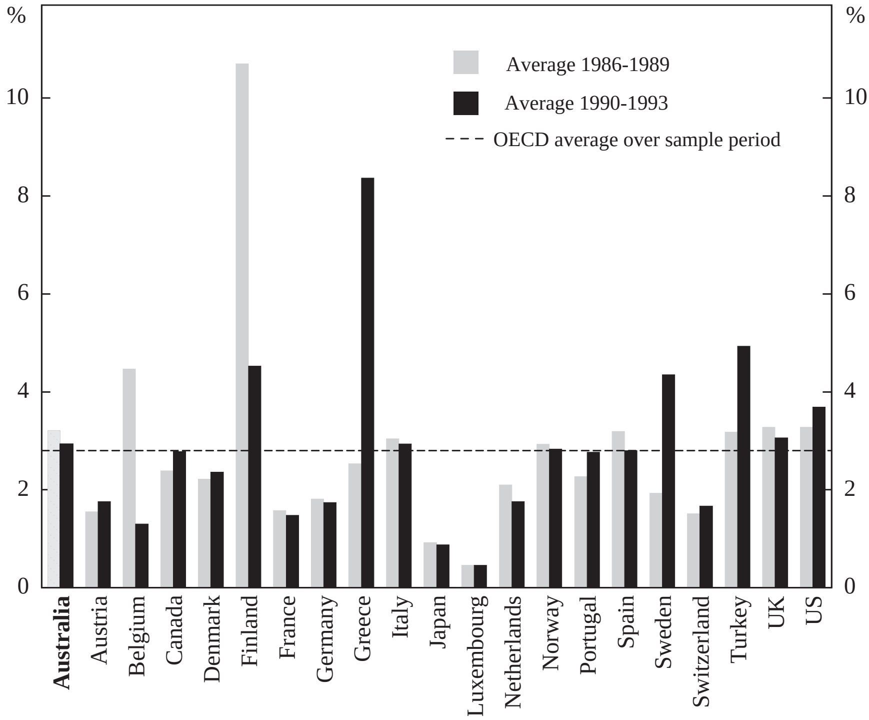
Figure 3: Operating Costs to Average Assets

Note: Data were obtained from the Domestic Markets Department of the RBA and measure the domestic operations of banks.

While international comparisons are particularly hampered by data inconsistencies, it is useful to at least attempt to ascertain how Australia's situation relates to that of other OECD countries (Figure 4).[1] Between the late 1980s and early 1990s, 11 of these 21 OECD countries experienced a fall in their ratio of operating expenses to average assets. Australia was one of those 11 countries. However, at 2.93 per cent, we remained above (although only slightly) the early 1990s sample average of 2.83 per cent. But a

1. International comparisons are problematic – the OECD collection, from which these data were drawn, contains a disclaimer that '... international comparisons in the field of income and expenditure accounts of banks are particularly difficult due to considerable differences in OECD countries as regards structural and regulatory features of national banking systems, accounting rules and practices, and reporting methods'. Definitions are not consistent and measurements are not standardised across countries. Most importantly for this study, data for many countries are global, rather than domestic (RBA 1994).

Figure 4: International Comparison of Operating Costs to Average Assets



number of provisos need to be made when using this measure to make international comparisons of Australian banks' productivity:

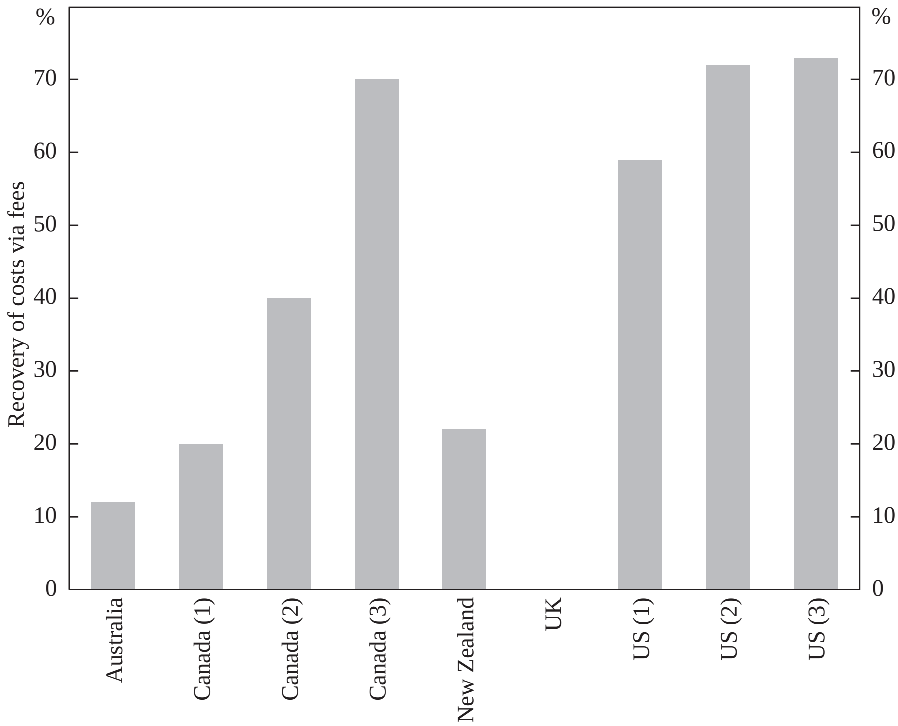
- Compositional shifts in banks' business can be expected to decrease the costs to average assets ratio without any increase in the efficiency of their individual operations. This influence may be significant because financial deregulation was associated with market liberalisation and the outward orientation of the Australian economy. As a consequence, there was substantial growth in banks' corporate and offshore activities, which command little payments system obligations.
- Banks' consolidated accounts data include their overseas operations and, thereby, can be distorted by acquisitions and mergers, especially if the overseas acquisitions have significantly different cost structures to the bank's domestic operations (Phelps 1991).

Overall, and despite their problems, the above 'input' measures are generally indicative of increasing efficiency and, therefore, of possibly rising productivity in the Australian banking sector over the period from the mid 1980s.

3.2 Output Efficiency

We now turn to some measures of banks' efficiency in pricing and achieving levels of *output*. Banks can charge their customers fees for services, can attempt to recoup their costs by charging a higher interest margin or, as is more likely, they can use some combination of fee charges and interest income. Compared with a range of OECD countries, Australian banks' reliance on service fees is relatively low, as shown in Figure 5. This figure is based on consumer market research – undertaken by NAB – which shows that a major barrier to more efficient pricing is the continued high aversion to fees in the consumer and business market. (The UK recovers almost none of its costs with fees. In its case, costs are recovered by wide interest rate spreads on transaction accounts.) This implied cross-subsidisation of services from interest rate margins, rather than the more comprehensive use of banking service fees (which would be more in accordance with the principals of 'user-pays' and marginal-cost pricing), implies an allocative output inefficiency in the banking system.

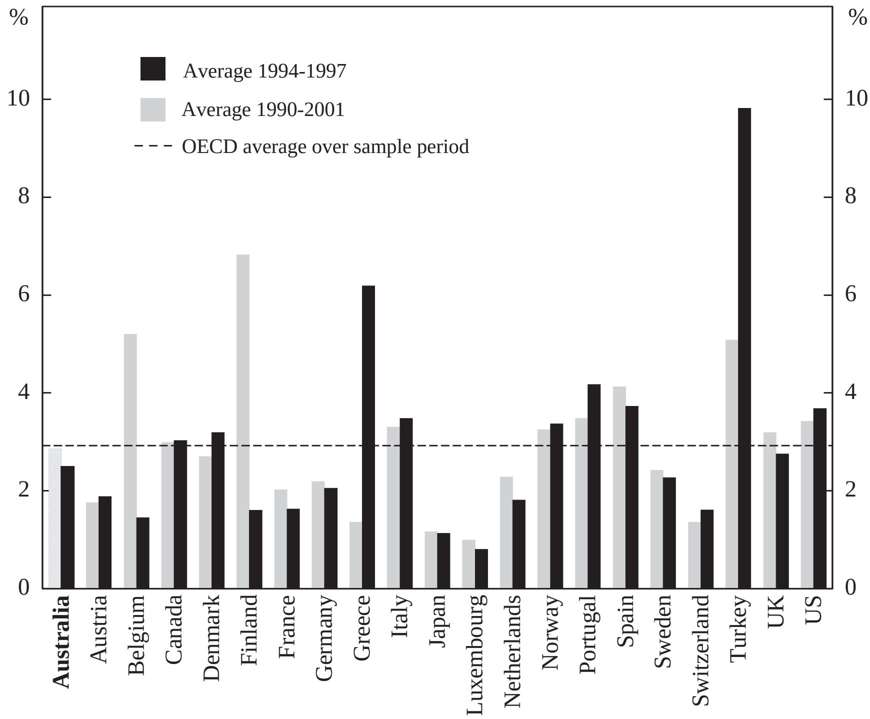
Figure 5: International Comparison of Cost Recovery in Transaction Accounts



Note: Alternative Canada and the US calculations refer to differential fee structure based on different delivering platforms – i.e. electronic, full service and a combination of the two.

Complementing fee comparisons, then, the average interest spread can be used as another general efficiency measure. It is here calculated as the ratio of banks' net interest income to average assets (Figure 6). Once again, 11 countries in this sample (of which Australia is one) experienced a fall in this ratio between the late 1980s and the early 1990s. Only slightly below the sample average over the first period, Australia's ratio fell to 2.49 per cent in the second period to be well below that sample average of 2.96 per cent. It should also be noted that Australian banks' net interest income tends to be biased

Figure 6: International Comparison of Net Interest Income to Average Assets

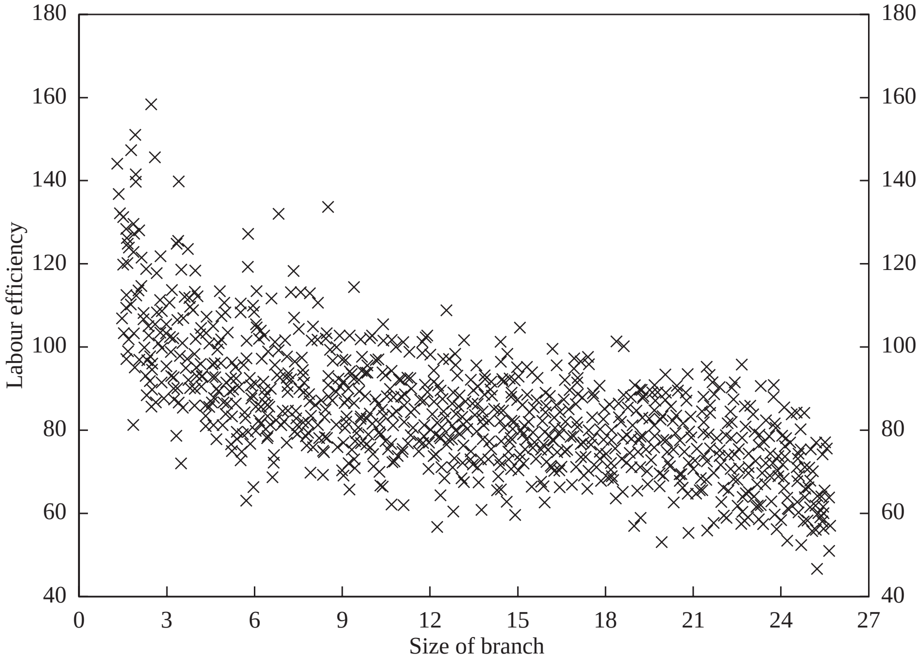


upwards by the treatment of bills (see RBA (1994)) and, furthermore, that Australian financial institutions typically rely more heavily on interest rather than fee income, implying that this measure may overstate Australian banks' efficiency. In this way, the net interest income to average assets ratio, like its complementary costs measure, provides some contradictory evidence. That said, in Australia there has been some, albeit minor, downward movement of margins.

Measures of *technical* output efficiency include estimates of banks' scale efficiency. Scale efficiency refers to banks or branches achieving an optimum size for producing financial services and thereby, ensuring operation at the minimum point of the average cost curve. Figure 7 shows that in the late 1980s, for NAB, there appears to be a negative relationship between branch size and branch efficiency. The strategy adopted by the NAB was to re-engineer its processes (through identifying key business activities that can either be streamlined or eliminated), upskilling its labour force and increasing the use of technology. Over time, the net effect of these initiatives has resulted in significant improvements in branch efficiency and elimination of the apparently negative relationship between branch size and efficiency.

As well, the increased competition resulting from financial deregulation may continue to provide impetus for the achievement of further technical output efficiencies through scope economies. Economies of scope are achieved when a bank recognises that the cost of producing a *range* of outputs is less than the cost of producing them *independently*.

Figure 7: The Relationship between NAB Branch Size and Labour Efficiency[(a)] (July 1990)



Note: (a) Labour efficiency is calculated as the ratio of the total volume of branch transactions (standardised by a scaling factor designed to convert the transactions to common time-scales) to the branch's total labour input (measured on an hours-worked basis and net of leave arrangements).

Finally, banks' profitability is often highlighted in discussions of how to measure the sector's productivity. Measured here as the rate of return on shareholders' funds, the gap between banks' profitability (Figure 8) and that of other companies has progressively been reduced. At one level, this in part reflects relatively flat margins, notwithstanding increased cost of funds to the banking sector. More fundamentally it reflects the importance of competitive forces. Indeed, expectations are that the gap of the 1980s (and earlier periods) will not re-emerge. While no definitive conclusions can be drawn from the closing of the gap, it does support the view that increased competition has delivered efficiency gains since the early 1980s.

3.3 Other Indicators of Productivity

A broadly-equivalent measure of labour productivity is 'net value added', estimated here as the ratio of NAB's net earnings to total personnel costs. This measure shows the contribution of labour to the net earnings of the bank (Figure 9) and has been improving since the early 1990s.

Figure 8: Returns on Shareholders' Funds

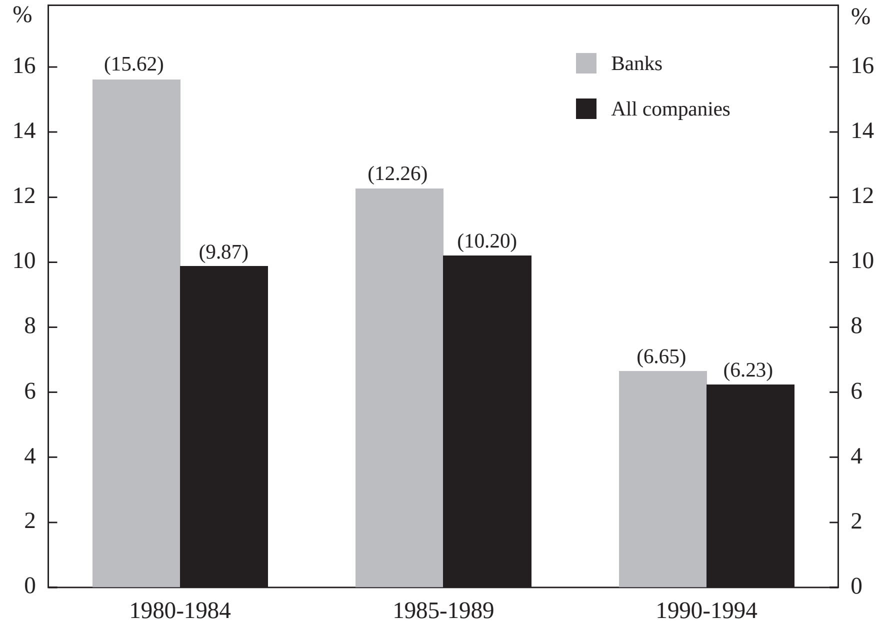


Figure 9: NAB's Net Value Added
(Net earnings to total personnel costs)

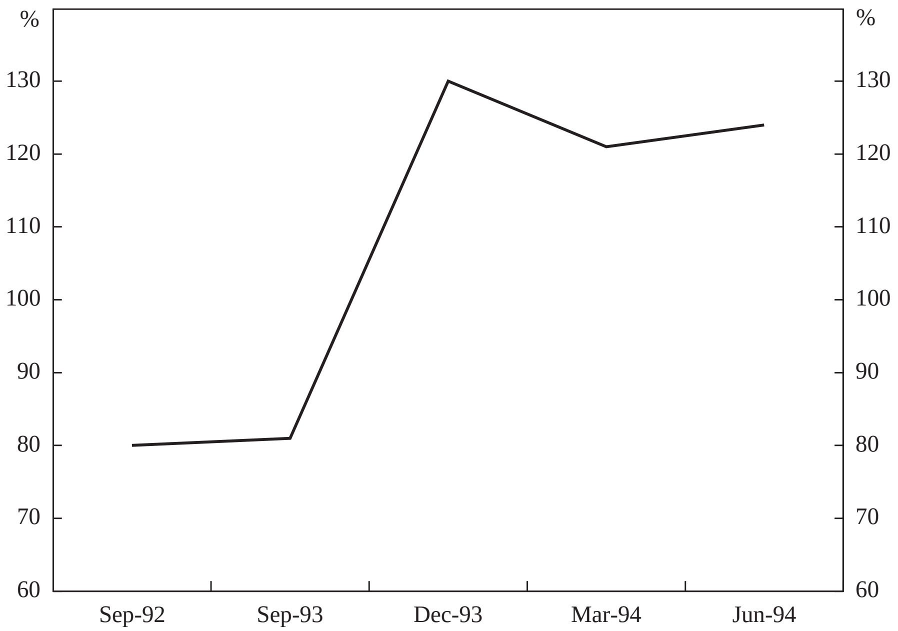
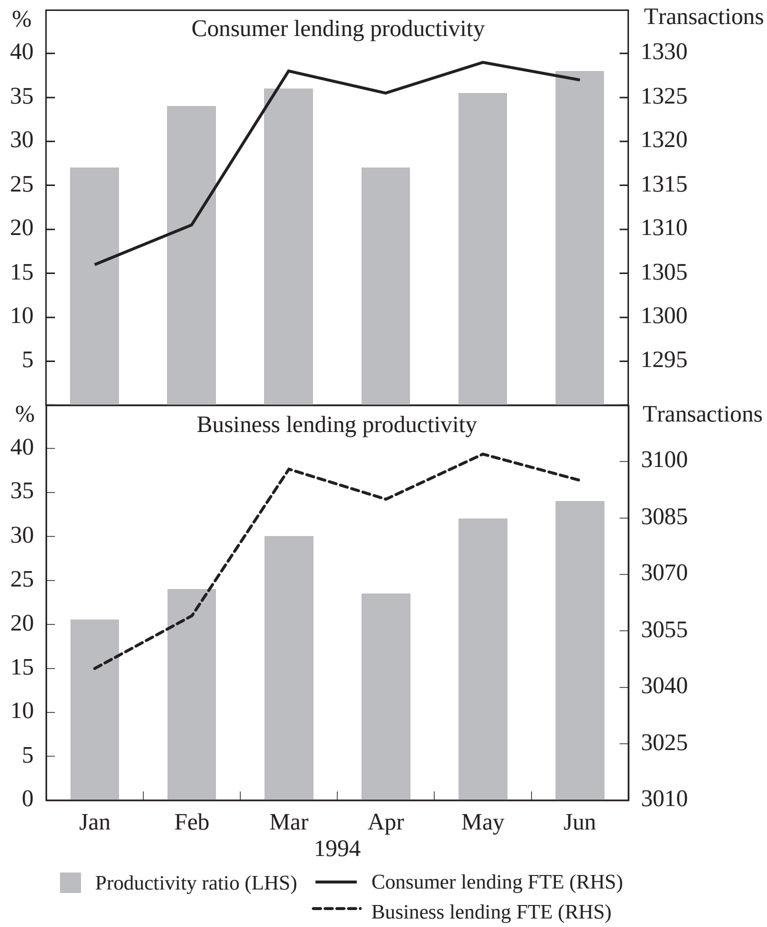


Figure 10: NAB's Net Value Added in the Consumer and Business Markets



Notes: (a) In each market, the volume of transactions is benchmarked according to a scaling factor which is designed to convert the transactions to common time-scales. Staff functions are then allocated according to whether the time was spent on household or business related jobs. This results in the estimation of a basic labour productivity measure for the household and business activities of NAB.

(b) FTE stands for the full-time equivalent measure of staff, and estimates the ratio of lending approvals in a particular category (e.g. loans for business purposes) to the labour resources employed in that area (as obtained from a time-and-motion survey).

Disaggregating these data into household and business markets implies that NAB has achieved productivity gains in both areas (Figure 10).[2]

Assuming that these National Australia Bank results are indicative of the banking sector as a whole, productivity once again appears to be improving in the 1990s.

2. The distinction between consumer and business markets is used here to differentiate lending by purpose – loans made for (small and large) business purposes are recorded as such; loans made for personal consumption (e.g. housing loans) are recorded as consumer lending.

3.4 Technology and Total-Factor Productivity

Technical progress is often referred to as total-factor productivity (TFP). A characteristic of the banking sector is its preponderance of new technology. This has been manifested in ATMs and credit cards, and more recently, the widespread installation of EFTPOS and the introduction of debit and smart cards. This type of technological innovation can be described as capital enhancing (or Solow neutral).[3] To the extent that technical progress augments banks' effective capital stock, this leads to an increase in the marginal product of labour. If labour is being paid the value of its marginal product, and the banking industry is competitive, then employment in the industry expands to equilibrate the marginal product of labour in banking to the economy-wide wage rate. Thus, measures of bank efficiency based on employed labour may be misleading. As well, technological innovation often leads to quality enhancement. And this highlights a further problem inherent in any attempt to gauge banking sector productivity – adjusting the measure of bank output for changes in quality becomes virtually impossible when the very nature of that output remains vague.

The sort of capital-enhancing innovation found in banking has another important implication – one that fits neatly with endogenous growth. Knowledge is created as a by-product of a physical investment process so that there is a public good aspect to that investment. Consequently, investment decisions by a bank (or group of banks) can enhance the productivity of other financial institutions in the economy.

4. Conclusions

Given the problems associated with the construction and interpretation of much of the data on bank efficiency/productivity surveyed above, each can only be considered as tentative evidence of actual productivity performance. However, the fact that almost all of the series point in the same direction supports the hypothesis that productivity in the banking sector has been rising during the 1990s. While some confidence can be placed in this qualitative statement, it is far harder to quantify the extent of productivity growth. Indeed, the challenges witnessed to date are not likely to be diminished. Banks continually look to re-organise their processes and exploit new technology in an attempt to compete with other providers of financial services. Consequently, measurement of productivity in banking begs further research.

3. A Solow-neutral production function is capital augmenting: $Y = (AK)^{\alpha} L^{1-\alpha}$.

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Micro Reform in the Australian Labour Market: Implications for Productivity and Growth

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1. Introduction

The issues being tackled by this Conference are perennial in economics and are at the heart of the discipline. Growth and productivity were the central concerns of Adam Smith's inquiry into the nature and causes of the wealth of nations. There has been phenomenal growth in the wealth of nations since 1776, and also in economic theory, but the enduring insights prevail. The key determinants of growth, both absolutely and relative to other nations, include physical resource endowments, social and political institutions, the distribution of income, the skills of the population, the extent of the market, social and physical infrastructure, generation/accumulation of sufficient investable resources, and technological innovation. Some (though not all) of these will be affected by microeconomic reform, but all of them affect the growth rates of employment, output and prices.

The next section of this paper traces the scope of micro reform in Australian labour markets over the past dozen years, and discusses in broad terms, the nexus between Australia's wages system and Australian productivity growth. The third section provides an overview of enterprise bargaining agreements reached in Australia in the 1990s. It instances several examples of agreements reached through enterprise bargaining, highlighting the inclusion of performance indicators and benchmarking, and the introduction of new work systems. A final section discusses Accord Mark VIII and prospects for Australian competitiveness in the years ahead.

2. Productivity and Micro Reform in the Australian Labour Market: Past Dozen Years

There is a view, rooted in neoclassical economic theory, that labour market *reform* is co-extensive with labour market *deregulation*. This view underpins the calls by some local commentators for abolition of the award system (which sets minimum wages and conditions of employment in Australia). The call is for a 'freeing up' of regulation in general, and relative wages in particular, to remove 'impediments' to the signalling function of relative wages in allocating scarce labour resources.

* The views expressed in this paper are those of the authors and do not necessarily reflect the views of their employers. We thank work colleagues and Palle Andersen for their helpful comments, but claim full responsibility for all errors in the paper.

There has been a long and thorough international search for evidence of this allocative role of wage relativities, but with staggeringly little success. This has generated a burgeoning theoretical literature (search theory, bargaining theory, human capital theory, implicit contract theory, Reddaway's 'job opportunities' theory, segmented markets, efficiency wages, ...) in a remarkable process of secondary elaboration on the orthodox simple market model.

The process of change described here, and embraced by Australia's union movement, does not draw at all on the orthodox view. The Accord has directly targeted macroeconomic aggregates – originally the prospective annual aggregate wage outcome, more recently Australia's relative inflation rate, and always employment growth – and also directly promoted reform and competitiveness at the micro level. Whilst maintaining the integrity and relevance of legal minimum conditions and rates of pay, the Accord has embraced the goals of efficiency, flexibility and productive performance in Australian enterprises. The union movement has been and remains party to the most thorough-going overhaul of award structures and provisions in the history of our arbitration system. Five major changes have been undertaken, or are underway:

- coordination of wages policy with other arms of policy;
- award restructuring;
- enterprise bargaining;
- single bargaining units; and
- social change.

These will be discussed in turn.

First, prior to 1983, the future growth of wages in Australia was a major uncertainty facing every business. Shut out of the economic policy process, unions simply bargained for wages as best they could, each in the interests of their own members. Wages growth was volatile and pro-cyclical, accelerating in the booms and slowing in the busts. There was no connection between wages policy and other policy instruments.

In rejecting 'fight inflation first' monetarism (which had been tried and had failed), the original Accord spoke of the need to integrate and harmonise all arms of policy.[1] Since its inception in 1983, wages policy has been integrated with economic policy generally. As a result, the growth of wages has been moderate and predictable, which is what matters for business, for investors contemplating major new investments.[2]

This wage restraint,[3] sustained for more than 12 years, has seen Australia top the OECD league tables for job growth (notwithstanding the recession). It has delivered

1. Statement of Accord between the ALP and ACTU, Regarding Economic Policy, February 1983.
2. See Chapman and Gruen (1991) for an early overview of the macro effects of the Accord on wages growth and industrial disputation.
3. A closely related change of fundamental importance has been the introduction of award-based superannuation. The SGC schedule of minimum employer obligations ensures that the labour-cost impact of the scheme is known with certainty years in advance. Accord VIII establishes similar employee obligations well in advance of their falling due. The superannuation arrangements target long-term macro-management concerns (retirement incomes, national saving and national infrastructure) with implementation carried substantially by the award system and harmonised with wages policy settings, resulting in regular, modest and predictable increases in nominal labour costs over an extended stretch of years.

Australia its lowest rates of inflation in many decades. And it has been achieved – uniquely in Australia – in such a way that the living standards of the weakest and lowest paid groups of workers during the 1980s had the greatest degree of protection. Flat dollar national wage increases, plus minimum rate adjustments under award restructuring, delivered greater protection to lower-paid groups than to the bulk of workers in the unions' heartland in the middle-income ranges. Additional support for low-paid workers with family responsibilities was secured through 'social wage' negotiations with government.

Real wages declined during the 1980s, but have risen modestly in the early 1990s as inflation fell rapidly. Throughout, profits have improved and the profit share remains at historic highs. Associated with this unparalleled wage restraint through the Accord has been a sustained decline in days lost due to industrial disputation. On average over the past dozen years, the time lost due to industrial disputes is more than 60 per cent lower than in the preceding decade.

Second, award restructuring has totally reshaped the legal framework which governs attitudes to work and training and the way in which work is done in Australian workplaces.

The award system evolved largely by accident over 80 years in Australia, but by the mid 1980s had become out of tune with modern approaches to work organisation and competitive efficiency. The realisation that companies are more flexible and competitive when emphasis is placed on team performance rather than individual output, when skills and competence are emphasised, when authority and responsibility are devolved to workers through flat management structures, and that quality earns a premium on prices, is a truth from the modern world. Award restructuring builds these principles into the institutional framework which sets the rules in Australian workplaces. The obsolete award provisions – which encouraged demarcation and discouraged skill formation and hindered responsiveness and flexibility – are either already gone or well on the way out.

In each industry the restructured awards which continue to set minimum standards in employment contain only a few, broadly-defined job classifications, linked by skill levels so as to provide a career path along which workers may progress throughout their working life by acquiring additional skills and competence. Award restructuring has reduced the scope for pettifogging demarcation, promoted multi-skilling and functional flexibility on the job, differentiated between award types, and established key minimum wage relationships in such a way as to curtail the leapfrogging between awards that had contributed to the wage 'explosions' of the late 1960s, mid 1970s and early 1980s.[4] This has been a process of regulatory reform, not de-regulation *simpliciter*.[5]

Award restructuring facilitates change. It has enabled and assisted the change process to occur and grow, but responsibility for actually changing things at any place of work is ultimately a matter for the workers and management there. Subject to the broad principles and minimum standards set by restructured awards, the precise details of change to take place in any workplace is best addressed by the people directly involved.

4. See Borland, Chapman and Rimmer (1992) for a more extensive discussion of the nature and effect of these changes.

5. See TUAC/OECD (1995) for a discussion of these issues in an international context.

Governments and unions and Industrial Tribunals can help and advise and assist, but enterprises (or companies) must actually do it.

So enterprise bargaining, the *third* area of fundamental reform in Australian labour markets was the logical next step in the process of change. Australia's union movement embraced enterprise bargaining in pursuit of productive *efficiency* and also (though this is not widely recognised outside of union circles) for reasons of *equity*.

If workplace change is widely perceived to be fair, it is more likely to be sustained over time, and not rolled back. Workers want improved living standards for themselves, their families and children, and an efficient, competitive economy is essential for a small, open nation to achieve these goals into the next century. Both award restructuring and enterprise bargaining are centrally about the pursuit of efficiency. It was the unionised sector which shouldered the major share of change under award restructuring, including acceptance of new work classifications, performance of a wider range of duties, undertaking training, and accepting greater accountability for work done.

However, the fact is that the weight of wage restraint in the 1983-90 period was also carried by the unionised sector of the workforce, overwhelmingly located in the middle-income ranges. High-income groups exercised no restraint, especially during the late 1980s boom. ('We exercised the restraint, they took the equity', as one wag put it.)

As inflation fell in the 1990s, the rate of erosion of living standards declined, and the opportunity emerged for the unionised sector to achieve some recovery in real living standards through enterprise bargaining for the same workers, actually required to implement the changes arising from microeconomic reform in the Australian labour market.

In Autumn 1991, writing on the theme of cracking Australia's 'high inflation mindset', the ACTU said:

> 'The productivity pay-off from award restructuring will show up in the national aggregates over the course of the nineties. Reforms to the wages system, when complete, will offer a coherent, stable framework for wage policy replete with a capacity for genuine workplace focus. The trade union movement will seek to protect workers' living standards, knowing that task is most effectively done in an environment of low inflation' (ACTU 1991, pp. 24-25).

The productivity performance of recent years is consistent with that prediction, and for our part we expect Australian productivity growth rates, as measured by the national accounts, to remain above the historical average throughout the second half of the decade. Whether this expectation is met will depend crucially on what happens to new investment spending in the next few years.

Today (as at March 1995) there are (in the Federal jurisdiction) some 4,200 separate agreements (covering around 1.4 million workers) operating across all sections of Australian industry, and the number rises daily. The nature of these agreements is as diverse as the companies and industries they cover. Some agreements have a term of six months, some 12 months, some two years or longer. The average duration is 17 months. Many of the longer-term agreements are 'closed' in the sense that they include allowance for any national-wage or safety-net increase which may occur during their currency. In some industries a 'framework' agreement has been reached by the employers and unions concerned, with company-specific negotiations taking place within that framework. Agreements exist in the public and private sector, in large and small companies. They exist across all sectors of industry and typically embrace details of changes in work arrangements and work performance as well as rates of pay. Overwhelmingly, agreements are conducted by single bargaining units (SBUs) representing workers at each place of work, which is a major efficiency gain in its own right.

The development of SBUs is related to the *fourth* major aspect of Australia's labour-market revolution. This is the thorough restructuring of the union movement itself.

For years, commentators have pointed to the existence of a multiplicity of craft-based unions in Australian workplaces identifying the resultant inefficiency of bargaining and promotion of demarcation as a major flaw in our labour-market structures. In the mid 1980s the ACTU had more than 150 affiliated unions, with three-quarters of unions accounting for around 20 per cent of union members. Today around 98 per cent of union members in Australia are covered by just 21 unions/union groupings organised along industry lines. Together with continued operation of single bargaining units, this will mean increasingly that each employer will have only one set of negotiations to conduct in order to reach an agreement covering all its operations. For workers, it heralds more efficient and effective delivery of a wider range of relevant union services.

There is no other example world-wide of a union movement restructuring itself in this way in peace time. In less than a decade, Australia's union movement will have transformed itself into a more effective, democratic organisation. It means less power and authority for the ACTU with more responsibility falling on the unions which directly represent working people.

Finally, each of the foregoing dimensions to Australia's continuing labour-market revolution has taken place against a backdrop of incessant social change. The participation rate for women has risen steadily here as in other countries, while that for men has declined a little. The incidence of part-time work has also grown rapidly. Private-sector employment has risen faster than in any other country, but public-sector employment has been flat or declined. More teenagers are staying longer at school; fewer work full time but many more work part time. These developments are common to most other industrialised countries, but are more pronounced in Australia because of our high rates of population growth.

In no way can these changes in the structure of our labour markets be attributed to the award system or the industrial tribunals, because award provisions also apply to part-time work and employment of young people and women, and the developments are being felt in countries without similar social institutions.

The union movement championed award restructuring and embraced enterprise bargaining with a view to securing an open, competitive economy, capable of sustaining first-world living standards into the next century. We have been party to the restructuring undertaken by corporate Australia in the early 1990s. One direct *consequence* of enterprise bargaining, pursuant to an efficiency agenda in Australia, will be not only greater efficiency in production and improved competitiveness in goods and services markets, but also 'a thousand microeconomic price adjustments' in the structure of *actual* wage relativities (though not of award minima). The direction of causation involved is the opposite of that assumed by orthodox economic theory, which posits flexibility in wage relativities leading to greater allocative efficiency in labour markets (as scarce labour supplies are bid to where they will be most profitably employed and receive the value of 'their' marginal product) and thus greater efficiency and competitiveness in the macroeconomy.[6]

Before outlining key features of recent enterprise bargaining, three things should be stressed. First, collective bargaining has a long history in Australia's manufacturing industry. Even in periods of centralised wage fixation, bargaining at the enterprise level over a range of issues has featured prominently.

Second, we support the change agenda in all sections of the economy, not simply in the market sector. To maintain solidarity, social cohesion and credibility, there can be no double standard in wages/incomes policy. In the private sector, particularly in manufacturing, productivity-related pay systems are ultimately tested in the market and the wages bill is paid by the firm. In the public sector, there is overwhelmingly no market test and the wages bill is met from consolidated government revenue.[7] Simplistic advocacy of 'productivity-based wage rules' provides no guide for such groups and safety-net wage adjustments only would soon see disaffection wreak havoc with the public services they provide. Consequently, under Accords Mark VII and VIII the Federal Labor government as employer has negotiated agreements covering its own employees. These agreements provide for service-wide, fair salary adjustments and the continuing implementation of change in public sector employment, with agency-specific adjustments also available, subject to certain criteria.

Third, productive performance at the enterprise level is an amalgam of investment in equipment and technology, management competence, workplace culture, and a diverse range of other factors. It follows that individually based piece-work arrangements are of limited utility in any adequate wages system. Group bonus schemes may have some greater merit depending on how they are structured.

What incentive is there for workers at any particular establishment to engage in enterprise bargaining? There is, of course, the altruistic reason that 'we are doing it for our kids', and this motivation is not to be denied. Nor should the concern for job security, to ensure the survival of the enterprise in an open, competitive world, be discounted (Belchamber 1994). This altruism is bolstered, however, by the fact that flat dollar safety-net adjustments barely keep pace with inflation for the lowest paid workers ($8.00 amounts to 2.4 per cent at the lowest Federal award rates of pay, and is 1.7 per cent of average minimum award rates). It follows that the *only* way to secure real wage

6. It is the latter vision which underpins calls for the abolition of minimum wage laws, such as those which resulted in the freezing of the US statutory minimum wage under Presidents Reagan and Bush, from 1 January 1981 to 1 April 1990, and in the denouncing of ILO minimum wage conventions by Thatcher's Britain in 1985. A direct result of that approach may well have been slower growth in productivity – see Gordon in this Volume. The recent applied work by Card and Krueger (1993) and others suggests that a re-examination of the conventional view of minimum wages is under way.

7. In the public sector, the requirements of accountability, transparency and disclosure are also far more rigorous and demanding than in the private sector. This limits the scope for 'over-award' and other discretionary payments to public sector employees. However, workers employed in the public sector are all part of Australian society and must have access to wage adjustments which keep their living standards in touch with movements in the rest of the workforce, where over-award payments are made.

increases in the 1990s is through enterprise bargaining and, pursuant to the Accord, enterprise negotiations must canvas an efficiency/flexibility agenda.[8]

In the next section we present an overview of enterprise bargaining in the manufacturing sector, and look at some examples in other sectors.

3. Enterprise Bargaining in Manufacturing

To highlight broad trends in the content of agreements and the wage outcomes negotiated in manufacturing, we have utilised the Commonwealth Department of Industrial Relations (DIR) Wage Agreement Database. Table 1 shows the outcomes for enterprise agreements in metals manufacturing, non-metals manufacturing and total manufacturing. Two periods are considered: October 1991 to March 1993, and the more recent period from April 1993 to December 1994.

Since October 1991 more than 3,500 economy-wide agreements (in the Federal jurisdiction) were recorded on DIR's database, of which half were in the manufacturing industry and covered more than 270,000 employees. The results show the percentage of manufacturing agreements that incorporated measures related to improving the productive performance of the workplace, and the range of wage outcomes achieved.

3.1 Measures to Improve Work Organisation and Use of Capital

A large number of agreements reached through enterprise bargaining in manufacturing include *measures* related to improving the productive performance of the workplace and these are being implemented on the job in workplaces throughout the country. The summary below covers three work organisation measures – quality assurance, teamwork, and continuous improvement/best practice – and the broad measure 'use of capital'. The data indicate whether the relevant matters were included or mentioned in agreements negotiated in manufacturing industry. In brief:

- More than 80 per cent of all manufacturing agreements included some measure related to work organisation.[9]
- Almost half of all manufacturing agreements contained provisions relating to quality assurance and a similar proportion included measures concerning continuous improvement/best practice. In non-metals manufacturing the proportion of agreements with such measures rose, from around 30 per cent to around 40 per cent; in metals it was steady at around one-half in both periods.

