

THE EVOLUTION OF EMPLOYMENT AND UNEMPLOYMENT IN AUSTRALIA

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ABSTRACT

This paper poses two questions: why did the equilibrium rate of unemployment rise so much in the 1970s, and why does unemployment increase rapidly during recessions, but decrease so slowly in the subsequent recovery, i.e. why is unemployment persistent? We find that equilibrium unemployment rose because of the economy's inability to adjust to the adverse shocks of the time; employment contracted in some sectors but did not expand sufficiently in others. In answer to the second question, we find that the sources of persistence are different for men and women. Male unemployment has been persistent because, following a recession, employment is created in female dominated sectors, rather than the male dominated sectors which experienced the greatest decline in employment. Female unemployment has been persistent because the growth in the demand for female labour has been matched by the growth in its supply. Finally, we find that recessions appear to have a permanent effect on the sectoral composition of the economy; i.e., recessions are periods of accelerated structural change.

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1. INTRODUCTION

Between 1950 and 1974, the average unemployment rate in Australia was 2.0 per cent of the workforce. Since then, it has been 7.3 per cent. Even more strikingly, from 1984 to 1989, employment growth averaged 3.5 per cent per year, by far the fastest growth in the OECD area. Yet, at the end of this period, the unemployment rate stood at 6.2 per cent, higher than following the great economic shocks of the mid 1970s.

In this paper, we ask why labour market performance in Australia has deteriorated so much; i.e. why, the natural rate of unemployment, or alternatively Non Accelerating Inflation Rate of Unemployment (NAIRU), is about six per cent of the labour force, when, for many years, it was synonymous with less than two per cent unemployment.¹ We also ask why high unemployment is so persistent, i.e. why it rises very sharply during recessions, but falls only slowly during periods of strong economic growth.²

¹ The terms natural rate of unemployment and NAIRU are often used interchangeably. However, this usage is incorrect, as the two concepts have different microeconomic foundations. The natural rate of unemployment is based on models of competitive goods and factor markets and so it represents a Pareto-efficient allocation of resources, subject to the constraints imposed by labour-market regulations, principal-agent problems, and so on. (See Johnson and Layard (1986) for a survey of the determinants and policy implications of the natural rate.) The NAIRU, on the other hand, is based on models of imperfect competition and therefore does not imply Pareto-efficiency. Thus, although both the natural rate and the NAIRU are defined as the rate of unemployment consistent with constant inflation, their welfare properties are very different. In this paper we do not address the issue of whether the correct terminology is the natural rate or NAIRU and instead use the neutral term "equilibrium rate of unemployment".

² For example, during the recession of 1982-83, the seasonally adjusted unemployment rate rose from 5.4 per cent in June 1981 to a peak of 10.4 per cent in July and September 1983. However, in the recovery and subsequent period of expansion the trough in unemployment, at 5.9 per cent of the workforce, did not occur until November 1989. Persistence is often used synonymously with the term "hysteresis", but this is not, strictly speaking, correct. Hysteresis occurs when transitory shocks

We examine in detail the recent evolution of employment and unemployment and offer a structural explanation for the deterioration in labour market performance evident since the mid 1970s. The data support the view that recessions are periods of accelerated structural change that impart asymmetric effects on the labour market, namely, the destruction of full-time jobs in manufacturing, mostly held by men, and the creation of employment in the service sectors of the economy. In the most recent period of sustained economic growth from 1984 to 1989, these new jobs were predominantly part-time and filled by women entering the labour force.³

A number of foreign studies, especially of the United States, have adopted structural explanations for a rising natural rate of unemployment. Summers (1986) finds that the secular increase in unemployment over the period 1965-1985 was concentrated among mature married men, job losers and long term unemployed; associated with this trend was a decline in employment in high wage sectors, such as manufacturing. Murphy and Topel (1987) examine this issue with an extensive micro data set which records employment, unemployment and earnings for 540,000 individuals over an 18 year period. They find that a decline in the inter-sectoral mobility of workers leads to higher unemployment rates and more frequent and longer spells of unemployment. In a follow-up paper, Juhn, Murphy and Topel (1991) find that the demand for less-skilled individuals in the United States has declined and that the secular increase in total unemployment is due to the rise in unemployment for this group.

In a recent exhaustive study, Layard, Nickell and Jackman (1991) examine unemployment in the OECD countries in terms of a macroeconomic model in which

which lead to, say, an increase in the unemployment rate also increase the equilibrium rate. While hysteresis is often thought in practice to be a cause of persistence, unemployment can be persistent even in the absence of hysteretic effects, e.g. when unemployment has an autoregressive root which is slightly less than unity. Indeed, even in the presence of hysteresis, it is possible, though not very likely, that unemployment can quickly return to (just above) its pre-shock level, and so not be persistent, in the sense of being above its equilibrium rate for a long period of time.

The existence, or otherwise, of hysteresis is really just a technical issue regarding the time-series properties of the unemployment data. While important in some contexts, this issue is not our concern in this paper. The interesting economic issue, which we examine in detail, is the cause of persistence in unemployment. See Bean (1992) for a survey of some models of persistence.

³ A part-time job is defined to be one where less than 35 hours per week are worked.

unemployment is determined, *inter alia*, by price and wage setting behaviour in imperfectly competitive goods and labour markets. They attribute differences in unemployment between countries to the extent of inter-firm co-ordination in price setting, and inter-union co-ordination in wage-setting (more co-ordination leads to less unemployment); to the design of systems of unemployment benefits and their effects on the job-search incentives of the unemployed; and to a host of other variables. Among other results, this study finds that Australia has a high degree of real wage rigidity, implying that adverse shocks (for example, to productivity) lead to large increases in the Australian NAIRU.

Our examination of the Australian data leads us to support the argument made by Gregory (1991), that a complete analysis of employment and unemployment requires separate scrutiny of four distinct labour markets; for men and women, and for full-time and part-time jobs⁴. We extend Gregory's study by examining these labour markets in terms of the gross flows into, out of, and within the labour force⁵; the duration of unemployment; and the evolution of employment, productivity and earnings in different sectors of the economy.

Briefly summarised, we find that the rise in the equilibrium unemployment rate that began in the mid 1970s was due to the economy's inability to adjust to the adverse shocks of the time. We also find that the sources of persistence in unemployment are different for men and women. Male unemployment is persistent because employment has mainly grown in sectors that employ women, not men. Female unemployment has been persistent because the growth in demand for female labour has been matched by the growth in its supply. Finally, we find that recessions appear to have permanent effects on the sectoral composition of the economy, i.e. recessions are periods of accelerated structural change.

⁴ Gregory, McMahon and Whittingham (1985) examine in detail developments in the female labour market in the period 1966 to 1982.

⁵ See Blanchard and Diamond (1990,1992) for analyses of the labour market flows in the United States.

The remainder of the paper is organised as follows. Section 2 presents some elementary facts on employment, unemployment and labour force participation. In Section 3 we examine the data on gross flows and duration of unemployment, while in Section 4 we look at disaggregated data on employment and unemployment by sector. An evaluation and summary of the paper are presented in Section 5.

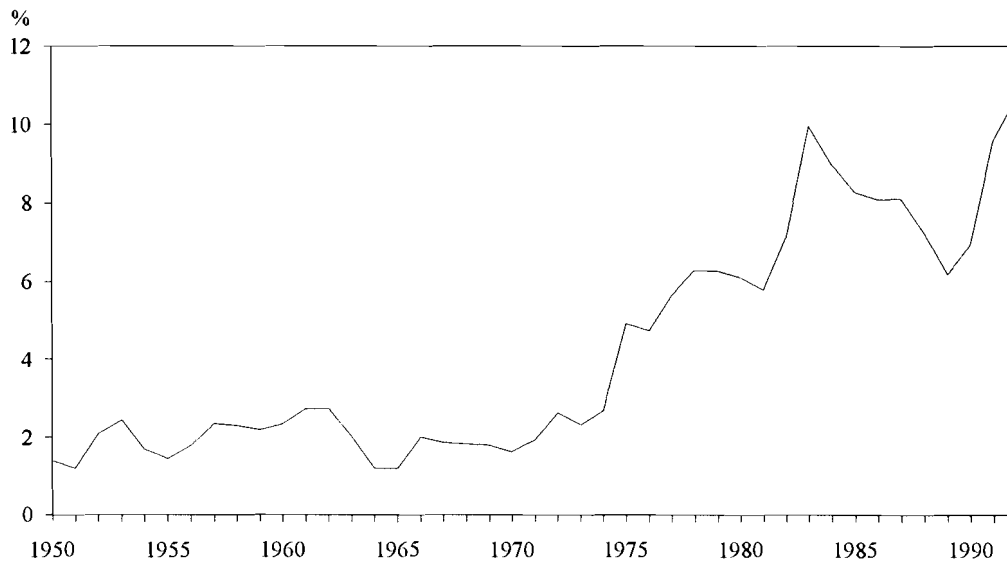
2. SOME FACTS

Figure 1 shows the aggregate unemployment rate from 1950 to 1992⁶. Three distinct regimes are apparent. The first was between 1950 and 1973, when unemployment cycled around an equilibrium of about two per cent of the workforce. The second was between 1974 and 1981, when the unemployment rate increased steadily to about 6.0 per cent. There were no apparent cycles during this time, suggesting this rise reflected an increase in the equilibrium rate of unemployment. Finally, there has been the period since 1982. Unemployment rose sharply during the recession of 1982-83, peaking at 10.0 per cent of the workforce. It then declined slowly over the remainder of the 1980s, falling to 6.0 per cent in 1989, and has since again increased rapidly, averaging 10.7 per cent in 1992.

However, the aggregate numbers mask considerable differences in the unemployment experiences of men and women, on the one hand, and of full-time and part-time workers, on the other. We show this in Figure 2, which plots the full-time and part-time unemployment rates for men and women from 1966 to 1992.⁷ Two observations can be made about full-time unemployment rates. First, the two full-time unemployment rates closely track the aggregate unemployment rate shown in Figure 1. Second, the full-time unemployment rate for women has, until recently, been considerably higher than for men. The recent downturn in the economy, however, has seen a narrowing of this difference.

⁶ The 1992 data in this section are the simple average of seasonally adjusted data up to and including September 1992. Data for other years are the quarterly averages of unadjusted data up to 1978 and the monthly averages of unadjusted data from 1978 to 1991.

⁷ That is, the unemployment rates for men and women seeking full-time work, and part-time work, respectively.

Figure 1: Unemployment Rate 1950-1992

Source: *The Labour Force : Australia, ABS Cat. Nos 6203.0 and 6204.0, Foster and Stewart (1991)*.

The two bottom panels show the unemployment rates of those people seeking part time work. Here, the differences between men and women are quite marked. While both part-time unemployment rates have trended upwards, and show less cyclical variation than full-time rates,⁸ the slight upward trend in women's part-time unemployment rate is much less pronounced than for the other three categories.

Figure 3 puts these comparative unemployment rates into some perspective by showing the numbers of unemployed in each category. The greatest proportionate increase in the number of unemployed has occurred in the full-time male labour market. The 1992 level of unemployment is fourteen times the level in 1966, while the rate of increase in the number of unemployed females seeking either part-time or full-time employment has been roughly half of this. However, the fact that the part-time female unemployment rate was relatively stable over this period suggests that a substantial increase in both the demand and supply of part-time women's labour.

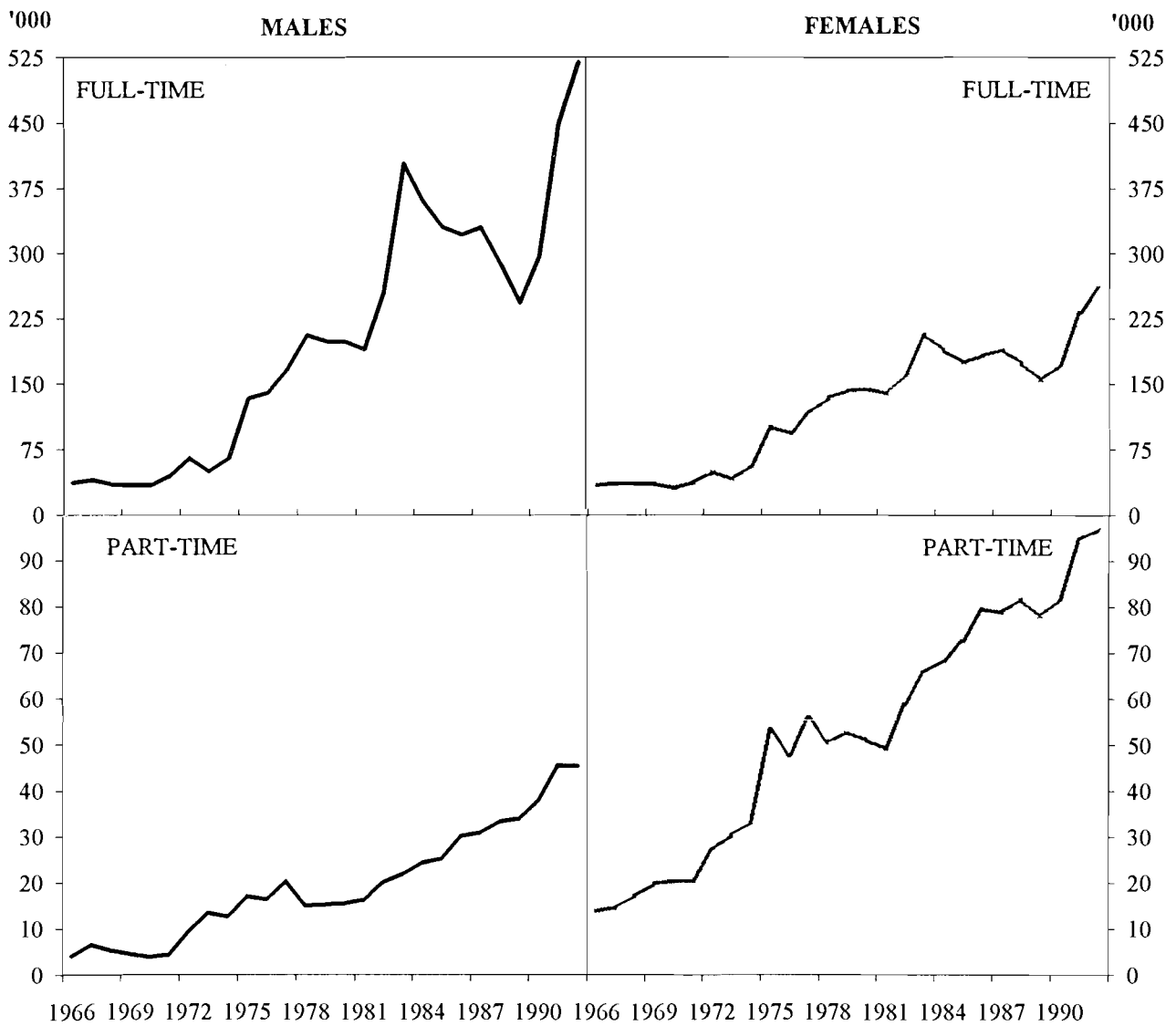
⁸ The part-time unemployment rate for men was inexplicably high between 1972 and 1977. This probably reflects problems in the data. A new and comprehensive monthly labour force survey began in February 1978; the data from this survey are likely to be more reliable than earlier data.

**Figure 2: Unemployment Rates by Gender and Type of Work Sought
1966-1992**



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

**Figure 3: Unemployment Numbers by Gender and Type of Work Sought
1966-1992**



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

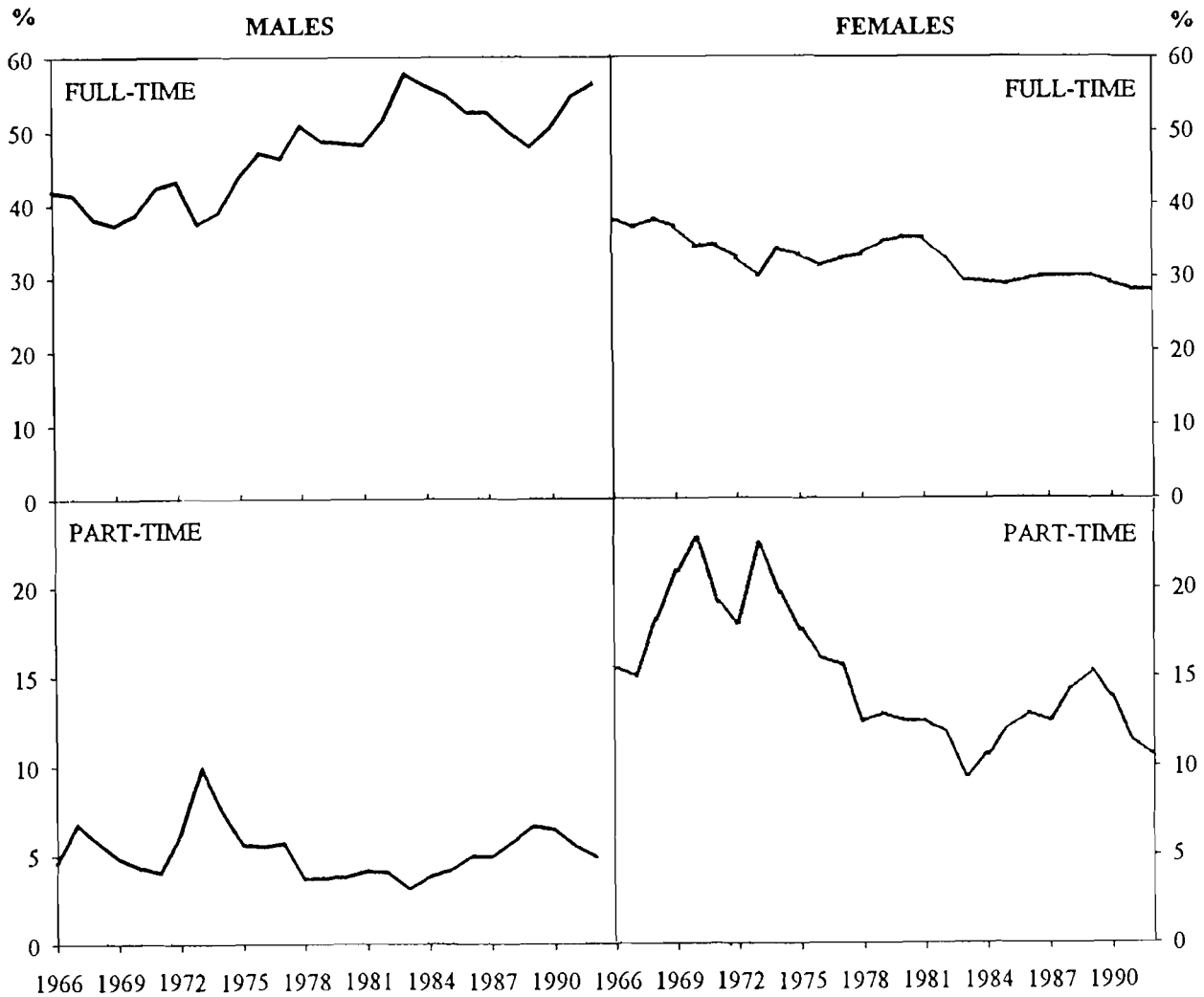
The unemployment data therefore imply that developments in the aggregate labour market have been dominated by the full-time male and part-time female markets. This supposition is confirmed in Figure 4, which plots the proportion of total unemployment accounted for by each category. Full-time male unemployment, as a proportion of the total has, since 1983, shown exactly the same pattern as the aggregate unemployment rate. Part-time female unemployment has shown the opposite pattern, falling as a proportion of aggregate unemployment during recessions and rising during periods of strong employment growth, reflecting the well-known pro-cyclical nature of women's labour supply. In trend terms, full-time male unemployment has been steadily increasing as a proportion of the total, while the fractions accounted for by full and part-time female unemployment have decreased. Part-time male unemployment has remained steady at about five per cent of total unemployment.

Further insight into female unemployment can be gained by separately considering the unemployment rates of married and unmarried women.⁹ This is done in Figure 5. The lower left quadrant shows that, since 1966, the unemployment rate for married women seeking part-time work has shown virtually no trend increase, and very little cyclical variation, implying that the part-time married women's participation rate is strongly pro cyclical, albeit around a rising trend.

The married women's full-time unemployment rate, in contrast, exhibits a slight upward trend, which clearly follows the aggregate unemployment cycle, although both the cyclical peaks and average unemployment are relatively low. On the other hand, both the full-time and part-time unemployment rates for unmarried women have shown large secular increases and a strong cyclical effect. In 1992, the unmarried women's full-time unemployment rate was a very high 16 per cent, and the part-time rate 11 per cent, compared with a rate of four per cent for married women looking for part-time work and eight per cent for those seeking full-time employment.