8. See 'Putting Jobs First', Accord VII, paragraphs 5.3-5.7 and Accord VIII, part 4.
9. The measures in DIR's wage agreement database also include those related to changing the 'work environment' such as consultative arrangements or strategies to reduce absenteeism or disputation. 'Work organisation' includes other sub-variables not shown here, such as functional flexibility/reduced demarcation. Closely related to work organisation change is how manufacturing workplaces are attempting to make better use of plant and equipment to improve productive performance. In DIR's database, such measures as introduction of new technology and continuous operation of machinery are included under a broad variable 'use of capital'.

Table 1: Agreements in Manufacturing
(Percentage of agreements that include the features shown)

	All manufacturing %		Non-metals %		Metals %	
	1/10/91-31/3/93	1/4/93-31/12/94	1/10/91-31/3/93	1/4/93-31/12/94	1/10/91-31/3/93	1/4/93-31/12/94
Measures:						
With a work organisation measure	88.76	80.40	83.86	76.55	91.56	84.45
Use of capital	33.88	22.27	30.94	18.59	35.55	26.15
Teamwork	36.81	31.13	18.83	25.80	47.06	36.75
Quality assurance	45.11	45.14	31.84	40.37	52.69	50.18
Cont. improvement/ best practice	42.35	44.37	30.94	39.70	48.85	49.29
New classification	13.36	18.23	19.73	20.94	9.72	15.37
Indicators:						
Output indicators	32.57	33.88	18.39	31.49	40.66	36.40
Cost indicators	34.36	26.48	18.83	22.11	43.22	31.10
Quality indicators	53.58	54.94	32.29	49.75	65.73	60.42
Remuneration:						
Performance pay	2.12	7.31	1.35	7.20	2.56	7.42
Gain sharing	0.49	3.27	0.45	3.85	0.51	2.65
Share acquisition	0.00	0.17	0.00	0.34	0.00	0.00
Bonus	0.81	1.29	0.00	1.68	1.28	0.88
Wage increases per agreement (annualised):						
A – to 2%	3.29	5.03	7.55	6.67	1.40	3.56
B – from 2% to 4%	10.08	31.58	13.84	32.59	8.40	30.67
C – from 4% to 6%	82.56	53.45	72.96	50.37	86.83	56.22
D – GT 6%	4.07	9.94	5.66	10.37	3.36	9.56
Wage increases per employee (annualised):						
A – to 2%	12.70	3.77	25.24	8.31	8.42	1.35
B – from 2% to 4%	11.51	30.79	7.03	32.94	13.04	29.64
C – from 4% to 6%	73.50	53.60	65.04	52.16	76.39	54.37
D – GT 6%	2.29	11.84	2.69	6.59	2.15	14.64

- More than 30 per cent of agreements included measures related to teamwork, and in addition, the proportion of agreements including measures to improve the use of capital ranged from 34 per cent (in the earlier period) to 22 per cent (in the later period).

3.2 Performance Indicators and Gain Sharing/Performance Pay

A variety of *indicators* have been included in agreements reached through enterprise bargaining in manufacturing:[10]

- More than half of agreements in manufacturing during both time periods contained quality indicators related to such matters as customer satisfaction/complaints, delivery, scrap and rework, external standards and other measures. Metals manufacturing agreements were twice as likely as non-metals manufacturing to have quality indicators in their agreements in the earlier period but the gap has since closed considerably.
- Around one-third of agreements in manufacturing during both time periods contained output indicators related to such matters as units produced per shift, cycle times and a range of other measures. The proportion is higher in metals, especially in the earlier period.
- The proportion of agreements containing cost indicators fell from one-third to one-quarter. These indicators include downtime, operating costs, and direct unit labour costs amongst others.

The situation changes quite markedly when it comes to performance pay, gain sharing, share acquisition and bonus payments. In the earlier period only 2.1 per cent of all manufacturing agreements had performance pay arrangements. No agreement had share acquisition arrangements, while less than 1 per cent had gain sharing or bonus arrangements. In the later period, just over 7 per cent included some form of performance pay linked to individuals, teams or other arrangements. Less than 4 per cent of agreements had gain-sharing arrangements related to all plant employees, while share acquisition and bonus arrangements were included in less than 2 per cent of all agreements in manufacturing.

4. Trends, Prospects and Key Issues

We discussed these results with officials of the Australian Manufacturing Workers Union (AMWU).[11] With respect to both the issues addressed and wage outcomes generated, the results are consistent with the Union's experience and objectives. Most estimates of hourly labour productivity in manufacturing over the 1989/90 to 1994/95

10. The indicators included in DIR's agreement database relate to output, financial performance, quality, cost and human resources/labour. Some of these are classified (where possible) by DIR's agreement analysts as developed, not yet developed or unclear. The summary in the tables covers cost, quality, and output indicators, but only in the broad sense of whether they were included/mentioned in manufacturing agreements.
11. The AMWU is Australia's largest manufacturing union and has been involved in many of the agreements reached.

period show trend annual increases around 4 per cent. Further, there are improvements in productive performance across a wide range of plants and significant improvements in a smaller group. From the late 1980s through the mid 1990s real wage increases have been achieved for manufacturing workers. This contrasts to the real wage reductions of the 1984/85 to 1989/90 period, when unions gave and honoured 'no extra claims' commitments in a high inflation, centralised wages system.

In our judgment the wage increases in manufacturing are sustainable due to the improvements in productive performance that have been achieved. This is consistent with inflation outcomes over the same period. Three significant factors are required to maintain these trends.

First, it will be imperative to increase the number of plants achieving significant improvements in productive performance. A critical issue here is the quality and capacity of Australian management. While a small number (perhaps 10 per cent of plants) have or are approaching world-class management, there is a real concern about the capacity of management to meet the challenge in moving average-performing plants towards best practice and low-performing plants to a higher standard.

Second, success in restraining both underlying and headline inflation will be crucial. Officials recognised that it was a lot easier to negotiate real wage increases and promote improved productive performance in a low-inflation environment.

Third, new investment in plant and equipment must be sustained at high levels for the rest of the decade. This will challenge both the external accounts, and monetary policy.

Perhaps the strongest view expressed was the acknowledgment that the reduction of real wages in the 1980s, the tariff cuts of 1988 and, since 1991, the realities of international competition and unacceptably high unemployment, had required the Union to focus on more comprehensive and innovative strategies for improving productive performance at the enterprise level.

There is a strongly-held view in the AMWU (and the ACTU) that traditional measures of capital and labour productivity are at best partial indicators of the progress being made in generating wealth.[12] The concept of 'productive performance' adopted by the Union from studies undertaken by the Massachusetts Institute of Technology is the dominant theme one finds in many of the Union's publications provided to members to assist them in collective bargaining. While noting traditional measures of labour and capital productivity, the AMWU emphasises that:

> 'productive performance is a broader measure of economic vitality. The productive performance of a firm or industry is composed of it's productivity and of various other factors that tend to be ignored in most economic statistics such as quality, timeliness of service, flexibility, speed of innovation and command of strategic technology' (AMWU 1994).

It is against this background[13] that Union officials and shop stewards involved in plant level negotiations have encouraged the development and implementation of productivity

12. Measures of 'capital' productivity may have some utility in partial analysis within sectors, but for macroeconomic purposes they tell us little. Labour productivity measures are of little use in partial analysis, but have some meaning as economy-wide indicators of scope for real wage increases for given shares of national income.
13. This conception is central to the AMWU's approach to enterprise bargaining; see the joint ACTU/MTFU submission to the September 1991 National Wage Case (Exhibit ACTU 1, D.165/91).

measurement to: create an awareness of productive performance within an organisation by focusing on existing activities; to establish a profile of existing performance from which to plan for future improvements; to provide ongoing mechanisms for a continuation of the productivity improvement process; and to provide ongoing mechanisms for the monitoring, analysis and evaluation of changes introduced.

The very low level of agreements incorporating gain sharing, performance pay, bonus or share acquisition schemes was also consistent with the AMWU experience.[14] However, it was acknowledged that some forms of alternative payment systems were being introduced in Australia and overseas to complement more important changes.[15] To this extent, the AMWU's preference is to develop a range of indicators to measure improvements in productive performance, have them taken into account by the plant's consultative committee, and use them where they assist the plant in improving productive performance. Any benefits to be introduced through gain sharing are usually additional to the agreed increases in the shop rate of pay and distributed where possible on a plant-wide basis.[16] While employee share-ownership schemes were not prominent in manufacturing, it was noted that where they did exist they were more likely to be dealt with outside the formal enterprise bargaining agreements.

The AMWU considers that agreements reached to date in manufacturing have put into place the basic infrastructure of consultative committees and a training agenda. There is emerging an alliance of sorts around what might be termed the concept of the 'high performance enterprise'. Both unions and employers have moved some considerable way towards agreed approaches to improvements in productive performance.

However, there remain a number of challenging, threshold matters to be addressed in future negotiations. One is to enhance the capabilities of management, particularly those in front-line positions who are often threatened by the devolution of decision making to work teams and by other aspects of workplace change. Another is improving the long-term strategic focus of senior management, particularly in those manufacturing plants that had given little attention to export market and product development. Too many issues still get put aside under the justification of managerial prerogative. Critical amongst these is new investment. For its own part, the AMWU accepts the need to further develop the training and skills of shop stewards and officials to enable them to deal with more demanding negotiations, construction of appropriate performance indicators and the all important implementation of change.

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14. During the earlier period, many employers had 'tried to introduce such systems as a substitute for all or part of any wage increase'; many of the schemes were 'imported from overseas without adapting them to the local circumstances of the Australian plant'; many were 'overly complex' and some simply represented 'new fads to introduce old-fashioned short-term cost cutting'. Workers at an enterprise level had frequently rejected the proposition that they carry the risk for management ineptitude/incompetence, especially when responsibility for key decisions affecting performance was retained by management.
15. These include the removal of Taylorism, changed job design, national skills standards, introduction of teams, competency training, decision making by the workforce, changed work organisation, and restructured career paths.
16. Several cases were mentioned where such systems had not worked for a variety of reasons. For example in some cases they were overly reliant on the performance of one part of the plant's operation. When this wasn't working properly the whole plant would suffer and disputes over who was to blame, rather than how to improve it tended to occur.

5. Enterprise Agreement Provisions: Diversity and Scope

Since late 1990, unions have pursued enterprise bargaining in the Accord framework, and have always addressed a broad agenda of issues. The quality and scope of recent agreements varies across sectors, industries and workplaces. During the first quarter of 1995, 655 agreements were certified, 400 in the non-metals private sector, 73 metals agreements and 182 public-sector agreements. Of the public-sector agreements, over 120 arose from municipal council restructuring or hospital amalgamations and did not address wages or productivity issues. In the non-metals private sector, 150 arose from manufacturing, 31 from construction, 68 from transport, the remainder spread across finance, mining, wholesale/retail trade, oil and gas, plumbing, and electrical contracting.[17]

The samples set out in the Appendix are drawn from that pool. The tables list the performance indicators and productivity measures included in agreements in the private and public sectors. Other issues addressed include work systems, productivity/service delivery processes, employment practices, consultation, long-term (strategic) planning, and short-term cost-cutting measures. Table A4 lists some target variables under these headings.

6. Summary and Conclusion

Microeconomic reform in the Australian labour market over the past decade has been extensive in its scope, and is continuing. It is a system-wide program of regulatory review and reform, not simply *de*regulation. The wages system has been harnessed to promote and support implementation of changes enabled by the reform program, in workplaces across the country.

Today the process of wage bargaining typically involves negotiation of workplace change as well. The formal requirements of award restructuring have filtered through into agendas, attitudes and discussion at workplace level. Change has been both structural (formal) and cultural. Though not discussed in this brief paper, overhaul of vocational education and training arrangements and labour-market programs has buttressed this change in the award system. In our judgment, the consequences of this embrace of change and reform will continue to percolate through to the macroeconomic aggregates over the remainder of the decade. Prospects are for low inflation and high real growth in the years ahead.

Microeconomic reform in the labour market is one amongst several issues at the heart of the Accord. Another is the distribution of national income. Both micro reform and distributional settings impact on inflation and growth. Accord Mark VIII, agreed on 22 June, continues this broad Accord agenda, potentially through to March 1999 (ACTU 1995). Entitled ‘Sustaining Growth, Low Inflation and Fairness’, it explicitly promotes the cause of improved productive performance in Australian enterprise, accepting that wage increases not so related must be limited. Parameters are established for safety-net wage rises, for the next four years. Public sector agreements will be related to productivity and other considerations.

17. These data are drawn from the ACTU Labour Information Network enterprise agreement database.

There is strengthened agreement regarding the goal of underlying inflation averaging 2 to 3 per cent over the course of the business cycle, and clear acceptance of the need for policy adjustment if it is in jeopardy. (In this respect, Accord VIII reflects in policy a presumed connection between low inflation and high real growth, which is consistent with the findings of Andersen and Gruen in this Volume.) Nonetheless, the proximate goal of 600,000 net additional jobs by March 1999 is fundamental, and puts a 5 per cent unemployment rate by the turn of the century within reach. Having regard to recent and prospective enterprise bargaining outcomes, Safety Net Adjustments, special cases, and employment growth, our sums say that aggregate wages growth under Accord VIII will prove consistent with the inflation goal and, indeed, underpin its achievement. If achieved, this would stand Australia in good stead for continued high rates of low-inflationary real growth into the next century.

Appendix: Enterprise Agreements

Table A1: Commonly-Used Performance Indicators

Productivity	• Volume of product available divided by number of employees • $ value of sales divided by labour hours
Quality	• Percentage of rejects • Percentage of reworks • Percentage of waste
Reliability	• Number of service calls over time • Number of warranties returned over time
Cost effectiveness	• Mix of product to waste • Maintenance costs per labour hour of production • Inventory damaged in store
Throughput	• Change-over time • Waiting time • Down time • Internal delivery time
Timeliness	• Response time to call outs • Turnaround • Delivery time to a customer • Repair turnaround time
Safety	• Injury rate • Number of safety breaches per month
Environment	• Spills/emissions • Environment audits

Table A2: Key Performance Indicators in Three Agreements

Smorgan Fibre Containers Agreement	The Agreement targets improvement in product quality, customer service levels, response time; and cycle time; as well as reduction in waste. It also targets improvement in work organisation and job design, and improvement in labour flexibility.
State Transit Authority of NSW (Balmain Ferry Maintenance Centre) Agreement	The key performance indicators include absenteeism, level of lost time through injuries, industrial disputation, average docking costs; and level of commercial activity. A monthly consultative committee is established with access to all financial information and monitors results.
James Hardy Pipelines Wangara Certified Agreement	Includes productivity standards such as per cent of rejects, tonnage of re-work, product weight variance to be less than 1 per cent, customer returns below 2 per cent; and machine down-time MRP.

Note: None of these agreements uses the performance indicators in isolation. For example the James Hardy Pipelines Wangara Certified Agreement includes a career development plan which will see a new 4 level skills matrix introduced, and aims to improve channels of communication, facilitate team work and decision making closer to the job.

Table A3: Use of Productivity Measures in Three Public Sector Agreements

Federal Court of Australia Agreement 1994/95	Goals include best quality service to the community, superior case flow management, a challenging and rewarding work environment, innovation in court administration, and excellence in administrative and legal decision making.
Australian Capital Territory (Enterprise Bargaining – Teachers) Agreement 1994	Provides for review of organisational structures to better utilise resources and reduce duplication; and to achieve quality management – AS 3904-2-1992; environmental efficiency through energy audits; and compatibility of technology across the service. It also commits to review arrangements for motor vehicles; provides for consideration of grouping penalty payments; and to review leave for workers with family responsibilities.
Department of Admin. Services Interiors Australia Agency Productivity Agreement 1994	Aims for continuous improvement, with introduction of quality assurance systems and use of project plans minimising rework. Specific targets include documentation standards and quality; invoicing processes; 'finishing the last 5 per cent'; and environmental best practice. The Agreement establishes feedback mechanisms (experiential learning). Three performance indicators are: Utilisation rate = billable time/total time Profitability = net margin/total sales Debtor days = value of outstanding invoices x 365/total sales Customer satisfaction will be monitored by customer survey.

Table A4: Matters Addressed in Enterprise Agreements

Work systems	Introduction of teams; employee involvement groups; job rotation; involvement of production workers in quality processes; and demarcation.
Production/service delivery processes	Implementing quality management; service standards case management; introduction of information technology; manufacturing resource planning; 'Just in Time' inventory process; 'finishing the last 5 per cent'.
Employment practices	Investing in skills development; removal of status barriers between management and workers; and recruitment practices.
Consultation and long-term planning	Employee involvement in strategic direction; union involvement; corporate goals and philosophy.
Short-term measures	Using casual, part-time and fixed-term contracts of employment (use of non-permanent staff now identified in a small number of agreements as a barrier to long-term productive reform); changes to working hours; averaging penalties; absenteeism; annualised salaries.

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Discussion

1. Henry Ergas

Case studies of industry restructuring all too often fall into two literary genres. The first is the ‘Boy’s Own’ school of analysis, full of villainous foreigners, visionary heroes, courageous gestures and ultimate triumphs – readers of Peter Roberts’ column, in which the brave Aussie battler invariably wins the day, will immediately recognise the style I have in mind. At the other extreme, and especially well-represented in the writing of economists, lies the cautionary tale. Like fallen maidens, firms, industries and countries are shown to lose their way; and regardless of the efforts they might subsequently make, virtue once lost is almost impossible to regain – although, extreme penitence and liberal self-flagellation may help, and are in any case widely seen as being their own reward.

The papers presented in this session mercifully avoid these approaches and provide a useful basis for examining aspects of the Australian experience. The industries they cover differ greatly, as do the changes they discuss. Yet there are some common elements, and it may be helpful to bring them out. Viewed as a whole, they suggested a profound change in the way Australian business operate – one yielding greater efficiencies, but not at zero cost.

BHP

The BHP story highlights the old way of doing things. Well into the 1980s, insular and indifferent management, sheltered both from real competition in product markets and from the threat of take-over, made little effort to modernise plant and equipment, to cut costs, and gain new markets. Thus, in 1954, just as world steel trade was set to expand, BHP’s Chairman, while noting that ‘unquestionably the current demand ... exceeds our present capacity’, argued against expanding to meet export needs because ‘the cost of freight from Australia to export markets is such that our steel can only be exported at satisfactory prices when a steel shortage exists throughout the world. ... Sound expansion can only take place at a rate in step with the overall home market’ (Syme 1954, p. 173). Thirty years later, similar views were echoed in BHP’s evidence to the Industries Assistance Commission; and when the Commission queried the slow pace at which new technologies were being introduced into the company’s steel making, it was told that ‘although [the company] acknowledged that its plant is old and does not embody the latest available technology ... it (noted that) the adoption of modern technologies would not necessarily result in lower costs ... In view of the discrepancy between the depreciation on written down plant relative to the cost of new plant, the adoption of the latest technology will not result in a reduction in costs *in the short term*’ – the clear inference being that it was consequently not worth doing (Industries Assistance Commission 1983, p. 114).

Management’s ‘quiet life’ was strengthened by the compact with the labour force. The Award system took much of the job of management away from those whose job it was. Conflicts were accommodated, rather than resolved; conditions, once granted, became entitlements; and the frequent disputes were primarily a way of triggering a conflict-management system 'essentially as conservative as the unions and the company, and all ... appeared to be satisfied with the *status quo*; alternative methods of settling working conditions and disputes seemed unnecessary, and perhaps more to the point, unrealistic' (Hughes 1964, p. 172).

The changes which occurred in the 1980s – the reduction in border protection, the liberalisation of capital markets, the moves towards increased flexibility in the industrial relations system – had two effects: they made the old way of doing things unviable; and they pushed firms towards a new way, in which an increased orientation to world markets (encouraged by the more realistic level of the exchange rate) has been accompanied by the search for greater flexibility and an enhanced ability to cope with the disequilibria which competitive markets always create.

This last point is worth emphasising. The changes we observe in firm behaviour do not only bear on the level of costs – they also involve the structure of those costs, and the effects of that structure on the firm's risk. In particular, increased competition – both in the product market and in the market for corporate control – has led firms in a wide range of industries to seek lower break-even points: to find ways of being less exposed to high fixed costs in an environment where demand and prices are less predictable. One result of this is great caution in capacity expansion: an enhanced incrementalism, in which alternatives are sought to large, lumpy and irreversible expansions in plan. BHP's recently announced investment in electric arc technology is a case in point, because it so clearly trades off higher marginal costs for substantially lower fixed costs.

NAB

The NAB case study also highlights the gains being made in productive efficiency – and leads especially directly to a consideration of the impacts on employees. Three points need to be made by way of background.

First, compared to its domestic rivals, the NAB has invested more and better in information systems which allow it to support and monitor outcomes both for individual employees and at the branch level.

Second, given these systems, the NAB has gone a fair way in restructuring operations so as to separate activities which differ in terms of the continuity of their work-flow, the nature of the physical assets needed to support them, and the skills they involve. Most recently, the NAB has, in South Australia and Victoria, separated all the back-office operations out of its branches and centralised them, while extensively redesigning the tasks involved. At the same time, all telephone enquiries nation-wide are now handled out of a single location at King Street in Melbourne.

Third, drawing on improved knowledge of work-flows and required skills, the NAB has substantially increased the flexibility of its resource use. Under its first Enterprise Agreement, part-time employment increased to around 20 per cent of overall hours; together with temporary employment, it is set for further substantial increases under the second Enterprise Agreement which has now been negotiated.

Viewed as a whole, these changes should make it far easier for the NAB to respond to market change; but there is one aspect of these changes which is especially interesting, in my view, and which I would draw to your attention.

This is the use of information systems to track the performance of individual employees against quantitative targets. In the past, many activities had no specific performance targets set for them – for example, the time taken by counter staff to respond and clear down a telephone inquiry. Over the past decade, task redesign (as the consultants call it) has involved specifying tasks and task sequences in great detail, translating these into formal, task-support systems, defining goals for each step these systems identify, and establishing robust (usually automated) processes for measuring performance relative to the goal set. Three consequences of this, which are still far from playing themselves out in Australia, are clear when one looks at banks or indeed, other service activities, in the US.

First, among clerical and sales staff, firm-specific skills have become much less important than general skills (such as computer literacy) – so that firms have far fewer incentives to hoard white-collar labour during downturns. This, in large part, accounts for the increased cyclicality of white-collar employment.

Second, given relatively objective measures of individual performance, poorly-performing staff are likely to be identified and if necessary dismissed far sooner than was previously the case, while the remuneration of those who remain becomes far more dependent on performance-related and incentive pay. The result is increased intra-skill-group dispersion in earnings.

Third, given that shirking can be directly detected and corrected, the middle-management role is very much more limited, and indeed, in its purely supervisory form, tends to disappear.

These processes are at work in virtually all white-collar activities; and although their impacts on productivity are difficult to measure for all the reasons given in the Conference papers, they clearly have major effects on the structure of earnings and more broadly on social relations. They can do a great deal to help firms improve performance and cope with more rapidly changing market conditions; but it may well be that some part of the firm's increased ability to cope with risk is being obtained by shifting that risk back onto employees.

Pacific Power

This brings me to my third and last case study, namely Pacific Power. Here the impetus for improvement has come not from the product market – at least, not yet – but from the changing demands of the shareholder. The paper does a very good job of assessing comparative productivity levels and I have little to add to the analysis it presents. I wonder if there is not more to be said about the nature of the challenge ahead – or at least about the challenge which Pacific Power will face, when it is fully exposed to competition.

Again, the US experience is illuminating in this respect. What has become increasingly important in determining performance in the electrical industry over the past decade is the capacity to manage risk. As commercial pressures have forced down reserve margins, difficult issues have arisen about how and by who the risks involved in capacity expansion will be borne. With utilities ever more unwilling to bear uncompensated risk, the failure to adequately resolve risk allocation problems is now seriously distorting investment decisions in the industry, greatly increasing the likelihood of severe power outages. Similar issues will need to be addressed in the Australian market, but will be very much complicated if a uniform approach is not found among the relevant States, notably to the treatment of stranded assets. Given the political commitment to liberalising this market, it is relative to the demands of this inherently more complex and risky competitive environment, rather than against the benchmark of other monopoly carriers, that Pacific Power's performance needs to be gauged.

Conclusions

Although the circumstances dealt with in the papers differ greatly, many similarities can be identified. The one I have stressed is the importance being given in industry not merely to reducing cost but also – and perhaps especially – to better managing the uncertainties inherent in competitive markets. The old social compact which characterised Australian industry – protection all around, undemanding management and owners, and an industrial relations system which accommodated conflict (rather than trying to resolve it) – no longer exists. But even the largest firms are having difficulty in creating a new one. For the thousands of smaller firms, the uncertainties and challenges are even greater – as are the costs of failing to adjust.

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2. Barry Hughes

This cluster of papers is best seen as an extension of Philip Lowe's painstaking attempt to flesh out, at the micro level, the macro productivity results. As I understand the state of play, macro research tells us that for the non-farm market sector:

- labour-productivity (LP) growth was slow in the 1980s, but it is possible, though not certain, that the pace is better in the 1990s;
- capital-productivity (KP) growth jumped in the 1990s; and
- as a result of these two statements, it is easier to demonstrate a structural KP than a LP shift in the 1990s.

No doubt because of its wage connection, and its greater use in general debate, attention has been concentrated disproportionately on labour productivity. Throughout the period since the mid 1980s there have been expectations that a surge in labour productivity was just around the next corner, though in the event the path seems to have had more twists and turns than the Adelaide Grand Prix strip.

We can put down the relative labour productivity disappointment partly to impatience. Economy monitoring is often as exciting as watching the grass grow. Things take time to evolve, and some things take a very long time. But part of the disappointingly long time for the fruit to appear might have been due to earlier inappropriate expectations. What should we have expected about productivity growth? These observations go some way towards explaining events.

One fountain of change was the opening of the economy, and especially the rounds of tariff cutting. But this is a relatively recent development, with significant progress on tariffs really starting from the very late 1980s and early 1990s rather than the mid 1980s. Change might have been threatened in the earlier period, but that threat was not a new event. What was new this time was that the threat had enough strength to overcome the usual political opposition, a position that did not become self evident until the recession of the early 1990s. In any event the significant steps along the tariff cutting road were the statements of 1988 and 1990, with actual changes spread out way down the subsequent track.

Tariff cutting might have been expected to be as much a capital as a labour productivity story. What was strange about the old ‘fortress Australia’ policy was the proliferation of small-scale capital plants, with Premiers competing amongst themselves to secure ‘industries’ (never firms) for their own patch. Auto assembly was a classic 1960s/1970s result, with scattered single-shift plants in every mainland State, destroying capital productivity in the process. The most obvious waste to this immigrant’s eyes was one of capital rather than labour, and it has been no surprise that when the global competition blowtorch was fired up the first input to be economised was expensive capital (through second shifts and other extensions of plant usage over the working year).

A second, related, wellspring of change came from industrial relations dynamics. The two previous points can be repeated. Despite the hype, the change in industrial relations did not get underway until the very late 1980s at the earliest. Accords Mark III, IV and V of 1986 to 1989 were about disguising real wage reductions by shifting the focus of debate onto future gains from productivity growth, and then about distributing centralised wage gains in return for promises to think about productivity changes (and clearing up award structures), rather than implementing more efficient practice at the workplace. Enterprise bargaining is a trend of the 1990s rather than the 1980s.

Again it is just as easy to see this bargaining as a capital than a labour productivity story – in extended hours of operation of coal mines, retail stores (the unmentioned flip-side of Lowe’s account), banks, the hospitality sector and manufacturing. This is not to deny that some of the changes were planned to lift labour productivity; the point is that the labour changes were only part of the story (and possibly initially the minor part).

Labour productivity growth comes from both TFP growth (the object of bargaining change) *and* increased capital intensity. The period of the early 1990s when enterprise bargaining began to take hold just happened to coincide with severe recession, a slump in investment and stagnation of capital – labour ratios. In other words, through this period of the first half of the 1990s, whatever was being achieved by way of TFP (and there is some evidence of a structural lift) was being obscured in its impact on LP growth by an unusual absence of the contribution from capital intensity. Given this conjuncture, it is perhaps not surprising that it is difficult to find persuasive evidence of a first-half-1990s structural lift in LP growth. Only now, with stronger equipment spending, should we expect both LP proximate sources to be working together – an optimistic thought for the near future (yet another corner to turn with optimistic expectation).

The Papers

All of the foregoing should have cautioned us to expect long delays before obvious productivity gains showed up on the scoreboard. How do the papers fit and extend this story? They extend the story by pointing to special non-macroeconomic factors that *depressed* productivity in the 1980s.

Lowe's important stress on deregulation's impact on retail labour productivity (although he accepts too readily for my taste the proposition that measured sales value added was unaffected by extended hours – note that the saving ratio has fallen – and omits the capital productivity flip-side of the story). A similar story emerges from a study of hospitality sector labour productivity (again with potential capital productivity implications neglected).

Although the industry is defined out of the ABS 'market' sector, Alan Oster and Lawrence Antioch's discussion of financial sector trends could have told a parallel story. Retail banking deregulation led to new outlets being established in the 1980s, with traditional banks hanging on to their premises for fear of giving the new competition an easy entry. I do not know what should be allowed for the extra convenience of even more banking outlets (not much shoe leather), but this phase must have blunted, and perhaps even reversed, the labour-productivity benefits to be gained from the higher capital intensity of computerisation and ATMs. But it provides greater hope for the 1990s now that this deregulation detour is ending.

The New South Wales Treasury study draws attention again to yet another adverse special factor of the 1980s in the form of the consequences of hugely-disappointed energy demand forecasts strangling electricity TFP in that State as the large discrete additions of Eraring and Bayswater came on stream. There is hope for the 1990s both in the record to date, and in the extra flexibility in dealing with future capacity additions to be afforded by the interstate grid.

Of course, there ought to have been particular successes that would have helped offset these negatives. Steel is often cited as an example, but even starting from a poor position in 1981, Peter Demura's paper reminds us that physical labour productivity (tonnes per steelworks employee) grew only 26.9 per cent in the seven years to 1988. It was subsequently, especially in the period since 1991, that productivity surged. Things often take a long time coming to fruition.

Partly in this context, Peter Demura's paper was valuable also for its short account of the trials and tribulations of BHP's attempt to lift productivity in the Port Kembla slab caster. Following the failure of much capital expenditure and labour effort, output suddenly lifted 20 per cent in the two years after 1992. Demura attributes the dramatic breakthrough to learning by doing (properly through teamwork and what used to be called industrial democracy) rather than simply through capital expenditure. There seems to be a fertile field for in-depth case studies of this sort, untangling both the contributing factors to success and failure in productivity improvement and the time-scales that typically might be involved.

Adding in contributions from possible measurement errors (after Gordon and Lowe), some important new light on the dismal recorded productivity of the 1980s might have been generated by this Conference. We are reminded repeatedly of the old saying that ‘time is a device to stop everything happening at once’. In the productivity field, everything rarely seems to happen all at once, with events conspiring to slow gestation periods.

The Apple, Belchamber and Bowtell paper also talked at length about the people involvement in productivity promotion. Unions are now ‘for productivity gains and competitiveness’, but it is hard to discern what their role in all this is other than cheerleading from the sidelines. I went looking for an exposition of the positive contribution that teams might make (with unions having a potentially important role to play in team formation), but I came away disappointed from their paper. There is a long list of ‘motherhood’ statements, but no assessment whatsoever of whether the union involvement facilitated or hindered the process of change. There remains almost a virgin field for research in the area, following up the sort of mini-case study presented by Demura but, for the moment, the union-productivity connection remains largely a matter of politicians and journalists at 20 paces.

3. General Discussion

The discussion centred on three main issues addressed in each of the case studies:

- the motivation for productivity reform;
- the process of reform; and
- the challenges to sustaining this process.

A common feature of the case studies is that reform was motivated by some crisis or by demonstrably poor productivity performance that jeopardised competitiveness. Enterprises were compelled to address the question: how did we get into this mess? It would appear that existing practices proved unable to deliver adequate productivity performance in the presence of shocks or the threat of increased competition.

It was noted that while initial responses related to cost cutting and rationalising resources, there were subsequent changes in the organisation of work and organisational culture that led to greater ‘production consciousness’. It was emphasised that this consciousness was not confined to enterprises. It was also recognised by the union movement which has undertaken reforms that complement those of enterprises. This represents a new form of collaboration, at the enterprise level, to achieve common goals of economic performance.

Despite these important changes, though, it was argued that much of the improvement in productivity observed to date might be described as recovery from ‘bad luck’ or ‘bad mistakes’. If so, the productivity benefits of microeconomic reform might, in fact, be small. A widespread view was that the next major change in productivity performance can only be achieved through technological advance.

Consequently, in the interim, it was questioned whether Australian enterprise will be able to achieve world best practice. Indeed, it was argued that Australia is sufficiently behind world best practice that we are a candidate for technological catch-up, in contrast to the messages of the Dowrick paper. In reply, it was proposed that microeconomic reform is in many ways a response to the threat of other nations catching up in levels of per capita income, so that the process of catch-up and convergence is a continual chase.

Finally, it was suggested that concerns about the performance of individual enterprises or industries relative to world leaders should be tempered with the knowledge that no country has a monopoly on world best practice: all countries have scope for improving productivity in some sectors. Best practice is, itself, perhaps the most mismeasured concept.

Growth in East Asia: What We Can and What We Cannot Infer From It

Michael Sarel*

‘In a world full of countries desperately trying to get richer, the winners become influential models for the rest. But exactly what is it that accounts for their success? This isn’t merely an abstract academic debate. The consensus tends to get built into the policies of dozens of ambitious countries, affecting patterns of world trade and much else’ (Washington Post 1995).

1. Introduction

It is now widely accepted that many countries in East Asia achieved a remarkable record of high and sustained economic growth. This achievement is possibly one of the most important economic developments in the past generation. Explaining East Asia’s success is extremely important, for at least two reasons. First, such an explanation might show the way to replicate this success in other regions of the world. Second, even if East Asia’s success is not replicable elsewhere, there is an urgent intellectual need to solve the puzzle of the phenomenal East-Asian growth rates. After all, not being able to explain such an important economic phenomenon would be a major defeat for the economics profession.

Despite the impressive number of research papers, books and articles published in recent years about the high-performing East-Asian economies, there is very little agreement on the main determinants of their success. Many economists describe the growth performance of the East-Asian economies – in particular, of Hong Kong, Korea, Taiwan and Singapore – as ‘miraculous’. Ironically, they also offer plenty of possible explanations for these miracles. These various explanations are diverse and use different categories of arguments. They are, if nothing else, a testimony to the creativity and cleverness of their authors.

The abundance of literature on the East-Asian miracle created a number of independent (and sometimes contradictory) explanations, feeding an ideologically charged debate that crosses many interdisciplinary boundaries. The number of these explanations vastly exceeds the number of miracles that have to be explained. To put it differently, there is a severe problem with the number of observations that can be used to discriminate between the different theories. Accordingly, the main objective of this study is not to present new evidence or theories on East Asia’s success. Instead, it attempts to critically review the different arguments and the main points raised by the studies that have already

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* The author would like to thank Palle Andersen, Michael Kremer and Bart Turtelboom for helpful comments. The views expressed in this study are those of the author and do not necessarily represent those of the International Monetary Fund. The term ‘country’, as used in this study, may not refer to a territorial entity that is a state as understood by international law and practice; the term may also cover some territorial entities that are not states but for which statistical data are maintained and provided internationally on a separate and independent basis. In order to be concise, this study refers to Taiwan Province of China as ‘Taiwan’ and to Republic of Korea as ‘Korea’.

addressed these issues, presenting some of their most important arguments and counter-arguments. The few original arguments in this study highlight problems associated with the existing analysis of East-Asian success.

The attempt to analyse some of the views in this debate inevitably concentrates only on some of its most important dimensions leaving out many interesting aspects.[1] In this study, the debate is classified along four main dimensions:

- the debate about the nature of economic growth in the fastest-growing Asian economies – that is, whether it was driven by productivity growth or massive factor accumulation;
- the debate about the role of public policy in general and, in particular, the role of selective interventions in promoting growth;
- the debate about the role of high investment rates and a strong export orientation as possible engines that drive the rapid economic growth in East Asia; and
- the debate regarding the importance of the initial conditions in economic growth and their relevance for policy.

Accordingly, the paper is organised as follows: after a very quick review of the main facts about growth in East Asia, it deals in turn with each one of the four dimensions of the debate. Finally, it offers some concluding remarks.

2. The Facts

The growth experience of Asian countries during the past generation is quite remarkable. As Figure 1 shows, the average growth rate achieved by the Asian continent is higher than the growth rates of any other region in the world. Since Asia is by far the largest and the most populous continent, it is natural to divide it into smaller regions and to compare the growth performance across the Asian countries. Figure 2 shows that the higher growth rates of the Asian economies (relative to the non-Asian economies) is fully explained by the superior performance of the eastern half of Asia, a region that includes the following ten countries: China, Hong Kong, Japan, Korea, Taiwan, Indonesia, Malaysia, the Philippines, Singapore and Thailand. The western part of Asia, as well as the Indian sub-continent, experienced rates of growth that are very similar to those of non-Asian countries.

Figures 3 and 4 go one step further and show the growth performance of each of the ten countries in East Asia. Here we can observe a large degree of variation between the individual economies. The worst performing country in this region, the Philippines, experienced a growth rate similar to the non-Asian economies, less than 2 per cent per year. Five of the countries (China, Japan, Indonesia, Malaysia and Thailand) achieved growth rates of around 3-5 per cent. These excellent growth rates are quite impressive, but are still modest in comparison with the phenomenal growth rates experienced by Hong Kong, Korea, Taiwan and Singapore. These countries, which came to be known as the

1. For example, it is beyond the scope of this study to consider the importance of geographic locations on the process of growth, or to address the promising theories about the non-monotonic dynamics of economic growth (suggested by Sarel (1994) and Ito (1995)), in which middle-income countries can 'take-off' and grow faster than either rich or poor countries.

Figure 1: World Growth
(1960-1990)

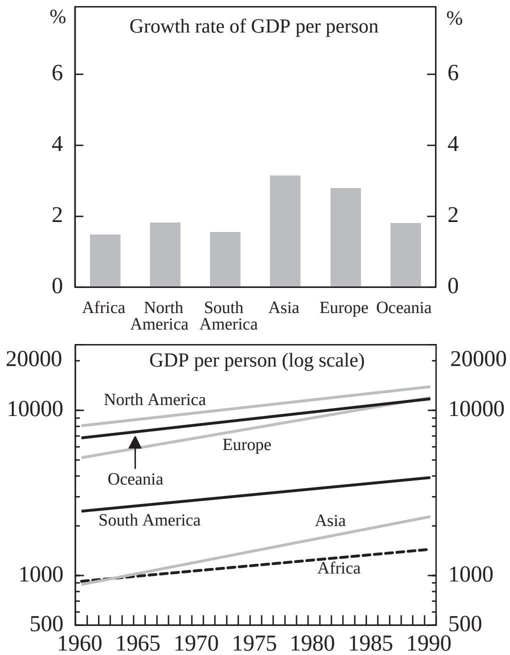


Figure 2: Asian Growth
(1960-1990)

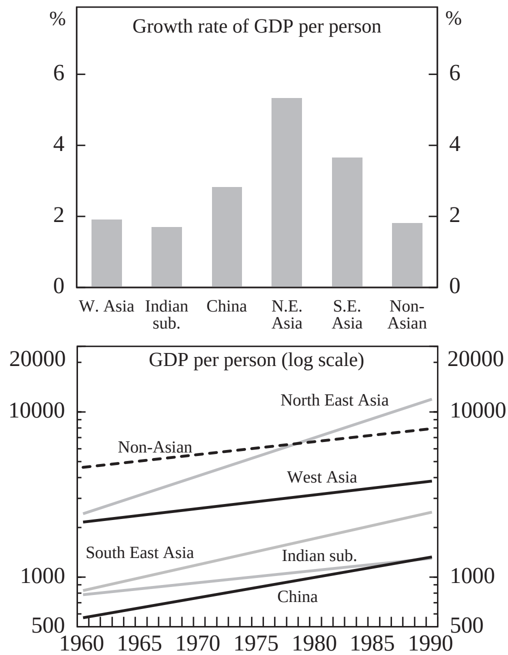


Figure 3: Growth in North-East Asia
(1960-1990)

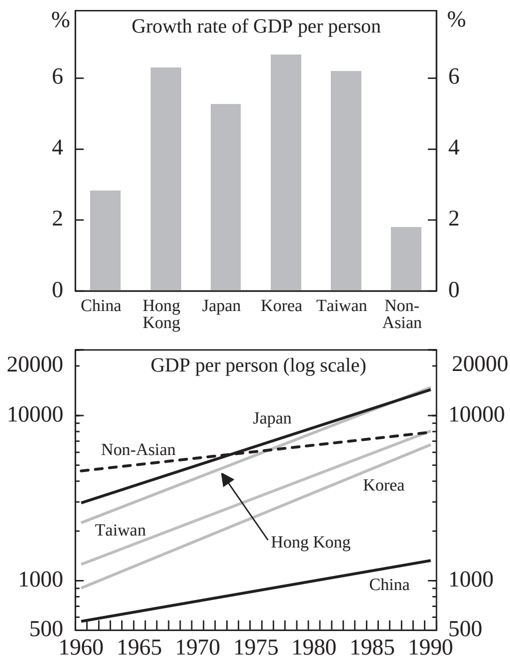
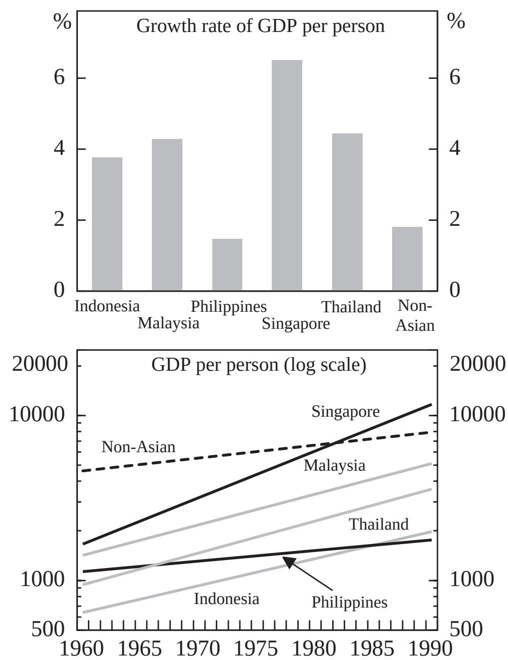


Figure 4: Growth in South-East Asia
(1960-1990)



Note: GDP per person measured in PPP 1985 dollars.

'Four Tigers', were the strongest performers, all four having similar annual growth rates of output per person, well in excess of 6 per cent. One simple reading of these results can show why these growth rates, sustained over a 30-year period, are simply amazing: while the average resident of a non-Asian country in 1990 was 72 per cent richer than his parents were in 1960, the corresponding figure for the average Korean is not less than 638 per cent.

3. The Nature of Growth: Productivity or Factors Accumulation?

This section presents the big debate about the nature of the growth process in East Asia, and in particular in Hong Kong, Korea, Taiwan and Singapore. This debate has profound implications about the future of the growth process in East Asia. It also raises difficult questions regarding the aspiration of other countries to imitate the East-Asian success. But first we have to introduce the basics of growth accounting, a simple method used to decompose growth rates, which lies at the centre of the arguments presented in this debate.

3.1 Some Simple Growth Accounting

The Cobb-Douglas production function is defined as:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \tag{1}$$

where Y is the amount of output, A is a technological constant, K is the amount of capital used as input, L is the amount of labour used as input, t is a time subscript and α is a parameter with a value between 0 and 1.

This production function, with a value of α around one-third, is often used to approximate the production possibilities of the economy. The reason is that it has many properties that we tend to observe in the national economies, such as constant returns to scale and constant factor income shares (with a capital share of α and a labour share of $1-\alpha$).

Dividing equation (1) by the population size, we get:

$$y_t = A_t k_t^{\alpha} l_t^{1-\alpha} \tag{2}$$

where y is the output per person, k is the capital per person and l represents labour per person (or the labour participation rate).

Equation (2) is a static equation. It represents the amount of output, as a function of inputs, in any specific period t. But from it, we can derive a dynamic version that describes how output per person increases over time:

$$\frac{\Delta y}{y} = \frac{\Delta A}{A} + \alpha\frac{\Delta k}{k} + (1-\alpha)\frac{\Delta l}{l} \tag{3}$$

Equation (3) decomposes the growth rate of output per person into three elements: the first element describes the growth rate of productivity (this term is also called the growth of total-factor productivity (TFP), the rate of technological progress, or the Solow residual); the second element describes the contribution of the capital stock per person growth rate; and the third element describes the contribution of the labour participation growth rate.

The decomposition done in equation (3) has a very important empirical application. We have a good idea about the magnitude of the parameter α (about one-third), it is easy to measure the growth rate of output per person, and it is possible, in principle, to measure the capital per person and the labour participation growth rates (the second and the third terms in (3)). Therefore, we can estimate the growth rate of technology (or productivity) and calculate the proportion of output growth per person attributable to this technological progress.

The growth decomposition in equation (3) also leads to an interpretation that plays a fundamental role in understanding long-run growth. It points out that a significant and sustained rate of technological progress is the only possible way, in the long run, for an economy to achieve a sustained rate of growth of output per person. The intuition for this result is that the labour participation rate can only increase for a while, but obviously cannot increase without bounds in the long run. Furthermore, higher growth in capital than in labour will lead to diminishing returns to capital with output growth falling over time, even if capital growth is maintained. Therefore, in order to achieve permanent growth, an economy must continuously improve its technology. This kind of growth is called 'intensive growth'. In contrast to intensive growth, increasing output by increasing inputs ('extensive growth') can work only for a limited period, but it cannot last too long.

In a famous study, Solow (1956) conducted a growth accounting exercise such as the one suggested by equation (3). Not surprisingly, he found that technological progress accounts for most of the growth of output per person, while accumulation of capital and changes in the participation rate play only a minor role. Since then, many other studies confirmed again and again that technological progress plays the major role in long-run economic growth. Accordingly, the traditional view about the success of the East-Asian countries emphasised the role of technological progress in the high growth rates achieved by these economies, and indeed most of the attention focused on the fast 'technological catch-up' in these economies.

3.2 A Contrarian View: The Extensive Growth Hypothesis

The collapse of the Soviet economy around 1990, after its apparent success in the previous decades, caught most people by surprise. Among many economists, the favourite explanation of this economic collapse is the 'Extensive Growth Hypothesis'. Easterly and Fischer (1994), among others, argue that the Soviet economy ran into inevitable diminishing returns after many decades of extensive growth caused by massive accumulation of capital not accompanied by technological progress, just as predicted by the growth-accounting framework.

This extensive growth hypothesis raises serious concerns about other economies that invested heavily during the past decades, and in particular some of the East-Asian countries. This comparison is explicitly made by Krugman (1994, p. 70):

> 'The newly industrialising countries of Asia, like the Soviet Union of the 1950s, have achieved rapid growth in large part through an astonishing mobilisation of resources. Once one accounts

for the role of rapidly growing inputs in these countries' growth, one finds little left to explain. Asian growth, like that of the Soviet Union in its high-growth era, seems to be driven by extraordinary growth in inputs like labour and capital rather than by gains in efficiency.'

These dramatic conclusions convey a very pessimistic message:

- The process of economic growth in the most successful economies in East Asia is not at all miraculous: it is just the expected outcome of massive accumulation of inputs.
- The path of growth that these economies followed in the past 30 years is not sustainable. Sooner or later, they will experience a dramatic decrease in their growth rates.
- The societies in these countries paid a huge price for achieving these impressive growth rates: they sacrificed a large amount of consumption and of leisure. Therefore, even if their so-called success can be replicated in other countries, it is probably not wise to do so.

The main issue, of course, is if the nature of the East-Asian growth process is indeed extensive, as Krugman concludes, or rather intensive. The 'extensive' view is based mainly on the research of Young (1992, 1994a and 1994b) and of Kim and Lau (1994). Young (1994b), for example, documents the fundamental role played by factor accumulation in explaining the extraordinary post-war growth of Hong Kong, Singapore, South Korea and Taiwan. His main conclusion is that '... one arrives at total factor productivity growth rates, both for the non-agricultural economy and for manufacturing in particular, which are well within the bounds of those experienced by the OECD and Latin American economies over equally long periods of time. While the growth of output and manufacturing exports in the newly industrialising economies of East Asia is virtually unprecedented, the growth of total factor productivity in these economies is not' (Young 1994b, p. i).

In a different study, Kim and Lau (1994) compare the sources of economic growth of the Four Tigers (Hong Kong, Korea, Taiwan and Singapore) with those of the G5 industrialised countries (the United States, Japan, West Germany, France and the United Kingdom). In this study, Kim and Lau use a new empirical methodology for estimating the relationship between aggregate output and inputs, including technical progress, from inter-country data, called the 'meta-production function'. Their conclusion is that '... the hypothesis that there has been no technical progress during the post-war period cannot be rejected for the four East-Asian newly-industrialised countries. By far the most important source of economic growth of the East-Asian newly-industrialised countries is capital accumulation, accounting for between 48 and 72 per cent of their economic growth, in contrast to the case of the Group-of-Five industrialised countries, in which technical progress has played the most important role, accounting for between 46 and 71 per cent of their economic growth'. Furthermore, they found that '[a]n international comparison of the productive efficiencies of the G5 countries and the East-Asian newly-industrialised countries indicates no apparent convergence between the technologies of the two group of countries' (Kim and Lau 1994, pp. 235-236).

The results of the two studies just described can have a large impact on the views of many economists on the nature of the growth process in East-Asian countries, and on their role as models for others. But how conclusive are these results? Given the simplicity of the growth-accounting theory, it appears that there should be no significant problems associated with this type of exercise. But in practice things tend to become very complicated. In general, as the next section will demonstrate, the conclusions based on these kind of studies are not very robust, but rather sensitive to the specific assumptions of each particular study.

The main reason for this sensitivity is the estimation process of the capital stock growth rate during the period studied. It is extremely difficult to estimate the capital stock in the base period, especially in the case of countries like the Four Tigers, for which there are no good data before 1960. Such an estimation is usually based on heroic assumptions regarding the depreciation rate of the capital stock and the investment flows in the period that precedes the beginning of the period studied. For example, what are the depreciation rates of the different types of capital? Are they equal across countries and across industries, or are they higher in the case of the fastest-growing economies? What method of extrapolation is being used to estimate the investment flows in the past? And what is the period that is used as reference for this extrapolation?

Additional significant problems are estimating the income share of capital (α) and the amount of labour per person (l). For example, should α be allowed to differ across countries and across industries? Should the official statistics regarding the labour participation be trusted? Is the amount of effective work proportional to the number of hours that people work, or does working extra hours lead to diminishing returns? And should the different types of labour be summed together? Most importantly, how should human capital be treated?

Even the most clever solutions to these problems cannot provide a categorical and irrefutable answer regarding the nature of the growth process, certainly not in the context of the East-Asian economies. Therefore, the results presented in studies such as those just described should not be regarded as definitive. Instead, they should be viewed as interesting, but only suggestive. More research, and certainly more time-series data, are required before reaching significant conclusions about this important issue.

3.3 Back to Growth Accounting: Some Counter-Contrarian Evidence

In this section, we conduct a growth-accounting exercise along the lines suggested by Young (1994a). Our database is the (PWT5.6a) update for the Summers and Heston (1991) database, and the period studied is 1960-90. The values for the different parameters and the method of extrapolation are conventional: the log of total investment during this period is extrapolated backwards, up to 1900; the capital stock is assumed to be 0 in 1900, and to subsequently increase by the investment flows, less depreciation; the values of the depreciation rate and of α are assumed to be, respectively, 0.04 and one-third; and we estimate the growth rate of the capital stock (and of productivity) only for the period 1975-90, trying to reduce the problems associated with the estimation of the capital stock in the base period.

The growth-accounting exercise conducted in this section does not attempt to improve upon or to compete with the results obtained by Young (1994b) and by Kim and Lau (1994). Both these studies are excellent exercises, carefully conducted and presented.

The only intention of this exercise is to demonstrate the general fragility of conclusions about the nature of the growth process in East Asia.

Figures 5 to 8 describe the results of this growth accounting exercise. Figure 5 compares the growth rates of output per person of the Four Tigers with those in the rest of the world during the periods 1960-75 and 1975-90. The first four bars in this figure describe the growth rates of Hong Kong, Korea, Taiwan and Singapore. The fifth bar describes the simple average of the growth rate during the same period of other 100 countries, representing the rest of the world ('row'). The sixth bar represents the mean of the growth rate in the rest of the world, plus 1.96 standard deviations ('row+1.96sd'). Assuming a normal statistical distribution, 95 per cent of the growth observations are expected to be found within 1.96 standard deviations of the mean value. Accordingly, there is a statistical chance of only 2.5 per cent that an economy will experience a growth rate higher than the value represented by the sixth bar. We define growth rates as 'high' if they are above 'row' but below 'row+1.96', 'very high' if they are around the 'row+1.96sd' value, and 'outstanding' if they exceed this value. Figure 5 shows that the growth rates of Hong Kong, Korea and Taiwan were 'very high' in the 1960-75 period and 'outstanding' in the 1975-90 period, while the growth rate of Singapore displayed the opposite pattern. (Therefore, the growth rates of the Four Tigers during the extended period 1960-90 do indeed deserve to be described as miraculous.)

Figure 6 describes, in the same manner, the growth of labour participation. The growth of labour participation was in general 'high' for the Four Tigers in both periods, and was 'outstanding' only for Singapore in the period 1960-75. In Figure 7, the first panel describes the growth rate of capital per person during the period 1975-90.[2] The rate of capital accumulation was 'high' in Hong Kong, 'very high' in Taiwan and Singapore, and 'outstanding' in Korea. The second panel of Figure 7 describes the final result of this growth accounting exercise: the estimated rate of productivity growth during the period 1975-90. We find this rate to be 'outstanding' for Hong Kong, 'very high' for Taiwan, something between 'high' and 'very high' for Korea, and 'high' for Singapore.

Figure 8 compares the productivity growth rates in the Four Tigers during 1975-90 with those achieved by Japan and the United States during the same period. The first panel shows that the productivity growth in all Four Tigers exceeded by far the productivity growth in the United States. Three of the four (except Singapore) also experienced higher productivity growth than Japan. The second panel of Figure 8 describes the proportion of growth of GDP per person that is explained by productivity growth. It demonstrates that, in the case of the Four Tigers, this proportion was not systematically different from those of Japan and the United States: for Hong Kong and Taiwan it was slightly higher, while in the case of Korea and Singapore it was slightly lower.

The conclusion that emerges is the following: although the Four Tigers accumulated capital and increased labour participation at a much faster rate than other economies, the increase in these two factors far from fully explains their exceptional growth rates; productivity growth also accounts for a significant fraction. In the case of Hong Kong, Korea and Taiwan, their productivity growth rates are as outstanding as their growth

2. For the reasons described above, we do not attempt the estimation for the period 1960-75.

Figure 5: Growth in the Four Tigers
(1960-1975 and 1975-1990)

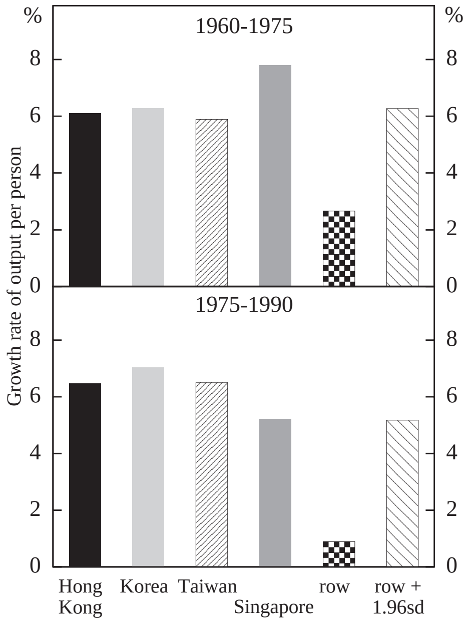


Figure 6: The Four Tigers' Labour Participation
(1960-1975 and 1975-1990)

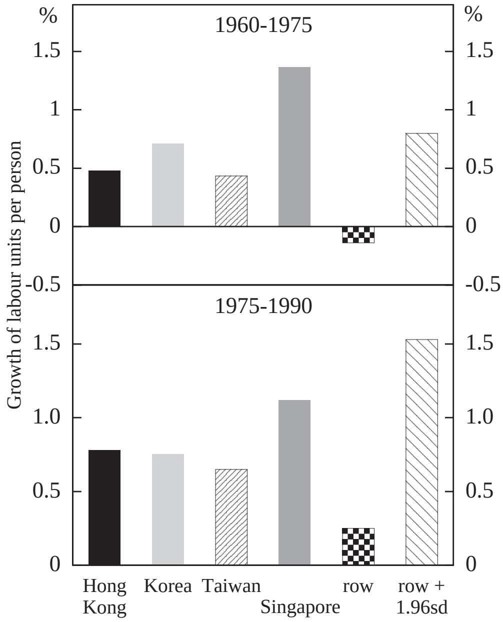


Figure 7: The Four Tigers' Capital and Productivity Growth
(1975-1990)

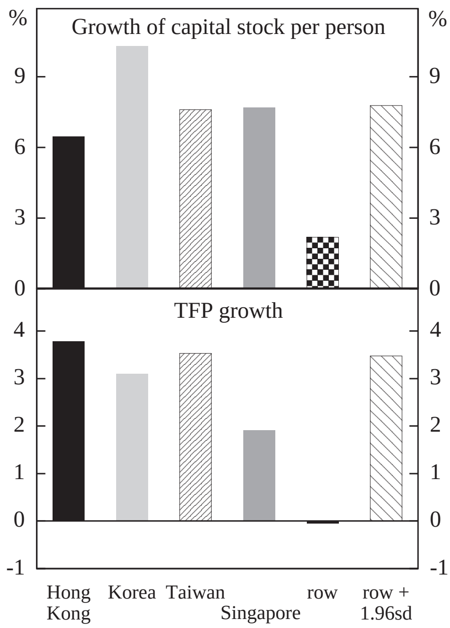
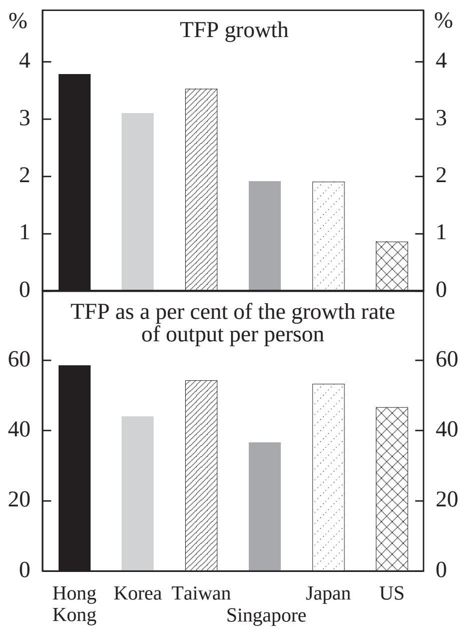


Figure 8: Productivity Growth in the Four Tigers, Japan and the US
(1975-1990)



rates. In the case of Singapore, the productivity growth is less spectacular, but is still much above the world average. As a percentage of the growth rates of GDP per person, the productivity growth rates in these four economies are roughly similar to those in Japan and in the United States.

It would be interesting to check how sensitive these findings are to changes in the main parameters of the growth-accounting exercise. Table 1 presents the results of such a sensitivity analysis. The first row of the table shows the average-productivity growth rate among the Four Tigers, obtained by using the baseline parameter values ($\alpha = 0.333333$, depreciation rate = 0.04, reference period used for extrapolation = 1960-90, estimation period = 1975-90 and beginning of capital accumulation = 1900). The other rows of Table 1 show the average-productivity growth for the same countries that is obtained by changing the values of the different parameters, one at a time.

Table 1: Sensitivity Analysis

Parameter values used in the growth-accounting exercise	Average rate of productivity growth Hong Kong, Korea, Taiwan, Singapore
Baseline parameters	0.0308
$\alpha = 0.25$	0.0368
$\alpha = 0.45$	0.0224
Depreciation rate = 0.02	0.0301
Depreciation rate = 0.08	0.0322
Reference period used for extrapolation = 1960-1975	0.0307
Reference period used for extrapolation = 1960-1965	0.0303
Estimation period = 1980-1990	0.0320
Estimation period = 1970-1990	0.0281
Estimation period = 1965-1990	0.0292
Estimation period = 1960-1990	0.0269
Estimation period = 1970-1985	0.0204
Beginning of capital accumulation = 1950	0.0304
$\alpha = 0.45$ and estimation period = 1970-1985	0.0100

The main results of the sensitivity analysis in Table 1 are:

- Some of the parameters (the depreciation rate, the reference period used for extrapolation and the beginning of capital accumulation) do not affect the results in any significant way.
- The two parameters that do have a significant effect on the results are α and the specific estimation period.

It is interesting to note that the findings reported by Young (1994a), regarding the low productivity growth in the Four Tigers, were obtained by using a relatively high value for α (0.45) and a specific estimation period (1970-85). According to Table 1, each one of these choices yields a significantly lower estimate of productivity growth for the economies of Hong Kong, Korea, Taiwan and Singapore. The last line of Table 1 shows the results that are obtained in case both changes (for α and for the estimation period) are made simultaneously. Compared with the baseline calculation, the results are fundamentally different. Instead of obtaining an impressive average productivity growth of 0.0308, the growth-accounting exercise now yields a meagre productivity growth of only 0.0100! No wonder Young (1994a, p. 973) concludes that '[i]n general, rapid factor accumulation, of both capital and labour, explains the lion's share of the East Asian growth miracle'.

4. The Role of Public Policy and of Selective Interventions

Lucas (1988, p. 5) asked: 'Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia's or Egypt's? If so, *what*, exactly?'. The importance of this question could hardly be exaggerated. A positive answer would be the academic equivalent of possessing a magic ability to transform everything into pure gold. Accordingly, the strongest ambition of the economists who examine the East-Asian success is to identify a set of public policies that promote economic growth.

This section examines three views on public policy and selective interventions by the government, and their roles in the East-Asian growth experience. The first view emphasises the positive role of free markets; it requires the government only to 'get the basics right', but opposes any kind of selective government intervention. The second view emphasises the problems associated with free markets, especially in developing countries; it fully embraces the idea that the government should get the basics right, but, in addition to that, it also advocates selective interventionist policies. The third view questions the legitimacy of any conclusions about effects of public policy and of selective interventions on economic growth.

4.1 The 'Good': The Neoclassical View

For a long time, this was by far the most popular view among professional economists, especially in the West. It is based mainly on the neoclassical approach to economics in general, and to economic growth in particular, but it also contains some ideological elements of an underlying belief in classical liberalism. The production possibilities of any economy, in this view, are limited at any point in time by the availability of physical resources and by the available technology. The rate of growth in the long run is determined by the rate of technological progress, which is usually viewed as an exogenous phenomenon, or as a natural outcome of the fierce competition in the *laissez faire* economic system. The markets are considered to be generally efficient. In this view, the role of the government in the process of economic development is important, but limited. The government should only concentrate on providing public goods and on 'getting the basics right', both in the microeconomic and in the macroeconomic domains. Except for this limited and well-defined role, the government should stay out of the way and abstain from any further interventions in private markets.

In the microeconomic aspects, the government should ensure property rights, law and order, enforcement of contracts and adequate provision of public goods, such as defence, infrastructure, and perhaps basic education and health care. It should avoid high tax rates, price controls, or any other significant distortion of relative prices. On the macroeconomic side, the government should ensure stable and low inflation, avoid excessive budget deficits, promote the integrity of the financial and banking systems, and ensure open markets, as well as stable and realistic exchange rates.

The advocates of this view see the success of East Asia as the natural outcome of these conservative policies. The World Bank (1993, p. 5) report on the East-Asian miracle, for example, points out that:

> 'Macroeconomic management was unusually good, providing the stable environment essential for private investment. Policies to increase the integrity of the banking system, and to make it more accessible to nontraditional savers, increased the levels of financial savings. Education policies that focused on primary and secondary schooling generated rapid increases in labour force skills. Agricultural policies stressed productivity change and did not tax the rural economy excessively. Governments either actively encouraged family planning or, at the minimum, did not restrict family planning choices. Finally, all the high-performing East Asian economies kept price distortions within reasonable bounds and were open to foreign ideas and technology, policies that, along with other fundamentals, facilitated efficient allocation and helped to set the stage for high productivity growth'.

4.2 The 'Bad': The Revisionist View

The revisionist view does not share the neoclassical belief in the efficiency of the markets. It asserts that, especially in poorer countries, there are many market imperfections (such as externalities in production, credit constraints, monopolies, unfair trade practices by multinationals and foreign firms, and a general lack of access to many markets). Accordingly, the government should play a central role in helping to acquire technology, allocate funds for key projects, and guide the development of the economy. Not surprisingly, the advocates of this view also see the success of East Asia as confirming their conviction. The revisionist view is summarised by De Long and Summers (1991, p. 448) in their claim that:

> 'it is often alleged that a number of countries have succeeded in growing rapidly by pursuing a government-led "developmental state" approach to development. The rationale for this policy is that countries which adopt the price and quantity structure of more affluent nations are more likely to grow than those that possess the structure of poorer countries. The government should jump-start the industrialisation process by transforming economic structure faster than private entrepreneurs would'.

The revisionist view represents a pragmatic approach to policy. It recognises that sometimes the government has to choose interventions that are firm-specific, highly complex and non-uniform. In extreme contradiction to the neoclassical 'doctrine', it allows (and sometimes even recommends) the active use of tax policy with the explicit aim of affecting the relative prices in the economy. Pai (1991, p. 47), for example, describes the tax policy in Taiwan during the past 40 years, from his perspective as the Chairman of the Board of the Export-Import Bank and claims that '... the remarkable economic development has not been achieved without effort. The hard work of the people and the effective development strategies of the government deserve much of the credit for the achievement. But tax policy also has played an important role in our development and contributed much to the progress we have enjoyed'. After describing the various tax measures that were adopted by the government during the past forty years, he concludes: 'It is very clear that the tax incentives described above were aimed at promoting investment in productive enterprises, stimulating export sales, and encouraging saving. [...] Though it is difficult to quantify the contribution of tax incentives to the outstanding performance of the economy, it is generally acknowledged that sound tax policies and their timely adoption deserve part of the credit' (Pai 1991, pp. 49, 53).

Even the World Bank (1993, p. 5) report, after emphasising the 'getting the basics right' policies in East Asia, concedes that '... these fundamental policies do not tell the entire story. In each of these economies the government also intervened to foster development, often systematically and through multiple channels. Policy interventions took many forms: targeted and subsidised credit to selected industries, low deposit rates and ceilings on borrowing rates to increase profits and retained earnings, protection of domestic import substitutes, subsidies to declining industries, the establishment and financial support of government banks, public investment in applied research, firm- and industry-specific export targets, development of export marketing institutions, and wide sharing of information between public and private sectors'.

4.3 The 'Ugly': We Cannot Say Anything Meaningful About Selective Interventions

In addition to the neoclassical and the revisionist positions, a third powerful argument about public policy can be made, changing the nature of the neoclassical-revisionist debate. This third position essentially claims that we cannot say anything meaningful about selective interventions, because we cannot properly identify the role that such policies play in the determination of economic growth. There are at least four reasons for this intellectual pessimism.

First, in analysing the 'successful' policies, there is a clear selection bias. As argued by the World Bank, '[w]ere some selective interventions, in fact, good for growth? In addressing this question we face a central methodological problem. Since we chose the high-performing Asian economies for their unusual rapid growth, we know before we begin analysis that their interventions did not inhibit growth' (World Bank 1993, p. 6). Easterly (1995, p. 268) makes the same point when he says that '... economists find it much more appealing to study what the successes did right than what failures did wrong: from 1969 to the present there have been 717 articles on Singapore in economics journals. On the Central African Republic, a country of similar population size but opposite performance, the number of articles over this period was: 1. It is not really clear why large positive outliers should contain more information than large negative outliers'.

Second (and this point is related to the first), in most cases it is impossible to offer a realistic counterfactual scenario. In other words, in analysing specific policy actions and selective interventions, we cannot address the most (and perhaps the only) relevant question: what growth rate would have been observed if these policies had not been in place?

Third, public policy in the successful East-Asian economies is far from homogenous. There is also a large variation in the specific sectors and industries that were targeted for selective interventions across different countries. Indeed, the more one examines the policies pursued by the different countries, the more evident it becomes how different, and sometimes contradictory, these policies were. Rodrik (1994, p. 37), for example, remarks that '[o]ne of the most useful features of the [World Bank (1993)] report is its documentation of the variety of policies and institutions that comprise 'the East-Asian model'. The model encompasses highly interventionist strategies (Japan and Korea) as well as non-interventionist ones (Hong Kong and Thailand); explicitly redistributive policies (Malaysia) as well as distributionally neutral ones (most of the rest); clientelism (Indonesia and Thailand) as well as strong, autonomous states (Korea, Japan and Singapore); emphasis on large conglomerates (Korea) as well as on small, entrepreneurial firms (Taiwan). This range of strategies, all followed more or less successfully, suggests that the search for a parsimonious explanation of the East-Asian miracle may well be futile'. A similar argument is made by Easterly (1995, p. 267) who argues that the performance of the Four Tigers has been used to support each development school's 'favourite prescriptions', ranging from free-market policies to encourage outward orientation to aggressive trade intervention.

Finally, there is a severe problem of determining the correct direction of causality. Many variables related to public policy (such as the fiscal balance of the government or the accumulation of education) are found in many studies to be positively correlated with growth. As a result, economists often consider these policies as promoting economic growth. The problem, however, is that observing a specific variable to be positively correlated with growth does not necessarily constitute a proof that this variable generates growth; it can be the other way around. For example, it is much easier for a government to maintain a healthy fiscal position and not to run budget deficits when the economy grows at a rapid pace and tax revenues are constantly increasing, than when the economy does not grow and there is a big demand for social expenditures and fiscal stimulus.

The same argument can be made about other variables, such as political stability, military expenditures as a per cent of GDP, the rate of increase in the level of education and the rate of industrialisation: when an economy is booming, people are much happier with their leaders and the country enjoys political stability; the economy can afford to decrease the share of GDP devoted to national defence (in the face of a constant external threat); it also can afford to subsidise education, causing a significant increase in the enrolment rate at all school levels.

In the important case of education and growth, two additional arguments regarding an inverse causality between the two variables can be made, addressing the demand side. First, because education is a normal good (or perhaps even a luxury good at the higher education levels), the demand for education increases significantly when the economy grows and the population becomes richer. Second, the process of rapid growth is accompanied by a rapid technological change. When the economy faces such a rapid technological change, the advantage of educated workers (over non-educated workers) is greater than when the economy and technology are stagnant. Therefore, there will be an increase in the demand for education of each individual, in order to compete with other individuals in the economy. In this case, the increased level of education will constitute a microeconomic advantage for the specific individual (relative to other individuals in the economy), but will not necessarily improve the macroeconomic prospects of the economy.

All these examples do not attempt to prove that policies are not important. Rather, they try to make the modest point that we still understand very little about the relationship between public policy and the miraculous growth rates of the East-Asian economies. Other countries should be careful in trying to imitate the East-Asian policies. Not understanding the causality between growth and industrialisation, in particular, proved to be a very costly mistake for many poor countries that pushed for a rapid industrialisation in a futile effort to boost economic growth.

5. Are Investment and Exports the Engines of Growth?

Among the many suggested determinants of growth in East Asia, the investment rate and export orientation, in particular, are held in very high esteem. Frequently, they are called the ‘engines of growth’, meaning that these activities are considered not only to contribute directly to growth, but also to generate spill-over effects to the rest of the economy. The policy implication of these views is obvious: if some sectors in the economy contribute to economic growth, while others do not, then the government should increase the growth rate by promoting these ‘good’ sectors. Therefore, it should promote investment and exports, using policy instruments such as direct subsidies or preferential allocation of credit. Because of the central role played by investment and exports in the attempts to explain the East-Asian growth, and because of the direct policy implications of this central role, this issue deserves special consideration.

5.1 The Main Arguments

The view of investment and/or exports as the engines of growth is based mainly on one empirical argument and on one theoretical argument. The empirical argument is simple: most East-Asian countries that experience phenomenal growth rates also experience impressive exports (and imports) and investment rates. The theoretical argument in the case of investment is that a high investment rate increases the capital stock, and some endogenous growth theories predict that this can permanently increase the growth rate (usually through increasing returns to scale or through externalities). In the case of exports, the theoretical argument is that export orientation increases the openness of the economy and exposes it to foreign technology (and, perhaps more importantly, to foreign competition), thus provoking a rapid rate of technological progress.

5.2 What is the Direction of Causality?

A previous section in this study argued that a positive correlation between two variables does not prove a direction of causality. Thus, in the case of export orientation and technological progress, the causality can run from the later to the former. Suppose that some industries significantly improve their technology (for example, by copying foreign technology) while other industries do not. Then, it is only natural that those industries with the more advanced technology can compete in the international markets and can increase their quantity of exports. In this case, the data will reveal a strong correlation between the export performance and the rate of technological progress across industries. A similar argument can be made in the case of a positive exports-technology correlation across countries: developing countries that are better in learning and applying advanced foreign technologies will enjoy an important advantage in the world markets and will be able to achieve a strong export performance.

The case of strong positive correlation between investment rates (or, equivalently, saving rates) and growth rates seems to be more promising. Nevertheless, a strong argument of reversed causality can be made even in this case. Such an argument was made, for example, by Carroll and Weil (1994). They examined the relationship between growth and saving using both cross-country and household data, and attempted to determine the direction of causality (in the Granger sense). They found that, at the aggregate level, growth causes saving but saving does not cause growth. Using household data, they found that households with predictably higher income growth save more than households with predictably lower growth. These findings represent a powerful reinterpretation of the growth-saving relationship. Carroll and Weil also offer a theoretical model that explains these findings. In their model, people have a high degree of habit formation. In the face of higher growth rates, they will only slowly and gradually adjust their consumption levels. In this case, increased saving rates are caused by increased growth rates, and not *vice versa*.

5.3 Period Averages Versus Initial Conditions

The main empirical argument for the importance of export orientation and a high investment rate as determinants of growth is the strong positive correlation between these two variables and the rates of growth found in cross-country studies. In particular, the best performing East-Asian economies, such as the Four Tigers, display exceptional investment rates and an extremely high degree of openness (defined as the amount of exports and imports relative to the size of the economy). The problem is that in most studies, the observed correlation is between the period averages of these variables and the period averages of the growth rates. The previous section, however, stressed the problem of possible reverse causality between growth and those other variables. This problem greatly reduces the potential of such comparisons of cross-country period averages to identify specific variables as the main determinants of growth.

The problem of reverse causality is a difficult one in growth regressions. There are no simple or perfect solutions to this problem. But one simple partial solution is to observe the values of the explanatory variables at the beginning of the period, rather than to take their average values during the period. Finding, for example, that economies with high growth rates during the period 1960-90 also had high investment rates or a significant export orientation around 1960, would go a long way towards solving the potential problem of reverse causality.

This section looks at the dynamics of the investment rate and of the openness of the economies of Hong Kong, Korea, Taiwan and Singapore, and compares the 1960 levels of these variables in the Four Tigers with those in other countries. The results of these comparisons are based on the PWT database and are presented in Figures 9 and 10. Unfortunately, the evidence presented in these figures does not offer much support for the views of exports orientation or high investment rate as engines of growth.

The first panel of Figure 9 shows the investment rate of the Four Tigers during the period 1960-90. The figure makes clear that the investment rates of Korea, Taiwan and Singapore increased dramatically during this 30-year period. Only Hong Kong had a roughly stable investment rate during this period. The second panel of Figure 9 compares the 1960 investment rates of the four countries to the 1960 investment rates of 100 other economies. The horizontal axis represents the level of output per person in 1960, and the solid line is the result of an OLS regression. This panel clearly rejects the view that investment rates were high in the Four Tigers in 1960. Not only were the investment rates in these economies not high in absolute values, but they were very modest even when compared to other countries with a comparable level of income. This finding is especially obvious in the case of Korea and Singapore.