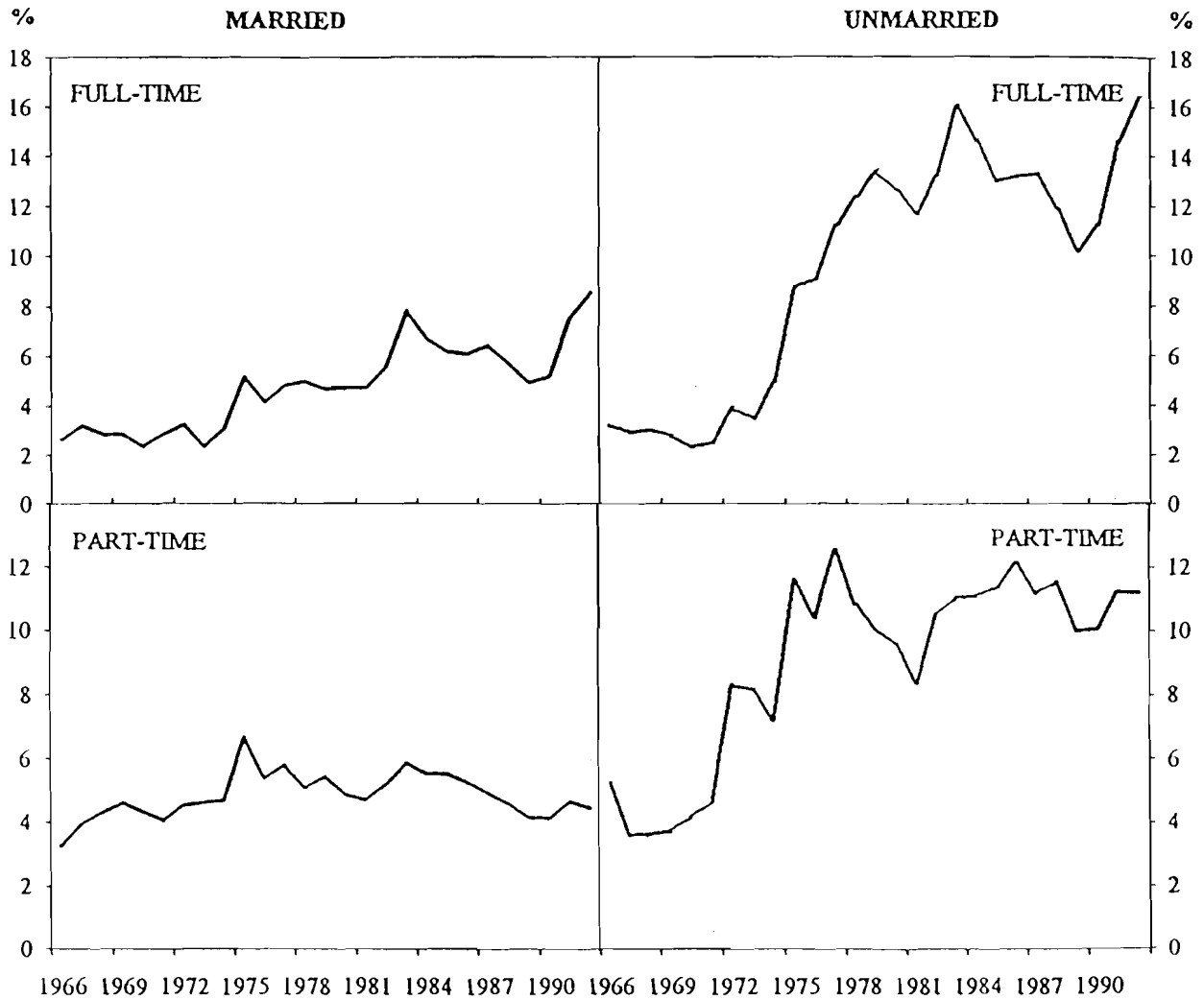
⁹ Despite the fact that, until recently, the participation rate for married women was less than for unmarried women (until the mid 1970s, much less), married women always made up a majority of the female labour force, over the period 1966-1992. This was because there were many more married than unmarried women of working age. (Foster and Stewart (1991), Table 4.4, p152).

Figure 4: Proportion of Unemployment by Gender and Type of Work Sought 1966-1992



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Figure 5: Female Unemployment Rates by Marital Status and Type of Work Sought: 1966-1992



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

There are probably two reasons for these large differences. The first is that unmarried women are disproportionately young women, and so the unemployment rates for unmarried women reflect the very high rates of youth unemployment generally.¹⁰ The second is that unmarried women, by definition, do not have spouses who are (probably) working and so are less able to leave the labour force when jobs are scarce and re-enter it at a more favourable time in the business cycle.

In Figure 6 we plot the full-time and part-time employment of men and women. Most striking is women's part-time employment, which grew by 281 per cent over the period 1966-1992, compared with the anaemic 23 per cent growth in full-time male employment. The increase in growth in the former category, and slowdown in the latter, began in the mid 1970s.

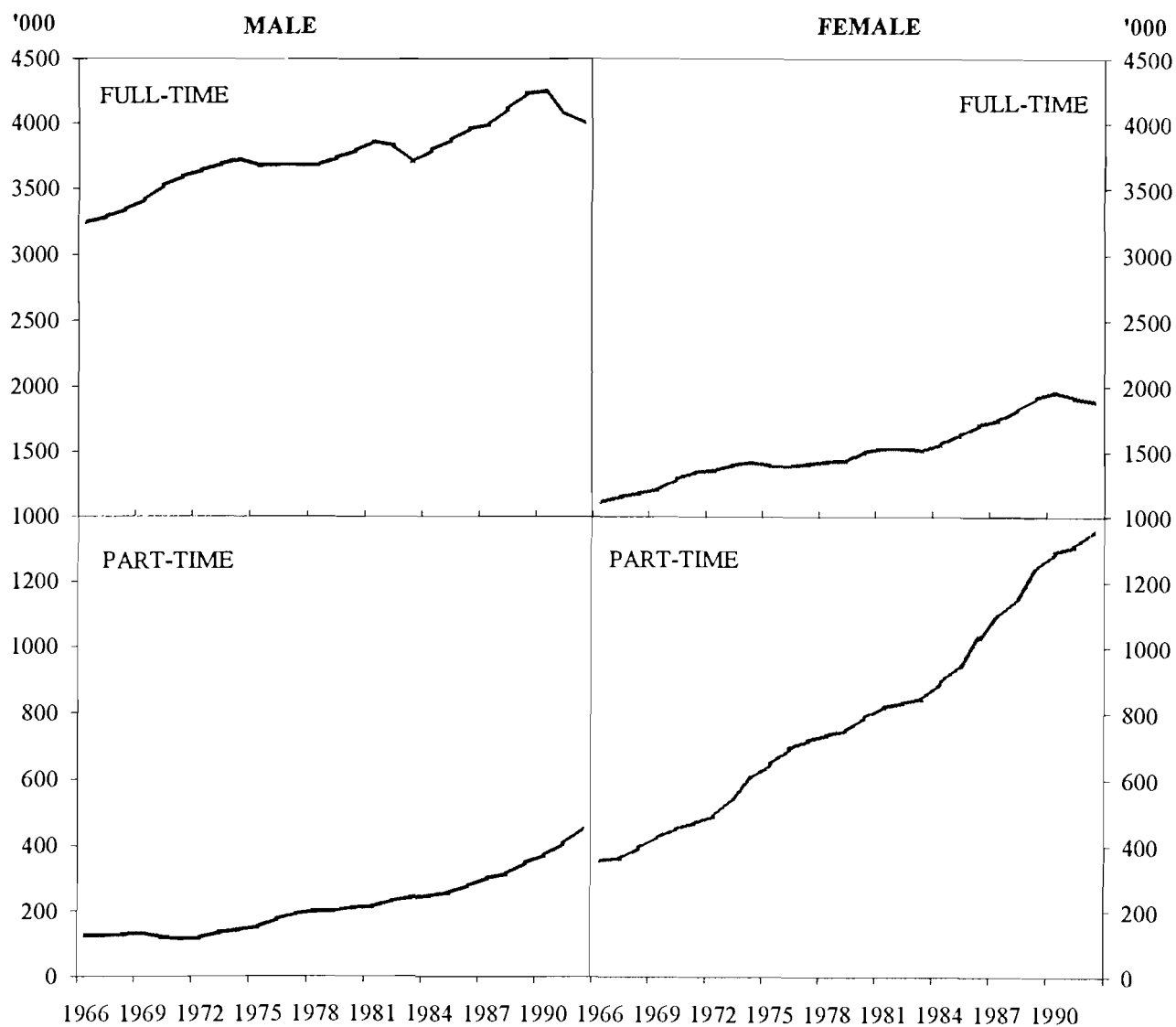
The share of each category in total employment is shown in Figure 7. Full-time male employment as a share of the total has declined steadily, with the opposite true for part-time women. Full-time female employment has constantly been around 25 per cent of the total, while the share of part-time male employment has risen constantly, but only to about six per cent in 1992. The share of part-time employment overall increased from 10.0 per cent in 1966 to 23.5 per cent in 1992.

In Table 1 we compare the loss of employment in the two recessions, 1982-83 and 1990-92. Clearly, the bulk of the job losses in the two recessions has been borne by men working full-time. Part-time employment of both men and women has increased in the latest downturn, as it did in 1982-83. However, this possibly reflects some underemployment, with firms cutting the hours worked by some employees.¹¹

¹⁰ In 1991, 21.7 per cent of 15-19 year old women in the labour force were unemployed, while the unemployment rate for all women was 9.2 per cent.

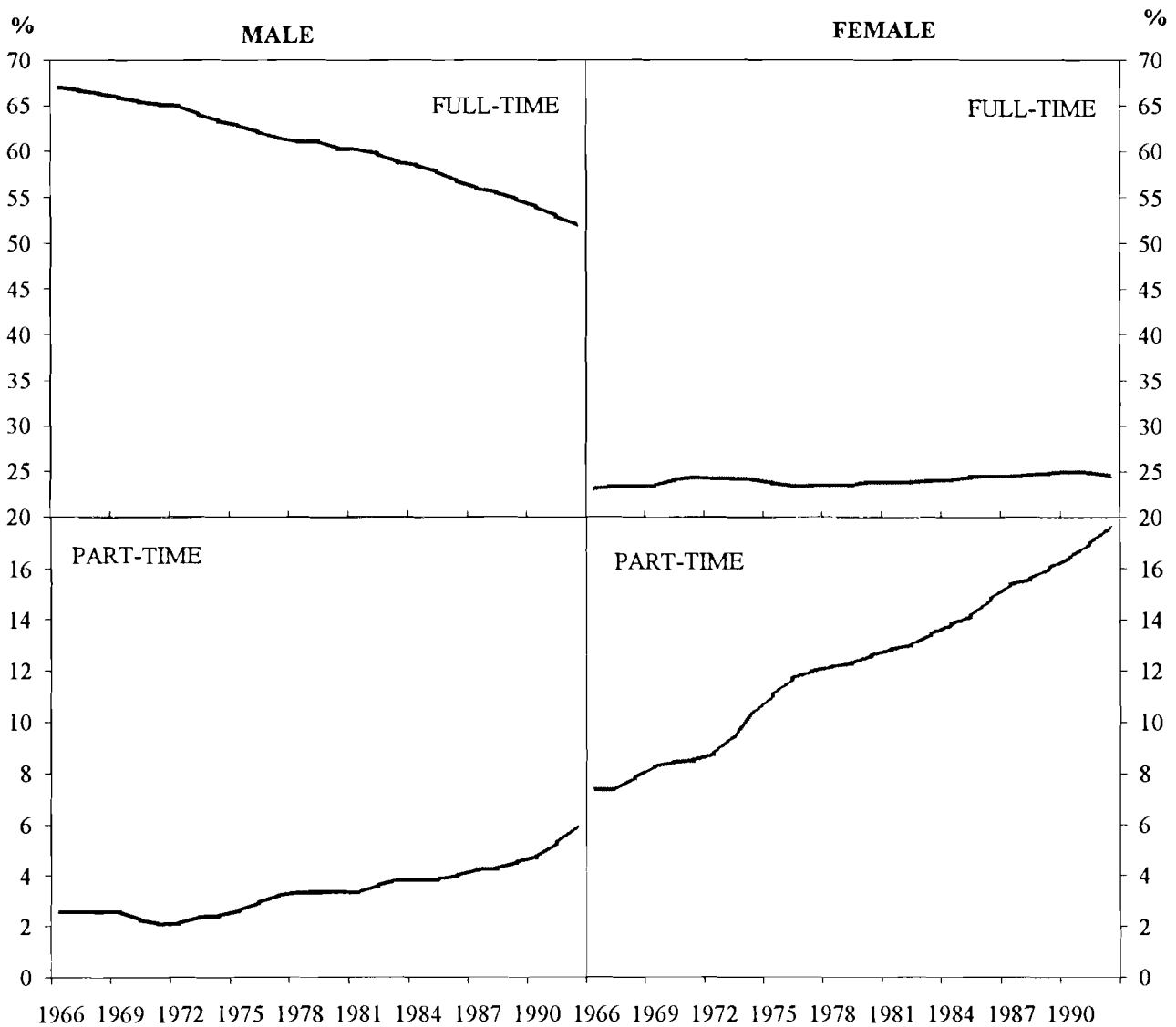
¹¹ The number of people working part-time but who would prefer to work more hours increased significantly in 1990 and 1991.

**Figure 6: Employment by Gender and Type of Work
1966-1992**



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

**Figure 7: Proportion of Employment by Gender and Type of Work
1966-1992**



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Table 1: Change in Total Employment in the Recessions 1982-83 and 1990-92 ('000)

	Males Full-Time	Males Part-Time	Females Full-Time	Females Part-Time	Total
Jan. 82-April 83*	-199.7	31.4	-55.6	10.6	-213.3
July 90-July 91*	-231.1	25.7	-102.6	3.4	-304.6
July 91-July 92*	-27.7	67.1	-1.7	83.6	121.3

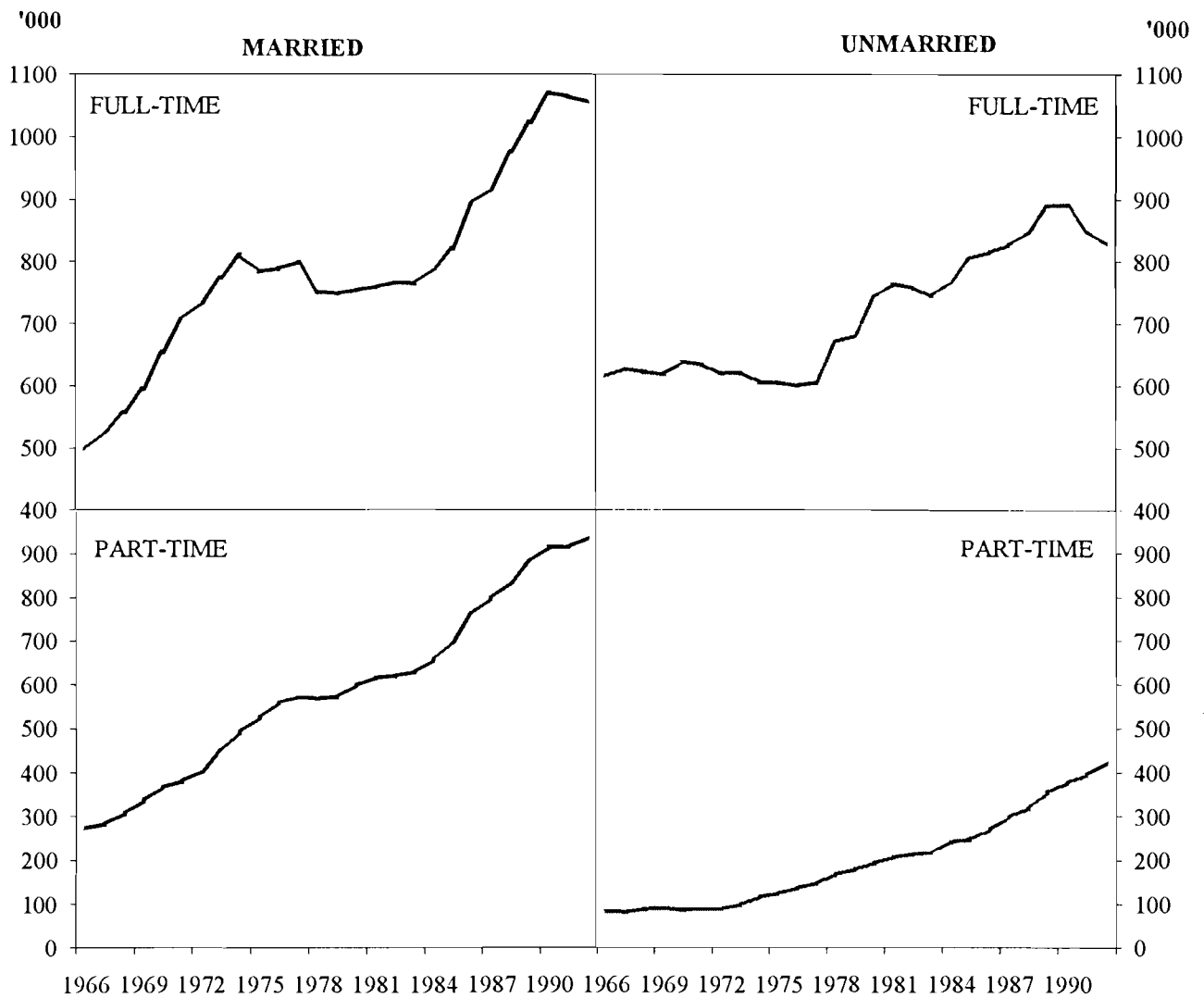
Note: The data in this table are seasonally adjusted, and '*' denotes peak to trough.

Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Figure 8 decomposes female employment. Here we can see that the bulk of the increase in women's employment, both full-time and part-time, went to married women. (However, full-time employment of married women actually fell slightly between 1974 and 1983, while it increased by 23 per cent for unmarried women.)

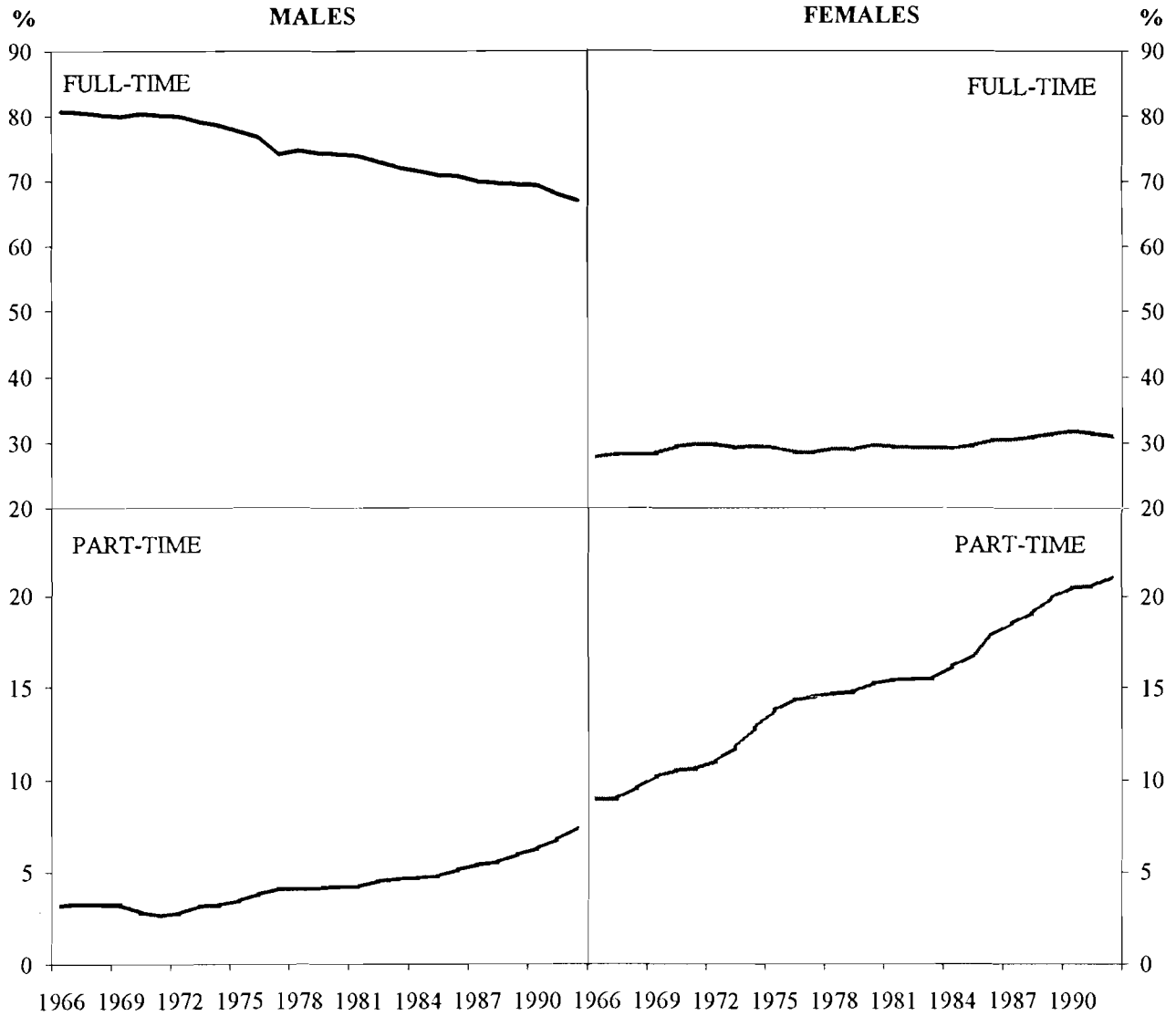
In Figures 9 and 10 we show participation rates - the proportion of the civilian population in each category aged 15 years and over that is in the labour force, either employed or unemployed. The decreasing participation of men, and increasing participation of women, is a well-documented fact (Chapman 1990). Figure 9 shows that the fall in male participation has been due to the decrease in full-time participation, as part-time participation has increased. These changes began in the mid 1970s, no doubt largely caused by the decline in the growth of full-time male employment. The increase in female participation has been largely due to an increase in part-time participation, which doubled over the 26 year period to 1992, while full-time participation remained at about 30 per cent. However, Figure 10 shows that this constancy was the result of offsetting factors: participation for full-time unmarried women fell secularly, probably due to increased retention rates in schools, while it increased for the three other categories.