Figure 10 repeats the same exercise for openness, defined as the log of the sum of exports and imports (as a percentage of GDP). The horizontal axis in the second panel of this figure represents the geographical area of the country, a variable that clearly

Figure 9: Investment in the Four Tigers

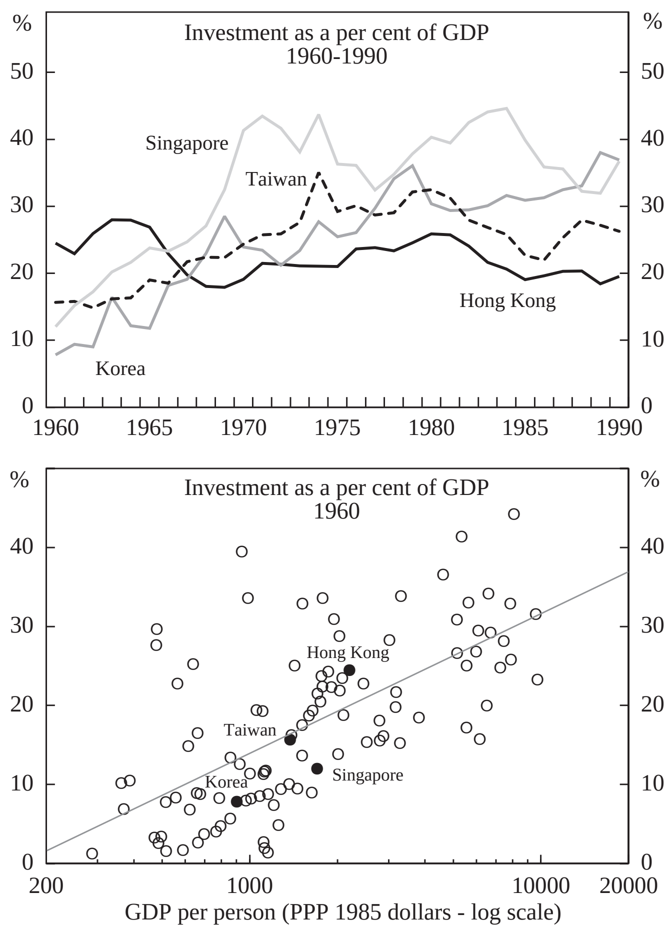
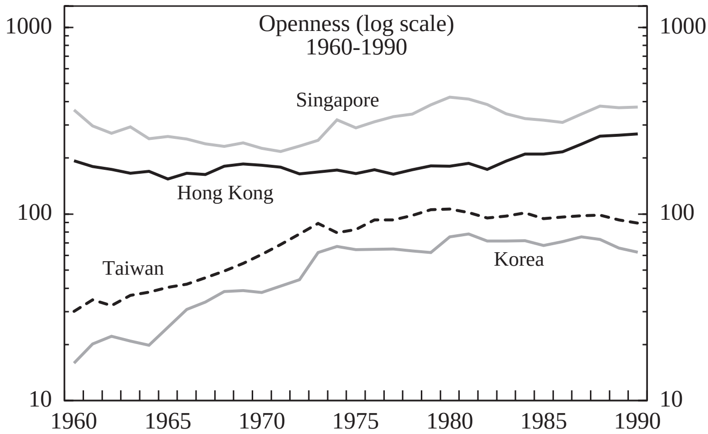
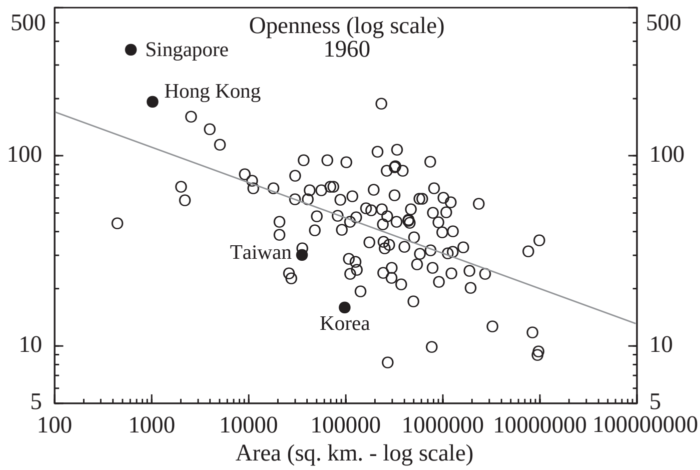


Figure 10: Openness of the Four Tigers





affects the degree of openness of an economy. In the case of Hong Kong and Singapore, the first panel of Figure 10 shows a high degree of openness, both during the 1960-90 period and at the beginning of this period. The second panel of the same figure, however, demonstrates that the small size of these economies can explain a significant part of this high degree of openness. In the case of Taiwan and Korea, the figure shows that they were not particularly open in 1960, neither in absolute terms nor relative to other countries of a comparable size.

Figures 9 and 10 demonstrate that high investment rates and a large degree of openness were certainly not a general feature of the Four Tigers in 1960. The case of Korea, the best growth performer in the period 1960-1990, is particularly striking. This country is found to have a low-investment inward-oriented economy in 1960. The high investment rates (in the case of Korea, Taiwan and Singapore) and the high degree of openness (in the case of Korea and Taiwan) were economic features that evolved in these economies only gradually, accompanying rather than preceding the process of economic growth. The view that these activities are 'engines' of growth does not find much support in the data.

6. Some Positive Evidence Regarding Initial Conditions

This section continues the examination of initial conditions, as a partial remedy to the problem of causality. It attempts to determine which variables (if any) characterised the initial conditions in the East-Asian countries, and their contribution to the subsequent growth of these economies. In contrast to the negative results presented in the previous section, we find some impressive positive empirical evidence regarding the presence and the role of initial conditions. The main arguments and all the tables presented in this section are taken from the study conducted by Rodrik (1994), who argues that the 'first place to look' for an explanation of the East-Asian miracle is the set of initial conditions that preceded the economic take-off. First, he discusses the general importance of initial conditions in the process of economic growth. Then, he examines the initial conditions in the East-Asian countries around 1960 and finds that, in some important respects, they were very different from what one would expect, given the income level of these countries. Finally, he demonstrates that the initial conditions in the East-Asian economies can explain a large fraction of their growth performance.

6.1 Cross-Country Evidence on the Importance of Initial Conditions

Table 2 reports the results of regressing average growth of income per person in the period 1960-85 on some initial conditions in 1960. This is a cross country regression, in the spirit of Barro (1991) and other empirical studies of economic growth.

Table 2: Importance of Initial Conditions

	Estimated coefficient	t-statistics
Constant	6.22	4.69
Per capita GDP (1960)	-0.38	-3.25
Primary enrolment	2.66	2.66
Gini coeff. (land)	-5.22	-4.38
Gini coeff. (income)	-3.47	-1.82

Notes: (a) The number of observations is 41 (the number of countries for which data on all the initial conditions were available).
(b) Adjusted R^2 is 0.53.

As can be seen, a small set of initial conditions can 'explain' a large fraction of the growth rates in the following period. The table demonstrates that, *ceteris paribus*, countries that were poorer, had good primary education, and had less inequality of income and of land distribution around 1960, enjoyed significantly higher rates of growth in the period 1960-85.

6.2 Did East-Asian Economies Have Unusual Initial Conditions?

Table 3 compares the actual data on education and demographics in eight East-Asian countries with the predicted values that we would expect, given their initial income. The predicted values (the numbers in parentheses) were obtained from a cross-country regression run on a 118-country sample, with per capita GDP in 1960 and its square used as independent variables.

Table 3: Education and Demographics

	Primary enrolment 1960 %	Secondary enrolment 1960 %	Literacy rate 1960 %	Fertility rate 1965	Mortality rate 1965
Hong Kong	87 (83)	24 (23)	70 (59)	4.5 (5.2)	3 (8)
Indonesia	67 (51)	6 (7)	39 (25)	5.5 (6.5)	14 (14)
Japan	103 (92)	74 (29)	98 (70)	2.0 (4.8)	2 (7)
Korea	94 (57)	27 (10)	71 (31)	4.8 (6.3)	6 (13)
Malaysia	96 (68)	19 (15)	53 (43)	6.3 (5.8)	6 (11)
Singapore	111 (78)	32 (21)	50 (54)	4.7 (5.4)	3 (9)
Taiwan	96 (62)	28 (12)	54 (36)	4.8 (6.1)	2 (12)
Thailand	83 (57)	12 (10)	68 (31)	6.3 (6.3)	9 (13)

Table 4 compares the inequality of income and land (around 1960) of the same eight East-Asian economies with other developing countries at a comparable income level.

Table 4: Inequality of Income and Land

	Gini coeff. (income)	Gini coeff. (land)		Gini coeff. (income)	Gini coeff. (land)
Hong Kong	0.49	n.a.	Argentina	0.44	0.87
Indonesia	0.33	n.a.	Brazil	0.53	0.85
Japan	0.40	0.47	Egypt	0.42	0.67
Korea	0.34	0.39	India	0.42	0.52
Malaysia	0.42	0.47	Kenya	0.64	0.69
Singapore	0.40	n.a.	Mexico	0.53	0.69
Taiwan	0.31	0.46	Philippines	0.45	0.53
Thailand	0.41	0.46	Turkey	0.56	0.59
Unweighted average	0.39	0.45	Unweighted average	0.50	0.68

Tables 3 and 4 present strong evidence that the eight East-Asian countries had initial conditions, in terms of education, demographics and inequality, that were significantly different (and better) than those in other countries with a similar level of income.

6.3 Can the Initial Conditions Explain the East Asian Miracle?

Table 2 points to a set of initial conditions that are beneficial for growth, while Tables 3 and 4 show that these initial conditions (equality of land and income, school enrolment, high life expectancy and low fertility rates) prevailed in the East-Asian countries around 1960. These findings raise the possibility (but do not prove) that these initial conditions may explain the phenomenal growth rates we observed in East Asia after 1960. Not surprisingly, the next question Rodrik asks is how much of the actual growth of the high-performing Asian economies can be explained by the initial levels of school enrolment and equality? His answer is 'quite a lot of it'. Table 5 compares the actual growth rates of five East-Asian countries (for which data on the Gini coefficient for land were available) to the growth rates that are predicted by the regression described in Table 2.[3]

Table 5: Contribution of Initial Conditions

	Actual growth	Predicted growth	% explained
Japan	5.76	4.26	74
Korea	5.95	5.24	88
Malaysia	4.52	4.44	98
Taiwan	5.68	4.96	87
Thailand	4.06	4.34	107
Unweighted average	5.19	4.65	90

The empirical evidence presented by Rodrik, regarding the importance of initial conditions in economic growth and their power to explain the East-Asian miracle, is quite impressive. Nevertheless, this evidence should be accepted only if accompanied by a large dose of caution. The main reason for this caution is the small number of observations that support these conclusions. Data on initial conditions in 1960, especially for developing countries, are extremely rare and their quality is questionable. While Rodrik's results suggest a possible explanation for the East-Asian miracle, they are not robust enough to rule out other possibilities.

Furthermore, it is not clear what are the normative implications of these findings. For example, suppose that land equality is indeed very beneficial for economic growth. Does that mean that land redistribution is a good policy to promote growth? The answer, obviously, is: not necessarily. The redistribution itself may be extremely damaging, by having a negative impact on property rights, political stability, or other factors that may be important for growth. The same argument is true in the case of low fertility rates: lowering fertility 'by decree' may be bad for growth, even if low fertility rates are found to be good for growth.

3. In fact, despite the obvious geographical concentration of growth success, there is little evidence to suggest that geographical factors play an important role, once one controls for other factors, such as initial conditions (or government policies).

7. Concluding Remarks

The recent literature on the East-Asian growth experience has produced a very intense intellectual debate. This study attempted to critically review the main arguments in this debate, covering some of its most important dimensions. Whilst challenging existing paradigms, the study does not offer clear and conclusive results which form an alternative explanation of growth. Nor does it make clear policy recommendations. Its main judgment is that, from a positive point of view, a promising avenue for the explanation of growth performance is the examination of initial conditions. But, from a normative point of view, it is far from clear what specific policies governments should pursue, beyond the standard set of policies aimed at ‘getting the basics right’.

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The Growth Experience of Japan – What Lessons to Draw?

Kengo Inoue*

1. Introduction

The Japanese economy experienced very rapid growth in the 1960s, but this growth significantly decelerated in the early 1970s. It is generally accepted that the growth potential underwent a ‘kink’, though the reason for this is still actively debated. Then, the economy showed a real growth rate of around 5 per cent on average for about 20 years. In the 1990s, however, the economy has been quite sluggish, and concerns are voiced whether Japan’s growth potential has undergone another downward kink.

Much research has been done to explain the rapid economic growth of the 1960s, but the more recent experience raises some pertinent questions which should have relevance to Asian and other developing countries:

- To what extent did the rapid growth of the 1960s more than reflect increased factor inputs?
- To what extent did it reflect a once-and-for-all resource shift out of agriculture, which cannot be repeated?
- Is there evidence that industrial policy helped growth at the macro level?
- To what extent does the recent slowdown support the view that Japan has hit the technological frontier, i.e. no more room for ‘copying’ advanced technology?
- What are the lessons from Japan’s track record, both for its own future and for other countries?

These are onerous questions, and this paper does not claim to offer definite answers to them. Rather, it tries to offer some insights based on the sectoral analyses of labour and capital inputs, together with the movements in output prices and returns on capital. While the techniques used are crude, they nonetheless seem to suggest some interesting points which have important implications as we look ahead. The summary and tentative conclusions of the findings are as follows:

- The relative shrinking of the primary sector did contribute substantially to the gain in overall productivity, or total-factor productivity (TFP), in the 1960s. What is striking in this episode is that the return on capital in the primary sector was kept high by the price-support system, and capital inputs in that sector grew almost in line with those in the overall economy. This resulted in huge losses in productivity in that sector, implying that capital was used quite inefficiently and would probably have been used more efficiently elsewhere.

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- The growth in the capital inputs of the manufacturing sector was somewhat faster than those in the overall economy in the 1960s, but not thereafter. It is not as though industrial policy allocated significantly more capital to manufacturing relative to other sectors. Rather, intense domestic competition kept manufacturing output prices stable, and the return on capital in this sector was always relatively low. Taken together with the first point above, it is doubtful whether the broad industrial policy (which includes agricultural policy) significantly contributed to growth even in the 1960s.
- The overall growth rate was halved in the early 1970s and remained fairly stable until the late 1980s. This reflected foremost the reduced pace of capital accumulation, and the fact that overall productivity was growing at a pace similar to that in the first half of the 1960s. While the data here do not explain the reduced pace of capital accumulation, demand factors might have been at work behind the slowdown.
- There was a distinct change in agricultural price policy. The price deflator in that sector rose less in the sub-periods 1976-80, 1981-85 and 1986-90 than the overall output deflator, and drastically reduced the return on capital. This curtailed investment in agriculture. Furthermore, what took place was much less inefficient. As a result, the negative contribution from agriculture was much smaller, while the positive contribution from the resource shift between sectors was also smaller.
- The gain in TFP in the manufacturing sector has been smaller since the early 1970s than in the 1960s, but there has been no declining trend, at least up to the late 1980s. There is no strong evidence to suggest a technological ceiling. The return on capital in this sector has also been stable since the early 1970s, again except recently.
- The tertiary sector seems to have always offered higher returns on capital than the manufacturing sector, as their output prices rose faster. The gain in TFP has been significantly less, on the other hand, as labour inputs have grown persistently faster than in other sectors. Considering the facts that this sector has been much less subject to international competition, and more subject to regulation than manufacturing, there seems to be a wide room for more efficient use of resources.
- The early part of 1990s is hard to interpret, as this sub-period only covers recession years. But the findings above suggest no supply factors that might severely inhibit growth in the medium term. Provided that demand management policies succeed in not suppressing R&D, and that deregulation results in more efficient resource use in the tertiary sector, the growth potential for Japan does not seem so bleak.

2. Factor Inputs and Total-Factor Productivity

The approach adopted in this paper is to try to understand the performance of the overall economy by looking at the growth in TFP of three major sectors. Developments in individual sectors are then analysed in the next section in terms of output price deflators and returns on capital.

The period since 1961 is broken down into seven successive five-year periods (except the last one, 1991-93), and the average rates of growth of real value-added are first shown, A. The contributions of labour, B, and capital, C, are then calculated by multiplying the average rates of increase in man-hours worked and real capital stock by the share of labour in national income in the first year of the period (α) and (l-α), respectively.[1] TFP is derived as A-B-C. No adjustments are made for capital utilisation, for which there are no macro data. Nor are the possibilities of 'hidden unemployment' in firms taken into account. But these factors are considered when interpreting the data.

The method used here to calculate TFP is a simple one, and works along much more sophisticated lines have been done on the overall Japanese economy. They show fairly wide divergence, and are reviewed by, for example, Hamada, Kuroda and Horiuchi (1987) together with their own estimates. For the purpose of this paper, which is to see sectoral and time-period *differences* in TFP growth, the simple method is probably sufficient.

2.1 The Overall Economy

Table 1 summarises the results for the overall economy. It is clear that the growth performance in the 1960s was much better, but omitting the 1990s which is a period of protracted sluggishness (and will be discussed separately), a number of things stand out:

- Labour inputs have been growing at a fairly steady pace except in 1971-75, which includes the adjustment period after the first oil crisis.
- The contribution of capital inputs accounted for about three-quarters of growth in the 1960s, but the contribution of gains in TFP was also large, particularly in 1966-70. (The 'technological progress' in this sub-period probably is exaggerated in this calculation, since the longest post-war boom took place in this sub-period and resource utilisation ratio was quite high. There were probably also economies of scale.)
- The rate of growth of capital inputs shows a distinct kink after 1976-80. TFP decreased in 1971-75, presumably reflecting the need for energy saving, but it since showed rates of increase comparable to 1961-65 until the late 1980s.

Table 1: Estimation of TFP, Total Economy
(Per cent per annum)

	Value added A	Labour input B		Capital input C		TFP A-B-C
1961-65	8.6	0.4	(0.9)	6.7	(11.8)	1.5
1966-70	11.8	0.7	(1.1)	7.0	(13.4)	4.1
1971-75	5.0	-0.6	(-1.3)	5.8	(10.9)	-0.2
1976-80	4.9	0.7	(1.3)	2.7	(6.6)	1.5
1981-85	4.2	0.4	(0.8)	2.5	(6.2)	1.2
1986-90	5.2	0.7	(1.1)	2.6	(6.6)	1.9
1991-93	1.0	-0.7	(-1.2)	2.4	(6.3)	-0.7

1. For this calculation, I assumed constant returns. There probably have been scale economies, though, and this possibility is mentioned when interpreting the data.

The kink in Japan's growth rate in the early 1970s is well known. But these findings suggest that it is mostly because of the reduced capital inputs and not stagnant productivity. This is different from the common notion, and is consistent with the view of Yoshikawa (1995), who emphasises demand rather than supply factors as the source of the kink. Yoshikawa stresses the number of household formation as the key factor, but the undervaluation of the yen in the late 1960s probably was another cause. Without going into the demand-supply debate, we proceed to sectoral developments to see the supply-side reasons.

2.2 The Primary Sector

Table 2 summarises the results for the primary sector (mostly agriculture). The growth rate of real output fluctuated, probably reflecting crops. As regards factor inputs, three things stand out:

- The labour inputs have shown a fairly steady decline, and the pace has *not* decelerated significantly. The wide-scale exodus of people from agricultural areas, which took place in the 1960s, had subsided by the 1970s, so this probably reflects reduced hours spent in agriculture. Many firms built factories in rural areas, and the mechanisation of agriculture made it possible for people there to work part-time both as farmer and factory worker.
- The rate of increase in capital inputs in the primary sector was quite high up to the 1970s, exceeding that in the overall economy in two sub-periods. Since the early 1980s, however, the rate has been significantly lower than in other sectors.
- Capital inputs in agriculture seem to have been very inefficient. They enabled people to leave agriculture, but did not increase real output significantly. TFP showed huge minuses up to the 1970s.[2] The situation improved in the 1980s, when the rate of increase in capital inputs decelerated but not the growth rate of real output.

Table 2: Estimation of TFP, Primary Sector
(Per cent per annum)

	Value added A	Labour input B		Capital input C		TFP A-B-C
1961-65	0.3	-0.4	(-3.9)	6.8	(7.6)	-6.0
1966-70	-2.2	0.1	(0.9)	10.6	(12.1)	-12.9
1971-75	2.6	-1.1	(-6.2)	9.1	(11.0)	-5.4
1976-80	-2.1	-0.4	(-2.1)	6.6	(8.3)	-8.3
1981-85	2.3	-0.6	(-2.2)	3.4	(4.7)	-0.5
1986-90	0.4	-0.7	(-2.4)	2.7	(3.8)	-1.6
1991-93	-3.3	-1.5	(-5.4)	2.4	(3.3)	-4.3

2. It might seem natural that TFP showed minuses because land is ignored in this calculation. Considering the fact that the negative gain in TFP almost disappeared in the 1980s, however, the conclusion that capital inputs up to the 1970s were inefficient would stand.

2.3 Manufacturing Sector

There is a popular notion (often supported by certain Japanese bureaucrats) that the government helped the manufacturing sector to grow. That it was the case until the 1950s is rarely debated, but efforts at directing resources into this sector were gradually discontinued. According to Table 3, capital inputs in this sector grew significantly higher than in other sectors only in 1961-65. Since the 1971-75 sub-period, moreover, capital inputs into this sector persistently lagged those into the tertiary sector.

Regarding TFP, it showed a huge gain in 1966-70 when output showed an annual average rate of growth of 14 per cent. It then stagnated but showed a rebound in 1986-90. The figures for both 1966-70 and 1986-90 probably overstate the gain in TFP, though, because the operating ratio was quite high in these periods with the longest and the second-longest post-war booms. In any case, the deceleration in the pace of output growth is attributable more to slower growth in factor inputs than to smaller gains in TFP. While this by itself does not answer the question of whether Japan now faces a technological ceiling, my own interpretation is that it is not a serious constraint, at least as yet. For one, there probably do exist economies of scale, which are assumed away in this calculation, and which are working less now because of the slower demand growth. Second, trade in technology, as seen in royalties payments, shows a very steady increase in the export/import ratio, from 0.13 in 1970 to 0.54 in 1993.

Table 3: Estimation of TFP, Secondary Sector
(Per cent per annum)

	Value added A	Labour input B		Capital input C		TFP A-B-C
1961-65	12.2	1.6	(3.0)	6.9	(14.9)	3.7
1966-70	14.0	0.7	(1.1)	5.9	(14.7)	7.5
1971-75	4.6	-0.7	(-1.3)	4.8	(10.3)	0.5
1976-80	5.0	0.9	(1.4)	1.6	(5.0)	2.4
1981-85	4.1	0.2	(0.3)	1.9	(5.7)	2.0
1986-90	6.1	0.5	(0.7)	2.1	(6.3)	3.5
1991-93	0.8	-0.6	(-1.0)	2.3	(6.4)	-0.9

2.4 Tertiary Sector

Table 4 shows that the tertiary sector has been attracting more of both labour and capital relative to other sectors (except capital in the 1960s). Although this sector also shows a kink in the pace of capital accumulation since the late 1970s, it is less sharp than in other sectors. TFP showed fairly large gains in the 1960s, but it grew only marginally in the 1980s.

2.5 Relative Sectorial Weights and Overall Productivity

Table 5 breaks down the gain in overall TFP into the contribution from each sector and the contribution of the change in relative weights. The change in relative weights of sectors did contribute substantially to the total gain in the 1960s, whereas it contributed

Table 4: Estimation of TFP, Tertiary Sector

(Per cent per annum)

	Value added A	Labour input B		Capital input C		TFP A-B-C
1961-65	8.6	1.5	(3.3)	5.9	(10.6)	1.2
1966-70	12.6	0.6	(1.2)	6.8	(12.5)	5.2
1971-75	5.5	0.5	(1.1)	6.3	(11.6)	-1.3
1976-80	5.6	1.3	(2.3)	3.3	(7.5)	1.0
1981-85	4.3	1.1	(1.9)	3.2	(7.1)	0.1
1986-90	4.8	1.2	(2.1)	3.3	(7.7)	0.3
1991-93	1.5	-0.4	(-0.6)	2.7	(6.9)	-0.8

Table 5: Decomposition of TFP Growth Rate

(Per cent)

		Explained by:			
	Annual growth rate of TFP	Growth rate of TFP in primary sector	Growth rate of TFP in secondary sector	Growth rate of TFP in tertiary sector	Change in relative weights of sector
1961-65	1.5	-1.0	1.2	0.6	0.7
1966-70	4.1	-1.4	2.6	2.1	0.9
1971-75	-0.2	-0.3	0.2	-0.7	0.6
1976-80	1.5	-0.4	1.0	0.6	0.4
1981-85	1.2	0.0	0.8	0.1	0.3
1986-90	1.9	-0.1	1.4	0.2	0.4
1991-93	-0.7	-0.1	-0.4	-0.4	0.2

much less in later periods. At the same time, the negative contribution of the primary sector narrowed to about zero in the 1980s, more than offsetting the smaller gains arising from the change in weights. The relative shrinking of agriculture contributed much to the high growth in the 1960s, but the inefficiency there was a big drag. In the 1980s, the decline in the relative share of agriculture contributed much less, but the negative contribution of its inefficiency stopped being a drag.

3. Output Prices and Relative Profitability

Table 6 shows rates of increase in output price deflators and wages together with returns on capital stock (profits/capital stock)[3] for the overall economy as well as for each sector. Some striking observations can be made.

3. In the absence of the data on marginal profitability, I used the average return. Since land is excluded from ‘capital stock’, the figures overstate the true profitability of investment. Also, part of the profits accrued to the firms run by individuals might be more like wages, so the figures for earlier periods in particular tend to exaggerate the picture.

Table 6: Price, Wage and Return on Capital

	p Annual growth rate, per cent	*w* Annual growth rate, per cent	*r* Annual level, per cent
Total			
1961-65	6.36	12.84	36.15
1966-70	5.28	13.88	39.87
1971-75	9.20	17.75	32.03
1976-80	4.90	8.39	23.20
1981-85	1.83	3.83	19.59
1986-90	0.99	4.06	19.15
1991-93	1.37	2.22	15.71
Primary sector			
1961-65	8.65	16.70	43.21
1966-70	9.26	21.39	37.82
1971-75	10.05	13.26	24.18
1976-80	3.89	5.70	14.50
1981-85	0.64	1.88	8.61
1986-90	0.33	2.25	7.17
1991-93	1.59	1.69	6.37
Secondary sector			
1961-65	2.84	12.33	30.57
1966-70	4.56	14.01	33.28
1971-75	8.03	17.63	27.06
1976-80	4.33	8.57	18.51
1981-85	1.02	4.37	16.00
1986-90	0.56	4.57	17.07
1991-93	0.70	2.25	14.53
Tertiary sector			
1961-65	8.15	12.59	38.81
1966-70	5.04	13.16	47.50
1971-75	10.28	18.14	40.36
1976-80	5.56	8.38	31.13
1981-85	2.53	3.46	26.70
1986-90	1.34	3.68	24.57
1991-93	1.81	2.17	19.11

Continued

Table 6: Price, Wage and Return on Capital *(Continued)*

	p Annual growth rate, per cent	*w* Annual growth rate, per cent	*r* Annual level, per cent
Wholesale and retail trade			
1961-65	0.90	14.06	45.59
1966-70	2.73	13.51	60.30
1971-75	8.77	17.08	48.14
1976-80	1.76	8.30	30.37
1981-85	0.68	3.36	22.54
1986-90	-0.27	4.20	16.61
1991-93	0.08	2.98	11.50
Services			
1961-65	13.31	12.70	73.48
1966-70	7.37	15.82	94.97
1971-75	14.51	20.65	72.37
1976-80	6.75	9.99	46.26
1981-85	4.33	3.13	33.80
1986-90	3.41	3.74	29.94
1991-93	3.20	1.94	19.03
Other industries in tertiary sector			
1961-65	7.00	10.66	30.34
1966-70	4.94	13.37	34.47
1971-75	8.88	18.19	30.45
1976-80	7.04	7.99	27.75
1981-85	2.75	4.75	26.48
1986-90	0.97	3.61	25.79
1991-93	1.88	2.59	22.22

Note: Where *p* is the output price, *w* is the nominal wage and the return on capita, *r*, is defined as operating surplus divided by capital stock.

3.1 Primary Sector

Output prices in the primary sector rose faster than in the other two sectors up to the 1960s, but they rose less in each of the three sub-periods 1976-80, 1981-85, 1986-90. This owes to a clear reversal in the agricultural policy, both in terms of rice price policy and import policy for other products.

Since wages increased faster in this sector in the 1960s, but less thereafter than in other sectors, it was the price developments that seem to have been the major determinant of returns on capital stock. In 1961-65, the primary sector was the most profitable sector of all, and although profitability rapidly dwindled thereafter, it was still almost as profitable in 1971-75 to invest in agriculture as in manufacturing (assuming that land was not bought). This explains why large-scale capital investments took place in agriculture up to the first half of 1970s. What should be noted is that these investments made sense in nominal terms – that is, they yielded good profits but were quite inefficient in real terms. They saved labour somewhat but not very much, and TFP declined conspicuously. Whatever the merits of agricultural policy in terms of achieving social equity and mitigating the pain of economic transition, it caused a sizeable allocative inefficiency without which the growth would have been even faster. In the 1980s, in contrast, output prices were quite stable and, although wages rose least rapidly in this sector, returns on capital came down sharply. Consequently, capital inputs grew much less fast. In terms of labour saving, however, they were much more efficient than in the 1960s, and TFP suffered much less.

3.2 Manufacturing Sector

Output prices in this sector rose persistently less than in the other two sectors up to the first half of 1970s. Thereafter, they rose somewhat faster than agricultural prices, but have been fairly stable. This means that capital inputs in this sector had to be of a type which increased productivity in *real* terms. While it cannot be said, strictly speaking, that investments which are aimed at increasing nominal productivity necessarily fail to increase real productivity, it is plausible that it was the case (see section below).

Regarding returns on capital stock, there is a clear kink after the 1960s, but they have been remarkably stable since the early 1970s. Again disregarding the most recent sub-period 1991-93, no secular downward trend in profitability is observed.

3.3 Tertiary Sector

Output prices in this sector rose faster than in the manufacturing sector, but less fast than in the primary sector during the 1960s. Thereafter, output prices have been increasing persistently faster than in other sectors. With the real output growing nearly as fast as in the manufacturing sector, the nominal output of this sector grew much faster than in the other two sectors. This is natural given that services are a ‘luxury’. Returns on capital stock do have a kink as in manufacturing, but the level is still significantly higher than in other sectors. Thus, capital outlays in this sector grew faster than in manufacturing since 1976-80. They were not of the labour-saving type, however, and gains in total productivity have been only marginal.

Further research needs to be done to determine whether it is inherently more difficult to raise productivity in the tertiary sector. Hair cuts are often cited to support such an argument. It seems likely, however, that there is still a large room for productivity gains in the tertiary sector. For one, TFP did show a sizeable increase at one point, an increase of 5.2 per cent per year in 1966-70. Second, output prices in this sector tended to rise because of the relative lack of competition, both because many of their outputs are ‘non-tradeable’ and because there are many regulations which limit entries and operations. With output prices rising, there was a room to make ‘easy profit’, and there was not much incentive to increase productivity in real terms. Table 7 breaks down the tertiary sector into three sub-sectors: wholesale and retail trade, services, and others. These show some

Table 7: Estimation of TFP, Sub-Sectors
(Per cent per annum)

	Value added A	Labour input B	Capital input C	TFP A-B-C
Wholesale and retail trade				
1961-65	16.5	1.3	4.0	11.2
1966-70	17.1	1.4	6.6	9.2
1971-75	6.5	0.2	6.8	-0.6
1976-80	9.0	0.9	3.2	4.9
1981-85	2.4	0.2	1.3	0.8
1986-90	5.2	0.4	1.6	3.2
1991-93	2.2	-1.8	1.0	3.0
Services				
1961-65	2.7	0.9	6.2	-4.4
1966-70	14.0	3.0	9.1	2.0
1971-75	3.1	0.7	8.4	-6.0
1976-80	4.5	2.0	4.9	-2.4
1981-85	6.0	2.4	4.6	-1.0
1986-90	4.2	2.2	5.3	-3.3
1991-93	1.0	0.4	3.5	-2.9
Other tertiary industries				
1961-65	10.1	2.6	6.6	0.9
1966-70	9.9	0.7	6.5	2.7
1971-75	6.3	0.6	5.7	0.0
1976-80	4.3	0.9	2.9	0.5
1981-85	4.5	0.7	3.8	0.1
1986-90	5.0	0.9	3.4	0.8
1991-93	1.1	-0.2	3.3	-2.0

interesting facts. First, wholesale and retail trade showed a large gain in TFP in the 1960s, probably reflecting the economy of scale. (Real output grew markedly, and large-scale supermarkets started to spread.) This sub-sector is still doing well in recent periods, even in 1991-93 when output grew only marginally. What is remarkable is that the price deflator has been quite stable since the beginning of the 1980s, so that capital investment there had to, and did, raise *real* productivity.

In contrast, the price deflator of services almost always rose faster than in other sectors, and sometimes even faster than wages. No wonder investment grew rapidly, but so did labour inputs, and TFP persistently showed losses.

These examples are circumstantial evidence, but they seem to support the thesis that competition tends to encourage investment which raises *real* productivity; either through efficiency or the economy of scale, this tends to raise TFP.

4. Industrial Policy

The findings so far tend to cast doubts about the effects of industrial policy broadly defined. Agricultural price support system was a clear failure: it drew much more capital to agriculture than was desirable[4] and capital was used very inefficiently there. The policy was reversed in the late 1970s, and the primary sector stopped to be a large negative factor for overall growth.

In the tertiary sector, which is much more regulated than the secondary sector, output prices also rose faster, and this tended to encourage investment. It seems to have yielded handsome returns in nominal terms, which was all that mattered to the investors, but did not raise *real* productivity. While the faster rise in prices reflected other factors than regulations, e.g. a faster rise in the demand for services, services being 'non-tradeable', etc., regulations which curtailed new entry were definitely a factor. Recent declines in long-distance phone charges and air fares, to name only a few examples, show that there is wide room for more competition and new business opportunities by deregulation.

In the manufacturing sector which supposedly was the target of industrial policy narrowly defined, capital inputs did grow faster in the 1960s than in other sectors. Whether it was the direct result of policy is open to question, however. It seems more the case that corporate managers saw huge potential markets as well as the room for the economy of scale to operate, and invested vigorously. It may be noted in this connection that the famous 'Income Doubling Plan' of 1961 was nothing more than a set of forecasts. Nonetheless, it probably had the effect of raising the corporate managers' expectations regarding the future growth of the markets. In any case, the government did not even make manufactured products more expensive relative to agricultural products. Another important point is that the government did not stifle competition, and this seems to have encouraged investment which raised *real* productivity.[5]

All in all, the government's contribution to the rapid economic growth of the 1960s seems to be exaggerated in the popular notion. Often ignored is its negative contribution through its wrong agricultural policy. If supporting farmers was a worthy goal, it should have been done by direct income support, which would not have skewed resource allocation as much as the actual policy of price support did. In the tertiary sector, too, Government regulations seem to have induced investments that did not raise real productivity, although one needs more evidence to be certain on this. Vestal (1994) wrote that there actually was no 'Japan type' industrial policy in Japan, and what actually took place contained a large element which hindered growth by protecting inefficient sectors. The findings in this paper support him.

5. The Recent Period and the Lessons

As noted before, the most recent period 1991-93 only covers recession years, and the picture is quite different. The rate of growth of real output was only 1 per cent, and TFP

4. This is not to say that the price policy was the only source of inefficiency.

5. There are some exceptions regarding 'infant industries'. Some important sectors were shielded from international competition until the 1960s, while domestic competition was fierce. This probably did help these industries to attain certain scales where they became viable and internationally competitive.

turned into the biggest ever minus. It is of course too early to say whether Japan's growth potential has undergone another kink, but a number of factors suggest that this sub-period is somewhat special, and that it should be possible to recover a fairly high growth potential.

First, the data for factor inputs for this period significantly overstate actual inputs. There was much labour hoarding, or 'hidden unemployment', as firms tried to refrain from firing workers. On the side of capital inputs, too, there was much more excess capacity. In manufacturing, for which data are available, the average operating ratio was 91.1 in this period, as compared with 95.1 in 1986-90. Thus, TFP, which is calculated as the residual, would be much understated.

Second, a major reason for the sluggishness in this period, and since, is the increase in imports, particularly from Asian countries. In the short-run, of course, they represent a leak from aggregate demand, but there are no reasons, at least theoretically, that competition from imports should lower Japan's growth potential. Rather, by inducing better allocation of resources, it *should* raise the potential.

On the other hand, there is a *danger* that Japan's growth potential might become lower. If the present stagnation continues for much longer, it may lead firms to revise their future expectations downward, which would mean less capital inputs including R&D. This would harm productivity gains, too. Also, a more efficient allocation of resources presupposes that capital and labour are free to move into areas where they can be most profitably employed. There are still many regulations, especially in the tertiary sector, and efforts to dismantle them are facing stiff resistance.

To conclude, it is important to lead the economy out of the present sluggishness, before firms become permanently bearish. It is equally important to dismantle the regulations which long outlived their usefulness. If efforts on these fronts are successful, there seem to be no data up to the late 1980s that suggest a bleak future for Japan.

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Discussion

1. Wong Fot Chyi

Michael Sarel provides a critical review of some of the issues which have been addressed by numerous studies concerning East Asia's remarkable economic growth over the past few decades. This is an area that has proven to be fertile ground for intense debate and controversy among growth and political economists, and will continue to be so. Here, I shall also restrict my discussion of his paper to the four main dimensions of the issues which he has identified as important, drawing on Singapore's experience whenever possible.

Productivity or Factor Accumulation?

Consider first the issue of total-factor productivity (TFP) measurement. In most empirical studies, TFP is measured either as a residual of output growth net of a weighted average of the growth in all inputs, or as a coefficient of time in a regression of output on the various inputs and time. In either methodology, there is an underlying assumption that all the factors, inputs and TFP, are independent of each other. However, several possible sources of interdependence between factors have been identified in the literature. These include the embodiment of technology in capital, non-neutrality of technological progress, and the complementarity of skill and capital (both physical and human).[1] The analysis of such interactions suggests that the contributions to output growth from TFP and the various inputs may be empirically indistinguishable. However, in many conventional growth-accounting exercises and regression studies, the effect of this interaction is usually credited to the inputs, thereby underestimating TFP growth.

I show in Table 1 the estimates of TFP growth for both the manufacturing sector and overall economy in Singapore which can be extracted from the literature.[2] The great variety of TFP growth estimates that have been obtained for the same country, some highly contradictory, should immediately give rise to caution in interpreting such TFP measures. Sarel has correctly highlighted the problem of robustness of TFP estimates. In particular, he has shown that they are sensitive to the weight being assigned to capital input and the specific estimation period. Another significant influence on the robustness of TFP results lies in the disaggregation of the various inputs. As Jorgenson and Griliches (1967) had initially argued, the residual from the growth-accounting exercise could be eliminated altogether by adjusting the inputs for shifts in quality, composition and other attributes.[3]

The point is that TFP calculations are notoriously imprecise, easily distorted by measurement errors in the data on inputs and output, and improvements in their quality.

1. See, for example, Kim and Lau (1992,1994), Hulten (1992) and Berman, Bound and Griliches (1993).
2. The estimates are mostly taken from Felipe (1994), who also provides the TFP estimates by various researchers for some of the other South-East Asian countries.
3. They had, however, retreated from that position after being criticised by Denison (1969). Even then, the effect of disaggregation of inputs on TFP estimates remains.

As shown by both Lowe and Gordon in this Volume, this problem is particularly severe in the financial services and electronics industries. It is even more so in an economy with rapid structural changes like Singapore, where the share of financial and business services in GDP had risen from 15 per cent in 1960 to 25 per cent in 1994 while the share of manufacturing, heavily weighted in electronics, had risen from 18 per cent to 27 per cent. Seemingly obscure differences in national-accounting methodologies can also lead to big differences in TFP growth between countries, rendering cross-country comparison a meaningless exercise. Moreover, despite its importance, the concept of TFP remains a relatively vague one. TFP, or technological progress estimated as a residual or a coefficient on a time trend, also has little policy implication, since we do not know where it comes from. The recent literature on TFP growth has not contributed significantly to our understanding of the process of economic growth in East Asia, although it has raised useful questions for further study.

Table 1: Estimates of TFP Growth for Singapore
(Per cent per annum)

Source	Period covered	Overall economy	Manufacturing
Chen (1977)	1957-70	3.62	—
	1960-70	—	3.34
Easterly (1993)	1960-85	3.02[(a)]	—
		1.69[(b)]	—
Elias (1990)	1950-87	1.81	—
IMF (1995)	1961-91	1.80	
Kim and Lau (1994)	1964-90	1.90	—
Nehru and Dhareshwar (1994)	1960-73	4.70	
	1973-87	1.50	
	1960-87	-0.80	
Toh and Low (1994)	1970-92	1.37	
Tsao (1985)	1970-79	—	0.08
Tsao (1986)	1966-72	0.60	—
	1972-80	-0.90	—
Wong and Gan (1994)	1981-90	—	1.60
World Bank (1993)	1960-90	1.19[(c)]	—
		-3.01[(d)]	—
Young (1992)	1966-85	-0.50	—
Young (1993)	1970-85	0.10	—
Young (1994)	1966-90	-0.30	—
	1970-90	—	-1.00

Notes: (a) Using Barro-type regression.
(b) Using Levine-Renelt-type regression.
(c) Sample includes high and low-income countries.
(d) Sample includes high-income countries only.

Public Policy and Government Intervention

On the role of public policy and government intervention, Sarel has succinctly summarised the three views on this issue. Without a doubt, this is an area of even greater controversy than TFP measurement. Even with respect to Japan, there is still no complete agreement among economists about how far policy intervention has been carried, and with what success. The World Bank (1993) also appears to have two minds about the role of government intervention in East-Asian economic growth.[4]

Differences of opinion about the role of government in economic development are most obvious in the analyses on the divergent growth experiences between East Asia and Latin America. In their survey of the literature, Adams and Davis (1994) surmised that the main reason for the difference in growth experience is one of economic orientation. Most East-Asian countries adopted an export-oriented industrialisation strategy at an early stage of their economic development, while most Latin-American countries clung to inward-looking import-substitution policies, at least until recently. In addition, the benefits of outward-looking policies in East Asia were reinforced by prudent macroeconomic policies and more cooperative relations between the government and other economic actors. As they put it:

> 'The crucial difference between the East Asian and the Latin American countries is not the extent of government intervention in the economy but the fact that intervention in East Asia has generally been market-conforming, facilitating adjustment to market forces, while in Latin America, as in other protectionist regimes, it has tended to be market-distorting, designed to protect interest groups from market pressures' (Adams and Davis 1994, p. 19).

The East-Asian government action has been termed 'neoclassical intervention' in the literature and I am inclined to subscribe to this view. But as Sarel has noted, there is such a large variation in the policies pursued by the East-Asian countries that the same set of countries have been used to support opposing schools of thought on economic development.

Investment, Exports and Initial Conditions as Determinants of Growth

On these three possible determinants of growth, Sarel is negative about the first two but positive about the third. He has quite aptly pointed out that correlations between growth and some chosen variables typically found in cross-sectional studies do not necessarily imply causality. Such studies are vulnerable to omitted variable bias, spurious correlation and reversed causation. On top of these, one also cannot be sure whether the diverse economic experiences represent different observations on some well-defined surface (see Levine and Renelt (1992)).

4. As Benjamin (1994) has highlighted, in one part of the report, World Bank (1993) asserts that 'our assessment of these major uses of intervention is that promotion of specific industries did not work' and, in another, it concludes that 'more selective interventions – forced savings, tax policies to promote (sometimes very specific) investments, sharing risks, restricting capital outflow, and repressing interest rates also appear to have succeeded in some HPAEs, especially Japan, Korea, Singapore and Taiwan, China'.

As a partial solution to the problem of reversed causality, Sarel uses initial period (rather than average period) observations for the explanatory variables. The problems of cross-sectional analysis which I have just mentioned notwithstanding, the use of initial period observations for the explanatory variables is not without its own problems. First, since economic growth is a dynamic process, the finding that initial period conditions are a significant determinant of growth for the ensuing 30 years is tantamount to saying that the high economic growth of East Asia is fortuitous. Second, as Sarel himself has noted, the quality of the data on initial conditions for most of the less developing and East-Asian countries is in dispute. As such, the empirical results derived from these data should not be taken seriously. Third, there is reason to believe that economic growth and some of the variables are closely linked in a virtuous cycle. These variables may also determine economic growth jointly, rather than singly. Thus, evaluating the respective individual effect of, for example, investment, exports or initial conditions on growth to the exclusion of the other variables may not yield meaningful results. Perhaps Singapore's experience with economic development might be instructive in this regard.

During the approximately three-decade period since achieving self-government from the British in 1959, the Singapore economy has evolved from a semi-closed, low-wage producer of mainly labour-intensive goods, to a very open, high-wage producer of high-technology, capital-intensive products. During the early years, Singapore's economic conditions were dismal. For example, in 1961, unemployment rate was a chronic 15 per cent, gross domestic savings rate was a negative 2 per cent and gross investment rate was a low 12 per cent. There were also the problems of severe poverty and a poorly educated population. Singapore's small domestic market, poor resource endowment, narrow industrial entrepreneurial base and lack of industrial capital were further constraints on growth. If at all, the positive aspects of Singapore's poor initial conditions were that it was very economically backward, since, as Dowrick in this Volume has shown, there are advantages to backwardness in economic development; and that its population had an even distribution of income, as we were all equally poor.

An initial unsuccessful attempt at import-substitution in the early 1960s quickly gave way to an export-oriented industrialisation strategy based on foreign investments. This was a break from the preferred development strategy in both policy and academic circles at that time. In fact, Singapore's economic development over the past three decades has been synonymous with the attraction of foreign direct investments by multi-national corporations to spearhead growth in the manufacturing industries. To attract foreign investments, however, Singapore had to first overcome the hurdle of its economic constraints and poor initial conditions and create a favourable climate conducive to investment. This required strong government intervention in providing the necessary infrastructure such as roads, ports, industrial estates, and public housing for the masses. The role of the government also extended to ensuring sound, stable and prudent macroeconomic policies, upgrading the educational level of the population and promoting private savings.

Between 1961 and 1994, Singapore's gross domestic savings rose from -2 per cent to 50 per cent of GDP, while gross investments went up from 12 per cent to 32 per cent of GDP. Real GDP and per capita real GDP grew at 8.5 per cent and 10.5 per cent per annum respectively, leading to a 46-fold increase in per capita nominal income from US$447 in 1961 to US$20,499 in 1994. Foreign direct investments had augmented low domestic savings during the initial years in boosting growth which, in turn, had generated higher savings and investments in a virtuous cycle. Studies (IMF (1995), for example) have also shown that the high savings rate in Singapore had been due to demographic factors and robust economic growth. The much cited compulsory pension fund system has very little forced savings effect, except during the early years, as total private savings have been much more than net pension contributions.

Although the sources of Singapore's high economic growth have been, and will continue to be, much debated, the analogy that has been made between Singapore and the Soviet Union certainly does not stand up to scrutiny. The crucial difference between the two economies is that one is outward-looking while the other is inward-looking. Thus, insulation from vagaries of international competition and failure to exploit and adopt best-practice technologies from the West, combined with the fact that much of its high investments were defence-related had led to the implosion of the Soviet economy.

Conclusion

As Sarel admits in his conclusion, his paper does not offer clear and conclusive results, nor make clear policy recommendations. If anything, much of his critique in the paper is negative, and this would certainly cloud the debate on the East-Asian growth miracle. Singapore's experience has shown that things are not as dismal as Sarel has concluded. Of course, one case does not make for generalisation. While the search for a unified explanation of the East-Asian miracle may well be futile, it has not curtailed the enthusiasm nor the number of officials from less developing countries visiting the East-Asian capitals to pursue and learn from their economic success. As Rostow (1995) puts it, miracle or not, the industrialisation of Asia will shape the next century.

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2. General Discussion

The discussion focused on three issues:

- the importance of government intervention in the Asian growth process;
- whether Asian growth was intensive or extensive; and
- the necessary pre-conditions for growth.

While participants generally agreed that there was a large amount of evidence that poor government policy could harm economic performance, opinion was divided about whether the opposite was true – that is, whether government policy could enhance economic growth. One participant argued that it may be more difficult in the current world economic environment to adopt a 'picking-winners' approach than it was in the 1960s and 1970s. The increased openness of trade and capital markets may reduce the ability of governments to favour one industry over another. In focusing on government intervention in the East-Asian economies, the poor experience of industry policy in many Latin-American countries tended to be overlooked. The lessons of the Asian growth experience were drawn mainly from the 'winners' rather than the 'losers'.

The issue of whether Asian growth was 'intensive' or 'extensive' was seen as vital to the debate on the relevance of Asian growth. If the Asian growth experience was solely due to the mobilisation of resources, when should we expect to see these economies slow down? Alternatively, however, there may be further scope for continued growth by reallocating resources more efficiently between sectors. Furthermore, one participant argued, if their growth simply involves mobilising resources, shouldn't this be easily replicable in developing countries which have had a very poor growth record? In terms of the lessons for Australia, if growth in Asia was extensive, then there is little that Australia can learn from the Asian experience.

There was also some debate about what were the necessary pre-conditions for growth. One participant argued that the Asian experience provided mixed evidence on the need for higher saving to encourage growth. In a number of countries, high saving rates followed economic growth, whilst in other countries high saving rates were in place before growth accelerated. Another participant emphasised the integrity of the financial system as a necessary pre-condition for growth: a sound financial system is necessary to mobilise resources and to allow saving to be transformed into productive investment. While much attention was paid to deregulation of financial markets, it was also noted that there are a host of institutional rigidities that can retard growth. In this regard, it was suggested that a key ingredient for a revival of growth in Japan was microeconomic reform in the non-traded goods sector. Finally, it was emphasised that the pre-conditions for good economic growth may vary with the maturity of the economy; a phenomenon not easily captured in cross-country growth regressions.

Macroeconomic Policies and Growth*

Palle Andersen and David Gruen

> 'Is there some action a government of Australia could take that would lead the Australian economy to grow like Korea's or Taiwan's? If so, what, exactly? If not, what is it about the 'nature of Australia' that makes it so? The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else' (With apologies to Lucas (1988)).

1. Introduction

Conferences on macroeconomics and macroeconomic developments usually conclude with a paper on the implications for macro-policies. However, for a conference on growth, this poses a bit of a dilemma. On the one hand, according to the natural-rate hypothesis which is accepted by many analysts, macroeconomic policies are neutral with respect to long-run real output and employment. Moreover, in the neoclassical theory of growth, technological progress falls like manna from heaven and the level of investment – the only variable susceptible to policy changes – affects the steady-state level of output, but not its rate of change. Endogenous growth theory recognises that technological change can be endogenous and that changes in the stock of capital – human as well as non-human – may generate positive externalities and are not necessarily subject to diminishing returns. However, most policy implications are microeconomic in nature and the theory does not assign any specific role to macroeconomic policies.

On the other hand, when looking at the growth performance of different countries over various periods and the policies they pursued, it is difficult to believe that macro-policies did not play a role. The impressive economic achievements of most industrial countries during the 1950-73 period owed much to reconstruction and technological catch-ups, but these catch-ups did not take place automatically. They were facilitated by policies promoting economic integration and investment in human and non-human capital. Growth was also helped by low inflation, the absence of fiscal imbalances and stable factor-income shares. While macro-policies aimed at full employment may well have had a positive effect, they may also have sowed the seeds for the slowdown during the 1970s and 1980s. The astonishing growth performance of the four NIEs (the four Asian 'tigers') and later the South-East Asian economies also seems to be associated with policies favouring low inflation and sound fiscal policies. At the same time, the 'lost decade' of the 1980s in Latin America and depressing developments in most of Africa can be traced, not only to political instability, but also to inward-looking policies that stimulated domestic demand growth while paying little attention to the costs in terms of inflation and external imbalances.

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If we accept the view that actual developments should receive a larger weight than pure theory, one important question remains: how should 'macroeconomic policies' be defined and measured and through which channels do 'good' or 'bad' policies affect growth? In this paper, we associate macroeconomic policies with monetary, fiscal and exchange rate policies as reflected in, or measured by, the rate of inflation, the budget balance, the real rate of interest, the real exchange rate and the current account of the balance of payments. This is not a very precise definition and it has the added problem that these measures of macroeconomic policies are to some extent endogenous to actual economic developments. As regards transmission channels, we are persuaded by Fischer's (1993) hypothesis that policies which lead to high inflation or large internal or external imbalances generate uncertainty which adversely affects growth. We also discuss additional channels which may exist if potential output depends on past developments in actual output because of path dependence.

The rest of the paper is divided into four sections. Section 2 provides a broad review of macroeconomic developments in the post-war period in an attempt to detect some preliminary evidence of the role of policies. Section 3 looks at the policy related variables in the generally-accepted theories of growth and the empirical evidence from cross-country regressions, reviewing major results as well as problems of measurement and interpretation. Section 4 deals with the relationship between inflation and growth while Section 5 summarises and derives tentative policy implications.

2. An Overview of Long-Run Growth Trends

To gain a preliminary impression of the potential role of macroeconomic policies, Table 1 presents long-run trends in per capita income growth over the period 1870-1989. Four features are worth noting:

- growth does not evolve along a smooth constant trend – there is clear evidence of 'epochs' of growth, raising important questions as to the causes of trend breaks;
- the period 1951-73 clearly stands out as a period of exceptionally strong growth and, seen in a longer perspective, post-1973 developments are relatively favourable;
- the growth performance of Australia is rather poor compared with that of other industrial countries, especially during 1951-73 when the growth differential exceeded one percentage point; and
- among the developing countries, the extraordinary growth performance of the Asian countries is of relatively recent origin as, prior to 1950, growth in Asia was well below that of other regions. By contrast, Latin America grew relatively fast before 1950, while growth was rather slow during 1950-73 and almost came to a complete halt in the post-1973 period. The same pattern is even more evident in Africa, following a somewhat better growth performance during the pre-war period.

The 1951-73 era is clearly the most interesting one, especially given the macro-policy activism during the period. To what extent did 'good' policies contribute to the high growth? It is generally recognised that once-off factors such as post-war reconstruction and catch-ups with the technological leader (the United States) had a large part in explaining the favourable growth performance. Thus excluding the United States,

Table 1: Long-Run Growth Trends
(Per capita GDP based on PPP weights, per cent per annum)

	1870-1913	1914-1950	1951-1973	1974-89
Industrial countries	1.3	1.2	3.5	2.1
Australia	0.9	0.7	2.4	1.7
Asia	0.3	-0.2	3.5	5.2
Latin America	1.3	1.3	2.3	0.6
Africa	n.a.	1.6	2.0	0.0

Source: Maddison (1993).

average per capita growth in the industrial countries exceeded 4 per cent (compared with less than 1 per cent over 1914-50) while the United States grew by only 2.2 per cent (1.6 per cent). These unique factors also implied that high growth was unlikely to continue; once the catch-ups had been completed, growth would return to a slower pace.

The catch-ups did not, however, occur automatically. They were no doubt facilitated by the move towards free trade and currency convertibility and within each country they were helped by higher investment in both education and physical capital. Indeed, by 1973 the investment/GDP ratio for the industrial countries had increased to over 25 per cent, compared with 22 per cent in 1960 and for the 1960-73 period on average (Table 2). In some countries with restrictions on capital movements, the rise in investment may have been helped by low-interest-rate policies. A favourable social environment, resulting in stable factor-income shares, probably also stimulated investment. In a few countries, ‘social contracts’ were instrumental in generating stable factor shares (see Crafts and Toniolo (1995)) but more generally, the stability was probably the result of the high rate of productivity growth. With most prices set as a mark-up on unit labour costs, high labour-productivity growth meant that moderately rising nominal wages translated into growing real wages and low price inflation. Distributional pressures and disputes could thus be resolved in a relatively non-inflationary way and without large short-term changes in factor income shares.

The role of demand-management policies is more difficult to evaluate (and will be discussed further in Section 3). Attempts to ‘fine tune’ the economy may have been instrumental in generating relatively stable growth rates during 1950-73, with a variability about one-third lower than in the inter-war period (Romer 1988) and also substantially lower than in the post-1973 period (see Table 3). This is likely to have reduced uncertainty and spurred investment.[1] On the other hand, it also appears that either policy makers went too far in ‘smoothing the cycle’, stimulating output to a level that, in retrospect, was too high relative to potential output, or they did not take sufficient account of shocks and other external changes that reduced potential output. Thus, while inflation was low on average, it accelerated significantly during the period (Table 2). Moreover, the labour share of income rose in the late 1960s and into the 1970s, pointing to strains

1. Kormendi and Meguire (1985), however, find a *positive* coefficient for the variability of income growth in a cross-country regression of per capita income growth.

Table 2: Performance or 'Policy' Indicators

	1960-73	1974-82	1983-94	1960-73	1974-82	1983-94
Industrial countries				*Australia*		
Inflation, average rate, %	3.7	8.7	4.6	4.6	11.6	5.6
Change in inflation[(a)]	3.7	-3.3	-2.6	6.2	-4.7	-8.4
Budget balance/GDP, %[(b)]	-0.2	-2.6	-3.1	1.4	-1.7	-2.3
Investment/GDP, %	21.7	22.0	20.9	25.5	24.2	24.6
Exports, % change[(c)]	8.0	4.2	5.7	7.5	3.4	7.0
Current external Account/GDP, %	0.3	-0.2	-0.5	-1.7	-2.8	-4.5
External debt/GDP, %[(e)]	n.a.	-9.2	-13.2	n.a.	15.9	41.5
Real long-term interest rate	3.0	0.5	4.8	1.1	-2.3	6.7
Sub-Saharan Africa				*Asia*		
Inflation, average rate, %	4.7	16.4	24.0	4.2	7.9	8.0
Change in inflation[(a)]	5.2	3.0	15.0	5.0	-4.5	3.5
Budget balance/GDP, %[(b)]	n.a.	n.a.	-7.0	n.a.	-4.0	-3.3
Investment/GDP, %	17.5	23.0	16.5	19.5	25.0	27.0
Exports, % change[(d)]	12.0	10.0	4.5	13.5	18.5	12.5
Current external account/GDP, %[(f)]	-3.1	0.6	-3.0	-1.3	-2.3	-1.4
External debt, GDP, %[(g)]	30.7	75.2	82.8	19.6	32.0	37.1
Latin America						
Inflation, average rate, %	23.8	49.5	137.5			
Change in inflation[(a)]	-5.0	37.0	112.5			
Budget balance/GDP, %[(b)]	-2.5	-2.0	-4.0			
Investment/GDP, %	20.5	24.0	19.5			
Exports, % change[(d)]	9.2	17.0	2.7			
Current external account/GDP, %[(f)]	-2.0	-4.3	-2.0			
External debt/GDP, %[(g)]	36.1	66.1	36.0			

Notes: (a) From first to last year of period.
(b) General government for industrialised countries; central government for developing countries.
(c) Goods and services in volumes.
(d) Merchandise exports in US$.
(e) 1984 and 1993, respectively.
(f) First two columns refer to 1970 and 1980 respectively.
(g) 1980, 1987 and 1994, respectively.

Sources: OECD, *National Accounts*; IMF, *International Financial Statistics* and *World Economic Outlook*; Fischer (1991); and authors' estimates.

Table 3: Output Growth: Trends and Variations
(Per cent per annum)

	1960-73		1974-82		1983-94	
	μ	σ	μ	σ	μ	σ
Industrial countries	4.8	0.95	2.1	1.85	2.9	1.15
Australia	*5.1*	*2.10*	*2.4*	*1.55*	*3.3*	*2.30*
Latin America	6.0	2.50	4.1	3.00	2.1	1.70
Asia	4.7	3.90	5.9	2.30	7.4	1.10
Sub-Saharan Africa	4.2	2.00	3.3	2.80	1.8	1.70

Note: μ denotes average growth of GDP and σ standard deviations of growth rates for the periods concerned. Comparisons with the figures in Table 1 should be made cautiously. The number of countries in each group is much larger than in Table 1, and the data refer to changes in aggregate real GDP in national currencies, rather than per capita GDP converted at PPP.

Sources: IMF, *International Financial Statistics*; OECD, *National Accounts*; and national data.

in the social fabric. One tentative conclusion emerging from this episode is, therefore, that macro-policies aimed at smoothing the cycle may increase the level as well as the average rate of output growth. However, such changes are only *sustainable* if the target level of output does not lead to rising inflation.

Because the productivity slowdown in the early 1970s[2] coincided with the breakdown of the Bretton Woods system and the rise in oil prices, it is tempting to associate floating exchange rates and higher oil prices with lower output and productivity growth. With the perspective of two decades, however, there is little evidence to support these hypotheses. The share of oil and other energy products in overall output costs is only around 5 per cent and while some early studies identified higher energy prices as the principal reason for the growth slowdown, most recent analyses do not find changes in relative oil and energy prices to be significant. The terms-of-trade losses suffered by many industrial countries combined with real wage rigidities have also figured prominently in explanations of the slower growth after 1973, especially for European countries. If, however, 'real wage gaps' were a major cause, the terms-of-trade gain following the decline in oil prices in the mid 1980s should have boosted growth and reduced unemployment, which it failed to do. The evidence is also weak regarding the growth effects of the rise in the variability of exchange rates: some have found that high variability has an adverse effect on trade but most have found no significant effects.[3] It seems more likely that these two events were themselves the results of the previous developments and policies and that the slowdown would have occurred in their absence, though it might have been less abrupt.

2. A slowdown in trend growth occurred in most industrial countries around 1973, while in many developing countries, the break seems to have coincided with the second oil price rise and the debt crisis (see Crafts and Mills (1995) and Ben-David and Pappell (1995)).
3. On the other hand, maintaining exchange rates at levels that are not consistent with 'fundamentals' can have adverse output effects (see Section 3). Such policies are more likely under fixed than under flexible exchange rate regimes.

Some have also associated the productivity slowdown with the change in the consensus view of economic policies from a Keynesian paradigm based on fine-tuning economies at close to full employment to a neoclassical paradigm stressing market forces and giving high priority to low inflation. However, the change in policy regimes did not take place overnight (though by the early 1980s most industrial countries had accepted this new view) and was thus less sharp than the 1973 trend-shift would suggest. A more plausible interpretation would seem to be that part of the high growth rate generated during the Keynesian regime was unsustainable and part of the slowdown during the neoclassical regime reflects the 'costs of repairing the damage' caused by the earlier policies.

This combination of over-expansionary policies followed by a period of re-establishing macroeconomic balance is even more striking for Latin America (Adams and Davis 1994). Although there was some slowdown between 1960-73 and 1974-82, growth in the latter period was still relatively high but, as it turned out, mainly based on fiscal and monetary policies aimed at expanding domestic demand. These policies *did* succeed in raising output growth, but they also resulted in widening fiscal imbalances, accelerating inflation and, above all, in steeply rising external deficits and levels of foreign debt. The unsustainability of the situation became evident in 1982, when world real interest rates rose and the measures required to correct the past mistakes resulted in the 'lost decade' of the 1980s. In Sub-Saharan Africa, too, short-term policies – to a large extent in the form of expanding the public sector – helped to maintain relatively high growth in the 1970s. However, since the earlier 1980s, aggregate growth has averaged less than 2 per cent, partly because of a 30 per cent fall in the terms of trade and other external shocks, but also as a result of correcting unsustainable fiscal imbalances and over-expansionary policies, reinforced by a large burden of foreign debt and limited access to international capital markets.

3. Growth Theories and Empirical Evidence

3.1 Growth Theories

For three decades, growth theory was dominated by the neoclassical Solow-Swan model in which output growth is determined by technical progress and growth in capital and labour inputs.[4] This model provides few channels for macro-policy influences. Thus, technical progress is assumed to be exogenous and most empirical studies do not suggest macro-policies have much influence on labour force growth. Capital growth, however, could be influenced by policies and, as further discussed below, the neoclassical model is often used to analyse the growth effect of policy-induced changes in capital stock growth or changes in the investment/GDP ratio. Moreover, when the Solow-Swan model is extended to include human as well as physical capital, it is possible to explain per capita

4. More formally, the Solow-Swan model assumes that output, Y, is determined by an aggregate production function, $Y = F(L, K, E)$ where L is labour, K is the gross capital stock and E is technical progress. The production function is often assumed to be Cobb-Douglas with constant returns to scale, which implies that $\Delta \ln Y = (1-b)\Delta \ln L + b\Delta \ln K + \varepsilon$ or $\Delta q = b\Delta k + \varepsilon$ where $q = \ln(Y/L)$, $k = \ln(K/L)$, *1-b* and b are the output elasticities of labour and capital, respectively, and ε is the rate of technical progress.

income growth in a broad range of countries and show that, after controlling for the determinants of steady-state income levels, poor countries grow faster than rich ones: i.e. that there is 'conditional' convergence in per capita income levels (Mankiw, Romer and Weil 1992).

It is also possible to disaggregate changes in capital into various types of investment, including public investment in infrastructure. Of course, as long as the framework of the neoclassical model is maintained, policy-induced changes in the growth of capital or the investment/GDP ratio do not change steady-state output growth but only the steady-state output level. In practice, however, this may be of limited importance because the transition period between steady states is very long, so that growth over extended periods (as opposed to steady-state growth) is affected.[5]

Romer (1986) initiated an explosion of research on how to explain or 'endogenise' technical progress in theories of long-run growth (Dowrick 1995). For the purpose of this paper, the most important features are the emphasis on capital or a specific type of capital as the principal determinant of growth and the possibility of externalities or imperfect competition implying that markets may not generate a Pareto optimum in general. Or, to put the second point differently, if firms and other economic agents cannot internalise all the benefits of their investments, the growth of capital will be below the socially optimal rate.

3.2 What Do We Learn From Cross-Country or Panel Studies of Long-Run Growth?

Most of the specific policy measures suggested by endogenous growth theories are microeconomic in nature and macroeconomic policies as defined in this paper rarely appear. Nonetheless, based on the experience of the 1970s and 1980s, many economists came to believe that sound macroeconomic policies were conducive to long-run sustainable growth. Fischer (1993) lists five conditions which together imply that a macroeconomic framework is conducive to growth: a low and predictable inflation rate; an appropriate real interest rate; a stable and sustainable fiscal policy; a competitive and predictable real exchange rate; and a balance of payments that is regarded as viable.

Fischer stresses uncertainty, arguing that a government that allows a high budget deficit or a high rate of inflation has lost control and generates uncertainty. Uncertainty and its effects on volatility are also the transmission channels stressed by Pindyck and Solimano (1993) who attempt to identify the principal determinants of variations in investment/GDP ratios over time and between countries. In all their regressions, they find inflation to be the main source of volatility in the marginal return to investment and of variations in the investment/GDP ratio.[6]

5. For example, assuming the parameter estimates in Mankiw *et al.* (1992), a 20 per cent rise in the savings ratio raises the steady-state level of labour productivity by 10 per cent. However, only half the adjustment is completed in 35 years and during the transition phase, labour productivity growth is approximately 0.15 percentage points (5/35) higher than prior to the change in saving.

6. This result also implies that attempts to capture the adverse effects of inflation in growth equations that control for the investment/GDP ratio will fail if inflation only affects growth via changes in investment; a point we return to in Section 4.

Indeed, with capital accumulation the principal determinant of long-run growth in both the neoclassical model and most versions of endogenous growth models, the determination of capital expenditure is likely to be an important transmission channel for macroeconomic policies and it might even be argued that macroeconomic policies should be designed with a view to stimulating capital expenditure. Moreover, if capital flows are less than perfectly mobile internationally or, for other reasons, balance-of-payments considerations act as a constraint on growth, the level of national saving and ways to raise it through policies – notably fiscal policy – become relevant as well. We address these issues in Section 3.3, following a brief discussion of measurement issues and problems of interpretation.[7]

Returning to Fischer's five conditions, note that they are not independent of each other, and there are plenty of individual country cases showing that satisfying one or two of these conditions is not enough. The most striking recent example is Mexico which in the 1990s, but before the December 1994 crisis, achieved a low inflation rate and consolidated its fiscal situation. However, growth remained low, because the real exchange rate was not competitive, leading to a nonviable balance of payments, combined with volatile but mostly quite high real interest rates. The members of the African franc zone provide another example. Because of the currency link with the French franc until early 1994 inflation was low, but over time the real exchange rate became increasingly uncompetitive and growth was well below even the modest rates of other African countries. Turning to the developed countries, several members of the European Community achieved low inflation, competitive exchange rates and viable balances of payments in the eighties and early nineties, but growth remained low because real interest rates were generally high and in several countries the fiscal situation was regarded as unsustainable. At the other end of the spectrum, many of the fast-growing Asian countries are often seen as being helped by their stable macroeconomic policies (Hughes 1995) including low inflation, sound fiscal policies, competitive exchange rates and balance of payments deficits that are generally regarded as viable because they reflect high imports of capital goods. Chile, which has achieved very high growth rates since the mid 1980s should also be mentioned as one country where macro-policies appear to have been instrumental in generating a transition from stabilisation to high and sustainable growth.[8]

The above list is by no means exhaustive. Nonetheless, finding clear evidence of policy influences from empirical studies has proven difficult. There seem to be four reasons for this. First, because all five conditions need to be satisfied, analyses including

7. Investment and saving are, however, not the only channels by which policies can affect growth over long periods. As suggested by Boltho and Holtham (1992), one empirical fact that a theory of growth needs to explain is why some countries grow at very high rates over long periods without encountering signs of decreasing returns to capital and/or labour. As discussed by Dowrick (this Volume), one reason for this is that these countries are on a transition path, catching up with the technological leader. Second, long-run growth could contain important elements of hysteresis, due to the existence of non-linearities and asymmetries, which again would make the growth path sensitive to macroeconomic policies. These issues will be further discussed in Section 3.3.

8. On a different tack, Sachs and Warner (1995) stress policies that protect property rights and promote openness, arguing that reversible policy mistakes in these two areas rather than initial conditions are the principal reasons for the absence of convergence in growth rates across countries.

only a subset are unlikely to produce conclusive evidence. On the other hand, because the five conditions are not independent of each other, multicollinearity problems often mar studies that include indicators of all conditions. Second, several countries have managed to grow strongly even over rather long periods (most notably Latin America in the 1960s and 1970s) before the accumulation of macroeconomic imbalances caused a slowdown. These exceptions from the general rule have lasted long enough to have exerted a distorting influence on analyses based on cross country comparisons. Third, none of the conditions can be directly related to policy instruments or 'executable' policies, but need to be proxied by other measures that are not necessarily exogenous with respect to general economic developments. In other words, analyses of policy effects will suffer from simultaneity or dual causality problems. Finally, even if these problems could be overcome, the coefficients estimated from cross-country regressions measure the strength of partial correlations and care must be exercised when interpreting them as behavioural relations and in deriving policy implications.

We conclude with a final point concerning the relative persistence of growth and macro-policy indicators. For most countries, levels of output and country characteristics, including many policy-related variables, are highly persistent through time, while growth rates are not (Easterly *et al.* 1993). In the Appendix, we verify this pattern of persistence for the OECD countries and discuss its relevance. As Easterly *et al*. argue, it suggests that while the differential shocks that hit countries play a big role in determining the cross-country variation in growth rates, macro-policies and other country characteristics are also important in explaining growth, in particular when countries are far from their steady-state incomes but also through the reaction of policies to shocks.

3.3 Specific Effects on Growth

Despite the problems raised above, we now turn to empirical estimates of specific policies, starting with fiscal policy and issues relating to investment and continuing with a discussion of possible balance-of-payments constraints on growth and the role of national saving. We then turn to the relationship between exchange rate policies and growth, the role of financial markets and the implications of path dependence for macroeconomic policy.[9]

3.3.1 Fiscal policy and public investment

A large number of cross-country analyses of growth have included measures of fiscal policy, focusing on three issues in particular: the relationship between the *size* of the public sector and growth; the likely adverse impact of fiscal imbalances and public debt; and whether certain types of public expenditure are associated with special positive or negative growth effects. Easterly and Rebelo (1994) is one of the most recent and most comprehensive studies dealing with the fiscal policy issues. It uses a new database for

9. We don't address the relationship between incomes policies and growth. For differing views on the implications of the Australian Prices and Incomes Accord for growth, see Blandy (1990), Chapman (1990), Fane (1990), and Gruen and Grattan (1993).

the public sector and analyses various indicators of fiscal policy and their effect on long-run per capita growth, including the budget balance, average tax rates, government consumption expenditure and public investment. The indicators are imbedded in a Barro (1991)-type equation estimated across 50-75 countries. Among the many results reported the following are worth noting:

- like most other analysts, Easterly and Rebelo find that the coefficients obtained for measures of the size of the public sector are fragile;
- the budget balance has a significant and positive coefficient, meaning that countries running large fiscal deficits tend to have lower growth (implying, of course, a failure of Ricardian debt neutrality); and
- public consumption seems to have a negative effect on growth, whereas public investment has a positive effect, with the strongest effects found for central and general government investment and for investment in education and transport facilities.

These results on public investment are consistent with a number of other recent studies which have looked at investment in infrastructure. While there has been a secular decline in the ratio of public investment to GDP in virtually all industrial countries, the implications of this decline were largely ignored until Aschauer (1989a, 1989b) found that a 1 per cent increase in the stock of public capital in the United States raised private sector capital productivity by 0.4 per cent, implying very high returns on public sector investment.[10] Equally high estimates have been obtained for Australia (Otto and Voss 1994a, 1994b) and for other countries as well.

Following Aschauer's startling results numerous other studies appeared, many of which cast doubt on his estimates (Gramlich 1994). While it would go too far to review this debate, there appear to be two principal implications for macroeconomic policies. First, reducing public investment merely as a means of cutting the government borrowing requirement is not an optimal long-run policy. Second, while federal grants encouraging infrastructure investment projects (which are mostly undertaken by State and local governments) with particularly high returns might be an area of policy relevance, the current consensus is for increased reliance on user fees or privatisation of infrastructure capital.

3.3.2 Aggregate investment

The above conclusion still leaves open the question whether, given the role of capital growth in both the neoclassical and endogenous growth models, fiscal policy should provide special incentives for investment in general. As a starting point, consider the neoclassical model assuming a Cobb-Douglas production function with constant returns to scale as given in footnote 4 above. For most countries with capital stock data, estimates yield values for b of about 0.3, implying that increasing the rate of growth of the capital stock per worker by 1 percentage point raises annual output growth per worker by 0.3 points. When capital stock figures are not available or subject to large measurement

10. In this context, note that the ratio of public investment to total government expenditure has averaged 17 per cent in South-East Asia but only 8 per cent in Latin America; see Adams and Davis (1994).

errors, Δk may be approximated by the investment/GDP ratio and the growth equation estimated as:

$$\Delta q = (r + \delta).(I / Y) + \varepsilon \qquad (1)$$

where δ denotes the rate of depreciation and *r* the required net rate of return.

When equation (1) is estimated across both developed and developing countries, Fischer (1993) and Dowrick (1994) find $(r + \delta)$ in the range 0.15-0.20 while Englander and Gurney estimate $(r + \delta)$ at 0.09 and at only 0.06 when the sample is confined to the OECD countries. For δ of approximately 0.05 (based on data for all OECD countries and assuming an average capital/output ratio of 2.5) the net return will be in the range 0.05-0.15 for the whole sample, but only around 0.01 for OECD countries. Moreover, when estimating the determinants of total-factor productivity growth, Englander and Gurney find that growth in the capital/labour ratio has no significant influence.[11]

On balance, the empirical evidence on aggregate investment does not point to very large positive externalities, nor does it provide strong support for special incentives.[12] Since in most countries there are numerous examples of distortions in relative prices due to the existing tax and subsidy structure, the current consensus appears to be that policies to encourage investment should mainly consist of reducing or eliminating existing distortions rather than attempting to 'pick winners' (see also Auerbach (1992)). In particular, tax systems in several countries, including Australia, distort relative prices in favour of residential investment, encouraging a type of capital expenditure and a composition of total investment which does not encourage long-run growth.

3.3.3 Growth and the balance of payments

A country's balance of payments position may influence its level or rate of growth of output in several plausible ways. In our discussion, we examine a range of possible influences, and focus particularly on the Australian experience.

If international capital flows are highly mobile, saving acts as a constraint on investment and growth for the world as a whole, but not for any individual country, as capital flows from countries with excess saving to those where profitable investment exceeds domestic saving. Access to foreign savings enables individual countries to fund higher domestic investment than would otherwise be possible.

The extent of international capital mobility, however, remains an unresolved issue. On the one hand, tests based on comparisons of interest rates such as onshore-offshore differentials suggest a high degree of capital mobility between countries. On the other

11. Gordon (1995), who analyses the adjustments of unemployment and the capital stock to various supply shocks to the labour market, reports results that are even more 'damaging'. Looking at the slowdown in labour-productivity growth between 1960-73 and 1979-92 in six of the G7 countries, he finds that it is mostly due to slower growth of total-factor productivity, whereas there is no systematic relation between changes in the contribution of capital per working hour and labour productivity.

12. Furthermore, while higher investment boosts economic growth, higher output growth also encourages investment. As a consequence, the estimated coefficient in equation (1) is likely to overstate the extent to which higher investment *causes* higher output growth. There have also been a number of recent studies dealing with the growth effects of special types of investment, especially expenditure on machinery and equipment (see Dowrick in this Volume).

hand, research examining the behaviour of real variables, like saving and investment correlations, consumption behaviour across countries, and the implications of the intertemporal approach to the balance of payments, suggest that even without institutional or legal barriers inhibiting the flow of capital internationally, the owners and managers of each nation's savings act to keep almost all of it at home (Feldstein and Horioka 1980; Tesar and Werner 1992; Lewis 1993; Obstfeld 1994; Feldstein 1995a, 1995b; Bayoumi and Klein 1995). This evidence therefore suggests that the balance of payments does act as a constraint, in the sense that countries with current account deficits invest less, and grow more slowly, than they would if domestic savings were higher. (A similar constraint would apply if domestic policy was aimed at maintaining external balance.)

One version of the idea that the balance of payments imposes a constraint on growth is presented by McCombie and Thirlwall (1994), hereafter MT. MT develop a demand-side model in which the growth rate 'consistent with balance-of-payments equilibrium' is determined by the rate of growth in total revenues available for expanding imports, allowing for the effect of terms-of-trade changes, changes in export volumes and net capital flows, and by the income elasticity of imports. Applying the MT approach to Australia suggests a growth rate consistent with balance-of-payments equilibrium of between 2 and 3 per cent per annum, well below the trend rate of growth of the Australian economy (see the Appendix for details).