**Figure 8: Female Employment by Marital Status and Type of Work
1966-1992**



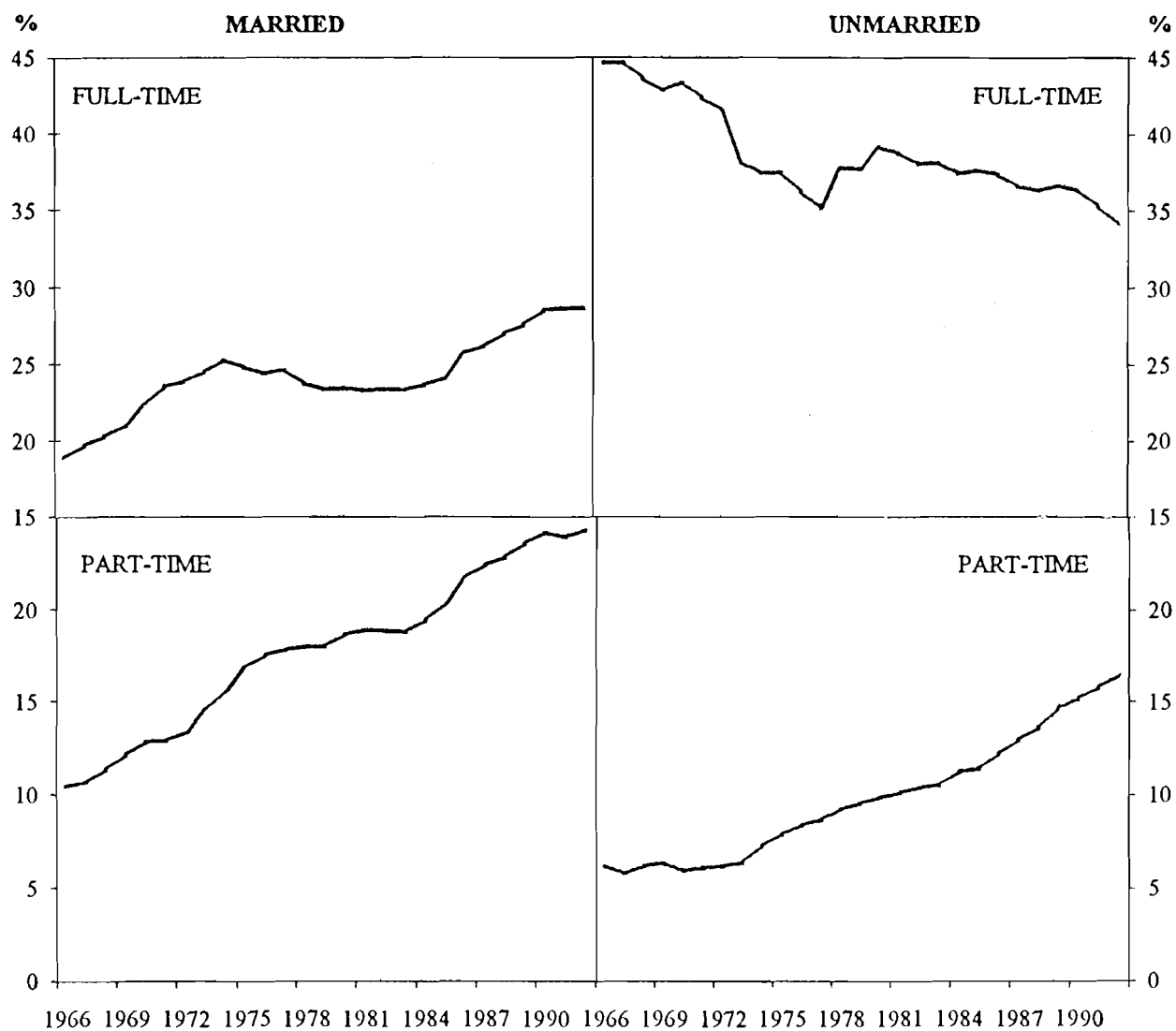
Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

**Figure 9: Participation Rates by Gender and Type of Work
1966-1992**



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

**Figure 10: Female Participation Rates by Marital Status and Type of Work
1966-1992**



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

The general picture that emerges from this overview is that the important changes to employment, participation and unemployment in Australia over the past 26 years or so have been driven by trends in the markets for full-time male and part-time female workers. We will elaborate this theme throughout the paper as we examine gross labour market flows, unemployment duration, and employment and unemployment by sector.

3. GROSS LABOUR MARKET FLOWS AND THE DURATION OF UNEMPLOYMENT

Our analysis of gross flows begins with the identity defining the steady state, or equilibrium, unemployment rate ¹²,

$$\frac{U}{N} \equiv \frac{S}{N} \frac{U}{S} \quad (1)$$

where U is the number of people unemployed at any point in time, N is the size of the labour force at that point in time, and S is number of people who become unemployed during an interval of time, commonly known as the inflow into unemployment. Thus, we define the steady state unemployment rate to be equal to the rate at which people enter unemployment, S/N , multiplied by U/S , the average time that people remain unemployed i.e., the average duration of unemployment.

In the steady state, the outflow from unemployment, denoted H , is equal to the inflow, S . Therefore we can rewrite equation (1) as,

$$\frac{U}{N} = \frac{S}{N} \frac{U}{H} = \frac{S/N}{H/U} \quad (2)$$

where H/U is the rate at which people leave unemployment i.e., the outflow rate. Thus, the equilibrium rate of unemployment at any point in time will increase either because of an increase in the inflow rate or a decrease in the outflow rate; the latter is equivalent to an increase in the average duration of unemployment.

¹² This exposition closely follows Layard et al. (1991).

Over any period of time, gross flows between the four states of the labour market i.e., full-time and part-time employment, unemployment and not in the labour force, can be quite large relative to the stocks of these variables, and especially large relative to the net change in the stocks. To see this, consider Table 2 which contains data on the inflows and outflows that occurred in August 1991. The table is read as follows. The entries in the rows marked FTE, for example, are the numbers of people in each of the four labour market categories this month who were in full-time employment in the previous month. The sum of the entries in the FTE rows, therefore, is total full-time employment in July 1991. The entries in the columns marked FTE are the number of people who remained in full-time employment or moved into full-time employment from part-time employment, unemployment or outside the labour force. The sum of the entries in the FTE columns, therefore, is the number of people who were employed full-time in August 1991.

Table 2: Gross Flows, August 1991, ('000)

	From\To	FTE	PTE	UE	NILF
Males	FTE	3084.5	51.9	42.4	36.5
	PTE	52.4	207.9	19.0	28.4
	UE	39.9	19.6	261.8	41.7
	NILF	26.9	32.6	49.9	1140.9
Females	FTE	1363.4	81.7	9.8	25.1
	PTE	85.4	865.9	22.4	69.1
	UE	16.1	28.0	139.5	55.0
	NILF	22.8	91.5	54.8	2333.2

Note: FTE = Full-Time Employment, PTE = Part-Time Employment, UE = Unemployed, NILF = Not in the Labour Force

Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

According to Table 2, 200,300 of the 601,600 people who were unemployed in July 1991 were no longer unemployed in August, either because they found employment (103,600) or left the labour force (96,700). They also show that 198,300 people became unemployed in August, either because they quit, were retrenched or otherwise left their jobs (93,600), or entered the labour force without finding a job (104,700).

The net effect of these changes was a reduction in unemployment of 2000 people, which is very small compared with the size of the flows.

Similarly, Table 2 shows that 277,400 people who were not employed in the previous month became employed in August 1991, while 252,700 people who were employed in July either became unemployed or left the labour force. The net increase in employment was therefore 24,700, again very small compared with the flows. Moreover, there were large flows within the stock of employed people: 133,600 left full-time employment and found part-time jobs, while 137,800 did the reverse.¹³

The implied stocks of employed and unemployed derived from the gross flow data will be substantially smaller than the direct (and more accurate) estimates found at the beginning of the monthly labour force survey (*The Labour Force: Australia*, ABS Catalogue No. 6203.0). For example, according to Table 2, there were 373,100 unemployed males in August 1991, a number found by summing the first four elements of the third column. The corresponding number in the first table of the labour force survey was 502,600.

The reason for this large discrepancy is that data on month to month flows can only be collected from respondents who are surveyed in consecutive months. However, each month one household in eight is dropped from the survey and replaced by a new household; this reduces the size of the sample from which flow data can be obtained and so increases the random sampling error of the flow estimates. What is more important, is that roughly an additional 10 per cent of respondents cannot be matched from month to month because they have moved or are no longer living in private dwellings; these people have to be excluded because they have characteristics different from the average and their inclusion would introduce a sample selection bias to the estimated flows.¹⁴ Moreover, the number of such people varies slightly from month to

¹³ These figures ought to be interpreted with some caution as they are not seasonally adjusted and labour force flows are subject to significant seasonal variation. However, the gross flows are always large relative to the net flows, regardless of the seasonal pattern.

¹⁴ This problem has been recognised in American data by Abowd and Zellner (1985) who propose a statistical method to correct it. However, the necessary information (based on re-interviews) does not exist in Australia.

month, and so the implied stocks for a given month in consecutive months are not consistent.¹⁵

Table 3: Conditional Probabilities, August 1991

	From\To	FTE	PTE	UE	NILF
Males	FTE	0.959	0.016	0.013	0.011
	PTE	0.170	0.676	0.062	0.092
	UE	0.110	0.054	0.721	0.115
	NILF	0.022	0.026	0.040	0.913
Females	FTE	0.921	0.056	0.017	0.027
	PTE	0.082	0.830	0.021	0.067
	UE	0.067	0.117	0.584	0.231
	NILF	0.009	0.037	0.022	0.932

Note: FTE = Full-Time Employment, PTE = Part-Time Employment, UE = Unemployed, NILF = Not in the Labour Force

Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

We correct for these problems by dividing the level of each flow by the sum of the elements of each row in which it appears, as shown in Table 3. The entries in this table can be interpreted as the probability of being in a given state, conditional on being in a particular state in the previous month. Thus, for men, the probability of being in full-time employment in August 1991 if they were unemployed the previous month was 0.110. The remaining men were either employed part-time, remained in

The problem is especially troublesome when the size of the labour force is revised following a census. During this time, one quarter, rather than one eighth, of the households in the survey is dropped from the sample. For this reason, the gross flow data from September to December 1987 should be treated with particular caution.

¹⁵ For example, the data in Table 2 imply that there were 363,000 unemployed males in July 1991, a number found by summing the entries in the row marked UE. If we were to sum the UE column using flow data for July, we ought to arrive at the same total. In fact, the number is 369,000.

unemployment, or moved out of the labour force in August 1991. The probabilities of these events were 0.054, 0.721 and 0.115, respectively.

In Figures 11 to 14 we plot a time series of each of the conditional probabilities illustrated in Table 2. The data run from 1981 to 1991 and are the annual averages of the monthly probabilities. The notation used is that of a conditional probability e.g., $\Pr(\text{UE}|\text{FT})$ is the probability of being unemployed given full-time employment in the previous period.

Figure 11 shows the evolution of the conditional probabilities of moving to and from unemployment. Several interesting patterns in the data are evident:

- the probability of men moving from unemployment to full-time employment declined quite sharply during the recession of 1982-83 and, consistent with persistence in male unemployment, only recovered very slightly during the ensuing six years of strong economic growth. This probability again declined significantly during 1990 and 1991, suggesting that, if the pattern of 1984-89 is repeated during the next period of economic expansion, any decline in unemployment is likely to be modest;
- the probability of men exiting unemployment by leaving the labour force rose significantly in the period 1984-1989;
- women appear to be much more likely than men to exit from unemployment by leaving the labour force; about 25 per cent of unemployed women have done so each month. Women have also been more likely to leave unemployment by finding a part-time job, but less likely to leave unemployment by finding a full-time job;
- for both men and women, the probability of remaining unemployed from one month to the next rises sharply during recessions but falls only slowly thereafter, again consistent with persistence in unemployment. The level of the series for men is higher than for women, mainly reflecting the greater tendency of women to leave the labour force rather than stay unemployed; and
- the probability of men entering unemployment from part-time employment has varied with the unemployment cycle around an average of about five per cent, while

for women, this probability has been quite stable at about two per cent. For both men and women, the probability of entering unemployment from part-time employment is greater than from full-time employment.

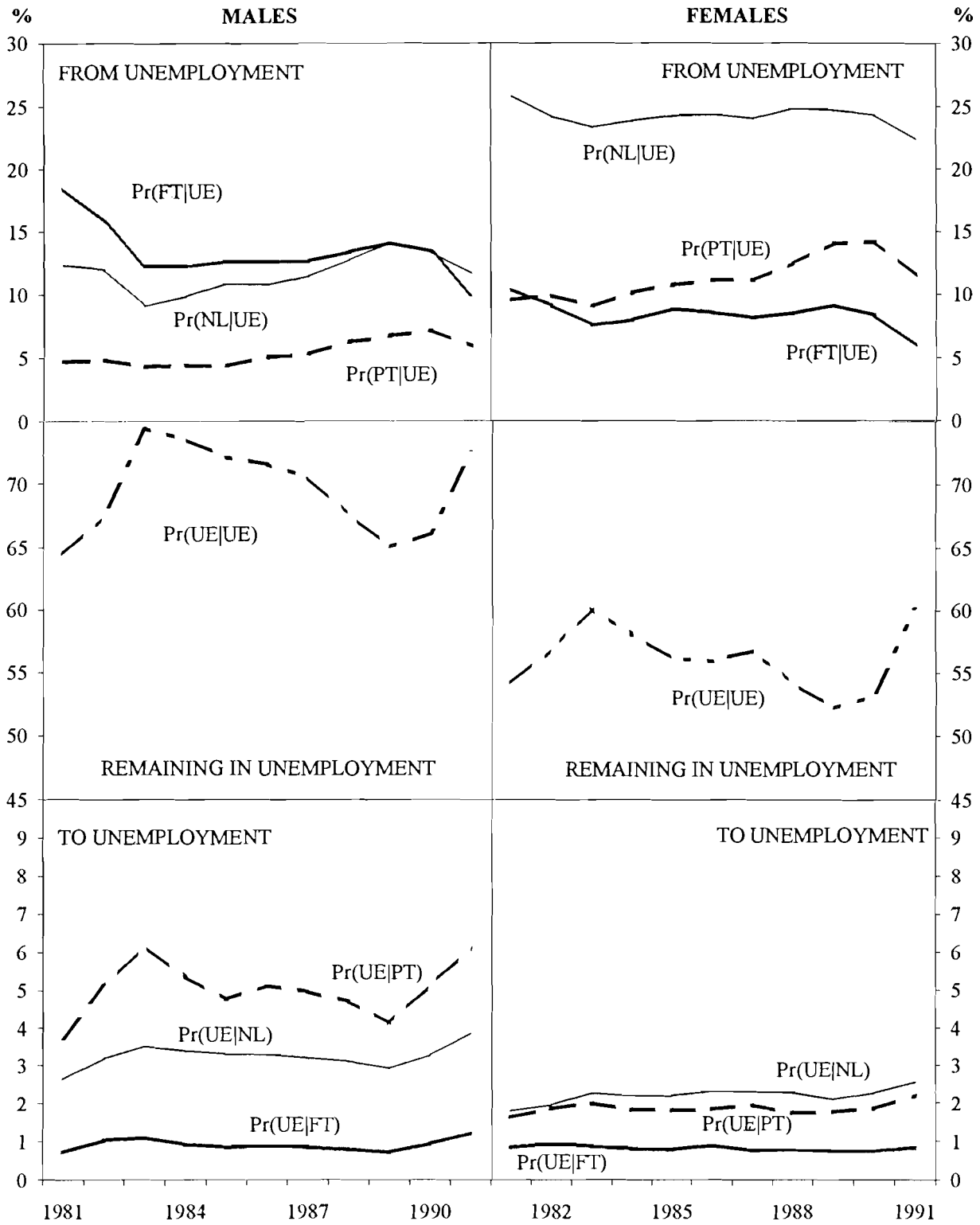
Figure 12 shows the conditional probabilities of moving to and from full-time employment. The major points to note are:

- the probabilities of men moving from full-time employment to another state of the labour market are small and have not moved much over time, although the probability of moving from full-time employment to part-time employment has shown a slight upward trend;
- the likelihood of women moving from full-time to part-time employment has increased over time, offsetting a fall in the probability of moving from full-time employment to outside the labour force; and
- for men, but not women, there is a clear downward trend in the likelihood of moving from part-time employment or outside the labour force to full-time employment.

In Figure 13 we plot the probabilities of moving to and from part-time employment. Note:

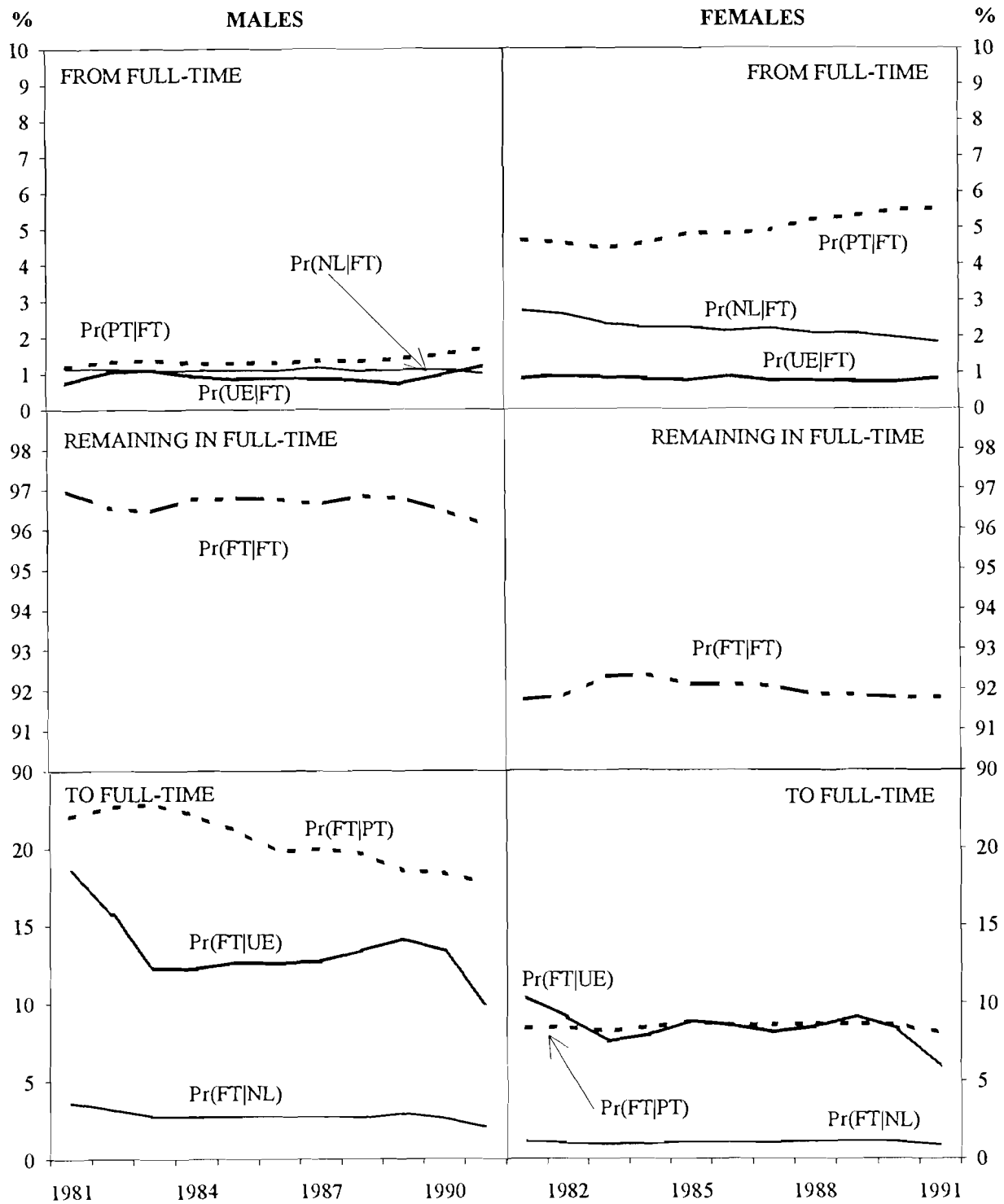
- the secularly declining exit rate from part-time employment to outside the labour force for women and from part-time to full-time employment for men;
- the trend increases in the likelihood of remaining in part-time employment for both men and women i.e. part-time employees are keeping their jobs for increasingly lengthy periods, perhaps reflecting the growing importance of "permanent" part-time work;
- the sharp increase, from 1984 to 1989, in the likelihood of both men and women moving from unemployment to part-time employment; and

Figure 11: Probability of Moving to and from Unemployment by Gender 1981-1991



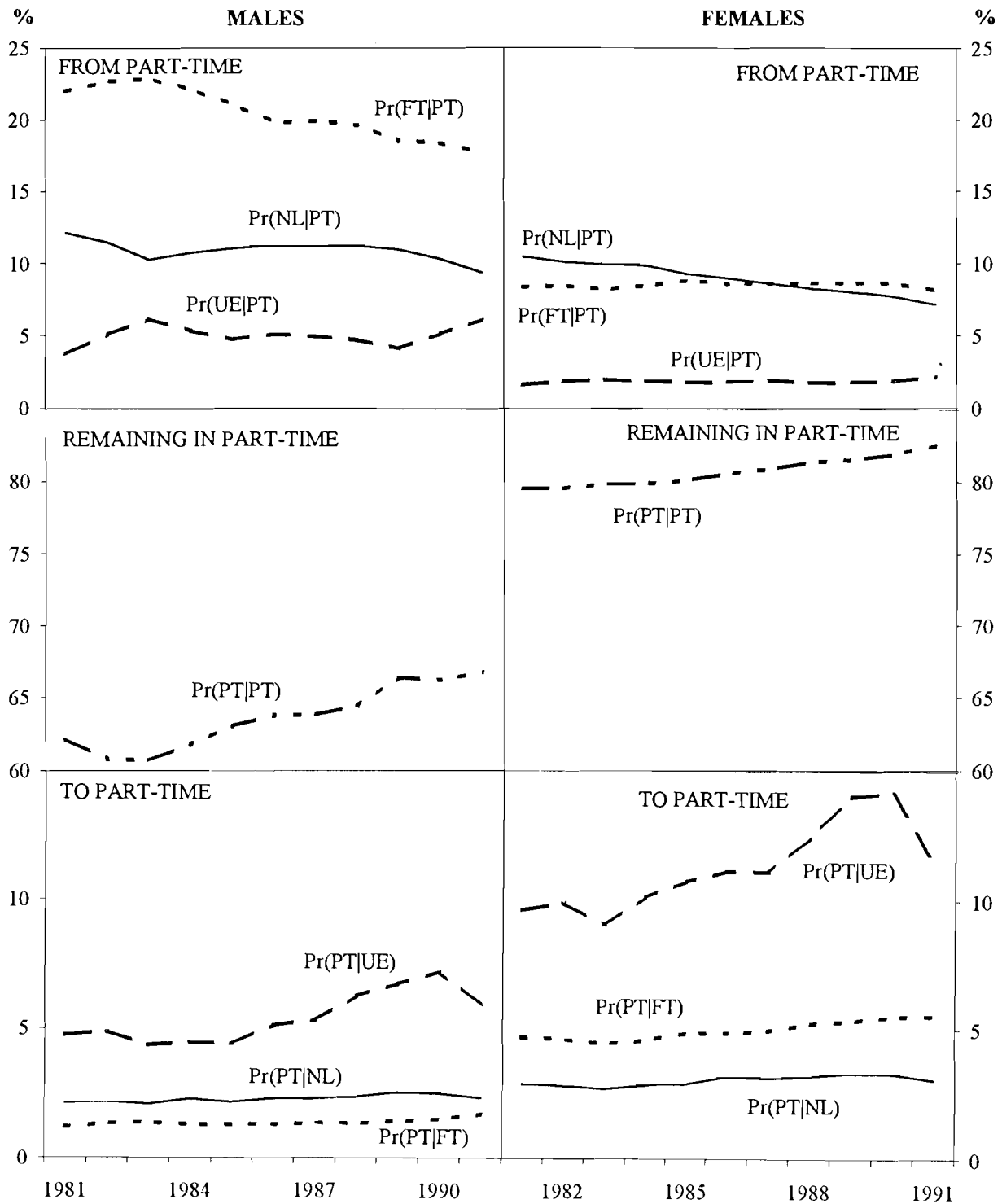
Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Figure 12: Probability of Moving to and from Full-Time Employment by Gender: 1981-1991



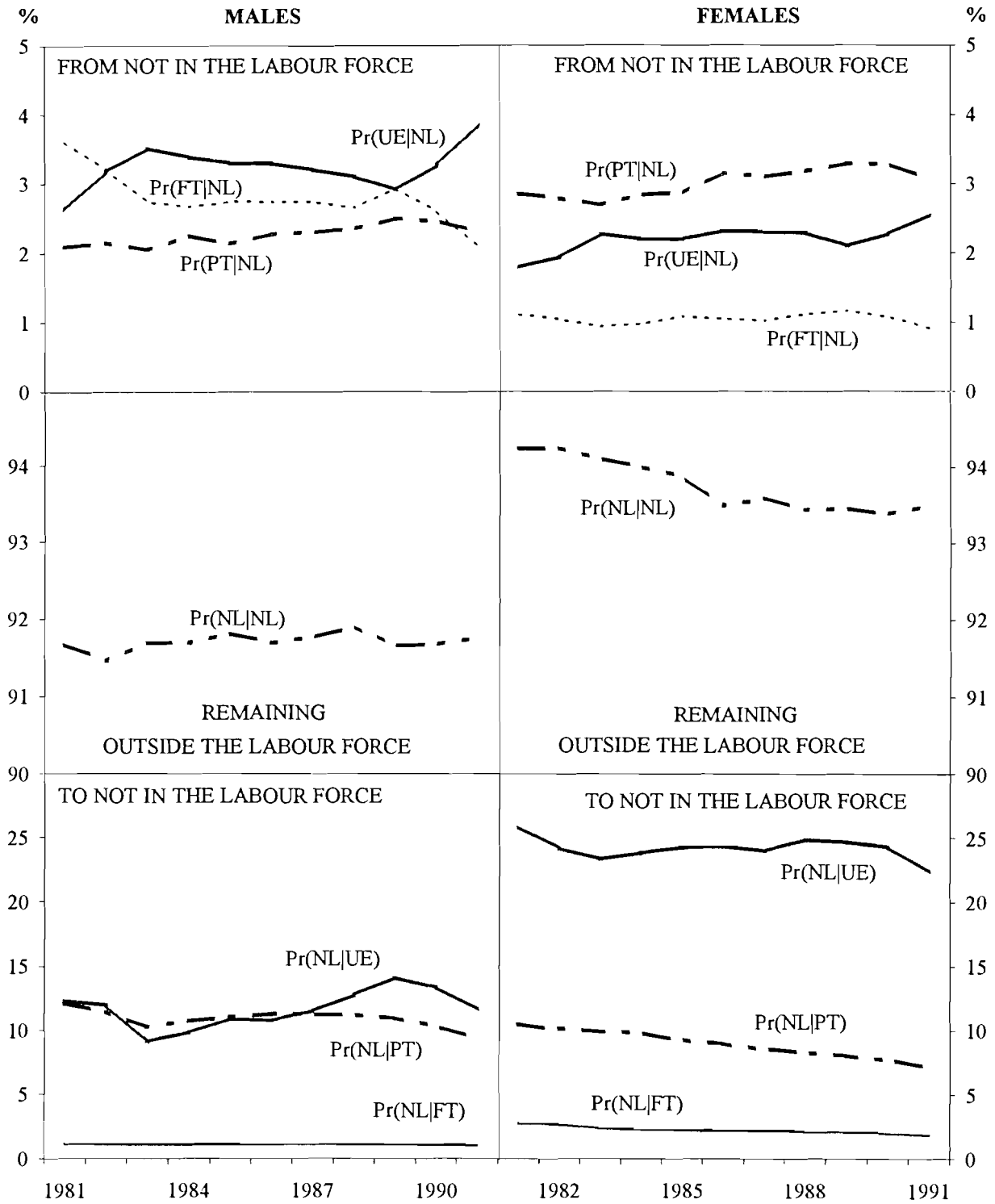
Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Figure 13: Probability of Moving to and from Part-Time Employment by Gender 1981-1991



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Figure 14: Probability of Moving to and from the Labour Force by Gender 1981-1991



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

- the trend increase in the probability of women entering part-time employment from outside the labour force. Although this increase appears to be small the implied flows, in absolute terms, are large.

Finally, in Figure 14, we plot the conditional probabilities of exiting and entering the labour force. The two top panels show the probability of entering the labour force. Of note is the increasing probability of women moving straight into the unemployment pool. The probability of remaining outside the labour force is shown in the two middle panels. Of note is the decline in this probability for women, consistent with their increased participation in the labour force.

Figures 11 to 14 suggest that the slow decline in unemployment following the 1982-83 recession was due to two factors:

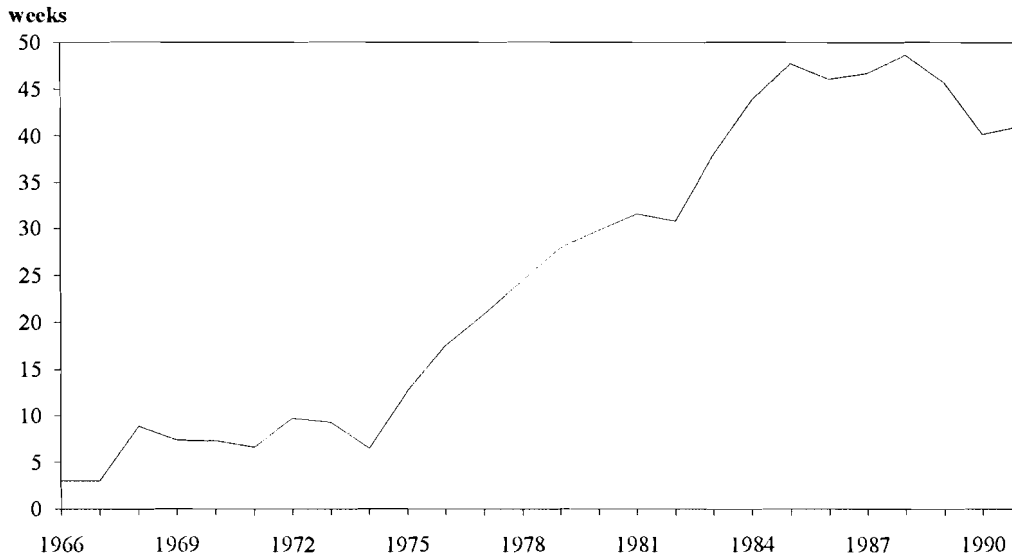
- the exit rate of men from unemployment to full-time employment did not recover its pre-1982 level ; and
- the increases in female employment were largely offset by the increased rates of entry of women into the labour force.

We cannot directly test whether the cause of the increase in the equilibrium rate of unemployment during the 1970s was an increase in the rate of entry to unemployment, or a decrease in the exit rate, since gross flow data do not exist for that time. However, we do have data on average duration of incomplete spells of unemployment from 1966 to 1991. They are shown in Figure 15.

This graph suggests that decreases in exit rates were the primary cause of increases in the equilibrium rate of unemployment in the mid 1970s, since average duration started to increase rapidly precisely at that time. In some respects, however, these data can give a misleading picture of the state of the labour market. For example, the average incomplete spell of unemployment can be increasing when unemployment is falling, e.g. between 1983 and 1989, when the unemployment rate fell by over four percentage points, this average increased from 37.9 weeks to 45.7 weeks. This is because exit rates from unemployment decline as the duration of unemployment increases i.e., those

who leave unemployment first are generally those people who have been unemployed the least amount of time.¹⁶ As unemployment falls, therefore, only the longer term unemployed remain, and so the average duration of the stock of existing unemployed increases. Conversely, because there were many new entrants to unemployment, average duration during the recession years 1990 and 1991 was less than in 1989.¹⁷

Figure 15: Average Duration of Unemployment 1966 to 1991



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0, Foster and Stewart, (1991).*

Another problem with the duration data is that some of them are wrong. For example, it is often the case that there are more people who report that they have been unemployed between 52 and 65 weeks than who, 13 weeks earlier, had been unemployed between 39 and 52 weeks, which is an arithmetic impossibility. The solution to this paradox appears to be that, when asked how long they have been

¹⁶ See Fahrner and Pease (1992) for some recent evidence on the relationship between exit rates and duration of unemployment.

¹⁷ A related problem is that the average complete duration of current spells of unemployment almost always exceeds the average duration of completed spells. This is because the former is heavily weighted by the long term unemployed.

unemployed, respondents to the labour force survey "cluster" their answers around six months, 12 months, 18 months etc, distorting the true duration data.¹⁸

One statistic less prone to these difficulties is the median duration of unemployment, shown in Figure 16. For men seeking full-time work, this duration clearly follows the unemployment cycle, as do the median durations of men looking for part-time work and women looking for full-time employment. Also of interest is the fact that the median duration of unemployment for those people searching for part-time work is significantly less than for those pursuing full-time employment. However, for men, this difference is not reflected in the differences between part-time and full-time unemployment rates. This is consistent with median male duration being much less than average duration, since it is the latter (given entry rates) which determines the equilibrium unemployment rate.

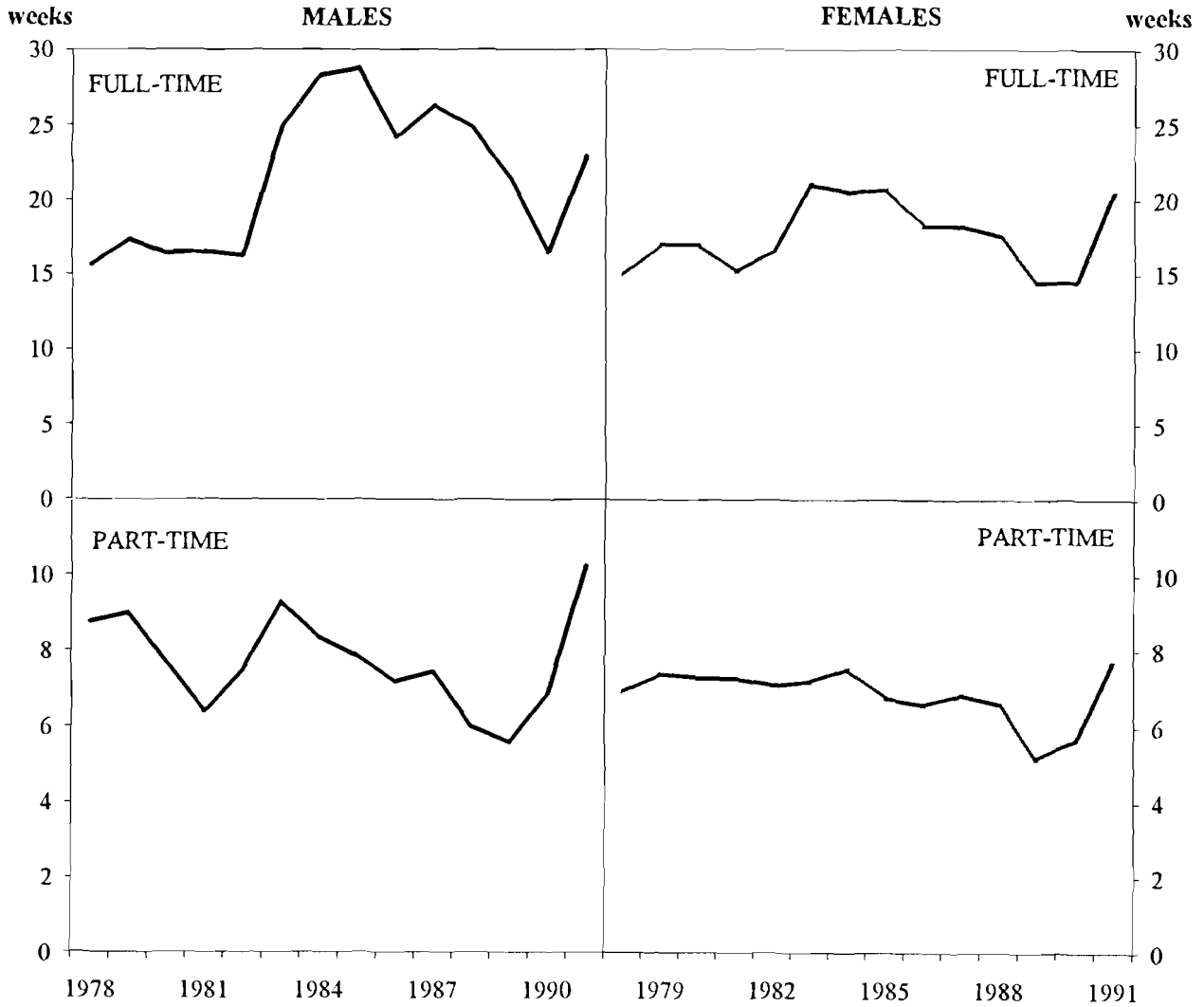
These facts confirm that, for men, long term unemployment is a serious problem. Also consistent with this suggestion is that, following the recession of 1982-83, male full-time median duration peaked only in 1985. Figure 17 shows that long term unemployment did indeed become more of a problem during the 1980s. The recession of the early 1980s led to a very large increase in long term unemployment for full-time males as a proportion of total unemployment for this group.¹⁹

This increase also helps explain the existence of persistence in unemployment. According to Figure 17, a recession leads to a more than proportionate increase in the number of long term unemployed. Since the long term unemployed have low exit rates, the average exit rate for all unemployed people falls in a recession, slowing any subsequent fall in the unemployment rate.

18 This tendency has been noted by Junankar and Kapunscinski (1990) and in American data by Akerlof and Yellen (1985).

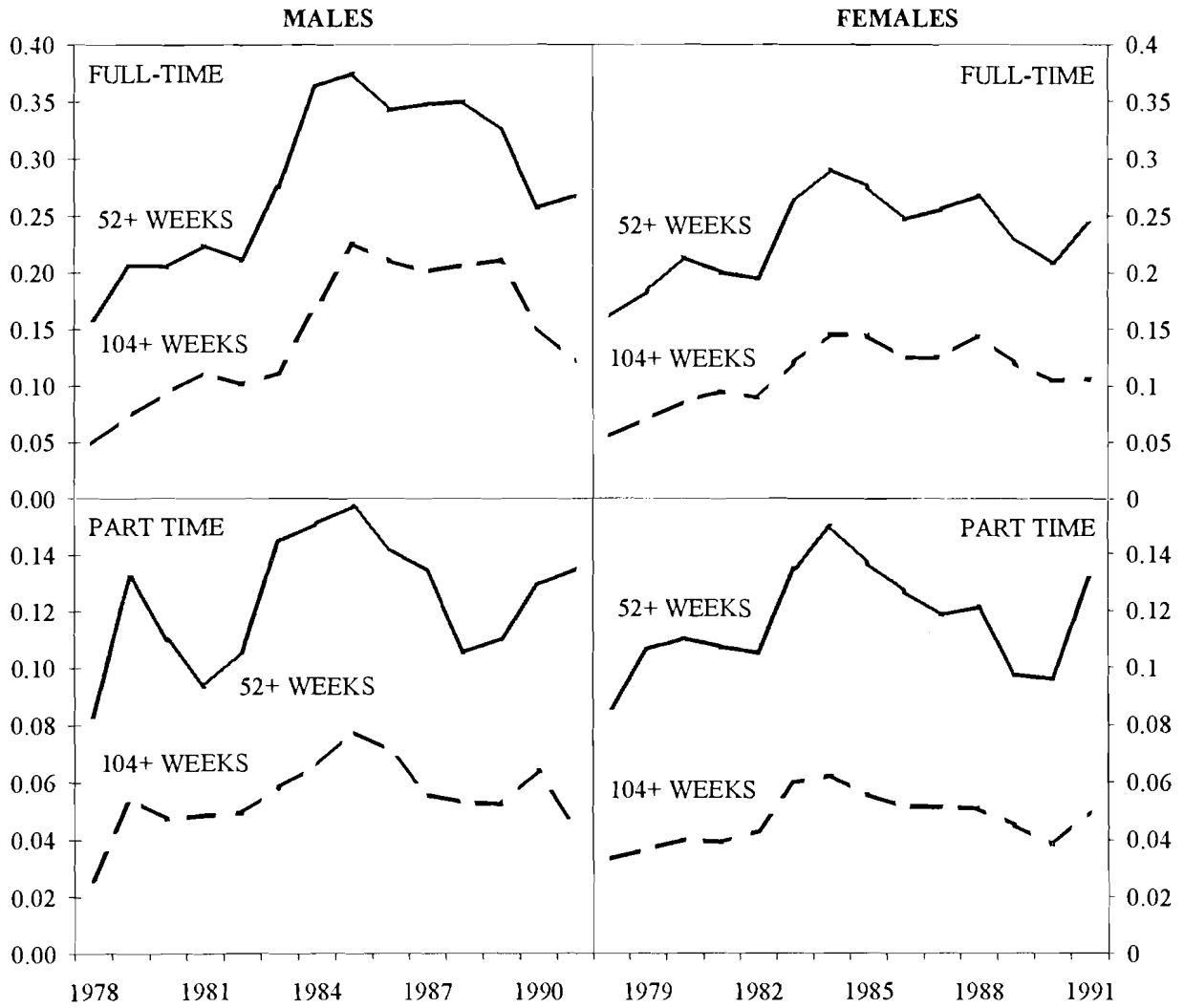
19 See Chapman, Junankar and Kapunscinski (1992) for a recent analysis of long-term unemployment in Australia.