The MT analysis uses an elasticities approach to the balance of payments, and as such, ignores the response of domestic savers and investors to the aggregate wealth implications of rising external indebtedness. It also excludes any real exchange rate change as part of the adjustment process. In reality, however, a depreciating real exchange rate is part of the economy's response to higher external indebtedness (Blundell-Wignall, Fahrer and Heath 1993). We therefore turn to the potential implications of this depreciation for real output.

A current account deficit of 4.5 per cent of GDP (the Australian average over the past decade) means that the ratio of net external liabilities to GDP currently rises at about 1.7 percentage points per annum (again, see the Appendix for technical details). As a consequence, the Australian dollar depreciates in real terms, at an estimated average rate of about 0.9 per cent per annum. This slow real depreciation is needed to generate a surplus on the trade and services account in the longer-run – which is required to fund the income payments on foreign liabilities. As the external liabilities ratio rises, the extent of required real depreciation also rises.

A depreciating real exchange rate, however, exerts upward pressure on the domestic price of imports, and creates domestic inflationary pressure. To keep inflation from rising then requires real unit labour costs to fall at an estimated average rate of about 0.4 per cent per annum (or, equivalently, real wages to rise at an average of 0.4 per cent per annum slower than labour productivity growth).[13]

13. See the Appendix for this estimate. An alternative way to view the issue may also be helpful. With traded goods prices determined in world markets, traded goods inflation is higher than domestic inflation when the real exchange rate is depreciating. For domestic inflation to remain steady, therefore, requires non-traded prices to rise more slowly than domestic inflation which, in turn, requires domestic nominal unit labour costs to rise more slowly than inflation. This generates widening profit margins in the traded goods sector (since economy-wide real unit labour costs are falling while the real depreciation is delivering higher output prices for traded goods) and thereby attracts resources into this sector, as required.

In principle, if real exchange rate depreciation proceeds smoothly and gradually, the labour market can deliver the required gradual fall in real unit labour costs without adverse consequences on the level of output in the economy. In practice, the gradual real depreciation is superimposed on large, medium-term, movements of the exchange rate (predominantly caused by fluctuations in the terms of trade). Hence, at times it may not be possible for the labour market to adjust sufficiently quickly, and price inflation will rise. According to estimates presented in the Appendix, in such situations, the level of output must be kept an average of 0.9 per cent lower than if there was no real depreciation to be absorbed. This estimate of the average output cost associated with keeping inflation steady may, however, be overstated as it assumes the labour market generates no reduction in real unit labour costs without a fall in output.

Turning to other possible influences, a high and rising level of foreign liabilities may well generate uncertainty because economic agents are unsure how the situation will be resolved. As previously discussed, more uncertainty may adversely affect investment (Pindyck and Solimano 1993) and therefore growth (Fischer 1993). There is also empirical evidence that, in general, real interest rates are higher in countries with large current account deficits (Orr, Edey and Kennedy 1995) and, in particular, in Australia (Gruen and Smith 1994) which also has an adverse effect on investment and growth.

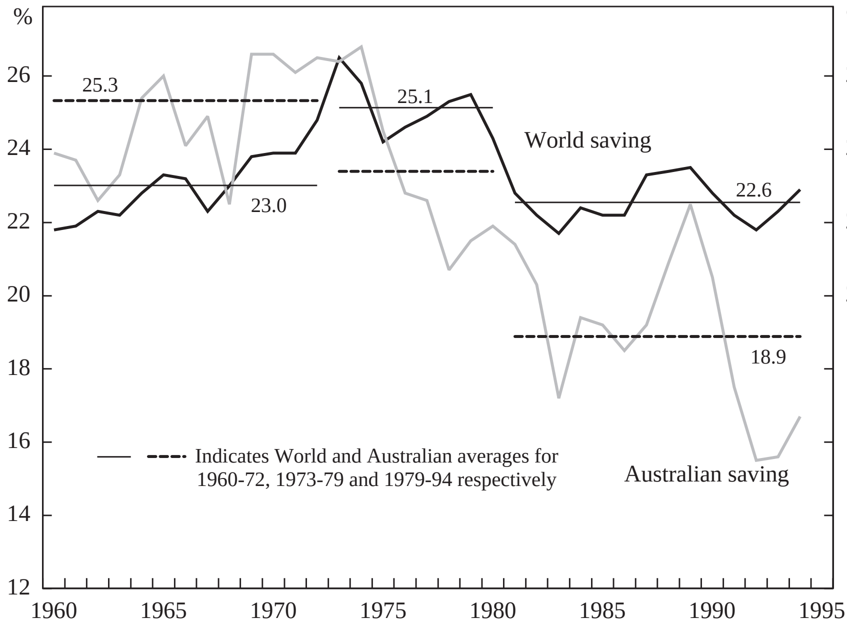
To conclude our discussion, we should point out that we have not directly addressed the question of whether the rising external liabilities are optimal or not (Pitchford 1990). Even with limited access to foreign savings, domestic investment will be higher than would otherwise be possible. Ultimately, the extent to which a country can rely on foreign savings to fund domestic investment and growth, depends on the rate of capital inflow the market accepts as sustainable. While it is impossible to be definitive, the sustainable rate of capital inflow may well be higher for Australia, with abundant natural resources and a stable political environment, than for many other capital importing countries.

3.3.4 National saving

As foreshadowed in the previous section, if savings do not move completely freely between countries, the level of national saving becomes an important determinant of the level of domestic investment, and hence of domestic growth. As can be seen from Figure 1, national saving relative to GDP in the world as a whole has fallen since the 1960s. The decline was slightly more pronounced for Australia, though Australia is not the only country with a steep decline in national saving. In six other OECD countries, the savings rate has fallen by $4^1/_2$ percentage points or more and, in Figure 2 and Table 4, the experience of these countries with respect to developments in total saving and its components is compared with that of three other OECD countries where the national savings rates have been relatively stable or increased slightly.[14]

14. Apart from Turkey, for which a sectoral breakdown of saving is unavailable, Belgium, Japan and Switzerland are the only OECD countries with relatively stable national savings rates. On the other hand, while Denmark, Iceland, Sweden and Spain have also seen national savings rates falling by 5-8 per cent of GDP, again their national accounts data do not allow a sectoral breakdown of saving.

Figure 1: National Savings, World and Australia
(Percentage of GDP)



Sources: IMF(1995) and ABS Cat. No. 5206.0.

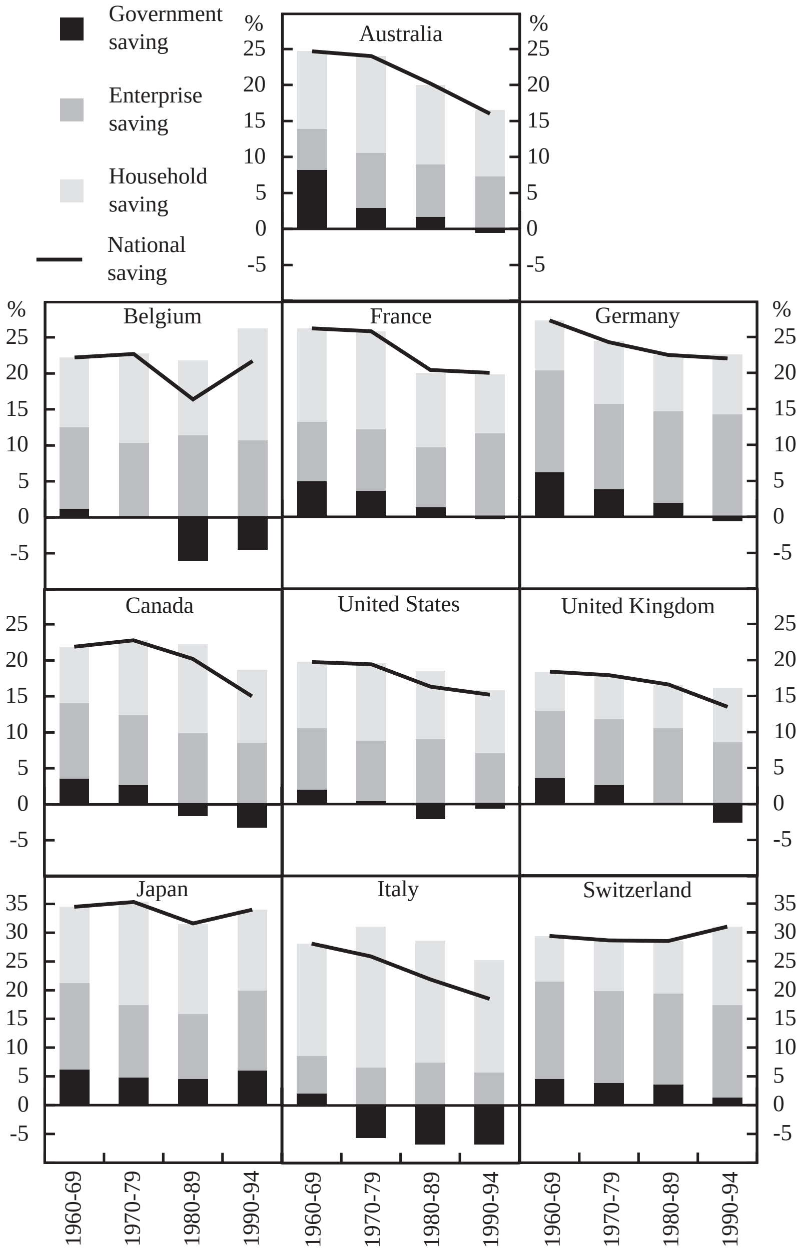
Table 4: Changes in Saving, Growth and the Current External Account
(1960s-1990s, percentage points)

Countries	NSAV	GSAV	PSAV	ESAV	HSAV	g	BoP
Italy	-9.6	-8.9	-0.8	-0.8	0.0	-4.6	-1.9
Australia	-8.7	-8.7	0.0	1.6	-1.6	-3.2	-1.9
Canada	-6.9	-7.3	0.4	-1.9	2.3	-4.2	-2.3
France	-6.2	-5.3	-0.9	3.4	-4.3	-4.5	-0.1
Germany	-5.3	-6.8	1.5	0.1	1.4	-1.5	-0.9
United Kingdom	-4.9	-6.2	1.3	-0.8	2.1	-2.0	-1.5
United States	-4.5	-2.6	-1.9	-1.4	-0.5	-1.8	-2.0
Belgium	-0.5	-5.7	5.2	-0.6	5.8	-3.3	3.5
Japan	-0.5	-0.2	-0.3	-1.0	0.7	-8.2	2.4
Switzerland	1.6	-3.1	4.7	-1.0	5.7	-4.1	6.8

Note: NSAV = national saving, GSAV = government saving, PSAV = ESAV + HSAV = private saving, ESAV = enterprise saving, HSAV = household saving and BoP = current external account, all measured as percentages of GDP, and g = rate of growth of GDP, annual rate. 1960s and 1990s refer to 1960-69 and 1990-94 respectively.

Sources: Elmeskov, Shafer and Tease (1991); OECD, *National Accounts*; OECD, *Economic Outlook*; IMF, *International Financial Statistics*; and authors' estimates.

Figure 2: Composition of National Saving
(Percentage of GDP)



Sources: Elmeskov *et al.* (1991); OECD, *National Accounts*; OECD, *Economic Outlook*; IMF, *International Financial Statistics*; and authors' estimates.

From the figure and the table the following points are worth noting:

- In all but one of the countries where the national savings rate has fallen by $4^1/_2$ percentage points or more, the main factor has been the decline in government saving.[15] In fact, in three of the countries, government saving has fallen by more than national saving. The one exception to this pattern is the United States, where the decline in national saving is almost equally split between government and private saving, with lower enterprise saving accounting for most of the latter.
- The experiences of the three countries with only minor changes in national saving, Belgium, Japan and Switzerland, show that maintaining a high national savings rate is not sufficient for generating or maintaining high growth. In all three countries, average growth fell sharply and this, combined with the weakening of enterprise saving, obviously had a much stronger adverse impact on investment than the improvement in household saving. In fact, there is growing evidence (see Carroll and Weil (1994) for industrial countries and World Bank (1993) for eight Asian countries) that the direction of causality goes, at least to some extent, from growth to saving. In other words, countries that grow faster tend to generate more saving.[16]
- While private saving has generally been stable (main exceptions are Belgium and Switzerland), in underlying terms they may have fallen, once a partial Ricardian equivalence effect is taken into account.[17] There have also been significant changes in the composition of private saving. In 7 of the 10 countries shown in the table, enterprise saving has tended to decline, while household saving has strengthened, in some cases quite significantly. Of the three remaining countries, only Australia and France show declines in the rate of household saving, possibly suggesting that in these two countries household saving is particularly sensitive to the different cyclical conditions of the 1960s and the 1990s or disincentives to household saving have become stronger.

The fall in government saving being the dominant influence in virtually all countries points to fiscal consolidation as the crucial policy measure to raise national saving, rather than, for example, special incentives to boost private saving.[18] Note, however, that the recent weakening of national saving appears to be a reversion towards longer-term

15. This differs markedly from patterns of change in the developing world (IMF 1995; Edwards 1995). In Asia, national saving rates have been rising, almost entirely because of private saving. In Latin America, by contrast, lower private saving caused a sharp fall in national saving in the 1980s. IMF (1995) finds that most of the rise in world real interest rates between 1960-72 and 1981-93 can be ascribed to lower government net saving and higher public debt in the industrial countries and estimates that the resulting fall in capital formation has led to a permanent loss equivalent to 2 per cent of world consumption.

16. See also Masson, Bayoumi and Samiei (1995) who agree that there is a positive correlation between savings and growth across a broad range of countries, but argue that the causality is unclear. There is also cross-country evidence of a non-linear relationship between national savings rates and per capita income *levels*, with savings rates very low in countries with per capita income near the subsistence level, sharply higher for middle-income developing countries and then about the same or lower for high-income industrial countries.

17. Recent estimates of Ricardian equivalence find that about one-half of a fall on government saving is offset by higher private saving (IMF 1995; Edwards 1995; Masson *et al.* 1995).

18. Australia is an exception to this general rule, with the figures in Table 4 understating the deterioration in household saving. From its peak in the early 1970s, household saving relative to GDP has fallen by almost 7 percentage points.

'norms' after an unusual postwar boom in saving. As can be seen from Table 5, the 1950-73 period was not only an unusual period with respect to growth but also with respect to gross national saving. In fact, the only country with a relatively smooth pattern of saving is the United States which, as noted earlier, also had a relatively smooth pattern of growth.

Table 5: Saving and Growth Over Longer Periods in Selected Countries

Countries	1870-1913		1913-1950		1950-1973		1973-1989	
	S/Y	*g*	*S/Y*	*g*	*S/Y*	*g*	*S/Y*	*g*
Australia	12.1	0.9	12.8	0.7	24.4	2.4	22.0	1.7
Canada	10.7	2.3	16.2	1.5	22.5	2.9	21.5	2.5
United Kingdom	13.7	1.0	6.3	0.8	17.9	2.5	19.2	1.8
United States	18.7	2.0	16.5	1.6	19.7	2.2	18.0	1.6
Japan	12.3	1.4	18.7	0.9	32.8	8.0	32.9	3.1

Note: *S/Y* = Ratio of gross national saving to GDP, in percentages and *g* = per capita GDP growth, in per cent per annum.

Source: Maddison (1992).

3.2.5 Exchange rate policies

One of Fischer's conditions for growth-conducive macroeconomic policies is that the exchange rate must be competitive and predictable. Very little empirical work has been done, however, on the relationship between exchange rates and economic growth, especially for the industrial countries. It has proven very difficult to identify equilibrium values for real exchange rates, making it almost impossible to quantify the extent to which they were over or under-valued compared to equilibrium. Further, while there is some evidence that large and persistent movements in real exchange rates affect short-run growth, very few studies have looked into the medium-term implications, partly because exchange rates have started to reverse before possible effects could be detected.

For developing countries, there is more evidence of exchange rate policies influencing growth rates. One variable frequently included in cross-country growth regressions is the differential between the official and the 'black market' exchange rate and in most cases there is significant evidence that maintaining an overvalued official exchange rate tends to reduce long-run growth.

Additional support for Fischer's condition may be obtained by comparing the experience of Asian countries with those of Africa and Latin America. Though exchange rate policies in Asia range from a currency board arrangement (Hong Kong) to various versions of pegging (Thailand), managed floats (Singapore) and a flexible rate (the Philippines) a number of countries have used exchange rate policies to promote export growth. As a result, real exchange rates have mostly been stable and tended to be undervalued. By contrast, Latin American countries have frequently relied on a fixed nominal exchange rate against the US$ or a slowly crawling peg as a means of reducing inflation. However, because other policies (notably fiscal policy) were not consistent with this target and indexation created a high degree of inertia, the rate of inflation exceeded that of the anchor country, resulting in appreciating real exchange rates and adverse effects for export growth and the development of the manufacturing sector. A similar experience, though at much lower rates of inflation and mainly affecting agriculture and resource-based industries, has already been noted for the members of the African franc zone.

While these comparisons do not yield definitive conclusions, they do suggest that countries have some medium-term influence on their exchange rates and that exchange rate policies have potential growth effects. Promotion of international competitiveness and exports of manufactured goods was part of the 'Asian growth strategy' and keeping the exchange rate slightly undervalued was an important instrument in this strategy. In Latin America and Africa, on the other hand, exchange rates have not been used to promote exports and growth but as a means to reducing inflation. Moreover, because these policies did not succeed in sufficiently reducing inflation and eventually failed in most cases, exchange rates have tended to be overvalued for long periods, with detrimental effects for exports and for aggregate growth.

3.3.6 Financial markets and financial systems

Financial market developments is another area where it has proven difficult to identify a clear relationship between policy-related variables and growth. For many years, this has been an area of intensive research efforts but also controversy. Early works (McKinnon 1973; Shaw 1973) suggested rather large potential growth impacts on the assumption that liberalising repressed systems would boost aggregate saving. This link, however, has found little empirical support, whereas alternative models focusing on the impact that financial liberalisation might have on the allocation of capital and the efficiency and cost of financial intermediation seem more consistent with the experience of liberalising countries (Lee 1991; Pagano 1993).[19] Nonetheless, many have remained sceptical, pointing to the financial crises often following liberalisation (Dornbusch and Reynoso 1989) or arguing that there is no role for finance or the cost of finance in neoclassical growth models (Lucas 1988).

More recently, new approaches based on endogenous growth models have been developed, stressing the role of financial systems in gathering information, evaluating innovative entrepreneurs and pooling financial resources to make successful innovations operational. Galetovic (1994) and King and Levine (1993) are two examples of this new approach and the latter test the empirical validity of their model on cross-country data, using four alternative indicators of financial activity and the depth of private financial markets. All four indicators are based on money and credit aggregates and appear to be robust when included in the cross-country regressions discussed in Section 4.

Nonetheless, this evidence should be considered with some caution. First, the indicators used are rather crude approximations to the services provided by modern

19. Pagano identifies three channels through which financial market liberalisation can raise growth: more efficient investment, a less costly transmission and intermediation process and higher saving. The empirical evidence clearly points to the first channel as the most important one whereas changes in the savings ratio have mostly had a negative effect and the impact of improvements in the transmission process is uncertain.

financial systems. Second, the potential role of interest rates remains a puzzle. In Galetovic's model, a principal function of financial intermediaries is to reduce the costs of credit, but in most empirical estimates nominal and real interest rates are statistically insignificant. Third, when confining the cross-country regressions to OECD countries, Englander and Gurney (1994) find no effects of financial variables on productivity growth, suggesting that the four variables proposed by King and Levine are not the appropriate indicators for industrial countries or that the impact of financial systems on growth becomes less important beyond a certain level of economic development (Berthelemy and Varoudakis 1995). Finally, while in theory financial deregulation should improve long-run efficiency, a typical feature of liberalising countries (industrial as well as developing) is that private sector saving has declined in step with the greater availability of credit. In several industrial countries, liberalisation of financial systems in the 1980s also led to asset price bubbles with severe and long-lasting repercussions for the financial system and for private sector balance sheets.

The empirical implementation of models of financial developments based on new theories of growth is still in its infancy and until indicators which better capture the underlying models have been constructed, it is difficult to draw any firm conclusions. It does appear, however, that financial markets are neither an 'engine of growth' nor are they purely passive. In the early phase of development, strong growth would be difficult to achieve unless it is supplemented by rapid development of the financial system, in particular intermediated finance, and at a later stage information gathering, pooling of financial resources and diversification of risks are important in promoting innovation and technical progress. Moreover, liberalised financial systems promote a more efficient distribution of capital and may enhance policy efficiency in general. On the other hand, moving from a regulated to a deregulated environment, when more fundamental factors such as a high investment/GDP ratio, low budget deficits and low inflation are absent, can have long-lasting and negative effects on growth.

3.3.7 Path dependence and macroeconomic policies

If, for some reason, the long-run or steady-state growth rate depends on the past history of actual growth, the scope for macroeconomic policies to influence growth widens: a policy mistake causing a recession in one year will have long-lasting and adverse effects on future growth while, conversely, policy measures that smoothly offset shocks will keep the economy on a higher growth path than it otherwise would have been. Whatever the source, the notion of path dependence creates an important link between short-term demand management policies and long-run output and is a challenge to those versions of the natural-rate hypothesis which postulate that policies have no long-run effect on output.

It is, of course, well known that productivity growth changes *within* the cycle, but there may also be effects on the medium-term evolution of productivity. Internal funds for investment are more readily available during booms than in recessions and banks are probably more willing to finance investment projects, especially those with high risks and high potential returns. At relatively low rates of unemployment, resistance to technological change may be lower than in periods when workers fear that labour productivity gains add further to the number of unemployed. On the other hand, recessions increase the pressure to improve efficiency and may be necessary to 'clean out' inefficient firms (Schumpeter 1939). Moreover, even if faster output growth has a positive net effect on productivity, there are clearly limits to how much can be gained, as an aggressive policy of 'going for growth' inevitably pushes up inflation.

The impressive growth performance after World War II, compared to the pre-Depression era, is attributed by some to a combination of path dependence, automatic fiscal stabilisers and macro-policy activism. Pre-eminent proponents of this view, De Long and Summers (1988), show that expansionary nominal demand shocks appear to have more effect on prices and less on output than contractionary shocks, and they point to a marked rise in output persistence and a significant decline in the average output gap in the post-war period, which they interpret as a consequence of successful counter-cyclical macro-policies after World War II.

While De Long and Summers probably go too far in their positive appraisal of demand management policies (Mankiw 1988) the asymmetric response to positive and negative nominal shocks they report supports the perception of most policy-makers who, having experienced the large output costs associated with reversing inflationary forces, have become more aware of the need to avoid excess demand pressures. It has also recently been supported by an analysis of the trade-off between inflation and the output-gap for the G7 countries. Laxton, Meredith and Rose (1995) find that a positive demand shock in an initial situation of zero excess demand leads to a rise in inflation of more than $1^1/_2$ percentage points while a negative shock of the same size reduces inflation by less than a $^1/_2$ of a percentage point. As a consequence of this asymmetric response, the average *level* of trend output is raised when the *variability* of output is lowered.[20]

Some simple policy prescriptions flow from these empirical results. First, when the trade-off is asymmetric and policy makers are faced with the risk of a permanent rise in inflation, prompt policy responses reduce the output costs of keeping inflation low and thus raise the long-run output level compared with a strategy of lagged and largely *ex post* interventions. In other words, the existence of an asymmetric trade-off supports the use of a pre-emptive policy strategy.

The second prescription also arises from the relationship between output variability and the long-run output level. Because of the numerous shocks to which an economy is exposed, there is a policy trade-off between minimising fluctuations in output from its potential and inflation from its target (Taylor 1992; Debelle and Stevens 1995). A policy strategy aimed at always keeping inflation close to its target and restoring price stability quickly after a shock generates larger fluctuations in output and thus lowers the long-run output level. By contrast, provided medium-term inflation remains close to the target, policy-makers tolerating short-term deviations from this inflation target can reduce output fluctuations and thereby increase the long-run output level. Assuming that credibility is not adversely affected, some tolerance in meeting the inflation target is thus likely to have a favourable impact on long-run output, compared with a more rigorous strategy which only allows deviations in the case of major supply shocks.

20. This is a general feature of a convex aggregate supply or Phillips curve (Mankiw 1988). In the Laxton *et al.* specification, *potential* output, at which inflation is steady, exceeds *average trend* output. The difference rises with the variance of output growth, and has averaged about half a per cent for the G7 countries.

4. Inflation and Growth

> 'Economic analysis of the costs of inflation – the mirror image of the benefits of price stability – is inevitably disappointing to the many ... who know that inflation is a deep societal problem. The question is whether what the many know is merely difficult to prove, or rather is substantially exaggerated' (Fischer 1984, p. 33).

Given the crucial role of monetary policy in determining the inflation rate in the longer run, it is important when discussing macro-policies and growth, to understand the relationship between inflation and growth. This section examines this relationship.

Of the myriad ways in which inflation reduces economic efficiency (summarised, for example, by Fischer and Modigliani (1978) and Briault (1995)) there are three of particular relevance for economic growth. First, even anticipated inflation distorts the intertemporal allocation of resources as higher nominal interest rates interact with the tax system to affect saving and investment. Second, unanticipated inflation generates greater uncertainty about future inflation, discouraging long-term contracting and raising risk premia on interest rates, which in turn inhibits investment. Third, because higher inflation is associated with larger relative price variability, price signals become more difficult to interpret and the sectoral allocation of resources is adversely affected.

While theoretical calculations have been made of some of the costs of inflation, much discussion is based on simple intuition rather than explicit theoretical formulations. Despite increasingly sophisticated attempts (see, for example, Black, Macklem and Poloz (1994)) it is still very difficult to provide theoretical analysis of many of the economic consequences of inflation. Again quoting Fischer (1984, pp. 45-46), speaking with some exasperation at this lack of progress:

> 'Surely inflation is associated with ... more weighty matters than money triangles and the efficiency of the price system.'

With theory providing little guidance on how the effects of inflation should be included in models of economic growth, most empirical studies simply add average inflation, and/or its standard deviation, to otherwise standard cross-country growth regressions. In discussing the evidence that emerges from these studies, we begin with the influential contributions of Levine and Renalt (1992) and Levine and Zervos (1993), henceforth LR and LZ.

In motivating their study, LR review the huge literature using cross-country regressions to search for empirical links between long-run growth and a variety of economic policy, political and institutional factors suggested by theory. They list 40 cross-sectional studies published between 1980 and 1990, each regressing the growth rate over a given period against a variety of variables. In all, *over 50 variables* have been found to be significant explanators of growth in at least one regression. As it is hard to believe that all these variables are important for growth, LR and LZ propose a strict test of the robustness of these regressions, based on Leamer's (1983) extreme bounds analysis.

LR and LZ consider regressions of the form:

$$\Delta q = \beta_i \mathbf{I} + \beta_m M + \beta_z \mathbf{Z} + u \qquad (2)$$

where Δq is per capita GDP growth, $\mathbf{I}$ is a set of variables always included in the regression, M is the variable of interest and $\mathbf{Z}$ is a subset from a pool of variables identified in past studies as potentially important explanators of growth. Their analysis involves first running a 'base' regression including the **I**-variables on their own. Then the variable of interest, *M*, and all possible combinations of up to three **Z**-variables are added to the regression. If the coefficient estimate β_m remains of the same sign and significant at a 0.05 level *in all these regressions*, then the variable *M* is described by LR and LZ as a 'robust' explanatory variable for economic growth. Alternatively, if the coefficient β_m changes sign or becomes insignificant in any regression, *M* is a 'fragile' explanator for economic growth. As this description makes clear, this is a very strict test of the robustness of the variable, *M*, as an explanatory variable for economic growth.

LR and LZ differ in their choice of **I**-variables for their base regressions. Both studies include initial secondary school enrolment as a proxy for initial human capital. They both also include initial real GDP per capita to allow for 'convergence': the fact highlighted by Dowrick (this Volume) that, other things equal, poor countries grow faster than rich ones. The LR base regression also includes population growth and the average investment share of GDP while the LZ base regression includes the average number of revolutions and coups over the sample period.[21]

For the purpose of examining the empirical relationship between inflation and growth, both base regressions are of interest. Inflation may plausibly affect economic growth by both altering the level of investment as well as affecting the efficiency of resource allocation. Adding inflation to the LR base regression, therefore, tests whether inflation affects economic growth after controlling for the level of investment. Alternatively, adding inflation to the LZ base regression tests whether inflation affects growth including its effect on the level of investment as one of its channels of influence.

Both LR and LZ conclude that inflation is a fragile explanatory variable for economic growth. They both find that average inflation (or its standard deviation) makes a statistically insignificant contribution to their base regressions. It should be noted, however, that these conclusions are based on regressions for about one hundred countries with average annual inflation rates over their estimation period, 1960-89, ranging from less than 3 per cent (for Ethiopia!) to 474 per cent for Bolivia.

In this paper, we are interested in the relationship between inflation and growth for countries like Australia with similar (advanced) industrial structures, and with comparable rates of inflation. We therefore apply the LR-LZ approach to examine the empirical link between inflation and growth for OECD economies with comparable inflation rates. We repeat the LR-LZ approach as closely as possible, thereby limiting the problem of data-mining: that is, of choosing among a large number of theoretically plausible specifications, the one that provides the strongest support for the story one is trying to tell.

It is often argued that fully-anticipated inflation imposes less economic costs than uncertainty about future inflation, and hence that the variability of inflation may be a better summary measure of the effects of inflation on growth than the average inflation rate. However, as Figure 3 shows for the OECD, there is a close correlation between average inflation and the variability of inflation (as measured by the standard deviation

21. Barro (1991) shows that the average number of revolutions and coups helps explain economic growth in a broad cross-section of countries.

Figure 3: Mean and Standard Deviation of Inflation Rates (1960-1993)
(22 OECD Countries)

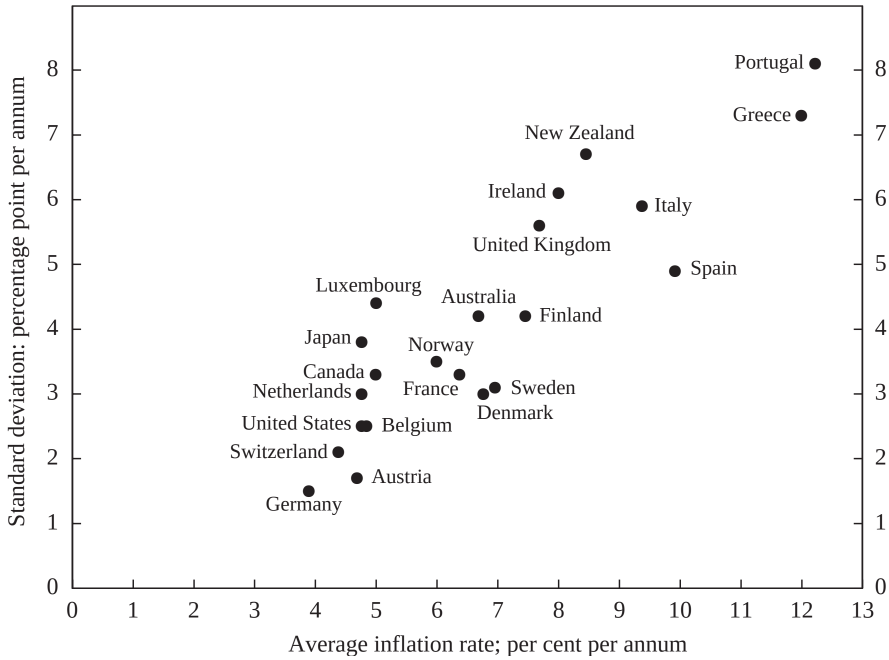
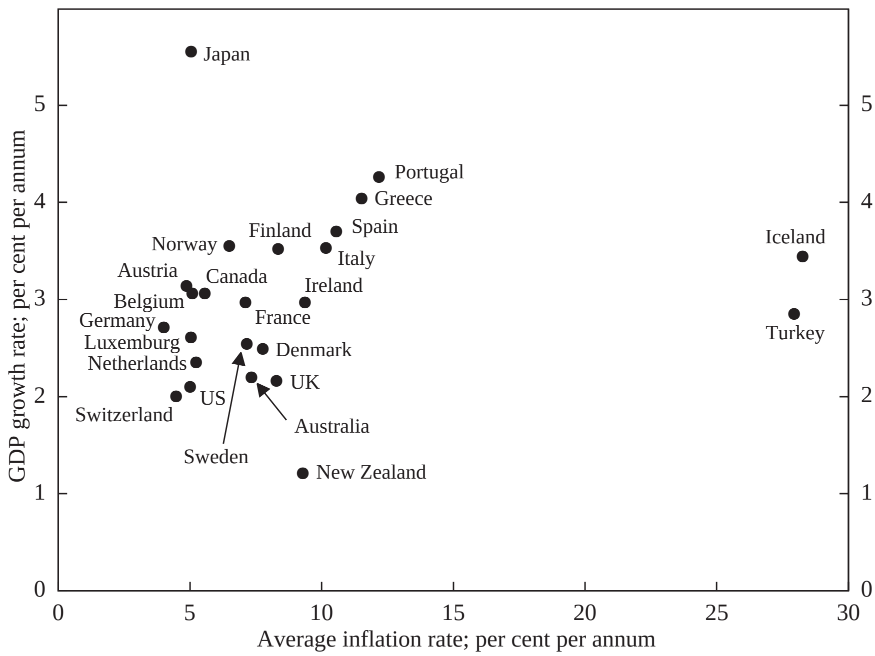


Figure 4: Per Capita GDP Growth v. Average Inflation for OECD Countries (1960-1989)



of inflation).[22] As a consequence of this correlation, it is a daunting empirical task to identify the effect on growth of the level and variability of inflation separately. In the empirical exercise to follow, we limit our analysis to examining the relationship between growth and average inflation, recognising that some of the effect on growth of higher average inflation may be a consequence of the fact that high inflation is also more variable inflation.

Figure 4 shows a scatter plot of the relationship between economic growth and average inflation for the 24 OECD countries over the period 1960-89. As previously mentioned, Iceland and Turkey are clear outliers, each with average annual inflation of 28 per cent, while the other 22 OECD countries had average annual inflation rates between 4 and 12 per cent (with Australian inflation averaging 7 per cent).

There is some evidence that the association between average inflation and growth weakens as inflation rises.[23] To minimise the influence of this effect on our regressions, we therefore exclude Iceland and Turkey from the analysis. (However, the Appendix reports regressions using the whole OECD sample.)

We now apply the LR-LZ approach to the 22 'low-inflation' OECD countries rather than the hundred countries used by them. The dependent variable is always average annual per capita GDP growth, though the explanatory variables for the LR and LZ base regressions are different, as discussed above. After estimating the base regression, we add the variable of interest, the average inflation rate (measured using the GDP deflator), and then up to three **Z**-variables to the regression. The base regressions and **Z**-variables are reported in the Appendix while Table 6 summarises the coefficient estimates on inflation for all 30 regressions.[24]

The estimated coefficient on inflation is negative for all thirty regressions (that is, higher inflation is associated with lower growth).[25] In about half the regressions, this negative estimate is statistically significant at a 5 per cent level, while in the other half, it is statistically insignificant. Using the definition introduced by LR and LZ, average inflation is, therefore, a fragile explanator of economic growth.

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22. The figure is from Edey (1994). Iceland and Turkey have much higher and more variable inflation than the rest of the OECD and are not shown. As discussed in Briault (1995), a large standard deviation does not necessarily imply more uncertainty if the process generating inflation variability is known. However, alternative measures of uncertainty, constructed from surveys or econometric models, also show a close correlation with the average rate of inflation.

23. See Fischer (1993) and Levine and Zervos (1993). Wright (1994) finds that while average inflation (*PI*) makes an insignificant negative contribution to growth in the LZ base regression, log(*PI*) makes a significant negative contribution – which also supports the point. By contrast, Barro (1995) argues that the relationship between growth and inflation is linear.

24. The data are from the database used by King and Levine (1993) and were kindly supplied to us by Steve Dowrick. We use four **Z**-variables for both LR and LZ sets of regressions. Each set therefore includes one regression adding the average inflation rate to the base regression, four regressions adding one **Z**-variable to this regression, six adding two **Z**-variables, and four adding three **Z**-variables, for a total of 15 regressions. Estimation is by OLS with heteroscedasticity-consistent standard errors. A coefficient estimate of -0.1, for example, implies that a fall in average inflation of 1 percentage point is associated with a rise in per capita GDP growth of 0.1 percentage points per annum.

25. This result seems in contrast with Figure 4 which suggests a slightly *positive* relationship between inflation and economic growth. This positive relationship occurs primarily because countries with low initial GDP tend to grow faster but also to have higher inflation. Controlling for initial GDP, the regressions suggest the relationship between inflation and growth is, in fact, negative.

Table 6: The Effect of Inflation on Growth for OECD Countries (1960-1989)

Regression type	Coefficient on inflation in growth regressions							
	Significant coefficients 5%		Significant coefficients 10%		Insignificant coefficients		Total	
	Average value	No.	Average value	No.	Average value	No.	Average value	No.
LR	-0.16	6	-0.15	5	-0.10	4	-0.14	15
LZ	-0.17	10	-0.14	3	-0.10	2	-0.15	15

A possible shortcoming of this cross-country analysis arises from the effect of supply shocks. Adverse supply shocks reduce output and raise inflation leading to a negative correlation between inflation and growth even when higher inflation has not caused lower growth. The cross-country regressions reported in Table 6 may perhaps be picking up the fact that some industrial countries suffered worse aggregate supply shocks than others, and hence had both lower output growth and higher inflation over the estimation period. Since the obvious adverse supply shocks, OPEC I and II, affected inflation and growth after 1973, we split the sample in 1973 and examine the growth experiences 1960-73 and 1974-89 separately.[26]

Table 7 summarises coefficient estimates on inflation for the two sub-samples. As the table makes clear, coefficient estimates derived for the sub-samples are less statistically significant than for the whole sample. It is also clear that the coefficient estimates on inflation are usually smaller in magnitude when estimated over 1960-73 than over 1974-89 or over the whole sample, 1960-89. This supports the earlier suggestion that some of the negative correlation between inflation and growth over the whole sample arises from the differential impact of adverse supply shocks.[27]

The overwhelming impression from the regressions reported in Tables 6 and 7 is that, after controlling for a range of other potentially relevant explanators, higher average inflation is correlated with lower average economic growth. Of the 76 regressions reported in the two tables, all but one give negative point estimates for the effect of inflation on growth. Furthermore, this conclusion should be of relevance for industrial

26. For consistency, in each sub-sample, we excluded from analysis all countries with an annual average inflation rate greater than 20 per cent. For the first sub-sample, 1960-73, all 24 OECD countries were included (Turkey and Iceland had average annual inflation rates of 11 and 16 per cent, respectively) while for the second, Iceland and Turkey were excluded.