**Figure 16: Median Duration of Unemployment
1966-1991**



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Figure 17: Proportion of Unemployment in each Labour Market held by the Long Term and Very Long Term Unemployed: 1966-1991



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Indeed, it is possible that this persistence could permanently affect average exit rates; in other words, recessions might lead not only to temporary, cyclically high unemployment, but a higher equilibrium rate of unemployment as well. Consistent with this conclusion is the fact, shown in Figure 11, that the recession of 1982-83 led to a permanent fall in the conditional probability of unemployed men obtaining full-time employment. Other things equal, this would have permanently increased the unemployment rate of men looking for full-time work.

4. EMPLOYMENT, PRODUCTIVITY AND WAGES BY SECTOR

Thus far we have described, in considerable detail, the differences in the patterns of employment and unemployment for men and women, and for full-time and part-time workers. In this section, we show that the principal cause of these differences has been the relative decline during the 1970s of those sectors where male employment has been largest, principally manufacturing and construction and the quite substantial increases in employment which have occurred in the service sectors; however, new employees in these industries (largely women working part-time) have tended to come to these jobs from outside the labour force. Thus, increases in employment have resulted in only modest corresponding reductions in unemployment.²⁰

Figure 18 shows employment levels by sector, over the period 1966 to 1991, for men and women, respectively. The major points to note are:

- the decline in manufacturing employment which peaked, in absolute terms, in 1973 for men and 1974 for women. As a result, manufacturing's share of total employment has fallen over this period from about 27 per cent to 18 per cent for men and from 21 per cent to 10 per cent for women;
- the fall in construction employment for men from 1975 to 1983 . Not until 1989 did male employment in this sector recover its 1975 level. Construction employment is

²⁰ Gregory (1991) estimates that, over the period 1966-1988, 58 per cent of new male jobs were filled from the male unemployment pool, while only 23 per cent of new female jobs were filled by unemployed women.

also highly cyclical, recording large falls in 1982-83, strong growth from 1984 to 1989, and large falls again recently;

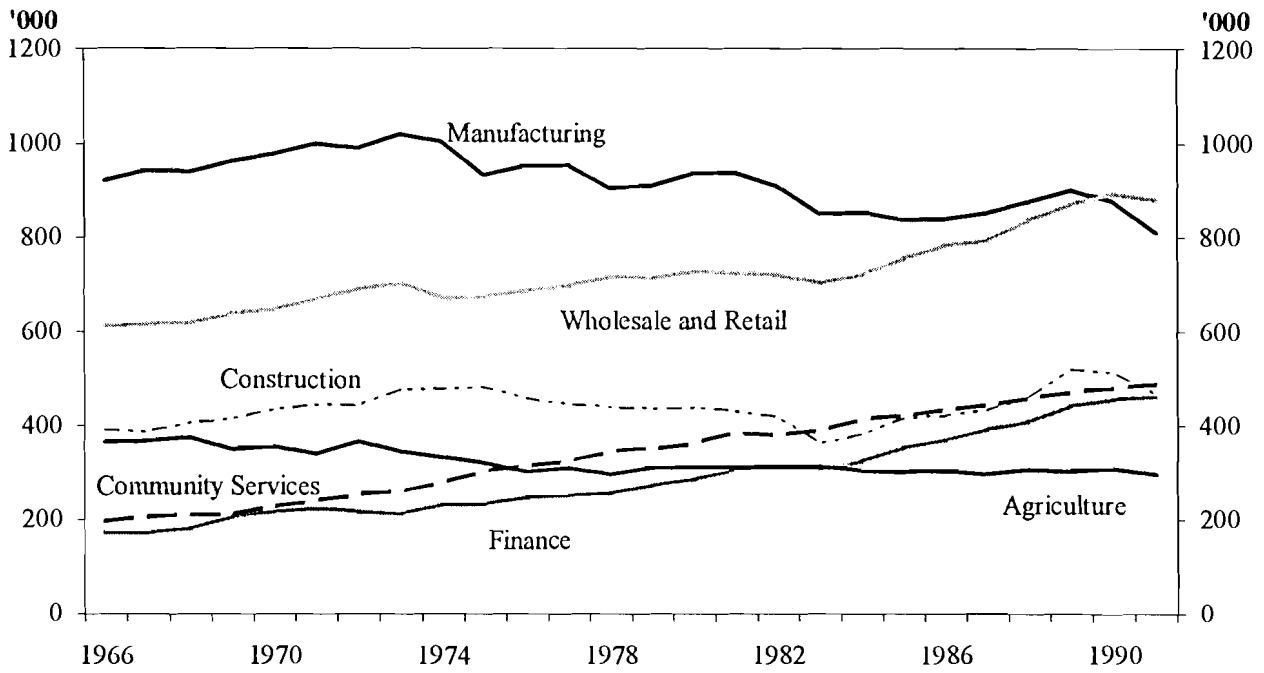
- the rapid increase in employment in finance²¹ and community services. The finance sector employed just over five per cent of men in 1966 but nearly 10 per cent of men in 1991. For women, the proportions were eight per cent and 13 per cent. The proportion of men employed in community services increased over this period from just under six per cent to nearly 11 per cent, while for women the increase was from nearly 20 per cent to nearly 30 per cent; and
- the declining importance of agricultural employment for men. Nearly 11 per cent of men were employed in agriculture in 1966; this figure fell to seven per cent in 1991.

Figure 18 gives us some insight into the cause of the rise in the equilibrium unemployment rate that began around 1974, and continued until the end of the 1970s. As we have noted, male employment in manufacturing and construction recorded negative growth during this time. A fall in employment in a particular sector (or sectors) should not in itself lead to growing unemployment, provided that other sectors expand at the same time, and there is no skills mismatch which prevents surplus labour in one sector from being employed elsewhere. Indeed, such a change would be expected - and desirable - as a part of any economy's normal path of structural adjustment. Employment in agriculture, for example, fell by over 10 per cent between 1966 and 1974 with no discernible effect on the unemployment rate. However, after 1974 no other sectors expanded sufficiently quickly to absorb the excess male labour; the consequent slow down in employment growth led to an increase in unemployment duration and hence in the equilibrium rate of male unemployment.

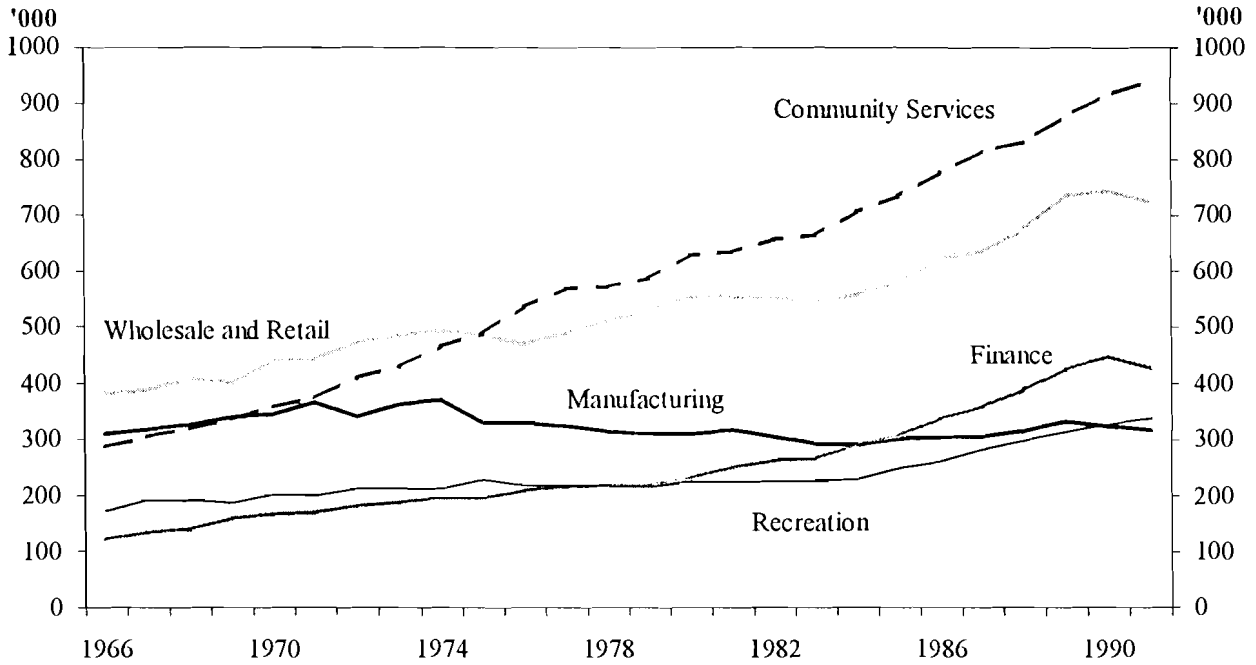
Female employment in manufacturing also started to fall in the mid 1970s. Unlike the male labour market, employment in one important sector - community services - grew strongly, but still insufficiently to absorb the excess female labour, which was exacerbated by fast growth in the female labour supply during this time.

²¹ "Finance" is actually "finance, property and business services" which, among others, includes real estate agents, property valuers and business services such as accountancy, advertising etc..

Figure 18: Employment by Sector: 1966-1991
Males



Females



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Thus, it would appear that the rise in the equilibrium rate of unemployment that was triggered in the mid 1970s was due to the economy's inability to adapt to the shocks of the time. These have been well-documented elsewhere (see e.g. Gregory and Duncan (1979), and comments on their paper). In particular, the very rapid increase in real wages, relative to both labour productivity and the cost of capital, appears to have been the crucial influence in initially increasing the rate of unemployment²². More fundamentally, however, it was the inability of real wages to adjust downwards in response to adverse shocks (such as the slowdown in productivity growth which began at this time in Australia, and the rest of the world) which raised the equilibrium unemployment rate.²³

Apart from the real wage effects, it might be argued that the decline in manufacturing employment was in part caused by the 23 percent fall in effective assistance to that sector which occurred in 1973/74.²⁴ In Section 4.1 we argue that there is in fact no simple causation running from falls in manufacturing protection to falls in manufacturing employment. Moreover, cuts in protection to one sector should have no lasting influence on aggregate unemployment, provided that the economy makes the necessary structural adjustments. Thus, if sector-specific shocks do have persistent effects on unemployment, the problem lies not in the occurrence of the shocks *per se*, but in the impediments to the flows of resources from declining to incipiently expanding sectors.

Figures 19 and 20 decompose the sectoral employment figures into full-time and part-time, over the period 1978 to 1991. Note:

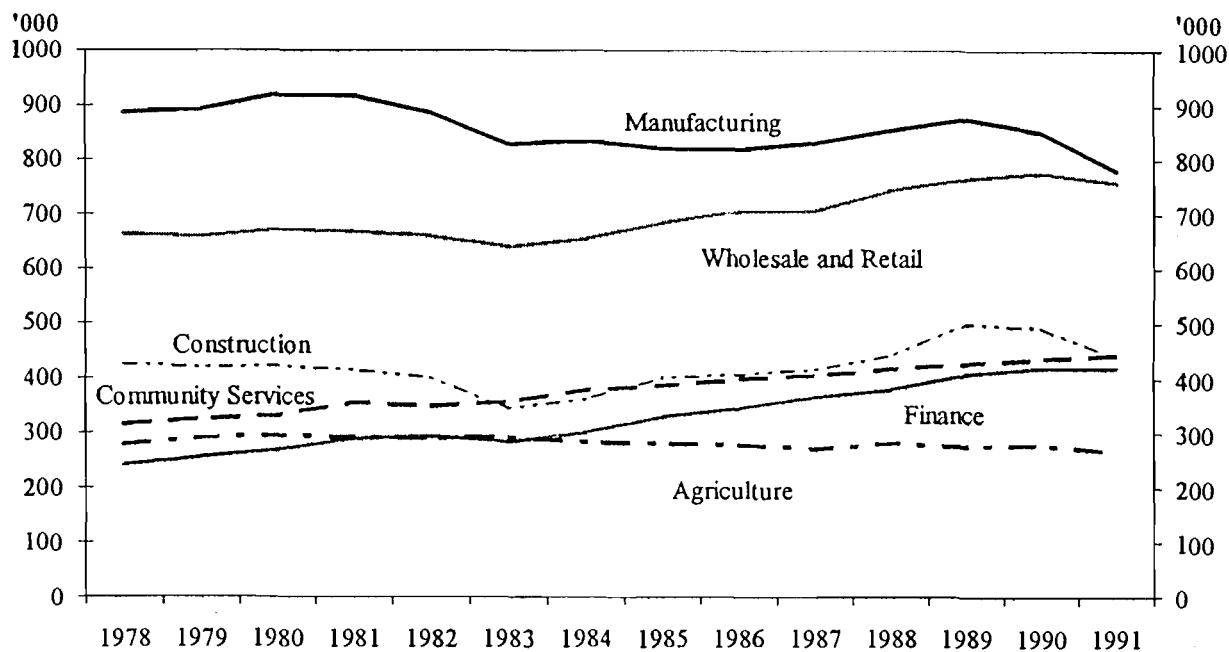
- the slow growth in full-time male employment. The only sectors to record any appreciable growth were community services and finance, and to a lesser extent, wholesale and retail trade;

²² Real unit labour costs increased by four per cent in each of the financial years 1973/74 and 1974/75. (Foster and Stewart (1991), Table 4.17).

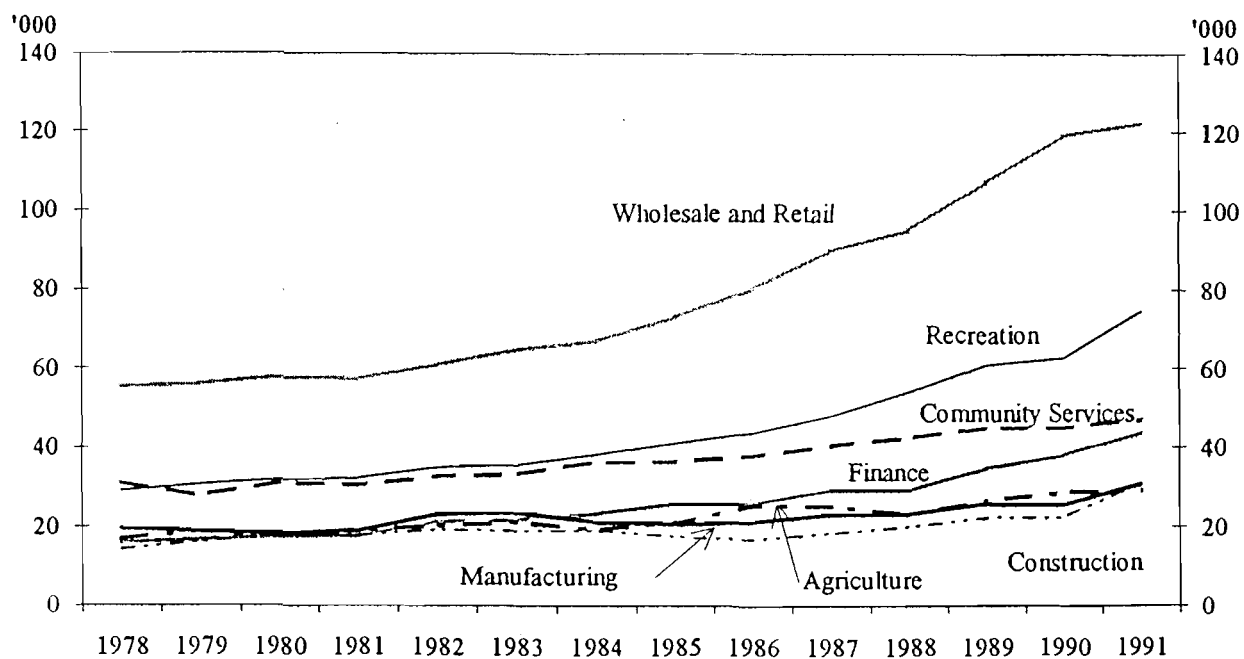
²³ For econometric evidence on this issue, see Layard et al. (1991), Chapter 9.

²⁴ Effective rates of assistance are published in the annual reports of the Industries Assistance Commission, later the Industries Commission.

Figure 19: Male Employment by Sector: 1966-1991
Full-Time

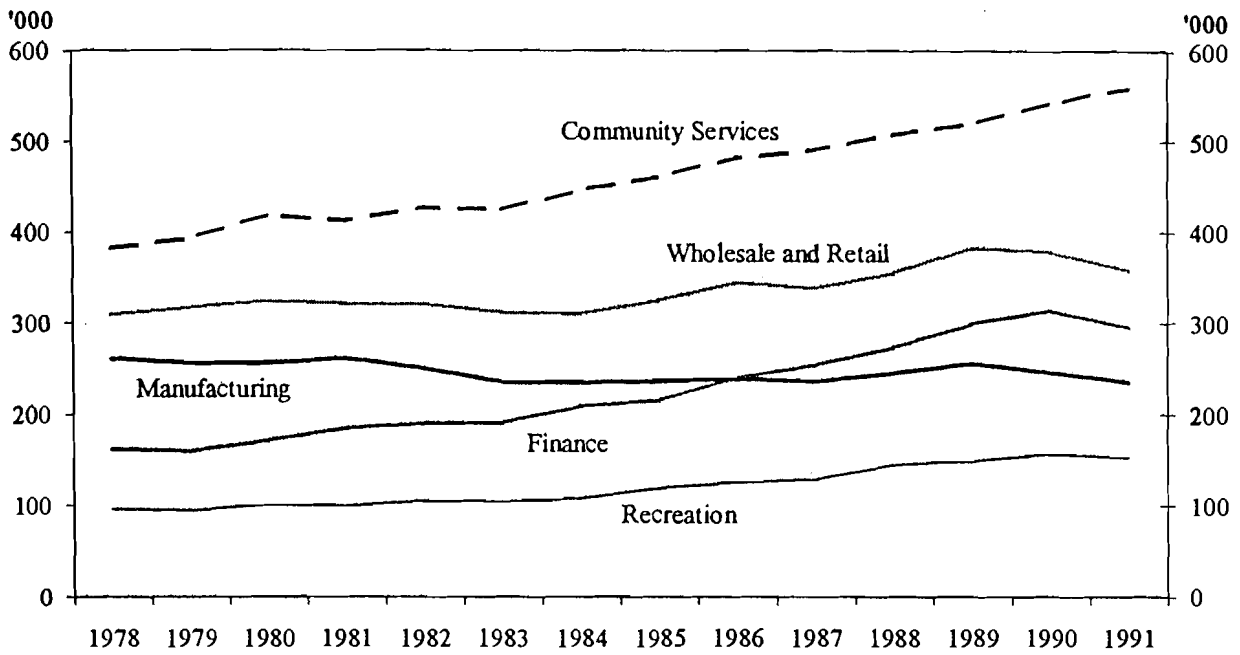


Part-Time

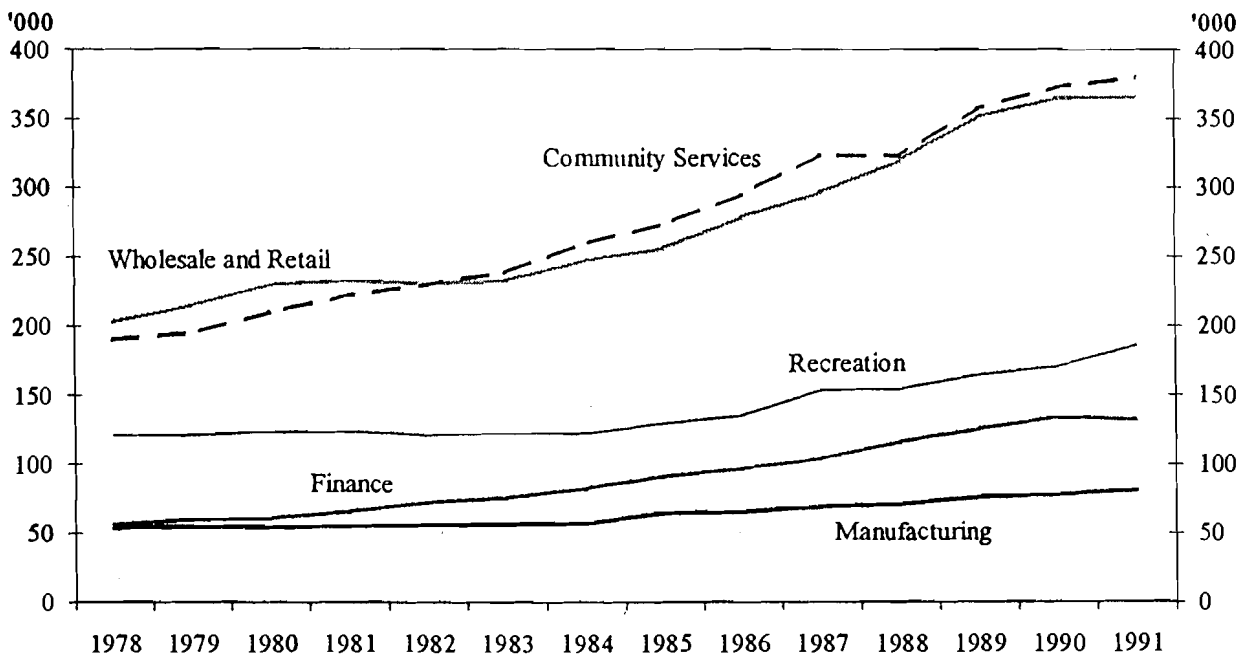


Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

Figure 20: Female Employment by Sector: 1966-1991
Full-Time



Part-Time



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

- the doubling of part-time male employment in wholesale and retail trade and the growth in part-time male employment in recreation (but the absolute numbers are small);
- the increased number of women employed full-time in community services and finance; and
- the very large rise in part-time female employment in finance, community services and wholesale and retail trade. By 1991, these last two categories accounted for nearly 60 per cent of part-time female employment. In contrast, the growth in full-time female employment in community services and wholesale and retail trade was much smaller.

An elementary, but nonetheless useful, method for interpreting these facts is to assume that sectoral employment levels are determined by the intersection of a downward sloping demand for labour curve and an upward sloping supply curve. We can then attribute declining employment over time to one of two factors: either inward shifts of the demand curve that may be due to factors such as declining demand for that sector's output; or inward shifts of the supply curve, due to declining numbers of people with the requisite skills or desire to work in that sector, for example. Similarly, increases in employment could be the result of outward shifts of the demand curve for labour, e.g. financial deregulation in the 1980s could plausibly have led to both increases in the demand for financial services and the number of people supplying them; or they could be the result of exogenous increases in labour supply, e.g. the steadily increased labour force participation of married women.

By examining the joint movement of wages and employment, we can ascertain the relative importance of these forces in the determination of sectoral employment. Shifts of the demand curve will result in employment and wage levels moving in the same direction, while shifts in the supply curve will result in them moving in opposite directions. If, for example, employment levels and wages have both tended to increase over time, we can conclude that outward shifts in the labour demand curve have dominated any shifts in the supply curve.

An important measurement issue which arises here is the treatment of the wage. In standard one-sector expositions, the relevant wage is "the" real wage W/P , where W is

the nominal wage and P is the price of the good. However, when there is more than one sector, this choice is not clear. The real wage relevant to the demand for labour in sector i is W_i/P_i , where W_i and P_i are, respectively, the nominal wage paid in that sector, and the price of that sector's product. However, for labour supply decisions, the relevant real wage is W_i/P , where P is a general price index i.e., an average of all prices. Another problem is that we want to abstract from outward shifts in the labour demand curve due to productivity improvements (which will tend to increase real wages, however measured) and outward shifts in the supply curve due to population increases (which will tend to reduce real wages).

The second problem can be resolved by deflating the industry real wage by an economy-wide real wage, so that shifts in the demand and supply curves lead to changes in relative real wages. We resolve the first problem by assuming that the relevant real wage is that which determines labour supply, implying that the relative real wage is equal to the relative nominal wage.²⁵ Under this assumption, the demand curve for labour is shifted by changes in relative product prices. A decrease in the relative price of manufactures, for example, will lead to an inward shift of the labour demand curve in that sector.

Figures 21 and 22 show scatter plots of wages and employment from 1976 to 1991 in selected sectors of the economy, for men and women, respectively. The wage, shown on the vertical axis of each figure, is the relative hourly nominal wage, as discussed above. Employment, shown on the horizontal axis, is constructed as total hours worked in each industry divided by total hours worked in the economy.

²⁵ The relative real wage is $(W_i/P)/(W/P)$, which is equal to W_i/W , where W is the average nominal wage. We construct this as a fixed weight average of all sectoral wages, with the weights determined by relative employment levels in 1976.

Figure 21: Employment vs. Hourly Wage - Males

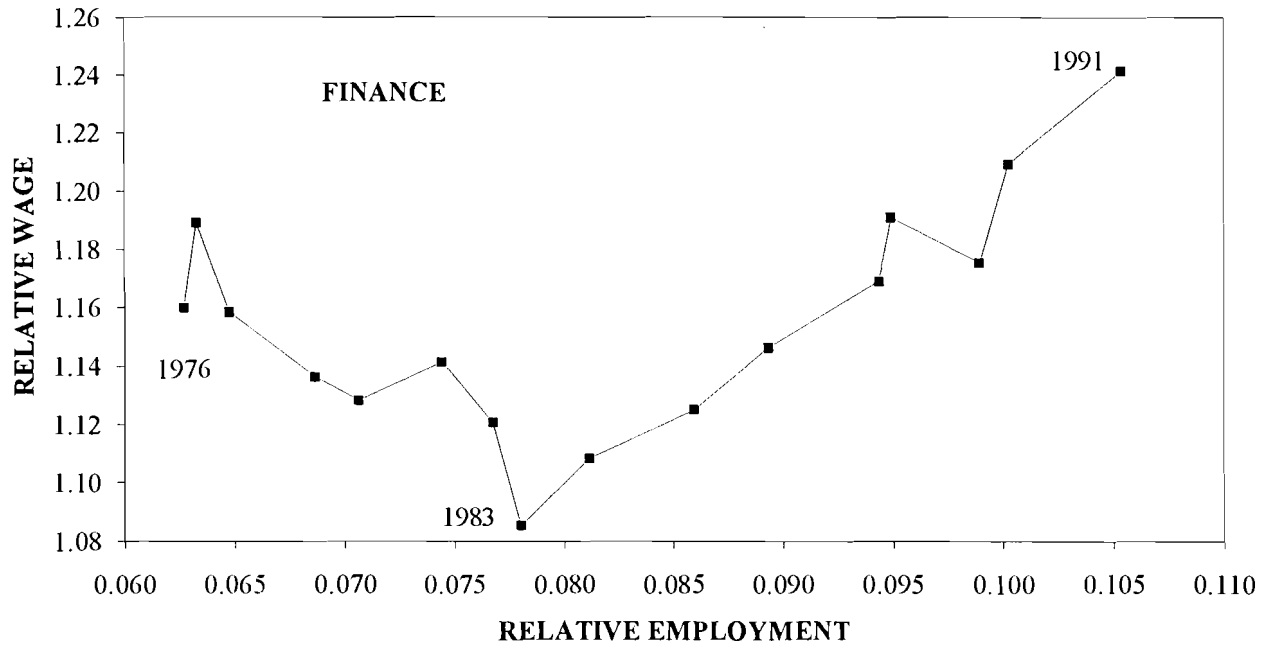
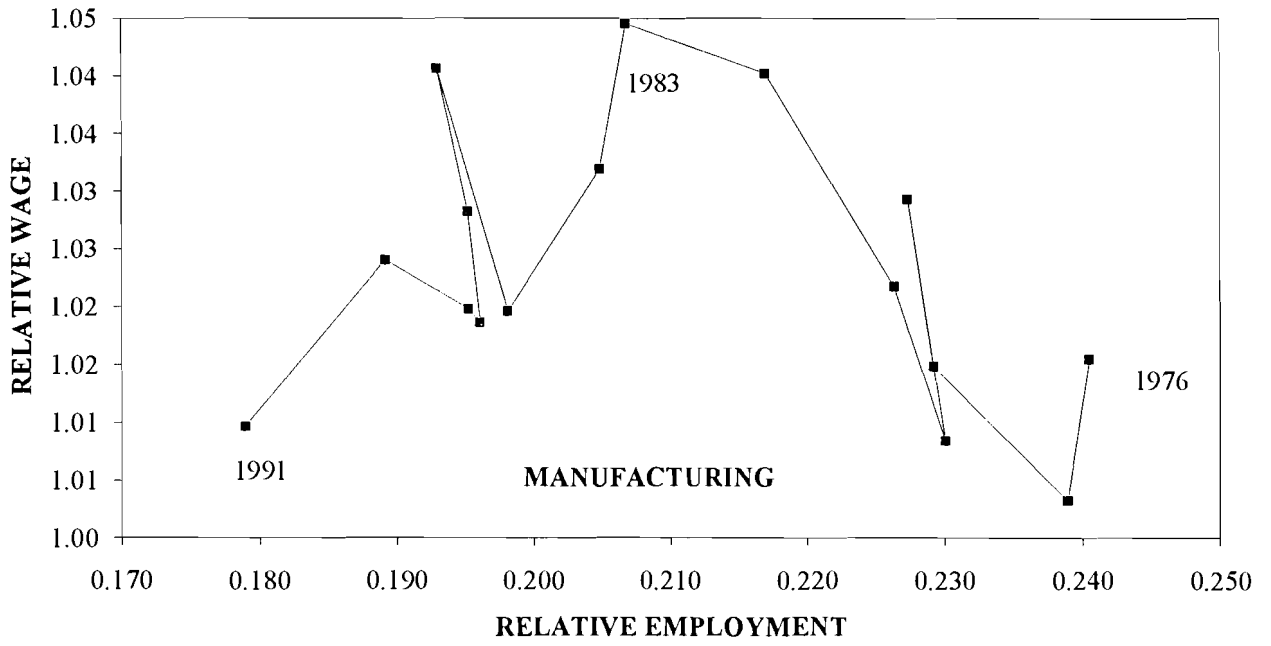
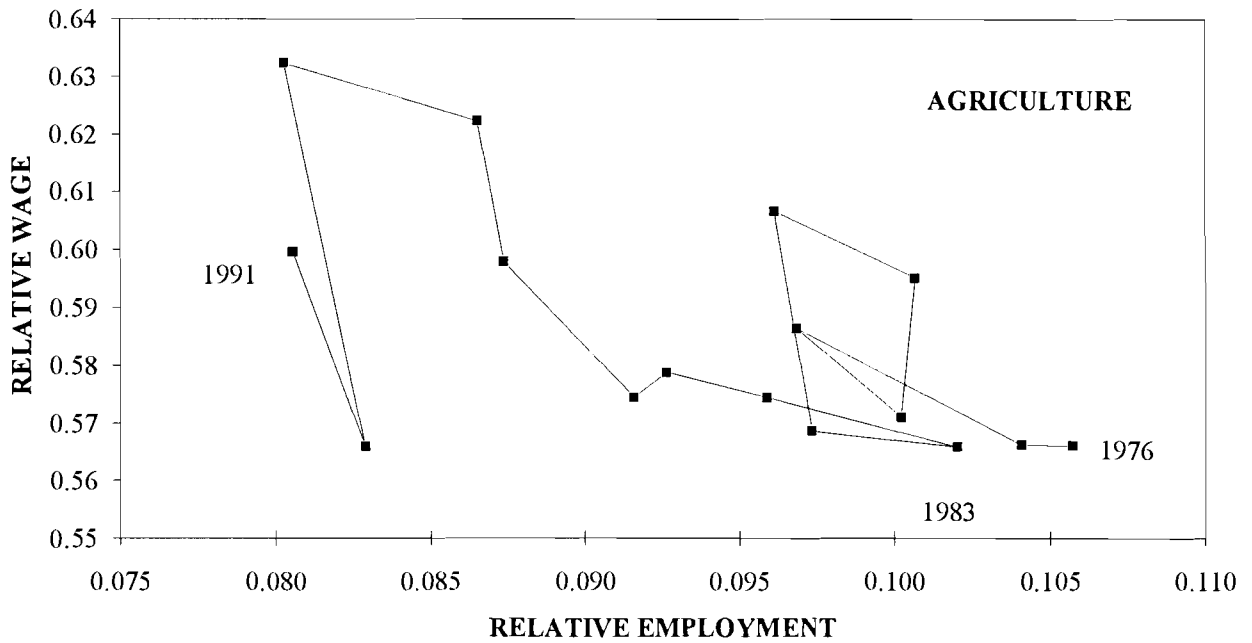
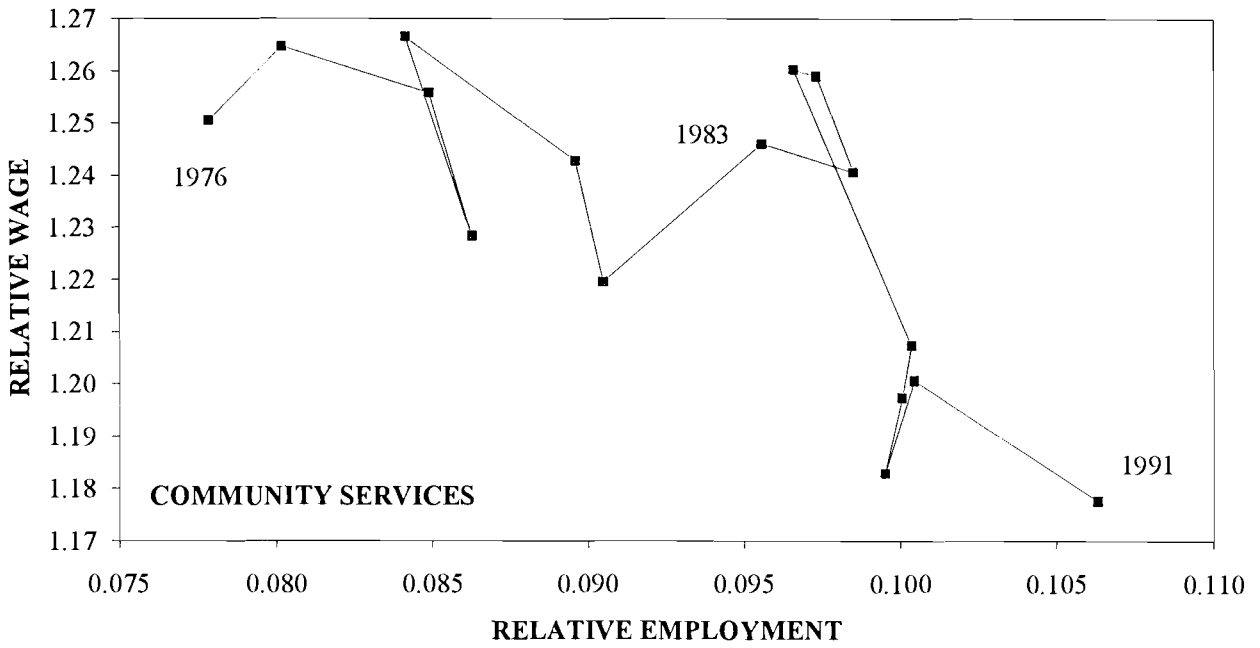


Figure 21: Employment vs. Hourly Wage - Males (cont.)



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0, Weekly Earnings of Employees (Distribution) : Australia, ABS Cat. No. 6310.0.*

Figure 22: Employment vs. Hourly Wage - Females

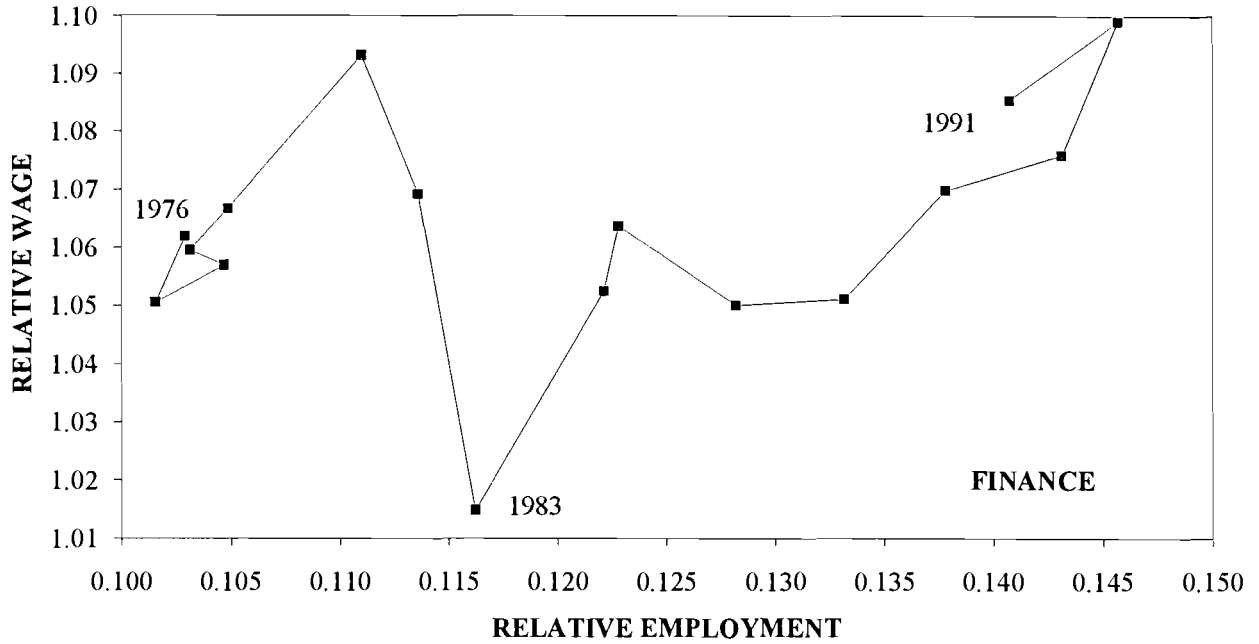
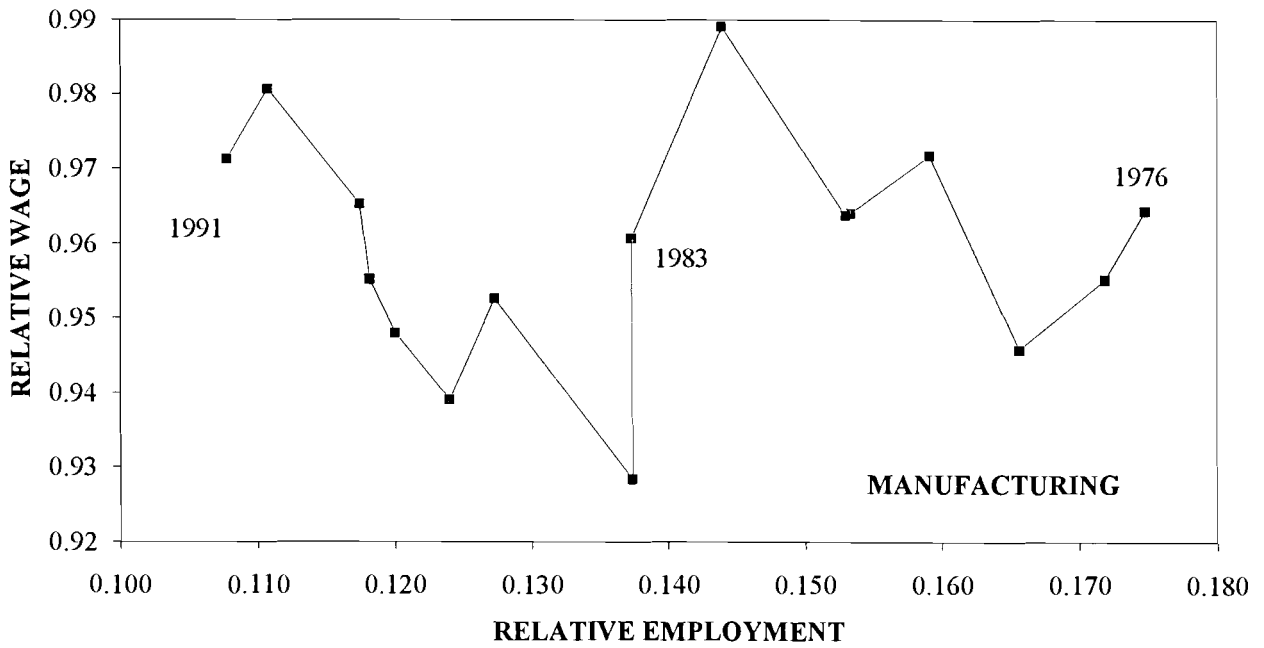
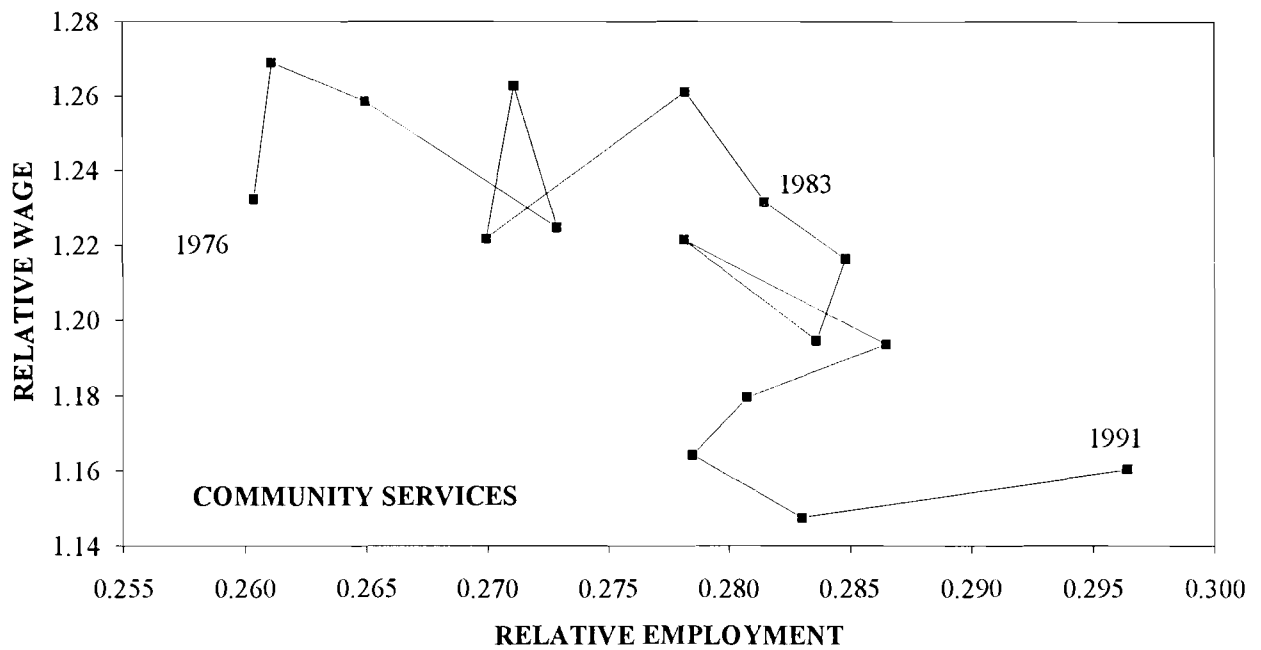
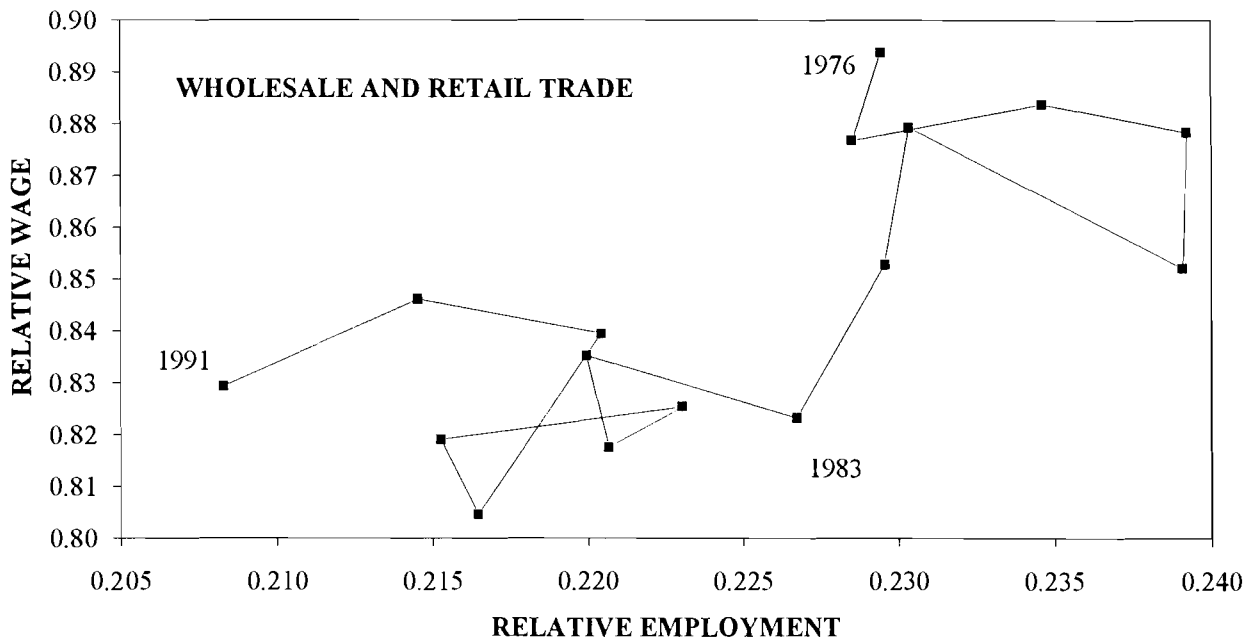


Figure 22: Employment vs. Hourly Wage - Females (cont.)