27. Another potential shortcoming of the analysis (suggested to us by John Quiggin) arises from possible mis-allocation of nominal GDP growth into real GDP growth and inflation (measured using the GDP deflator). For given nominal GDP growth, under-estimation of real GDP growth implies over-estimation of inflation and vice versa. If the extent and direction of mis-measurement is the same in each country, the analysis is not invalidated. If mis-measurement varies between countries, however, a spurious negative correlation is generated between measured growth and inflation. We therefore repeated the analysis using consumer price inflation which reduces this measurement problem. The coefficient estimates on CPI inflation are almost all negative and similar in magnitude to those reported in Tables 6 and 7. They are, however, much less statistically significant.

Table 7: The Effect of Inflation on Growth for OECD Countries by Sub-periods (1960-1973 and 1974-1989)

Regression type	Coefficient on inflation in growth regressions					
	Significant coefficients (10%)		Insignificant coefficients		Total	
	Average value	No.	Average value	No.	Average value	No.
LR 60:73	-0.04	11	-0.08	4	-0.05	15
LZ 60:73	-0.06	8	—	—	-0.06	8[(a)]
LR 74:89	—	—	-0.09	15	-0.09	15
LZ 74:89	-0.10	7	-0.11	1	-0.10	8[(a)]

Note: (a) One of the conditioning variables in the LZ regressions is not available for the sub-periods (see the Appendix).

countries like Australia since it is derived for OECD countries with average inflation rates less than 20 per cent per annum.

Not surprisingly, given the importance of the issue, the literature contains a large number of empirical studies estimating the effect of inflation on growth. Table 8 summarises the recent evidence, based primarily on cross-country studies for OECD economies in the 1960s, 1970s and 1980s. The table reports only the most relevant of the many regression specifications presented in each study. While the regressions reported are not all independent of each other, there is at least some variation in sample periods and in the explanatory variables used. Given the problems of adverse supply shocks discussed above, the table also reports some results for samples which end before OPEC I.

As Table 8 makes clear, there is professional disagreement about the statistical significance of the relationship between inflation and growth. Some studies (for example Kyriakopolous (1991), LR, LZ, Clark (1993) and Englander and Gurney (1994) conclude that the relationship between inflation and growth is either statistically insignificant at conventional levels of significance or fragile. Others (such as Grimes (1991), Cozier and Selody (1992), Fischer (1993) and Motley (1993)) argue that there is indeed a significant relationship, with higher inflation correlated with lower growth.

Despite this disagreement about statistical significance, it is striking that the vast majority of growth regressions in the literature report negative coefficient estimates on inflation. This is of course true of those studies that find a significant negative relationship between inflation and growth. It is also true, however, of the vast majority of studies that conclude that the relationship is statistically insignificant (see Table 8). For example, LZ report eight different specifications for their cross-country inflation-growth regressions. While the coefficient on inflation in these regressions is sometimes statistically significant and sometimes not – indeed, that is LZ’s point – *the coefficient is always negative*.

Table 8: Cross-Country Studies of the Relationship Between Inflation and Growth

(Dependent variable: real GDP growth or per capita real GDP growth in per cent per annum)

Authors	Period	Model	Sample	Coefficient on average inflation	t-statistic (abs. value)
Grier and Tullock (1989)[(a)]	1951-80	Panel	24 OECD countries	0.01	0.2
Grimes (1991)	1961-87	Panel	21 OECD countries	-0.11	9.2
Kyriakopoulos (1991)	1960-88	Cross country	24 OECD countries	-0.02	0.9
Cozier and Selody (1992)[(b)]	1960-85	Cross country	22 OECD countries	-0.13	1.8
Levine and Renelt (1992)	1960-89	Cross country	Non-oil countries	-0.004	1.7
Levine and Zervos (1993)	1960-89	Cross country	Non-oil countries	-0.002	0.6
Motley (1993)	1960-88	Cross country	22 OECD countries	-0.13	2.4
Clark (1993)	1960-85	Cross country	22 OECD countries	-0.13	2.2
	1960-88	Panel		-0.08	1.9
	1950-70	Cross country		-0.13	1.1
Fischer (1993)[(c)]	1961-88	Panel	Non-oil countries	-0.13	2.0
	1961-72	Panel		-0.20	3.4
Englander and Gurney (1994)[(d)]	1960s-90	Panel	19 OECD countries	-0.06	1.6
Barro (1995)[(e)]	1960-90	Cross country	About 80 countries	-0.024	4.9
				-0.016	0.5

Notes: (a) The reported regression also includes the standard deviation of inflation, *SDPI*, with a statistically significant negative coefficient. As *PI* and *SDPI* are highly correlated, the coefficient on *PI* is very imprecisely estimated.

(b) Average inflation, *PI*, enters this growth regression as log(*PI*). The coefficient estimate, -0.13, is the estimated effect on growth of a one percentage point rise in inflation at the sample mean inflation rate, 7.7 per cent per annum (derived from their Table 12).

(c) Results are from two of the many regressions reported (equations (36) and (48)). The former allows the effect of inflation on growth to depend on the inflation rate, and we report the coefficient for inflation less than 15 per cent per annum. The latter truncates the sample before OPEC I.

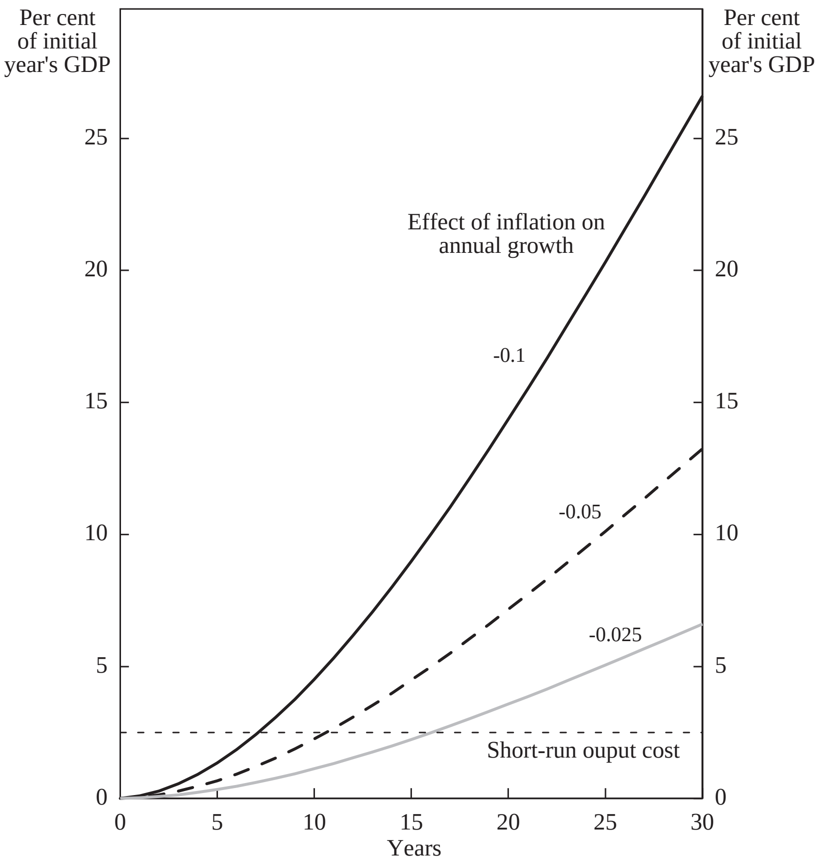
(d) The dependent variable is growth in output per employee in the business sector.

(e) Results are from two of several regressions reported. The former assumes the coefficient is independent of the inflation rate. The latter allows the effect of inflation on growth to depend on the inflation rate, and we again report the coefficient for inflation less than 15 per cent per annum.

While the results are not as robust as one would like, the most obvious interpretation of the evidence in Tables 6 to 8 is that the negative correlation between inflation and growth arises from a causal relationship. That is, other things equal, lower inflation leads to higher economic growth. (A possible alternative interpretation is that countries with low inflation also tend to have a range of growth-enhancing policies, due to a consensus about the benefits of economic growth. While the analysis attempts to control for the effect of other policies, one might argue that the measures it uses – budget surplus, ratio of trade to GDP, etc. – are too imprecise to capture the benefits of a general community commitment to growth.)

Nonetheless, accepting the interpretation that inflation has a causal impact on growth, it is worth quantifying the estimated gains from lower inflation implied by the point estimates in the tables. To do so, we assume a plausible value for per capita output growth (2 per cent per annum) and for the real interest rate used to discount future income (5 per cent per annum). Figure 5 then shows the cumulative gain in per capita output, discounted to the present, from reducing the inflation rate by one percentage point.

Figure 5: Cumulated Output Gain From Reducing Inflation By One Percentage Point



Results are presented for three alternative estimates of the effect of average inflation on annual growth (-0.025, -0.5 and -0.1), and the Figure also shows Stevens' (1992) estimate of the short-run output cost of reducing inflation by one percentage point, 2.5 per cent of one year's GDP.

As Figure 5 shows, disinflation is an investment activity: the costs are borne at the time, while the gains accrue gradually and only outweigh the costs after an extended period. If the annual growth dividend from a one percentage point fall in inflation is as small as 0.025 – an estimate smaller in magnitude than most of the estimates in Tables 6 to 8 – it takes about 16 years for the discounted cumulated gains from faster growth to exceed the short-run output costs of achieving lower inflation (see Figure 5). However, even from such a small growth dividend, the cumulated gains from faster growth eventually exceed the short-run costs by a substantial margin. Of course, if the growth dividend from lower inflation is larger, the 'break-even' point occurs earlier and the eventual gains from lower inflation dwarf the initial costs. Thus, while the estimates in Tables 6 to 8 are sometimes statistically insignificant, they are of considerable economic significance. Measured over an extended period, they imply substantial cumulated output gains from lower inflation.

To conclude, it is worth stressing that the available empirical evidence for industrial countries since World War II, is mute on the issue of whether there are gains from achieving zero or very low single-digit inflation. There are simply no data on economies operating with very low inflation for extended periods. The lowest annual inflation rate in the OECD over the 30 years, 1960-89, was achieved by Germany with a 4 per cent average. Over the shorter period, 1960-73, the lowest average annual inflation rate was in the United States, again with 4 per cent, while over the period, 1974-89, Japan had the lowest inflation with an annual average of 3 per cent. The effect on output growth of achieving average inflation below these rates is simply unknown.

5. Conclusions

The industrial world achieved an impressive improvement in long-run growth in the first generation after World War II. Since then growth has been slower, though it remains significantly above the rates recorded in the first half of this century. This slowdown renewed interest in the determinants of long-run growth and the last decade has witnessed an explosion in both theoretical and empirical studies of growth. Several analysts have also examined whether there is a role for macroeconomic policies in explaining the growth performance of the 1950-73 period, the subsequent slowdown and in improving the prospects for future growth.

This paper has reviewed this new literature, looking at both theoretical and empirical aspects that may have implications for the design of macroeconomic policies. The evidence reported is, to some extent, selective and tentative. Furthermore, since the principal determinants of growth are factor accumulation and technological progress, the impact of macro-policies is probably at the margin. Nevertheless, on balance, we conclude that macro-policies do make some difference to long-run growth. We draw the following five broad conclusions from our study.

First, although both neoclassical and endogenous growth models assign a major role to capital accumulation, policy measures to boost aggregate investment through special incentives do not seem to be called for. There is little evidence that aggregate investment yields excess returns, suggesting that the positive externalities postulated in some versions of endogenous growth theory are very small at an economy-wide level. Consequently, the main tasks of policy makers in this area are to remove existing distortions (especially those favouring investment in property) and to abstain from reducing public investment in infrastructure merely as a means of restoring fiscal balance.

Second, in a world of liberalised capital flows, saving acts as a constraint on investment and growth for the world as a whole but less so for an individual country, as capital flows from countries with excess saving to those where profitable investment exceeds domestic saving. Yet, reliance on foreign saving is not costless as countries with growing external liabilities face higher real interest rates, a depreciating real exchange rate, and perhaps, a higher degree of economic uncertainty. Ultimately, capital inflows are limited to the rate the market accepts as sustainable, which for a country like Australia, with abundant natural resources and a stable political environment, may be higher than for many other capital importing countries.

Third, in many industrial countries, declining national saving rates are primarily a consequence of lower government saving, suggesting the need for reduced fiscal imbalances. In Australia, private savings have also fallen substantially, suggesting a role for specific incentives to boost this component of savings. There is also some evidence that the causation between higher national saving and faster growth may run both ways. While many cross-country regressions identify the saving rate as one of the principal growth determinants, several recent studies suggest that faster growth also leads, with some lag, to a higher saving rate.

Fourth, recent evidence suggests that when economies are near potential output, the short-run trade-off between inflation and the output gap is asymmetric, with short-run rises in output being more inflationary than falls in output are disinflationary. If this is the case, it opens a channel by which macro-policy can influence the level of long-run output. This has two implications. The first is that a policy strategy that acts pre-emptively to counter expected future demand pressures and quickly mitigates the effects of unexpected shocks has a positive effect on the level of output, compared with a more hesitant approach which acts only when the demand pressures have appeared. Second, provided inflation is kept close to its target in the medium-term, policy which tolerates some short-term deviations of inflation from its target can reduce fluctuations in real output and thereby generate a higher long-run output level than a policy with the sole goal of keeping inflation close to its target.

Fifth, because monetary policy determines inflation in the long run, a key role of monetary policy in influencing growth depends on the relationship between inflation and growth. Although most economists believe even moderate rates of inflation adversely affect growth, unambiguous evidence has been difficult to come by. While there is still professional disagreement on the robustness of the empirical evidence, it does appear that higher inflation, and the associated increased uncertainty about future inflation, adversely affects growth in the industrial countries. Moreover, the gains from lower inflation appear to exceed the initial costs of reducing inflation within about a decade.

Appendix A: Influences on Growth

A1. The Persistence of Growth Rates and the Determinants of Growth

As briefly discussed in the text, while levels of output have a high degree of persistence, for most countries, growth is not very persistent. The correlation between average growth rates in the 1960s and in the 1970s is as low as 0.15 for 89 non-oil countries and only slightly higher (0.3) when the same calculation is done for the 1970s and 1980s (Easterly *et al.* 1993). By contrast, country characteristics, including many policy related variables used in most cross-country regressions, are highly persistent.

We have explored this problem further for the OECD countries (excluding Iceland and Turkey) in Table A1 by regressing average growth for 5-year periods over subsequent 5-year periods. Panel (a) of the table shows that out of 21 correlation coefficients only 4 are significant, with the highest being the one for the two sub-periods of the 1960s. By contrast, as panels (b) to (d) show, inflation as well as general government deficits and investment (both as ratios to GDP) exhibit much more persistence than growth. For investment, even ratios 30 years apart yield a coefficient of almost 0.5. For inflation, the effect of the two oil shocks is clearly evident while the degree of persistence strengthens considerably for the more recent years when inflation declined. Budget deficits, on the other hand, have become less persistent in recent years, probably reflecting countries' differential success in consolidating their fiscal positions.

What is the relevance of these results for the link between policies and growth? First, country characteristics are not the only determinants of growth; as Easterly *et al.* conclude, a substantial part of the variation in growth arises from shocks, in particular terms-of-trade shocks. Second, one interpretation of the results is that country characteristics mainly serve to explain relative per capita income levels while growth rates are more dependent on shocks, and are therefore more variable. Nonetheless, policies can still have a significant influence on growth, especially when countries are far from their steady-state income levels. Third, while shocks are important in explaining growth, policy reactions to the shocks influence how growth is affected. For instance, when comparing the coefficients in Table A1 for the two oil shocks, it is noticeable that following the first oil shock (1965/70 to 1970/75) the correlation for GDP growth remained at a relatively high 0.43 while for inflation the correlation fell to 0.31. By contrast, between 1975/80 and 1980/85 the correlation for GDP growth declined to only 0.01; inflation, on the other hand, remained highly persistent because most countries tightened monetary policy to prevent the second oil shock from pushing up inflation.

Table A1: Indicators of Persistence for 22 OECD Countries

	1965/70	1970/75	1975/80	1980/85	1985/90	1990/95
(a) GDP growth						
1960/65	.74*	.30	.19	.02	.14	.26
1965/70		.43	.52*	.12	.50*	.08
1970/75			.28	.48*	.39	.28
1975/80				.01	.31	.19
1980/85					.10	.38
1985/90						.20
(b) Inflation						
1960/65	.50*	.45**	.01	.15	.31	.12
1965/70		.31	.06	.23	.31	.43
1970/75			.69*	.50*	.35	.32
1975/80				.85*	.85*	.52*
1980/85					.87*	.72*
1985/90						.82*
(c) General government deficit/GDP						
1960/65	.83*	.73*	.71*	.60*	.46	.01
1965/70		.83*	.75*	.48**	.50*	.01
1970/75			.78*	.56*	.41	.03
1975/80				.59*	.35	.00
1980/85					.56*	.18
1985/90						.38

	1960	1970	1980	1990
(d) Investment/GDP				
1960		.78*	.57*	.48**
1970			.73*	.66*
1980				.64*

Note: The numbers shown in panels (a) and (b) are correlation coefficients between average rates of respectively real GDP growth and inflation for the five-year periods in the first column and the subsequent five-year periods given in the first row. Similarly the numbers in panels (c) and (d) are correlation coefficients between respectively government deficit and investment/GDP ratios for the periods or years shown in the first column and the periods or years given in the first row. * and ** indicate respectively 99 and 95 per cent levels of significance.

A2. Growth and Balance of Payments

The McCombie and Thirlwall model

To derive their balance-of-payments consistent growth rate, McCombie and Thirlwall (1994) [MT] start from the balance-of-payments identity:

$$P_d X + F = P_f EM \tag{3}$$

where: P_d is export prices in domestic currency;

P_f is import prices in foreign currency;

X is exports of goods and services (in volumes);

M is imports of goods and services (in volumes);

E is the exchange rate (measured as domestic currency per unit of foreign currency); and

F is the capital account balance.

No distinction is made between export prices and domestic prices, which implies that the real effective exchange rate is identical to the terms of trade.

Export and import volumes depend on income and relative prices as follows:

$$\begin{aligned} M &= (P_f E / P_d)^{\psi} Y^{\pi} \\ X &= (P_d / P_f E)^{\eta} Z^{\varepsilon} \end{aligned} \tag{4}$$

where: ψ = demand elasticity of imports with respect to relative price of imports;

η = demand elasticity of exports with respect to relative price of exports;

π = elasticity of imports with respect to domestic income (Y); and

ε = elasticity of exports with respect to foreign income (Z).

Taking rates of change, denoted by small letters, (4) becomes:

$$\begin{aligned} m &= \psi(p_f + e - p_d) + \pi\, y \\ x &= \eta(p_d - e - p_f) + \varepsilon\, z \end{aligned} \tag{5}$$

Similarly, equation (3) can be rewritten in rates of change:

$$\theta(p_d + x) + (1 - \theta) f = p_f + m + e \tag{6}$$

where θ denotes the proportion of import expenditure met by export earnings. Then inserting (5) into (6), the balance-of-payments constrained growth rate can be written as:

$$y^* = [(\theta\eta + \psi)(p_d - e - p_f) + (p_d - e - p_f) + \theta\varepsilon z + (1 - \theta)(f - p_d)] / \pi \tag{7}$$

where the first term on the right-hand side measures the trade volume effects of relative price changes and will be positive for a real depreciation (or terms-of-trade deterioration); the second term the income effect of terms-of-trade changes; the third term the effect of export growth; and the last term the effect of capital flows (measured in constant prices) which is positive in case of inflows. The sum of the four terms determines total revenue available for expanding imports and the corresponding growth of income is then derived by dividing by the income elasticity of imports.

To provide estimates of y^* for Australia within the MT framework, two specific problems need to be addressed. First, how should capital inflows be defined and measured? One possibility is to include only those flows (for instance, foreign direct investment, equity portfolio inflows and long-term debt inflows contracted by the private sector) that are mainly attracted by prospective returns in the Australian private economy.[28] Alternatively, one can ignore capital inflows in the calculation of y^* and leave them for an *ex post* evaluation in the event that actual output growth deviates from y^*. A second issue is the treatment of net income and transfers, which are not included in MT's measure of revenue available for imports but would significantly affect y^* if they do not remain constant. To generate our results, we include changes in capital inflows only as a memorandum item, and subtract the growth of net income payments to abroad from the growth of export earnings, with a weight corresponding to their share of total export revenue. With these assumptions, Table A2 shows our estimates, using average figures for 1959/60-1993/94 and the shorter period 1972/73-1989/90.

Table A2: Growth and the Balance of Payments: Australia

(Percentage per annum, unless otherwise indicated)

Variables	Actual or estimated values: 1959/60-1993/94	1972/73-1989/90
Growth in net income payments to abroad:	6.5	8.3
Change in the terms of trade:	-0.5	0.6
Growth in export volumes	6.0	4.5
Adjusted export growth [(a)]	4.50 – 5.00	3.25 – 4.00
Balance-of-payments constrained GDP growth [(b)]	2.75 – 3.05	2.00 – 2.45
Actual GDP growth	3.7	3.1
Change in capital inflows: as per cent of GDP	1.0	5.1

Notes: (a) Obtained from equation (5) by subtracting the weighted growth of net income payments (weight = the share of net income in total export revenue) and the combined effect on income and trade volumes of terms of trade changes, allowing for two extreme cases: $\theta\eta + \psi + 1 = 0$ (i.e. no adjustment to export growth) and $\theta\eta + \psi = 0$ (ie. export growth adjusted for the full terms-of-trade change).

(b) In calculating y^*, it is assumed that the proportion of import expenditure met by export earnings, θ, is 0.95 while the income elasticity of imports, π, is 1.55, from Dwyer and Kent (1993).

28. As noted in IMF (1995), countries with abundant natural resources tend to have large and sustained capital inflows. Higher labour-force growth should have a similar effect.

The implications of rising external liabilities

To derive the results in the text, we use the following empirical ingredients. First, the Blundell-Wignall *et al.* (1993) equation for the Australian real exchange rate, when re-estimated over the period 1984:1 to 1994:4, implies that a one percentage point rise in the ratio of net external liabilities to GDP is associated with a real depreciation of 0.5 per cent.

Second, the relationship between net external liabilities (*NEL*) in years t and t+1 and the current account deficit (*CAD*) in year *t* is given by $NEL_{t+1} = NEL_t + CAD_t$. Dividing throughout by *GDP* and letting lower-case letters denote ratios to *GDP* gives:

$$(1+g)\, nel_{t+1} = nel_t + cad_t \tag{8}$$

where g is nominal GDP growth per annum. Assuming g = 0.06, a current account deficit of 4.5 per cent of GDP (average for the last ten years) and a net external liabilities to GDP ratio of 45 per cent (the current value) implies that the net external liabilities to GDP ratio is rising by 1.7 percentage points per annum, leading to an average annual real exchange rate depreciation of $0.5 \times 1.7 = 0.85$ per cent.[29]

Third, to estimate the inflationary impact of this real exchange rate depreciation, we rely on the price equation in Wilkinson and Lam (1995) which explains domestic prices in the long-run by unit labour costs and import prices, with coefficients 0.7 and 0.3 respectively. In the long run, a 1 percent *nominal* depreciation therefore raises domestic prices by 0.3 per cent and hence translates into a *real* depreciation of $1 - 0.3 = 0.7$ per cent. It follows that a real depreciation of 0.85 per cent per annum generates a rise in domestic prices of $0.3 \times 0.85 / 0.7 = 0.36$ per cent per annum.

To completely offset the domestic price effect of the real depreciation, real unit labour costs must fall by $0.3 \times 0.85 / 0.7 = 0.36$ per cent per annum. With no explicit mechanism to reduce real unit labour costs, this outcome can only be achieved by reducing the level of real output. To derive the required reduction, we use the sacrifice ratio of 2.5 (Stevens 1992). To prevent the real depreciation and the rise in import prices from pushing up the domestic inflation rate, actual output must be reduced on average by about 0.9 per cent (0.36×2.5).

A3. Inflation and Growth

The LR base regression applied to the 22 low inflation OECD countries is:

$$\underset{(2.35)}{\Delta q = 2.47} \;-\; \underset{(6.13)}{0.35\, RGDP60} - \underset{(0.56)}{0.20\, GPO} + \underset{(0.92)}{0.72\, SEC} + \underset{(2.43)}{8.18\, INV} \tag{9}$$

29. The current *nel* value of 45 per cent is calculated by cumulating current account deficits since 1970. This is the relevant measure for our purposes since we use the Blundell-Wignall *et al.* estimate of the sensitivity of the real exchange rate to changes in *nel*. Note, in passing, that the effect of a given current account deficit on the change in *nel* is inversely related to the actual size of *nel*. On the other hand, the sensitivity of the current external imbalance to changes in foreign interest rates increases in proportion to *nel*. Both relations are relevant to the notion of a balance of payments constraint, but will not be discussed further.

($\overline{R}^2 = 0.61$, estimation period 1960-89, absolute value of White robust t-statistics in parentheses), while the LZ base regression applied to the 22 low inflation OECD countries is:

$$\underset{(6.60)}{\Delta q = 6.03} \;-\; \underset{(4.28)}{1.96}\, LRGDP60 + \underset{(0.71)}{0.22}\, LSEC - \underset{(1.77)}{3.32}\, REVC \tag{10}$$

($\overline{R}^2 = 0.57$, estimation period 1960-89, absolute value of White robust t-statistics in parentheses).

The variables are average per capita real GDP growth in per cent per annum (Δq), per capita real GDP in 1960 (*RGDP60*), average annual rate of population growth (*GPO*), initial secondary school enrolment rate (*SEC*), average investment share of GDP (*INV*) and the average number of revolutions and coups per year (*REVC*). *LRGDP60* and *LSEC* are log(*RGDP60*) and log(*SEC*).

For the set of LR regressions, the **Z**-variables are: government consumption share of GDP (*GOV*), export share of GDP (*X*), the average number of revolutions and coups per year (*REVC*), and the ratio of liquid liabilities to GDP (*LLY*), while for the set of LZ regressions, the **Z**-variables are: the government fiscal surplus ratio to GDP (*SURY*), the ratio of total trade to GDP (*TRD*), *LLY* and the black-market exchange rate premium (*BMP*).[30]

Both the LR and LZ base regressions contain statistically insignificant explanatory variables when estimated for the 22 low inflation OECD countries (see above). We include these variables in the analysis reported in the text to reproduce the LR-LZ approach as closely as possible. Nevertheless, to establish that our conclusions about the correlation between inflation and growth are robust to the exclusion of these variables, we repeat the analysis for the whole estimation period 1960-89 and for the sub-period 1960-73, excluding from each base regression any variable with an absolute *t*-statistic less than 1.5. This implies that, for the LR whole estimation period regression, *GPO* and *SEC* are excluded, for the LZ whole estimation period regression, *LSEC* is excluded, for the LR 1960-73 regression, *SEC* is excluded, while for the LZ 1960-73 regression, *LSEC* is excluded.

These modified LR and LZ regressions generate the following results. The coefficient on average inflation in all 30 regressions estimated over 1960-89 is negative with point estimates ranging from -0.11 to -0.20, mostly significant at 5 per cent. For the 15 LR and 8 LZ regressions estimated over the sub-period 1960-73, the coefficient on average inflation is negative in 20 (out of 23) regressions with point estimates ranging from -0.09 to +0.01 but always insignificant at a 10 per cent level. We infer from this exercise that the conclusions drawn in the text about the inflation-growth relationship are robust to the exclusion of insignificant explanatory variables from the LR and LZ base regressions.

30. These **Z**-variables correspond closely to those used by LR and LZ. We added *LLY* (one of the LZ **Z**-variables) to the list of **Z**-variables used by LR to generate more regressions. For the LZ sub-sample regressions, we used *GOV* instead of *SURY*, but lacked data on *BMP* and so were limited to eight regressions for each sub-sample.

We also looked for any systematic non-linearity in the relationship between growth and inflation for our sample, and sub-samples, of OECD countries. To do so, we added the square of average inflation, PI^2, to each regression in our original analysis. No systematic results emerged from this exercise, with both the size and sign of the coefficients on *PI* and PI^2 often changing from one regression to the next.

For completeness, we also report results adding average inflation (*PI*) to the LR and LZ base regressions when the sample includes all 24 OECD countries. The LR regression is then:

$$\begin{array}{l} \Delta q = \underset{(2.23)}{2.21} - \underset{(4.66)}{0.34}\, RGDP60 - \underset{(0.78)}{0.23}\, GPO + \underset{(1.20)}{0.87}\, SEC + \underset{(3.06)}{9.01}\, INV - \underset{(0.17)}{0.004}\, PI \end{array} \tag{11}$$

($\overline{R}^2 = 0.58$, estimation period 1960-89, absolute value of White robust t-statistics in parentheses), while the LZ regression is:

$$\Delta q = \underset{(7.48)}{6.40} - \underset{(4.78)}{2.02}\, LRGDP60 + \underset{(1.35)}{0.38}\, LSEC - \underset{(2.36)}{4.32}\, REVC - \underset{(0.56)}{0.016}\, PI \tag{12}$$

($\overline{R}^2 = 0.50$, estimation period 1960-89, absolute value of White robust t-statistics in parentheses).

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Discussion

1. Bob Gregory

Most economists believe that good macroeconomic policies generate faster economic growth over the longer term. But the empirical research that demonstrates convincingly which policies promote faster growth rates is remarkably insubstantial. This important Andersen and Gruen paper is to be welcomed both as a survey of the literature and for adding new Australian results for our consideration.

The authors have set themselves a very large task. These comments focus on the subsections of their paper that relate to the current policy issues concerned with inflation, economic growth and the balance of payments. Other sections of the paper are equally stimulating, but there is insufficient space to discuss them.

Growth and the Balance of Payments

There is no doubt that the electorate, a large proportion of economic commentators and a significant fraction of the business community regard the continual accumulation of large current account deficits as an important policy issue. None of these groups, however, tie the possible macro-policy responses to the deficit to the impact on the future long-run growth rates of the Australian economy. Andersen and Gruen attempt to do so.

Their analysis begins with an elasticities approach to analyse consistency between balance of payment outcomes and GDP growth rates. In its simplest form, it proceeds in the following steps:

(i) it estimates a growth rate of foreign exchange receipts;

(ii) it subtracts an estimate of exogenous capital inflows to estimate foreign exchange receipts available for imports; and

(iii) it then applies the income elasticity of import demand to the growth of foreign exchange receipts to calculate the GDP growth rate consistent with foreign exchange receipts. The resulting GDP growth rate is consistent with a stable real exchange rate.

The estimated GDP growth rate is low – for example, 2.0 to 2.45 per cent per annum between 1972/73 and 1989/90. Australia grew faster than this and, as a result, there was a substantial devaluation of the currency and accumulation of foreign debt.

The suggestion that Australia can only grow at 2.0 to 2.45 per cent without real devaluations is a very pessimistic outcome. Other economic objectives, such as reducing unemployment, suggest a required GDP growth rate of nearer to 3.5 or 4.0 per cent for at least the next five years. Consequently, if we pursue the unemployment objective the prognosis is clear: reducing unemployment will involve continual real devaluations. This is the most important empirical message of the paper.

The analysis of Andersen and Gruen is very simple and with little effort one can imagine adding all sorts of sophistications or producing a long list of criticisms but, at the end of the day, the outcome would not be changed much.[1] The model and estimated numbers seem to capture the Australian economy as many perceive it – put simply, when Australia grows at a rate that makes significant inroads into unemployment, the current account deteriorates, there is downward pressure on the exchange rate and policy is tightened.

Many academics and some policy makers have argued that we should forget about the balance of payments and that the current account deficit should not be thought of a constraint. They would not necessarily deny the validity of empirical analysis such as Andersen and Gruen, only the policy relevance.

But large devaluations arising from the large current accounts deficits will inevitably impose policy constraints. Even if the current account and exchange rate data could be hidden from policy makers, it would still be true that the combination of exchange rate devaluations and a low inflation target will impose strains that lead to policy reactions less favourable to the achievement of low unemployment.

If, in the longer term, Australia needs further large real devaluations, this poses significant policy problems. Real devaluations can be affected in two ways: either through domestic inflation rates which are significantly lower than those of our trading partners; or through nominal devaluations which are not offset by increased domestic inflation. Neither will be easy to achieve.

Domestic inflation rates below that of our trading partners seem very unlikely for three reasons.

- With the exception of some Asian countries, most of our trading partners, particularly New Zealand, Europe and the US, seem to be clearly on low-inflation paths. Consequently, to achieve inflation rates sufficiently lower than our trading partners is likely to require Australian inflation outcomes just marginally above zero.
- Current wage-setting arrangements seem unable to produce the very low nominal wage outcomes that might be required. Restricting nominal wage increases to produce the rate of inflation of our trading partners, as agreed by the ACTU, would be insufficient under the Andersen-Gruen scenario. What is needed is nominal wage increases lower than this. The prognosis is not optimistic in the current environment where enterprise agreements appear to extend to only 22 per cent of the labour force, and wage increases are currently proceeding at annual rates somewhere between 4.5 and 5.5 per cent, despite 8 per cent unemployment.
- The faster the rate of productivity growth, the higher will be the rate of any nominal wage increases consistent with low inflation rates. Productivity growth rates have accelerated recently, but it is unlikely that they will continue at the current rate. In the longer term, an underlying productivity growth rate of say, one or one and half per cent, average nominal wage increases of 4.5-5.5 per cent and the need for real devaluations, all seem inconsistent with an inflation target of 2-3 per cent. At least one of these links must change. Hopefully, underlying productivity growth will increase more than is currently indicated, but it seems unlikely.

1. The criticisms would include the following. Some attempt should be made to incorporate the saving-investment identity into the analysis. Perhaps the export elasticity is too low and the import income elasticity too high.

Given the Andersen-Gruen scenario, and the above interpretation of the current labour-market institutions, nominal exchange rate devaluations will be required. But how can this be managed without the price increases feeding into domestic prices and costs in a way which further increases inflation beyond that required to make traded goods more profitable?

Under a centralised wage-fixing system there is, in principle, an answer: wage increases could be discounted for necessary exchange rate devaluations. But we do not have a centralised wage-fixing system. If the Andersen and Gruen analysis is roughly right, it is not easy to see a clear way whereby we can achieve significantly lower unemployment, lower inflation and lower current account deficits on a long-term sustained basis.

Perhaps, however, the Andersen-Gruen empirics are not right and should be thought of as an interesting exercise that brings out some of the links between important economic variables. Application of an elasticities approach to the balance of payments has a long history in countries with large current account deficits, although it has become less common over the past two decades. It is an approach which usually leads to pessimism.

So to end the section on a more optimistic note we make two remarks:

- First, the large real devaluations that occurred in the mid 1980s seem to have strongly affected the rate of growth of Australian manufacturing exports. Growth rates have been well above historical standards and the future for manufacturing exports looks promising. Manufacturing export volumes were low and consequently fast growth rates have not impacted to a large degree on the current account deficit. As time passes, however, the impact of manufacturing export growth should become much more significant. In other words, perhaps Australian export receipts may increase quickly in the future and allow faster GDP growth rates.
- Second, the elasticities approach does not adequately focus on the changing saving and investment balance that is required to correct current account deficits. Australia will also need to save more if the current account deficit is to be changed. A policy response to increase savings is now in place with more attention being devoted to government saving and the development of superannuation schemes.

Inflation and Growth

Andersen and Gruen suggest that if Australia can reduce domestic inflation this will increase productivity which will raise living standards and increase output potential. These changes may make it easier to bring about the resource switch to the traded goods sector, and the expenditure reduction relative to output, that is required to change the current account deficit. The argument in this section of the paper is as follows: reversing the accumulation of current account deficits requires devaluations which, other things being constant, will produce more inflation. More inflation will reduce productivity growth. Hence the major policy problem is to control inflation and manage the real devaluation.

The empirical work linking inflation and productivity growth focuses on a database of 24 OECD countries, excluding Ireland and Turkey (Andersen and Gruen, Figure 4).

The analysis proceeds as follows:

- Casual inspection of Figure 4 suggests that inflation and GDP per capita growth rates are *positively* associated, especially if Japan and New Zealand are excluded.
- Consequently, to establish a *negative* relationship between inflation and GDP per capita growth rates, other variables must explain the positive relationship. To account for the positive relationship they regress GDP per capita growth against real per capita income of each country at the beginning of the period, which matters a great deal, and other variables which seem much less significant, such as secondary school enrolments and the investment share of GDP. This is the base regression equation.
- When inflation is added to the base regression equation, it exhibits a negative sign, but the coefficient is statistically insignificant (Andersen and Gruen, Appendix).
- They then adopt a different research strategy of adding sets of variables including inflation, to see whether the inflation coefficient changes or becomes significant as each new set of variables is added.
- They conclude that the accumulation of negative coefficients suggests that ‘lower inflation leads to higher economic growth’.

There are many comments that can be made at each step of this analysis.

- What should be the relevant dataset? The first issue is to decide whether any countries should be excluded from the analysis. The authors exclude two countries, but one naturally feels uncomfortable about this decision since there is no obvious reason to exclude two of the outlying observations, but not the other two. The point is made clear from inspection of Figure 4. The line joining New Zealand and Japan (outlying data which will receive a large weight in a regression) is *negative*. These countries are included and must increase the likelihood of producing a negative relationship between productivity growth and inflation. The line of best fit for the other countries is clearly *positive*. Perhaps the results should have also been reported when the four outlying countries were excluded.
- The second issue involved in becoming comfortable with the empirical analysis is to make a judgment as to how many independent observation there are in the dataset. For our purposes, are Austria and Germany sufficiently disconnected to be treated as two separate observations? Similarly, should Belgium, Luxembourg and Holland be separate observations? This concern will become more important as the integration of Europe increases. If the effective number of observations is considerably less than 24, then there must be doubt as to the statistical power of the analysis.
- The major variable explaining the different per capita growth rates of GDP is the base period GDP per capita of each country. This variable measures the catch-up effect. The very strong performance of this variable, in the context of Figure 4, suggests that the more catch-up is undertaken, the greater is the inflation rate. This invariably makes one feel uneasy about the ability of the regression analysis to adequately allocate the effects of catch-up and inflation separately.
- The technique that Andersen and Gruen apply to the data involves adding combinations of the same set of variables to the same base equation and observing

the change in the inflation coefficient. The inflation coefficient is negative in all but one regression and, for the period as a whole, is often significant at the five per cent level. How should we treat this accumulation of negative coefficients? I am not sure because it is important to realise that each regression is not a separate test of the hypothesis. It is the same database and the same variables that are being alternated.

- Finally, it is disappointing that the weakest results are derived from the second most recent period. This invariably reduces the confidence that we can place in the results for current policy.