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0, Weekly Earnings of Employees (Distribution) : Australia, ABS Cat. No. 6310.0.*

Some interesting patterns are apparent. The first panel of Figure 21 shows that male manufacturing hours, as a proportion of total hours, declined significantly from 1976, with two separate trends occurring in relative wage levels. The first, from 1976 to 1983, saw relative manufacturing wages increase (implying an inward shift in the labour supply curve), while relative manufacturing wages fell quite sharply from 1983 to 1991, implying an inward shift of the demand curve.²⁶

In sharp contrast, consider the relative wage and employment levels of males in finance, shown in the second panel. The increase in employment is quite evident, as is the increase in wages since 1983, coinciding, and no doubt caused by, the deregulation of the financial system and property boom of the 1980s. Community services in the third panel also saw a large relative increase in male employment. However, wages in this sector tended to fall, suggesting a shift in labour supply rather than demand. The final panel of Figure 21 shows steadily declining employment in agriculture, and a volatile relative wage, possibly due to inward shifts of both the demand and supply functions.²⁷

The first panel of Figure 22 shows a fall in the hours worked by women in manufacturing, but unlike men, an increase in wages over the 1980s. This suggests the dominance of supply factors rather than demand. Why this occurred is not obvious, although the increasing attractiveness of employment in other sectors is a possibility.

²⁶ It is interesting to note that this decline in relative manufacturing wages coincided precisely with the operation of the Prices and Incomes Accord, one of the undesirable consequences of which is supposed to be its inability to deliver the relative wage movements necessary for the efficient working of the labour market. As Figures 21 and 22 show, changes to relative wages can occur under a regime of centralised wage fixation. Of course, it is always possible to argue that even greater relative wage movements would have occurred in the absence of the Accord, but this is a difficult proposition to test.

²⁷ These facts are also consistent with a model in which increases in agricultural productivity, together with falls in the relative price of agricultural goods, produce a fall in agricultural employment. Such a model is outlined in the Appendix 1 and is broadly consistent with two stylised facts: the large increases in agricultural productivity (see Table 4) and a decline in Australia's terms of trade (Foster and Stewart 1991, p29).

The following panel shows the large increase in employment and wage levels of women in finance, again no doubt due to the effects of financial deregulation and the property boom. It is possible that women moved from manufacturing to finance, attracted by higher wage levels brought about by the outward shift in demand for workers in the finance sector. (It is also possible that women were attracted into finance from outside the labour force, making the wage lower than it would otherwise have been. However, since the net effect of these moves was a clear increase in finance sector wages, demand factors must have been dominant.) The relative decrease in female employment in wholesale and retail trade, shown in the third panel appears to have been due to both demand and supply shifts, reflected in the volatile wage. The same appears to be true of employment in community services.

In Table 4 we show average growth rates of output, employment and hours worked for all sectors, over five periods. These periods are 1966/67 to 1973/74²⁸, a time of strong economic growth and very low unemployment; 1974 to 1981, a period of weak growth and a steadily rising unemployment rate; the two recessions 1982-1983 and 1990-1991, which saw very rapid increases in unemployment, and 1984-1989, a period of strong output and employment growth, and a steadily but slowly falling unemployment rate. The major points of interest are:²⁹

- the very large growth rates in manufacturing productivity during the two periods of expansion. From 1966/67 to 1973/74, manufacturing output grew on average by 5.8 per cent per year, while employment and hours each grew by only 1.7 per cent per year. From 1984 to 1989, annual output growth averaged 4.4 per cent, while growth in employment and hours averaged only 1.3 per cent and 2.3 per cent, respectively;

²⁸ We use financial rather than calendar years for this period because the data are available only on a financial year basis until August 1974.

²⁹ When calculating industry output, the Australian Bureau of Statistics mainly uses employment data from the Survey of Employment and Earnings; by construction, labour productivity in community services, finance, and public administration and defence is zero. Because all our employment data come from the Labour Force Survey, our productivity measures in these three sectors can differ from zero.

Table 4: Average Annual Percentage Changes in Output (Q), Employment (E) and Hours Worked (H) by Sector

Sector	1966/67-1973/74			1974 - 1981			1982-1983			1984 -1989			1990 - 1991			
	Q	E	H	Q	E	H	Q	E	H	Q	E	H	Q	E	H	
Agriculture	1.9	0.0	0.3	3.3	-0.2	-0.9	1.2	0.0	-0.2	2.9	0.4	-0.2	2.9	0.4	-0.3	0.3
Mining	18.3	3.4	3.8	2.8	4.0	4.2	3.5	1.8	-1.9	7.0	1.0	2.7	6.0	-5.0	-3.4	
Manufacturing	5.8	1.7	1.7	1.6	-1.2	-1.7	-4.4	-4.4	-7.0	4.4	1.3	2.3	-3.5	-4.3	-4.5	
EGW	7.4	0.4	-0.1	4.9	3.4	2.6	3.6	4.3	3.0	4.8	-2.8	-2.3	3.0	-6.1	-5.1	
Construction	5.4	3.2	3.1	3.8	-0.5	-1.3	-6.3	-7.9	-10.3	5.1	6.6	7.8	-8.0	-5.0	-6.0	
WRT	5.2	2.6	2.1	2.3	0.9	0.1	-1.2	-1.2	-1.8	4.4	4.3	4.1	-1.6	-0.1	-0.1	
TSC	6.9	2.3	2.3	4.8	1.2	0.4	1.0	2.1	0.5	6.1	1.3	2.1	2.1	-0.5	0.3	
Finance	4.8	4.6	4.1	3.4	4.2	4.0	1.0	1.4	0.2	7.4	7.2	8.0	-1.4	1.4	1.5	
Public	3.4	4.8	4.6	2.5	3.2	2.8	1.5	2.6	1.1	1.9	1.1	1.7	1.5	4.4	4.6	
Comm Serv	6.4	5.2	4.0	5.1	5.0	4.9	4.5	1.6	0.9	4.1	4.2	4.5	3.9	2.9	3.7	
Recreation	4.9	3.2	2.3	1.8	1.4	1.0	1.8	0.7	-0.1	3.2	5.6	5.8	0.6	4.3	3.3	
Total	5.6	2.6	2.2	2.9	1.3	0.6	-0.4	-0.9	-2.3	4.8	3.5	3.8	-0.3	-0.1	-0.2	

Notes: **Agriculture** is Agriculture, Forestry, Fishing and Hunting; **EGW** is Electricity, Gas and Water; **WRT** is Wholesale and Retail Trade; **TSC** is Transport, Storage and Communication; **Finance** is Finance, Property and Business Services; **Public** is Public Administration and Defence; **Comm Serv** is Community Services; and **Recreation** is Recreation, Personal and Other Services.

Source : *The Labour Force : Australia, ABS Cat. No. 6203.0, Australian National Accounts, Gross Product, Employment and Hours Worked, ABS Cat. No. 5222.0, Australian National Accounts: National Income and Expenditure, ABS Cat. No. 5204.0.*

Table 5: Sectoral Shares of Output (Q), Employment (E) and Hours Worked (H)

Sector	1966/67-1973/74			1974-1981			1982-1983			1984-1989			1990 - 1991		
	Q	E	H	Q	E	H	Q	E	H	Q	E	H	Q	E	H
Agriculture	8.6	8.1	10.0	4.8	6.6	8.4	4.3	6.5	8.3	4.3	5.9	7.4	4.1	5.5	6.8
Mining	3.2	1.4	1.4	6.7	1.3	1.4	6.4	1.5	1.6	7.5	1.4	1.5	8.3	1.2	1.4
Manufacturing	28.6	24.8	25.2	21.4	21.0	21.7	19.9	18.6	19.0	18.8	16.6	17.4	18.1	15.0	15.9
EGW	3.6	1.9	1.9	3.3	1.9	1.8	3.8	2.2	2.1	3.8	1.9	1.8	4.0	1.3	1.3
Construction	7.5	8.4	8.7	9.0	8.1	8.4	8.6	6.9	7.0	8.2	7.1	7.4	7.3	7.3	7.5
WRT	16.6	20.4	20.4	18.1	20.1	20.0	17.7	19.8	19.9	17.0	20.2	20.0	16.5	20.8	20.1
TSC	8.1	7.6	7.6	6.6	7.6	7.6	7.2	7.9	8.0	7.7	7.4	7.6	8.1	6.9	7.3
Finance	8.8	6.8	6.4	10.0	7.9	7.7	10.8	9.1	8.9	11.8	10.4	10.4	12.6	11.5	11.7
Public	3.8	3.7	3.4	4.5	4.6	4.3	4.4	4.7	4.4	4.2	4.7	4.4	3.9	4.6	4.4
Comm Serv	7.3	10.9	9.5	11.1	14.8	13.2	12.4	16.5	15.0	12.5	17.5	15.8	13.0	18.2	16.7
Recreation	3.9	6.1	5.5	4.5	6.2	5.5	4.5	6.4	5.9	4.3	6.9	6.3	4.2	7.6	6.9

Notes: See Table 4 for sectoral abbreviations.

Source : *The Labour Force* : Australia, ABS Cat. No. 6203.0, *Australian National Accounts, Gross Product, Employment and Hours Worked*, ABS Cat. No. 5222.0, *Australian National Accounts : National Income and Expenditure*, ABS Cat. No. 5204.0.

- the large growth in productivity in 1984-1989 in electricity, gas and water, and transport, storage and communication which continued in 1990-1991. In contrast, output per employee in these sectors fell over 1982-1983. This difference probably reflects the commercialisation of many government-owned business enterprises in recent years;
- large falls in output, employment and hours worked occurred in manufacturing and construction during the two recessions, 1982-1983 and 1990-1991. However, unlike manufacturing, employment in construction grew strongly from 1984 to 1989;
- agricultural productivity grew strongly in most periods; and
- productivity in mining grew exceptionally strongly during the two periods of expansion, 1966/67 to 1973/74 and 1984 to 1989. However, this growth was probably driven by capital accumulation, and the mining sector is, in any case, a relatively small part of the economy, especially in employment.

The sectoral shares of output, employment and hours worked, in each period, are shown in Table 5. The declining importance of manufacturing and agriculture is quite apparent, as is the increasing importance of the service sectors.

4.1 Manufacturing

We now turn to a more detailed analysis of manufacturing, the only sector, apart from agriculture, where employment has been falling, in absolute terms, over the past 20 years. Table 6 shows that, within the manufacturing sector, the growth rates of output, employment and productivity have been far from uniform. For example, between 1984 and 1989, productivity growth in the transport equipment industry was very small. On the other hand, output growth in basic metal products averaged 4.3 per cent per year, while employment fell by 1.8 per cent per year. Very large productivity gains also occurred in paper, non-metallic mineral products and fabricated metal products. This period of high productivity growth followed a savage reduction in employment during the recession of 1982-83, especially in the metals industries.

Table 6: Average Annual Growth Rates of Output (Q) and Employment (E) in Manufacturing

Sector	1977-1981		1982-1983		1984 -1989		1990 -1991	
	Q	E	Q	E	Q	E	Q	E
Food	1.0	-2.5	-0.2	3.6	3.1	0.6	3.0	-3.9
Textiles	1.4	-2.9	-5.4	-6.9	5.2	1.5	0.3	-6.5
C&F	0.7	-0.2	-2.0	-2.7	1.7	0.0	-10.1	-6.5
Wood	1.0	2.8	-5.1	-4.9	5.0	4.0	-6.7	-6.7
Paper	3.9	1.3	-1.8	2.2	6.5	1.5	-2.0	-1.6
CP&C	3.2	-0.6	-0.5	-4.9	3.1	0.9	0.8	-5.1
NMP	0.9	-1.4	-7.3	-3.3	5.6	1.0	-14.0	0.7
BMP	3.4	2.9	-5.1	-8.5	4.3	-1.8	-3.9	-5.3
FMP	4.5	0.3	-10.0	-6.8	6.8	2.5	-1.5	-3.2
Transport	0.3	-2.1	-2.9	-9.6	2.6	2.0	-14.0	-8.3
Other M	2.1	-0.3	-10.7	-10.9	5.2	1.2	-4.4	-2.7
Misc	3.5	-0.6	-4.7	0.0	5.6	2.8	-5.6	-3.3
Total	2.1	-0.4	-4.4	-4.4	4.4	1.3	-3.5	-4.3

Food is Food, Beverages and Tobacco; **C&F** is Clothing and Footwear; **Wood** is Wood, Wood Products and Furniture; **Paper** is Paper, etc, Printing and Publishing; **CP&C** is Chemical, Petroleum and Coal Products; **NMP** is Non-Metallic Mineral Products; **BMP** is Basic Metal Products; **FMP** is Fabricated Metal Products; **Transport** is Transport Equipment; **Other M** is Other Machinery; **Misc** is Miscellaneous.

Source: *The Labour Force : Australia, ABS Cat. No. 6203.0, Australian National Accounts, Gross Product, Employment and Hours Worked, ABS Cat. No. 5222.0.*

We noted above that the reduction in male manufacturing employment since 1983 was probably due to a reduction in demand for manufacturing workers.³⁰ One explanation for this decline, quite common in popular discussions, is that technological innovation has reduced the demand for manufacturing workers. At first glance this seems an unlikely explanation, because the way in which technology is usually modelled results in increased output for all combinations of inputs to production and therefore leads to increased, not decreased, employment in the technologically improved sector.

However, in Appendix 2 we describe a two-sector general equilibrium model in which labour-saving technological progress in the capital-intensive sector, e.g. manufacturing, can lead to a reduction in employment in that sector, provided the elasticity of substitution in production between capital and labour in each sector is sufficiently small. We know of no convincing evidence one way or the other on this question.

Another explanation, currently popular in some circles, is that reductions in tariffs and other trade barriers on imported manufactures caused contractions in the output and employment in some manufacturing industries. In Table 7 we show changes in employment and effective protection in the manufacturing sector. Two points are immediately apparent. The first is that most of the job losses in manufacturing, over the period 1976 to 1991, occurred during the recession years 1982-1983 and 1990-1991. In some industries, in fact, over 100 per cent of net job losses over the extended period occurred during those four years. The second point is that there was no significant reduction in effective protection during this time; indeed, effective assistance actually increased in some cases. We therefore find it difficult to conclude that the reduction in manufacturing employment was simply caused by declining industry assistance.

³⁰ We also noted that the relative reduction in female manufacturing employment was probably due to an inward shift of the supply curve. The male/demand effect dominates, however, due to the much larger size of the male manufacturing labour force. Between 1973 and 1991 total manufacturing employment fell by 254,000, comprising a fall of 208,000 men and 46,000 women.

Table 7: Employment and Protection in Manufacturing 1976 - 1991

Industry	Change in		Change in		Change in	
	Employment 1976 to 1991 (^{'000})	Effective Protection (per cent)	Employment 1981 to 1983 (^{'000})	Effective Protection (per cent)	Employment 1989 to 1991 (^{'000})	Effective Protection (per cent)
Food	-20.3	18	12.8	10	-14.7	3
Textiles	-13.3	51	-5.0	55	-4.3	72
C&F	-16.3	118	-4.7	172	-10.3	172
Wood	11.1	18	-9.4	15	-14.6	16
Paper	17.4	30	4.8	25	-4.2	11
CP&C	-12.8	24	-6.4	15	-6.3	12
NMP	-5.4	9	-3.5	4	0.7	3
BMP	-21.5	16	-17.4	10	-8.3	9
FMP	-8.5	36	-16.5	31	-8.1	19
Transport	-49.6	61	-25.8	67	-20.9	37
Other M	-38.5	25	-37.8	21	-8.2	18
Misc	3.2	25	-0.3	28	-5.5	23
Total	-154.3	28	-108.9	24	-104.5	17
		15		21		15

Notes: See Table 6 for industry abbreviations. The average rate of effective protection calculated as $(VA-VA')/VA'$ where VA is value added with protection, VA' is value added without protection. Estimates of effective protection for calendar years are averages of adjoining financial years. Source: *Industries Commission and Industries Assistance Commission Annual Reports, various issues.*

The decline in manufacturing employment might, however, be associated with the fall in industry assistance in another sense. Table 7 shows that most of the falls in manufacturing employment have occurred during recessions, and that these falls have been largely permanent.³¹ That is, we think that in addition to being periods of temporarily slow aggregate economic activity, recessions are also periods of accelerated structural change. Viewed in this light, the slow fall in unemployment following a recession is readily explainable. While the purely cyclical increase in unemployment is eventually reversed, the recession-induced structural adjustment is not.

The data suggest that this structural adjustment has involved a permanent change in the composition of aggregate employment, away from manufacturing and towards services. However, the new jobs have not been filled by manufacturing workers who have lost their jobs in the recession but by new entrants to the workforce. There is no obvious theoretical reason for this to be the case, but it is possible that these new jobs have characteristics (e.g. are part-time) and require skills that are more suited to these new entrants (such as women re-entering the workforce). Declines in industry assistance facilitate this structural change.

We are unaware of any formal theory in the business cycle literature that models this structural adjustment process exactly; however some interesting recent papers by Caballero and Hammour (1991) and Hall (1991a, 1991b) highlight some of the important mechanisms that could be at work. These papers view recessions as periods of economic reorganisation and renewal, an idea first articulated by Joseph Schumpeter (1939)³².

³¹ This observation is based on only one observation, the period 1984 to 1989, and so needs to be treated with some caution. However, we argue below that there are good reasons to believe that the loss of manufacturing employment in the current recession will not be recovered at a later stage.

³² A related literature deals with the interaction between aggregate disturbances and sectoral productivity shocks. Davis and Haltiwanger (1990) investigate the connection between the heterogeneity of establishment-level employment changes and aggregate employment fluctuations over the cycle. They construct a theoretical model which suggests how both aggregate and allocative disturbances can drive fluctuations in job creation, job destruction, productivity, output and unemployment. Their empirical analysis indicates that allocative disturbances were very important in the determination of these variables in U.S. manufacturing over the period 1972 to 1986. See also Davis and Haltiwanger (1992), Aghion and Saint-Paul (1991) and Saint-Paul (1992).