My judgment is that the support for a negative relationship between inflation and productivity growth is not as strong as suggested by the authors. There are obviously matters of empirical judgment to be made, but it just seems that too much effort has to be expended to find the results and reverse the impression created by Figure 4.

The paper includes other interesting features that have not been discussed here. There is a table, and comments, in the Appendix which show that the persistence of policy-related variables is much greater than the persistence of GDP growth rates. Persistence of inflation is also much greater than the persistence of productivity growth. The implications of these results deserve a paper of their own. The initial conjecture that it is the incidence of shocks that affect the different performance of countries, rather than policy differences, is interesting.

2. General Discussion

Discussion focussed on two main questions about the effect of the macroeconomic environment on productivity and growth:

- Is there an external constraint on long-run growth?
- What is the relationship between inflation and growth?

There was agreement that low domestic savings are a constraint on investment and growth if capital is not sufficiently mobile between countries. It was argued, however, that the correlation between saving and investment identified by Feldstein and Horioka cannot necessarily be interpreted as a sign of capital immobility. It could, for example, be induced by governments targeting the current account. It was also suggested that the ways in which the current account deficit might constrain growth should be examined in a different framework. In particular, it was suggested that externalities associated with current account deficits should be given greater prominence. It was also argued that external imbalances may generate uncertainty inhibiting long-term investment and growth, or perhaps lead to greater fluctuations in the business cycle.

Nonetheless, many felt that saving-investment imbalances are an important issue, and that deficient domestic savings are of policy concern. On this point, it was also argued that education and health expenditure should be classified as investment rather than consumption. While this does not change the fiscal or external balance, it does imply that government investment and savings are higher than official statistics suggest.

The issue of addressing imbalances between saving and investment led to discussion about the role for macroeconomic policy in creating an environment conducive to growth. Here, there was agreement that macro policy makers must 'get the basics right', since policy mistakes can be very costly. But does good macro policy influence long-run growth only at the margin, or is its effect more powerful? This question led to discussion about the long-run gains of low inflation.

There was a consensus that high rates of inflation adversely affect growth. At rates of inflation relevant for advanced industrial countries, however, there was disagreement about the empirical evidence. There was discussion about Figure 4 in the paper which suggests a *positive* bi-variate correlation between inflation and growth. It was pointed out, however, that while poorer countries tend to have higher inflation, they also tend to grow faster because of technological catch-up – thereby generating a spurious positive correlation between growth and inflation. There was also discussion about the role of outliers and measurement errors in influencing the empirical results.

Some participants agreed with the paper that the widespread finding of a negative relationship between inflation and growth, even if sometimes statistically insignificant, was suggestive that lower inflation is indeed conducive to faster growth. The point was also made that while the growth effects of low inflation may be small, when cumulated over long periods of time, the consequences for output and living standards can still be substantial.

Final Discussion

1. Adrian Pagan

Lately, I've been watching television, and one of the people I see on it a lot is Tina Turner. Now Tina may seem to be an odd person to introduce into a central bank conference, but her songs have titles that fit pretty well with some of the issues raised by this Conference. First up, there is the line that she belts out on television in support of the local football code, while standing on what appears to be the Sydney Harbour Bridge: 'better than all the rest'.

Better Than all the Rest

Ian Castles provided an excellent paper on the difficulties of making inter-country comparisons of living standards, illustrating that a recognition of these difficulties extends back to at least the first decade of this century. He convincingly argued that the ICP results displayed an anti-Australian bias and that multiple-country comparisons should be eschewed in favour of bilateral comparisons, where more reliable assessments could be made. As well as specific issues concerning the valuation of money income, the paper stimulated my thoughts over a few secondary points. In particular, whom should we compare ourselves to and what should be the basis of the comparison? Many times we saw that comparison set as being the OECD average, but I couldn't shake the impression that this was like comparing the Pagan Pastoral Company to BHP. My own preference would be to see comparisons with Canada or Sweden and, in the future, perhaps South Africa, as these represent countries that are of similar population size and/or resource endowments. Related to this aspect is the question of what we want to compare? Much of the Conference was taken up with inter-country comparisons of productivity in sectors such as construction, manufacturing, etc., whereas I felt it might be more useful to look at a traded/non-traded sector division.

Returning to Tina Turner's musical lexicon, outside of the set of rugby league enthusiasts she is probably better known for her chart-toppers, leading me to my second and third themes, which are represented by amended versions of the title of one of her recent hits: 'what's love got to do with it?'.

What's Supply Got to Do With It?

The Conference was remarkable for the number of ways in which we re-arranged or added to a basic equation. Defining Y, K and L as levels of output, capital and labour respectively, where $Y = AK^{\alpha}L^{\beta}$ is generated by a Cobb-Douglas production function, we can express the growth rates of output, y, capital, k, labour, l, and total-factor productivity, a, as:

$$y = a + \alpha k + \beta l \qquad (1)$$

from which the growth rate in labour productivity is:

$$y - l = a + \alpha k + (\beta - 1)l \tag{2}$$

$$= a + \alpha(k - l) \tag{3}$$

provided constant returns to scale $(\alpha + \beta = 1)$ are imposed.

Phil Lowe computed the LHS of equation (3) for a variety of industries, making some conjectures about why it was small or negative, particularly in the retailing industry. He then plotted *Y/L* against the real wage, finding a nice upward-sloping relation. To justify such a connection, we would need to replace *(k - l)* by the change in the real wage. In periods when the capital stock is fixed, that would be a standard optimality condition, but when k is not fixed, we would expect *K/L* to depend on the ratio of the wage rate to the rental price of capital, and this may not be proportional to the price level in periods like the late 1980s when real interest rates rose sharply.

Instead of writing the equation as one explaining labour productivity, we could have used it to describe capital-productivity movements:

$$y - k = a + (\alpha - 1)(k - l) \tag{4}$$

A comparison of equations (3) and (4) shows that both capital and labour productivity cannot increase without there being an increase in TFP, so that the claims in the Conference of rises in both in recent years is tantamount to a statement about TFP increases.

Table 1 gives estimates of $(y - k)$ for various periods in this country. What is especially noticeable from this table is the weak post-World War II performance in capital productivity, which resulted in a substantial rise in the capital/output ratio. The implication of this is best seen by writing (1) as:

$$y = a + \alpha\left(\frac{Y}{K}\right)\left(\frac{I}{Y}\right) + \beta l \tag{5}$$

where *I* is net investment, an equation Steve Dowrick used in his paper for explaining country variations in growth rates of output. In the post-World War II period Australia

Table 1: Capital Productivity Growth Rates
(Per cent per annum)

1900-10	1.45
1910-29	-1.21
1930-38	2.14
1946-60	-0.75
1961-70	-0.80
1970-79	-0.72
1970-89	0.18
1989-94	0.48

Sources: From 1900-79, the results are from Kaspura and Weldon (1980). For 1970-89 and 1989-94, they are computed, assuming α = 0.3, from OECD Working Paper Nos 145 and 152, respectively.

attained historically very high investment ratios with gross non-dwelling public investment hovering around 8-10 per cent of GDP, while private investment was in the 10-14 per cent range. But these high shares did not produce particularly high growth rates in output, as the rate of return to capital, $\alpha\left(\frac{Y}{K}\right)$, was low. Such a phenomenon was remarked on by Nevile (1967), who concluded that the capital/output ratio in Australia was high by international standards. One might suggest many reasons for this outcome, related to tariff protection, etc, and it is therefore encouraging to see the improvement in capital productivity in the 1990s. Indeed, it is possible that capital productivity has increased at a faster rate than shown in the table. Bob Gordon pointed to the problems of measuring real quantities with deflators that have a fixed base year, and for which there have been sharp changes in quality. Computers are the most obvious offender on this score, and given their importance in Australian equipment investment, Aspden argued that this might be expected to have led to an overstatement of import and investment demand, that is: *k*.

A different way to use the equation is to define TFP growth:

$$a = y - l - \alpha(k - l) \tag{6}$$

Michael Sarel performed such an inversion in order to estimate a in Asian economies, concluding that the estimates were sensitive to the size of α (as well as the time period chosen to measure *y, l* etc). Moreover, some recent revisionist views of the 'Asian miracle' could be attributed to their ascribing a large value to α. Writing the equation as above shows that the sensitivity arises only if the capital/output ratio is growing very strongly, and accounts for why growth-accounting exercises performed on industrial economies had not encountered such a problem. Sensitivity of solutions to parameters has also been an issue with computable general equilibrium (CGE) models, and it might be useful to provide sensitivity elasticities $\eta_\theta = \left(\partial a / \partial \theta\right)\left(\frac{\theta}{a}\right)$ of a to a parameter θ, as was done in the CGE context by Pagan and Shannon (1985). Using the numbers in Table 1 of Sarel's paper, $\eta_\alpha = -0.8$.

Finally, one might argue that $\beta + \alpha > 1$, either because of increasing returns in production or because TFP depends on *K* and *L*. Starting with a production relation $Y = A^* K^\gamma L^\delta$ and $A^* = AK^c L^d$, we would have $Y = AK^\alpha L^\beta$ where $\alpha = \gamma + c,\ \beta = \delta + d$ could now easily sum to more than unity. Steve Dowrick dealt with the literature on this way of producing endogenous growth, but very little discussion at the Conference entertained such a possibility. I must admit to being sceptical of the value of this literature, and this perception might have been shared by others.

The idea of focussing upon the supply-side constraint is another useful framework when analysing the possible magnitude of future growth. Capital stock and labour-force growth raise policy issues relating to the savings rate, as well as re-training of the labour force to enhance skills and immigration, and these are best handled by Vince FitzGerald. This leaves the potential growth of TFP to be identified. The National Australia Bank Survey, reported in Oster's paper, has around 2 per cent per annum anticipated productivity growth across most industries for the next three years. The question asked in the survey seems ambiguous. If it was interpreted as labour productivity it would imply a very low rate of TFP growth, so it seems more likely that it is an estimate of *a*. Hence, one would have to be optimistic about TFP growth.

Growth regression studies provide a decomposition of *a* into an exogenous component and a ‘catch-up’ term. Steve Dowrick argued that some of the ‘Asian miracle’ could be attributed to the latter, and there was argument at the Conference over how important that explanation was. Results in Sarel’s paper tend to suggest that the growth rates of some Asian economies are well explained by growth regressions – see his Table 5 – but the residuals presented in Figure 2 of Helliwell (1991), as well as comments by Ross Garnaut and Wong Fot Chyi, would tend to view such a conclusion as a manifestation of selection bias, with economies such as Hong Kong and Singapore having large positive residuals from growth regressions.

Normally, the expectation would be that an advanced country like Australia would not find much of a contribution from ‘catch-up’ to *a*. But this stance was belied by the very interesting micro studies that were presented. It seemed as if Australia was well away from best practice in steel production, electricity generation and (possibly) banking, although the gap has been narrowed in the 1990s. These studies suggested that there could be a substantial catch-up contribution to *a* in the next decade. It would be interesting to see a wider range of studies addressing this possibility.

What’s Demand Got to Do With It?

A final issue which surfaced sporadically was the role of demand management in ensuring that *y* and *y** remained close to one another. It is intriguing to see how demand management has been relegated to a back-seat in discussions of growth. Historically, economists treated demand in its various guises, e.g. trade, as a most important factor in generating growth, as evidenced by the staple theory of growth; Noel Butlin’s view that Australian growth was heavily influenced by public investment; and Snooks’ (1994) demonstration of fast growth rates in England during 1490 to 1600 (sandwiched between centuries of stagnation).

Andersen and Gruen turned the Conference’s attention to demand factors, albeit more on the volatility of the latter rather than its level. I am in general agreement with their main conclusions on the matter of the importance of good demand management, but would quibble with some of the detail. Given my long-standing interest in inflation in Australia, it should be no surprise that the main reservation I had with their paper arose from the work concerning the correlation of inflation and growth. Designating the coefficient of inflation in growth regressions as β, they engage in some ‘meta-analysis’ of past studies regarding the size of β. If we took n independent studies with corresponding estimates of β, $\hat{\beta}_j\left(j=1,\ldots,n\right)$, a finding that $\hat{\beta}_j$ is always negative would be extremely strong evidence that the true value of β is negative, since realisations of the random variable $\hat{\beta}$ show too many from the left-hand tail of its density if $\beta \geq 0$. But the sampled $\hat{\beta}_j$ in Andersen and Gruen’s paper are not independent, either due to the ‘extreme-bounds’ technique employed or the use of overlapping time and country observations, and so it is hard to know how significant the finding of a common negative sign is. Although I believe that very large inflation rates are likely to be deleterious for growth, I am not persuaded that the same is true for the range of inflation rates that Andersen and

Gruen consider, particularly given the censoring of Iceland and Turkey on the grounds that these moderate growth and high inflation countries weaken the correlation.

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2. Vince FitzGerald

Papers at this Conference have ranged from a 'big picture' conspectus of growth theories by Steve Dowrick, to several papers canvassing measurement problems – beginning with Ian Castles' – to a series of micro-oriented examinations of productivity performances and their apparent drivers; then back to country and inter-country level growth studies for East and North Asia; and finally to Andersen and Gruen on macroeconomic policies and growth.

I don't intend to try to review all of those contributions. In particular, while I was impressed with what we heard about the sheer fuzziness of our measures of output, and hence price and hence productivity (particularly so in the service sector), I have little further to add on that Conference theme to the discussions we have already had. Equally, it was very valuable to hear from Philip Lowe, Robert Gordon and all of those presenting case studies of comparative productivity levels and productivity growth, but again I don't want to pick up further specific points from those papers, but will reflect on issues discussed in those sessions only at a general level.

I want to focus primarily at the economy-wide and public-policy level, and so mainly on Steve Dowrick's paper and the papers presented by Michael Sarel, Kengo Inoue and Palle Andersen and David Gruen. I myself am very interested in experiences of growth across countries and over time, but my main interest is in policies relevant to Australia here and now, in the 1990s, and over the medium and longer term.

Steve Dowrick's opening paper tabled a summary of the possible explanatory factors for countries' growth experiences (emerging out of his survey of the field), and discussed the policy implications – but this area of policy implications was not, I think, picked up adequately in the subsequent discussion session. His explanatory factors were:

- population growth;
- labour supply;
- physical capital accumulation (equipment and infrastructure particularly);
- human capital;
- knowledge accumulation (as distinct from human capital) – i.e. R&D and the creation of intellectual property;
- government consumption;
- trade and specialisation; and
- macroeconomic settings.

Given time constraints, I have to specialise, so will talk about only this subset of those topics:

- physical capital accumulation;
- government consumption; and
- macroeconomic settings.

That list does not include *saving* explicitly, but it is closely linked especially to the first item – and also to the other items – on that short list in a number of the papers, and I want to concentrate on it here. (I note that I have written extensively elsewhere on the human capital dimension, specifically on training reform.)[1]

I have argued elsewhere[2] that national saving in Australia has recently been sub-optimally low, and seemingly increasingly so from about the mid 1970s onwards. As in a number of other OECD countries, the decline in Australia's saving can largely be attributed to the *public sector*, and largely at the Federal government level. This attribution is not just a matter of comparisons with the past, but a matter of the fact of persistent public dissaving – i.e. excessive incurrence, on average over the cycle, of debt liabilities to finance recurrent public expenditures. This is something which is not sustainable – either on good public finance principles or in terms of intergenerational equity – and which cannot plausibly be explained away (as some commentators have sought to do) by regarding certain government current spending as capital in nature, at least in part (e.g. education expenditure).[3] What the decline in national saving has to do with physical (and for that matter, human) capital accumulation and growth I will return to in a moment.

As Andersen and Gruen pointed out at this Conference, Australia has, by comparison with other OECD countries, also seen an unusually large decline in *private* saving, and clearly so in household saving – noting that saving in enterprises has returned to fairly high levels during the recent (1991-95) recovery. The picture of decline in saving is thus consistent across public and private sectors and in any case does not change radically if alternative measures of saving, counting some human capital related spending as saving, are adopted; moreover, it is not purely cyclical on *any* measure. I would not argue, even if it could be demonstrated conclusively that policy could raise saving *and* that this would

1. See The Allen Consulting Group (1994a, 1994b).
2. Principally in FitzGerald (1993).
3. See FitzGerald (1993, Appendix A).

accelerate growth, that we should necessarily, on that ground alone, do so, if this meant overriding private choices about consumption and saving.

The fundamental public policy reasons for correcting *public* dissaving I have alluded to already, and there are equivalent arguments for correcting *distortions* to private saving decisions.[4] There is also a strong argument – one, I note, which is apparently accepted even by that great New Zealand interventionist Roger Douglas – for requiring minimum self-provision for retirement through private saving earmarked for that purpose, in order to prevent the otherwise very little restricted ability of many present households to impose uncompensated burdens on future taxpaying households. This essentially 'moral hazard' argument is especially strong if the proportion of aged in the population is rising rapidly. Note, however, that for a policy for minimum retirement saving to work in intergenerational equity terms, it *must* succeed in raising the capital intensity of the economy, i.e. capital per worker (and possibly overseas assets per worker) in order to raise the future ratio of non-wage to wage income.

Let me now return to what all these points about saving have to do with growth. Michael Sarel's paper gave an excellent discussion of alternative explanations of the East-Asian growth experience. Especially for Singapore, it would be easy to conclude that his demonstration that Alwyn Young's well-known results are very sensitive to the choice of key parameters throws out the story that Singapore's growth is explained entirely by high rates of provision of factors (and not by total-factor productivity growth). But to conclude this would surely be to 'throw out the baby with the bath water'. Sarel's figures suggest that even with alternative parameters to those adopted by Young, Singapore's growth is still 60 per cent attributable to causes other than TFP growth, including importantly the high rate of accumulation of capital, financed by high saving rates. In other words, this effect of saving on investment and thence growth may not be the *whole* story, but it remains standing as *a major part* of the East-Asian growth story.

While at least some of the East-Asian economies clearly combined this with other important ingredients in growth – including, along the way, relatively high levels and possibly above average rates of accumulation of *human* capital – there is nevertheless an apparently clear demonstration here that it is possible to raise output per worker by raising capital per worker, whatever rate of TFP growth is being achieved, and to keep doing this over time-scales stretching into decades before this potential source of growth in GDP per capita runs into diminishing returns – as Kengo Inoue's paper indicates may have begun to occur in Japan, although only after many years into the high-growth process.

Of course, saving by definition has a cost in foregone present consumption, and in most macroeconomic models almost any measures to increase it will have the (Keynesian) effect of initially depressing growth below the path it would otherwise take, for perhaps as long as a number of years, before positive effects on investment and productive capacity are reflected in higher GDP growth. Thus we should look at the inter-relationship between saving and growth in an appropriately long time frame.

Andersen and Gruen suggest that, at least to some extent, the well-documented positive association of saving and growth over periods longer than a few years may

4. For an excellent exposition of principles here see Friedman (1990).

involve growth stimulating saving rather than the reverse. Sarel also quotes a paper by Carroll and Weil suggesting that it is increased growth which increases saving. It is almost certainly so that higher growth stimulates higher saving, at least as a matter of inertia in spending patterns until there is adjustment to higher levels and growth of incomes, but I do not think that this has been demonstrated to be the *main* direction of causation. Rather it is likely to be a *feedback*, and probably a temporary one. Why should households, once they have come to believe that a higher growth rate will be long-lasting – i.e. that they can count on having higher incomes and faster growth in their incomes in the future – react by *reducing* the proportion of their *present low incomes* which they consume?

A number of other studies which have examined the causality issue for different countries and over time (e.g. Nelson (1993) and Hutchison (1992)) have shown that the main causality is *from* saving *to* investment. Because the effect on investment is less than one for one, the external deficit is also reduced, to a partial extent.

This, indeed, is surely one of the best-established broad empirical facts in economics, thanks to the extensive stream of work started 15 years or so ago by Feldstein and Horioka (1980). Why, particularly when the short-run effect may be to *reduce* growth, should the main causality be that way, from saving to growth? While the usual attribution of cause is to immobility of capital, I think it is better to think of it as a process whereby increased savings are naturally and rationally more likely to be invested at home than abroad. Here are some plausible reasons for this:

- Given that the main source of decline in OECD saving rates is declining public saving, we can observe that governments in budgetary trouble almost everywhere cut capital expenditure first. In Australia, the consequence of 20 years of this is a clear backlog in many types of infrastructure investment – reflected in the fact that a range of possible ‘catch-up’ infrastructure projects presently show high expected returns. (I have written elsewhere on this.[5]) By contrast, governments with fundamentally strong budgets can readily borrow on favourable terms to finance good infrastructure, or for that matter, good human capital enhancing expenditures. That is, increased public saving is clearly likely to lead to increased public investment – and, especially if it is achieved via reduced recurrent spending rather than via taxes affecting private incentives to save and invest, to increased national saving and investment, and to a lower underlying external deficit.
- In terms of private saving, one reason for the primary causality being from saving to growth may be as follows. Many of the potential business sector investments, especially in small and middle-sized enterprises (SMEs), can only offer attractive risk/return combinations to well-informed (and necessarily, therefore, mainly local) investors who are or can become familiar with the firms’ prospects. Of course, this applies to no investor group more than to the proprietors of such firms (and I believe this is part of the story in some East-Asian countries) which experienced high rates of saving in the form of profits retained in SMEs in the early stages of growth.[6]

5. See The Allen Consulting Group (1993).

6. See for example, in respect of Taiwan, Woo and Liu (1993).

In short, I think that in countries where there is evidence that saving has been sub-optimally low – which seems strongly indicated for Australia, at least – the literature supports the view that policy should and can bring about increased public, and possibly private, saving; and that this will lead to increased capital accumulation and a higher rate of growth over an extended period.

Importantly, there are not many *other* areas in which we can point to as clear a possibility for government policy to affect growth, but nevertheless this Conference leads me to largely the same kind of conclusions on this score as were reached by both Sarel and Andersen and Gruen – that is, we will at least improve the chances of achieving good growth by maintaining 'good policies', including:

- good public finances, namely sustainable (surplus) recurrent budgets;
- good public investments, undertaken (or not) on economic benefit/cost rather than budgetary criteria;
- strong government support for human capital formation, through education and training;
- undistorted incentives for private saving, subject only (on 'moral hazard' grounds) to a requirement for minimum self-provision for retirement; and
- generally, stable macro and micro policies conducive to saving and domestic capital accumulation and to productivity growth.

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Summaries of the Papers

The Determinants of Long-Run Growth

Steve Dowrick

During the post-war period, economic growth rates have differed substantially between regions. In OECD economies, the rapid growth of the 1950s and 1960s has been followed by a pronounced slowdown. In contrast, East-Asian economies have sustained remarkably high growth rates, while the performance of Latin America and Africa has been unimpressive. These disparities in growth performance have engendered a renewed interest in the determinants of long-run growth.

A simple model is developed to explain phases of growth common to all developing countries. Upon reaching a productivity threshold, growth takes off, accelerates and subsequently slows down as the economy matures and opportunities for growth provided by technological catch-up are exhausted. Estimation results suggest that over half of the disparate growth performance between regions in the post-war period is explicable by this model. Seen in this light, productivity growth in Asian economies is not substantially different from the earlier productivity performance of developing European economies.

A discussion of the importance of initial conditions to this growth dynamic is supplemented by a review of other determinants of growth – some are complements, and some are substitutes for the model of catch-up and convergence. The importance of investment in a general context is underscored by the evidence that countries which encouraged substantial capital deepening experienced superior growth performance. The role of specific types of investment is also considered. Investment in human capital is growth enhancing, as is government investment to some critical level at which the cost of distortionary taxation needed to finance the public investment outweighs the benefits. Finally, investment in research and development, the linchpin of a class of endogenous growth models, is found to be the source of substantial feedback and spillover effects due to the public good nature of knowledge and the increasing returns it generates.

Empirical evidence of the determinants of growth is reviewed in an Australian context. It is concluded that once an allowance is made for each country's position on their development path, Australia's post-war growth has been approximately average for a mature industrialised economy. Such average performance implies room for either improvement or deterioration, contingent upon policy action. Here an important part of the policy debate is the role that can be played by savings, recognition of the private-sector productivity gains that arise from public-sector investment, continued improvement in educational attainment and facilitation of research.

Measuring Economic Progress

Ian Castles

Among economists, and the public generally, considerable attention is paid to quantitative measures of economic progress, such as official league tables of relative real income. Of particular concern has been the fall in Australia's real per capita income relative to other countries: where in the late 1930s Australia ranked 4th in such league tables, its position has slipped progressively and is presently 15th. There are, however, a great many conceptual and practical difficulties associated with identifying these relativities. Consequently, there is a need for greater circumspection in the use of such comparisons, and for a more informed understanding of their limitations.

International comparisons of economic progress are the outcome of an extensive pricing exercise. Meaningful comparisons require that national currency expenditures are converted to a common currency unit by the price of a set of representative goods. By representative it is meant that *between* countries the goods are identical in quality, and that *within* countries they have a similar weight in consumption and a similar relative price. A fundamental problem is that items that are identical in quality and quantity tend not to be typical of the relevant area of expenditure. There can be little doubt that estimates of Australia's relative economic position are substantially affected by the fact that the list of items priced was initially prepared for the purpose of supporting comparisons between European countries. When attempts are made to address this problem by utilising unofficial surveys, or comparisons of actual contents of typical family budgets, different rankings in real income levels are obtained. In fact, when account is also taken of differences in living conditions and the preferences of communities, there is a far more positive picture of Australia's relative living standard than implied by conventional league tables.

The decline of Australia's relative position on the real income scale does not, however, depend on the reliability of purchasing power studies, but is due to the growth rate of Australia's real per capita output being lower than that of most other high-income countries. This is not of itself cause for concern. This outcome inevitably reflects Australians' social choices – their choice to distribute resource wealth through relatively high real wages, encouragement of a wider dispersion of resources through fast population and labour-force growth and, perhaps most prominently, the higher priority paid to those aspects of life that are not included in conventional national accounts. These factors, more than any others, may explain the relatively slow growth in measured real incomes in Australia through this century.

Labour Productivity Growth and Relative Wages: 1978-1994

Philip Lowe

Between 1985 and 1991 there was virtually no growth in labour productivity in the non-farm sector in Australia. While wage restraint played an important role in generating this outcome, this paper argues that it is not the sole explanation. The approach adopted in the paper is to use industry-level data to examine some of the other possible explanations for the productivity slowdown. It also uses the industry-level data to examine the relationships between wages, prices and productivity growth.

Labour-productivity growth rates vary widely across industries. Over the past decade and a half, annual rates of productivity growth have exceeded 5 per cent in the utilities and communications industries. In contrast, the level of labour productivity has fallen in both the recreation, personal and other services industry and in the finance, property and business services industry. It is virtually unchanged in the construction industry and in retail and wholesale trade, labour productivity growth has averaged just 0.7 per cent per year.

The paper analyses productivity trends in those industries which experienced declines in labour productivity over the second half of the 1980s, and examines the contributions of various industries to the aggregate slowdown. The largest single industry in the economy is the retail and wholesale trade industry and it experienced a particularly large decline in productivity growth. This ‘deterioration’ in performance can be attributed, in part, to the deregulation of trading hours. While deregulation of hours has set in train changes that will make for a more efficient industry, it did require more hours to be worked in retail stores. Under current measurement practices, the result is a decline in labour productivity as the increased output of ‘convenience’ is ignored. As the service sector continues to expand, the difficult of measuring convenience and quality will make interpretation of the data on productivity increasingly difficult.

Given that extensive deregulation of shopping hours has now occurred, the retail industry should again make positive contributions to measured labour-productivity growth. Measurement problems in a number of other industries may also be less severe than they were over the second half of the 1980s. In addition, continuing microeconomic reform suggests that the rate of productivity growth over the second half of the 1980s is not the right benchmark for the second half of the 1990s. While rates of productivity growth experienced between 1991 and 1994 are unlikely to be sustained, labour-productivity growth should continue at a faster pace than in the 1980s.

Finally, the data on prices and wages by industry show that differences in productivity growth rates across industries are reflected in differences in price movements and not differences in wage movements. Eventually, even those industries with no productivity growth pay their workers higher wages; the counterpart is an increase in the relative price of the output of low-productivity-growth sectors.

Problems in the Measurement and Performance of Service-Sector Productivity in the United States

Robert J. Gordon

For a number of years, American economists have been concerned with the slowdown in US productivity growth that has been evident since the early 1970s. Productivity growth has slowed from an average of 2.27 per cent during 1950-72 to an average of just over 1 per cent during 1972-94, and has generally been lower than in other G7 countries. This paper examines whether the experience is a common international phenomenon and also whether the productivity slowdown was common to all sectors of the US economy. It suggests some possible explanations of the slowdown, focussing in detail on the problem of measurement.

The productivity performance of the various sectors of the US economy has actually been quite diverse. Some sectors (agriculture and mining) have experienced quite high rates of productivity growth by international standards, whilst other sectors (particularly service sectors) have performed very poorly – both absolutely and by international standards. Overall, the post-1972 slowdown in productivity growth in the US was, in fact, smaller than in other countries, but this was partly because US productivity growth was relatively poor in the earlier period.

Mismeasurement has often been advanced as a cause of the slowdown in growth and the poor aggregate productivity performance in the US. To provide a satisfactory explanation, however, measurement problems need to have increased in the recent period and be greater than in other G7 countries. Contrary to earlier findings, this does appear to be the case. The paper argues that the use of a single base year in the US, rather than regularly changing base years, does bias the US results because it fails to take account of changes in relative prices. Productivity growth may also be mismeasured because of sources of bias in the consumer price index caused by factors such as changes in relative prices, the increasing importance of discount stores and changes in the quality of goods and services. Since these factors tend to bias the CPI upwards, output and productivity are biased downwards.

The impact of the oil shocks and a decline in public infrastructure are ruled out as explanations for the productivity slowdown. Instead, the paper advances three alternative explanations. The first of these is the increased importance of 'hard-to-measure' sectors of the economy. The second is the fall in real wages in the bottom half of the income distribution, caused by the weak bargaining position of labour, that may have resulted in the employment of less productive workers. Finally, the slowdown is attributed to an exhaustion of ideas. Certainly, until this problem is addressed there remains a bleak trade-off between productivity improvements and unemployment.

Case Studies of the Productivity Effects of Microeconomic Reform

The apparent slowdown in productivity for much of the 1980s has reflected disparate productivity performance between sectors of the economy. Levels of productivity have fallen in a number of intermediate industries. And yet, many of these industries have been the target of microeconomic reform. The suggestion is that much of the fall in productivity can be attributed to measurement problems, since the output of these industries is inherently difficult to value. Given these measurement difficulties, case studies can provide valuable insights to productivity development at the enterprise level.

Four case studies of enterprise activity were conducted. Three of these – BHP Steel, the New South Wales electricity industry, and the National Australia Bank – related to productivity performance of providers of a key intermediate input. The fourth case study – the Australian labour market – related to the way in which organised labour is responding to the objectives of enterprises. A key message to emerge from these studies is that, at an enterprise level, much stronger evidence of productivity improvement can be found than is evident in data for the aggregate economy. Invariably, the initial improvement in productivity has been motivated by some crisis. Efforts to address the crisis have then evolved into a more comprehensive program of reform aimed at sustaining productivity growth and improving competitiveness.

Despite the diversity of enterprises examined, there are striking similarities in the features of their reform programs. There is a general tendency to cultivate better use of resources, both human and capital. This is evidenced by increased commitment to the development of skills, improvement of relations between workers and management, and the rationalisation of capital requirements. Technology is also being harnessed to exploit scale economies or to improve the range and quality of services. However, competitiveness is the abiding concern of enterprises. Regardless of whether they are private or corporatised, or whether they trade in domestic or international markets, enterprises are striving to increase their competitiveness and approach world best practice. Productivity improvements are central to this goal. Furthermore, it is a goal increasingly shared by organised labour.

Microeconomic reform in the labour market has encouraged a transition to enterprise-based wage agreements. Consequently, organised labour has increased its focus on the objectives of enterprises and returns to labour are now more rigorously benchmarked against indicators of performance. Against this background, the union movement in Australia explicitly promotes productive performance in the context of the macroeconomic policy objective of sustained low-inflationary growth.

Growth in East Asia: What We Can and What We Cannot Infer From It

Michael Sarel

East-Asian economies have achieved a remarkable record of high and sustained economic growth. This achievement is one of the most important economic developments of recent decades. Quite apart from raising living standards in a populous area of the world, explaining this success might permit such growth performance to be replicated elsewhere. There is also the intellectual challenge of explaining this economic phenomenon in terms of economic conditions and policies, rather than describing it as ‘miraculous’.

Debate about the East-Asian growth experience centres on four main issues. The first is whether growth has been driven by improvements in productivity or by massive, but unsustainable, factor accumulation. The second is whether public policy, in particular selective interventions, have successfully promoted growth. The third is whether high rates of investment and export orientation have been the engines of growth. Finally, there is debate about the importance of the conditions that prevailed at the beginning of the growth episode.

The paper challenges the view that East-Asian growth has been driven solely by massive factor accumulation by demonstrating the sensitivity of growth-accounting exercises to changes in parameter estimates of these factor shares. It argues that while factor accumulation has been important, so too has technology. This is, in fact, an optimistic finding, since technology is the key to achieving continuous growth.

The role of public policy is, however, more difficult to assess; in particular those policies which encourage investment and exports. In the first place, there is a clear selection bias. The East-Asian growth performance has been so impressive that it is hard to believe that policies have inhibited growth. More problematic, though, is identifying whether economic growth has permitted the adoption of particular policies, or whether the policies have generated the growth.

The paper deals with this issue of reverse causality by examining initial conditions. In particular, it looks at whether high rates of investment and exports accompanied or preceded growth. If particular conditions precede growth, one can be more confident that they helped generate the growth. If, however, they accompany growth, it may be that they have been induced by it. Evidence is presented that high rates of investment and exports have evolved quite gradually, rather than preceding growth in East Asia. It is suggested that the conventional view that investment and exports have been the engines of growth may be overstated. However, there are a number of initial conditions common to the high-performing East-Asian economies that may have played a role in their success. These economies were characterised by low initial-income levels, less inequality of land and income distribution, and better primary education than other developing countries that have since been much less successful. When attempts are made to control for these initial conditions, a large part of the so-called East-Asian miracle can be explained. This suggests that a promising avenue for the explanation of growth performance, in particular the disparities that exist between regions, is the examination of initial conditions.

The Growth Experience of Japan – What Lessons to Draw?

Kengo Inoue

The Japanese economy experienced very rapid growth in the 1960s, but this growth has since decelerated. So far, in the 1990s, economic activity has been subdued and productivity has diminished further. Concerns have been expressed that, as a result, Japan’s growth potential has fallen. The paper attempts to shed light on the Japanese experience of productivity and growth by performing a sectoral analysis of labour and capital inputs, together with output prices and returns to capital.

Evidence is presented that, in the 1960s, the fall in the relative size of the primary sector in Japan did not contribute substantially to the gain in overall productivity during this rapid growth phase. This was because the artificially high return on capital in this sector encouraged growth in capital inputs in agriculture and resulted in a huge loss of productivity. However, a major change in agricultural pricing policy in the 1970s reduced the return on capital and curtailed investment in agriculture. Furthermore, what took place was much less inefficient. Consequently, the negative contribution from agriculture was much smaller, but the positive contribution from the resource shift between sectors was also smaller.

The growth in total-factor productivity in the manufacturing sector is shown to be much smaller in the 1970s than in the 1960s, but it is argued that there is no evidence of a declining trend, at least until the recent recession. Furthermore, the return on capital in this sector has been stable since the 1970s, again until recently.

The tertiary sector has offered much higher returns on capital than the manufacturing sector. The gain in total-factor productivity, on the other hand, has been much less because labour inputs have growth persistently faster in tertiary industries than elsewhere. Furthermore, since this sector is less exposed to international competition and is more subject to regulation, there is much scope for productivity-enhancing reform.

The early part of the 1990s is difficult to interpret given the cyclical influence of recessed activity on productivity. Successful demand management policy is considered vital to avoid such cyclical influences becoming structural and reducing Japan's potential output. So too is the dismantling of regulations that have long outlived their usefulness. If efforts on these front are successful, it is argued that the sectoral evidence of growth and productivity performance prior to the recent recession suggest no reason for a bleak future for Japan.

Macroeconomic Policies and Growth

Palle Andersen and David Gruen

While economic theory is largely mute on the question of whether macroeconomic policies affect long-run growth, an examination of the experience of different countries over various periods and the policies they pursued, lends strong support to the idea that macro policies do play a role in the growth process.

A macroeconomic policy framework conducive to growth can be characterised by five features: a low and predictable inflation rate; an appropriate real interest rate; a stable and sustainable fiscal policy; a competitive and predictable real exchange rate; and a balance of payments that is regarded as viable. Countries with these macroeconomic characteristics tend to grow faster than those without them, though there are many individual cases of both developing and developed countries suggesting that satisfying only some of these conditions does not sustain strong growth. It is also important to recognise that the direction of causation is somewhat ambiguous: while good macro outcomes should be conducive to growth, strong growth is also conducive to good macroeconomic outcomes.

The paper presents a wide-ranging examination of both theoretical and empirical evidence on the many ways macroeconomic policies may influence economic growth. Given monetary policy's crucial role in determining the inflation rate in the longer run, there is a particular emphasis on the relationship between inflation and growth.

The following five broad conclusions are drawn. First, although growth models assign a major role to capital accumulation, there is little evidence that aggregate investment yields excess returns, and so special policy incentives to boost aggregate investment appear inappropriate. Second, countries with low national saving invest less and grow more slowly than they would if saving were higher. Ultimately, the extent to which a country can rely on foreign savings to fund domestic investment and growth depends on the rate of capital inflow the market accepts as sustainable. For Australia, with abundant natural resources and a stable political environment, this may be higher than for many other capital importing countries. Third, declining national saving rates in many industrial countries are primarily a consequence of lower government saving, suggesting a need for reduced fiscal deficits. In Australia, however, private savings have also fallen substantially, suggesting a possible role for specific incentives to boost private savings.

Fourth, when economies are near potential, short-run rises in output seem to be more inflationary than falls in output are disinflationary. This implies that macroeconomic policy acting pre-emptively to counter expected future demand pressures and quickly mitigating the effects of unexpected shocks has a positive effect on the level of output, compared with a more hesitant approach acting only when demand pressures have appeared. Further, provided inflation is kept close to its target in the medium term, policy which tolerates some short-term deviations of inflation from its target reduces fluctuations in real output and generates a higher long-run output level than a policy with the sole goal of keeping inflation close to its target.

Finally, although most economists believe even moderate rates of inflation adversely affect growth, unambiguous evidence has been difficult to come by. There is still professional disagreement on the robustness of the empirical evidence, but it does appear that higher inflation, and the associated increased uncertainty about future inflation, adversely affects growth in the industrial countries. The gains from lower inflation appear to exceed the initial costs of reducing inflation within about a decade.

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