In the model of Caballero and Hammour, product units embodying the latest techniques are continuously being created, while obsolescent units are being destroyed. Demand falls during a recession, leading to an increase in the rate of destruction and a decrease in the rate of creation; the extent to which demand fluctuations are accommodated along either margin depends on the costs of creation. This model is applied to U.S. data on gross labour market flows in manufacturing with the result that the rate of job destruction is found to be much more responsive to changes in activity than the rate of job creation, and that output fluctuations are asymmetric - contractions in output are sharper and more short-lived than expansions. However, these asymmetries are smoothed by the rate of job creation, which is more responsive to expansions in activity than contractions. The rate of job creation, therefore, is roughly symmetric around its mean. Job destruction, on the other hand, amplifies the asymmetries of the output cycle, and so the net effect of the business cycle on employment is asymmetric: unemployment rises sharply during a recession but falls only slowly during the expansionary phase of the cycle.

In Hall's model of business cycles, recessions provide a favourable time to reorganise and undertake productivity-improving activities because the opportunity costs of doing so are temporarily low. Central to this model is the concept of agglomeration externalities, the idea that, because there are complementarities associated with both production and reorganisation, economic activity takes place more efficiently in concentrated periods of time and space.

These models lead to the view that recessions are times of "cleaning up", when outmoded techniques and products are purged from the economic system. They do not directly address the issue of recessions as periods of accelerated structural change, but it is not difficult to see how the models could be so extended. For example, the model of Caballero and Hammour could be extended to two sectors, with variations in demand leading to adjustment along four margins - the rates of job creation and destruction in each of the two sectors.³³

³³ Another class of models which can explain the asymmetric behaviour of U.S. manufacturing employment has been recently developed by Cabellero and Engle (1991, 1992a, 1992b). In these models economic agents at the microeconomic level make infrequent, but large, adjustments in response to random shocks. (Formally, Cabellero and Engle characterise behaviour in terms of an adjustment hazard function; the probability of adjustment increases the larger is the deviation of a variable from its targeted value.) These models are then used to generate aggregate dynamics with properties that are consistent with the data, such as gross employment flows in US manufacturing. Conceivably, models of this type could also be used to explain how large

These types of the models address the propagation mechanism of recessions, but not the issue of the shocks which initiate the cycle. This is one of the most hotly debated issues in modern macroeconomics, with a consensus view emerging that both nominal and real shocks are empirically important, though their relative significance is still a matter of debate (King et al, 1991). The shock which precipitated the 1982-83 recession is often thought to be the large wage increases which occurred in the metals industries in previous two years, with these increases (especially the wage package of December 1981) acting as a catalyst for wage increases in the rest of the economy (Treasury, 1982).³⁴ In Table 8, we show some of the increases in real wages in the metals' industries that occurred between 1980 and 1982. It is perhaps not unreasonable to conclude that the massive fall in employment in these industries in the ensuing recession was associated with these increases in real wages, which did not appear to be accompanied by any corresponding increases in productivity. However, if our view of recessions as periods of accelerated structural change is correct, these job losses probably would have occurred eventually anyway.³⁵ In this sense, the fundamental cause of the decline in employment in the metals' industries in the early 1980s was ongoing structural change in the economy; the prior increase in real wages was the proximate cause which largely determined the pace of that change.³⁶

negative shocks, such as recessions, can lead to changing structural behaviour in firms, and the consequent implications for sectoral and aggregate employment.

³⁴ Other factors, such as the world-wide recession and the rural drought, were also important in determining the length and severity of this recession.

³⁵ BHP Steel, for example, used the recession of 1982-83 as a catalyst for modernising its plant and equipment, and especially for labour shedding; it now employs about one-third the number of workers than it did before the recession. It seems reasonable to speculate that these changes would probably have occurred anyway over the 1980s, but, in the absence of the wage rises of 1980-82 and subsequent fall in economic activity, would not have occurred in such a concentrated period of time.

³⁶ We are not, however, asserting that the recession of 1982-83 was, apart from the international influences and the drought, in any sense unavoidable, much less desirable. A good deal of the lost output and employment in this recession could probably have been avoided in the absence of the generalised wage increases of the previous two years.

Table 8: National Average Wages for Metal Industry/Metal Trades Award Members 1980-1982

Classification	1980 \$	1982 \$	Real Increase (per cent)
Toolmaker	232.85	299.50	6.3
Fitter	228.40	313.20	13.3
Boilermaker	225.30	308.90	13.3
Welder - 1st Class	222.90	306.90	13.8
Machinist - 1st Class	218.60	288.20	9.0

Notes: These figures do not include the June 1982 Metals Industries Award increase; the estimated real increases are based on the 21 per cent increase in the CPI between March 1980 and March 1982.

Source: *Amalgamated Metal Workers and Shipwrights' Union, National Wages and Conditions Survey, June 1982.*

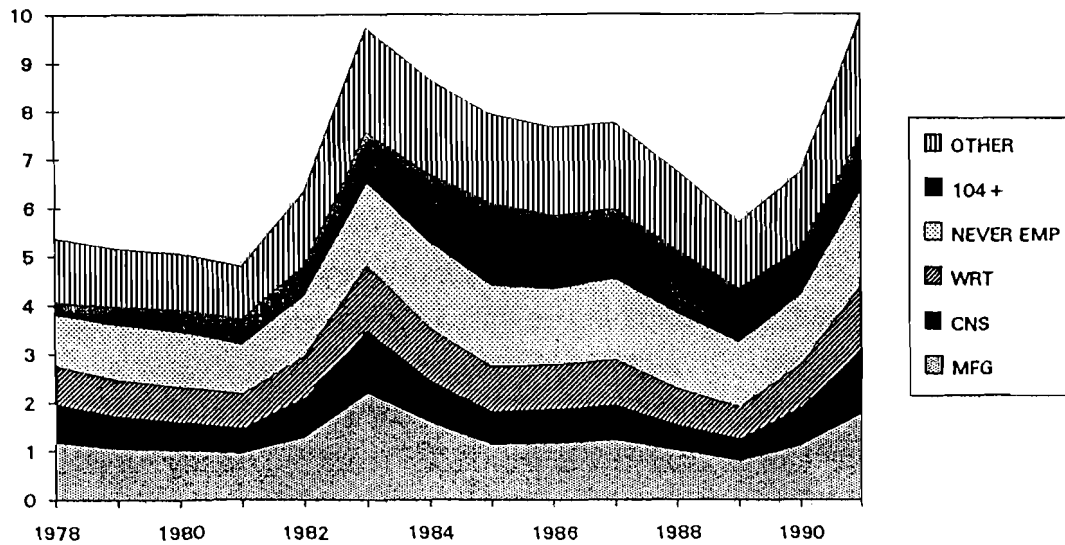
4.2 Persistence in Unemployment: Sectoral Evidence

To complete this section, we present data on sectoral unemployment. These data, together with those on employment by sector, duration and participation presented earlier in the paper, allow us to deduce the principal structural causes of persistence in Australian unemployment. Unemployed people are defined as belonging to the sector in which they were last employed full-time, provided that employment was in the previous two years.³⁷

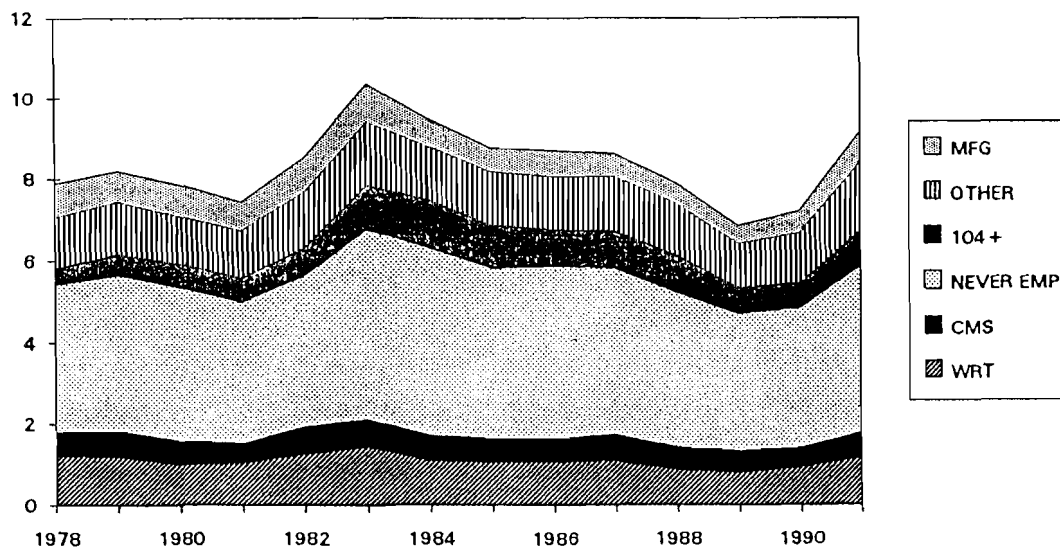
Figure 23 shows the very long term unemployed (those unemployed for greater than 104 weeks), the major sectors, and the new entrants to the full-time labour force, as components of the aggregate male and aggregate female unemployment rates.

³⁷ The very long term unemployed are therefore excluded from the sectoral unemployment data, as are new entrants to the labour force, such as school leavers, and unemployed part-time workers.

Figure 23: Decomposition of Unemployment Rates: 1978-1991
Males



Females



Note: NEVER EMP is never employed full-time, 104+ is unemployed for over two years, CMS is Community Services, WRT is Wholesale and Retail Trade, MFG is Manufacturing, CNS is Construction and OTHER is all other unemployed people classified by industries which are not given separately.

Source: *The Labour Force: Australia. ABS Cat. No. 6203.0.*

Consider the unemployment rate of men. During the recession of 1982-83 it peaked at just under 10 per cent in 1983; by 1987 it had fallen to about eight per cent, still three percentage points above the rate in 1981. Interestingly, the three sectors that account for over 70 per cent of male unemployment - manufacturing, construction, and wholesale and retail trade, appear to have contributed, between them, only about 20 per cent of persistence.

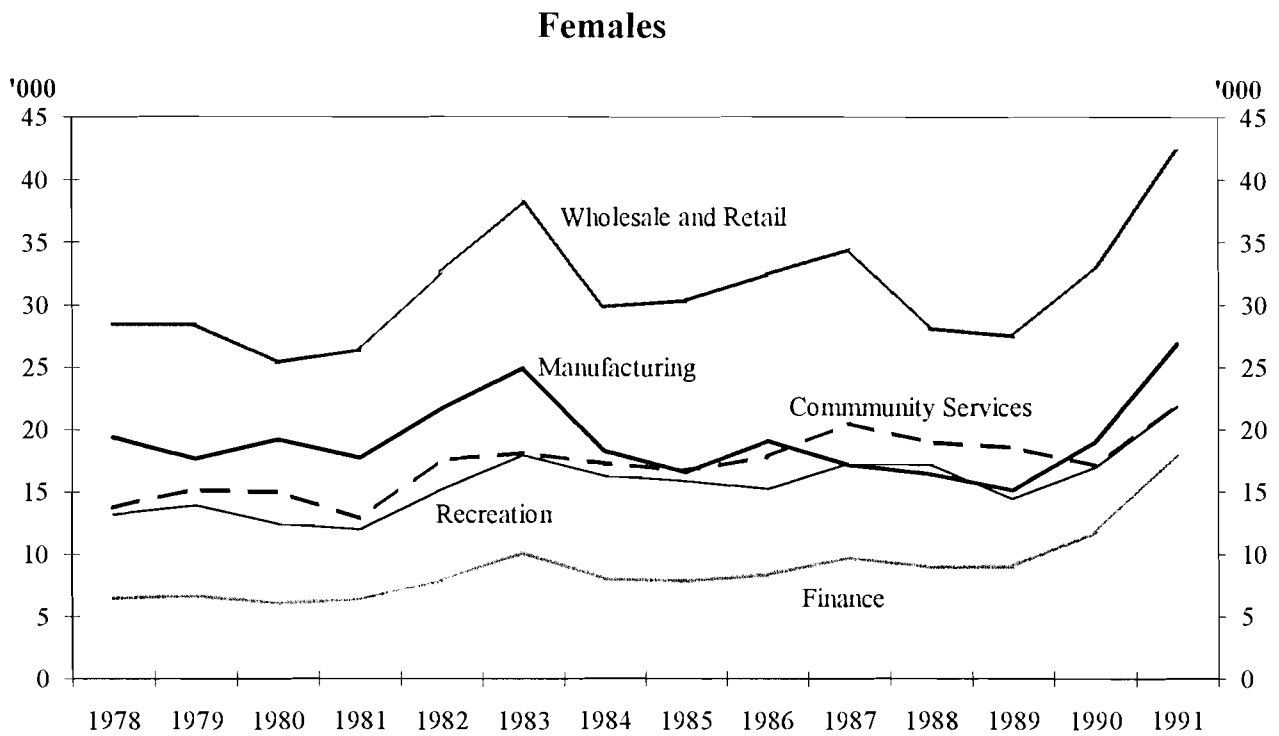
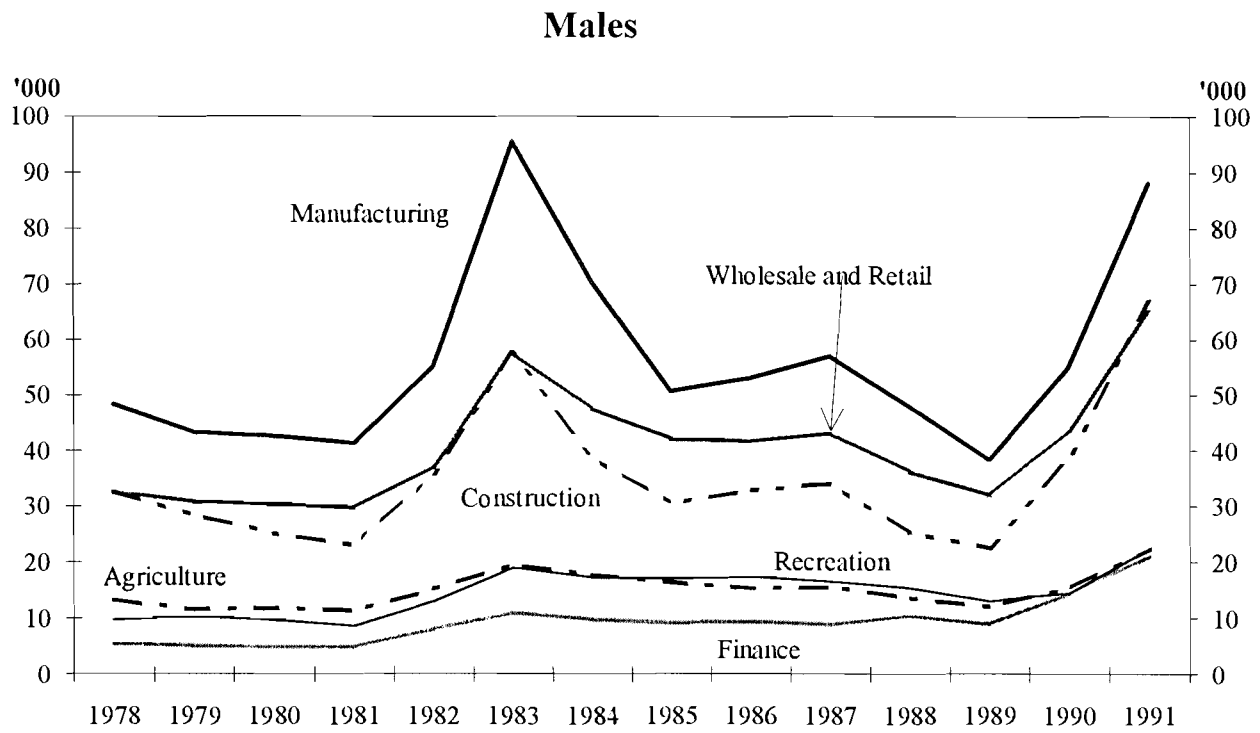
The sectors labelled "other" (principally agriculture, finance and recreation) contribute about one third of persistence, despite their much smaller contribution to total unemployment. (The sectoral contributions to total unemployment of those who have worked full-time in the last two years can be seen in Table 9.) The persistence of agricultural unemployment can be easily seen in Figure 24, which plots the number of people unemployed in each sector. Unemployment in agriculture in the 1980s hardly fell from its 1983 peak; since agricultural employment was also flat, the agricultural unemployment rate was very persistent. The source of the increased contributions to total persistence from finance and recreation is their increased relative importance in the economy as a whole.

Slightly less than half the persistence in male unemployment has come from two categories which are not sector-specific. These are the very long term unemployed, and those unemployed people who have never held a full-time job or have been out of the full-time labour force for at least two years. The latter is partly due to the increased difficulties school leavers have in finding employment: in 1987, 18.0 per cent of 15-19 year old males were unemployed, compared with 11.2 per cent in 1981.³⁸

Given the negligible growth in manufacturing employment it is puzzling that persistence in manufacturing is not measured to be much larger than it is. One possible explanation is that former manufacturing workers tend to leave the labour force in large numbers, given the rather poor job prospects in their sector. Another is that they account for a large proportion of the very long term unemployed. We have no way of knowing this for sure, since the very long term unemployed are not classified by sector.

³⁸ Foster and Stewart (1991), Table 4.16.

Figure 24: Unemployment by Sector: 1978-1991



Source: *The Labour Force : Australia, ABS Cat. No. 6203.0.*

**Table 9: Distribution of Unemployment by Sector
Percentage of Total**

Males				
Sector	1978-81	1982-83	1984-89	1990-91
Manufacturing	28.9	30.2	25.9	25.7
Construction	18.0	18.7	15.0	19.0
WRT	20.4	19.0	19.8	19.6
Agriculture	7.9	6.9	7.4	6.8
Recreation	6.3	6.4	7.9	6.7
Finance	3.3	3.8	4.6	6.4
Other	15.2	15.0	19.4	15.8
Total	100.0	100.0	100.0	100.0

Females				
Sector	1978-81	1982-83	1984-89	1990-91
Manufacturing	20.7	20.3	16.3	17.3
Comm Serv	15.9	15.5	17.5	14.7
WRT	30.4	30.8	29.1	28.4
Recreation	14.4	14.4	15.3	14.6
Finance	7.2	7.8	8.3	11.2
Other	11.4	21.2	13.5	13.8
Total	100.0	100.0	100.0	100.0

Notes: The numbers in the table are the proportions of those who are unemployed and have worked full-time in the last two years, accounted for by each sectoral component. Therefore, "other" includes all those who were employed full-time in the past two years in a sector which has not been included separately. See Table 4 for sectoral abbreviations.

Source: *The Labour Force : Australia, ABS Cat. No. 6230.0.*

However, in Table 10 we show the proportion of those unemployed for between one and two years accounted for by each sector. We can see that former manufacturing workers are disproportionately represented in this group³⁹. Assuming that this pattern is repeated among the very long term unemployed, we have some evidence, albeit weak, that the persistence of male unemployment is partly due to the inability of displaced manufacturing workers to find employment elsewhere in the economy. Also disproportionately represented are displaced workers from wholesale and retail trade. This is also puzzling, since employment growth in this sector was strong after the 1982-83 recession. However, most of this growth was in part-time employment; it would appear that these jobs were largely filled by entrants to this sector rather than former full-time employees.

Table 10: Proportion of Unemployed with Durations between One and Two Years by Sector: 1978-1991

Agriculture	3.3	Finance	2.6
Manufacturing	17.3	Public	2.7
Construction	7.0	Comm Serv	4.1
WRT	13.9	Recreation	5.5
TSC	3.0	Other Sectors	1.8

Notes: See Table 4 for sectoral abbreviations. Note also that only 60% of those unemployed between one and two years can be classified by sector, the remainder being those who have not worked full time in the last two years.

Source: The Labour Force: Australia, ABS Cat. No. 6203.0.

The bottom panel of Figure 23 decomposes female unemployment. It is immediately apparent that persistence is less of a problem for women; by 1987, 60 per cent of the increase in female unemployment (from its trough in 1981) had wound back, compared with 40 per cent for men. It is also apparent that the bulk of female unemployment comes from women who are entering the workforce or have not been working full-time. This category also contributes most to the persistence

³⁹ Over the period 1978-1991, former manufacturing workers accounted for 17.3 per cent of those unemployed between one and two years, and nearly 25 per cent of previously employed full-time workers. However, over the same period manufacturing workers accounted for only 20 per cent of the fully employed work force.

of female unemployment. There appears to be little or no sectoral persistence; this observation is confirmed by the lower panel of Figure 24.

The data therefore suggest that persistence in female unemployment is not driven by the sectoral mismatch which seems to characterise, to a large extent, the persistence in male unemployment. This conclusion is supported by the fact that high median unemployment durations, which decline slowly, do not appear to be as much of a problem for women as for men. The sectoral data are consistent with our conclusions based on the gross flow data: female full-time unemployment fell only slowly over the recovery period 1984 to 1989 because the increases in female employment were largely offset by increases in labour supply.⁴⁰ Further evidence for this hypothesis is the slight increase in female unemployment in community services during this period, despite the very large increases in employment in that sector.

5. EVALUATION AND SUMMARY

This paper has examined the evolution of Australian employment and unemployment in an attempt to answer two questions: why has the equilibrium rate of unemployment increased so much in the past two decades, and why does the unemployment rate rise so sharply during recessions, but fall only slowly in the ensuing period of economic growth?

The answer to the first question is that the economy was hit by a number of shocks during the mid 1970s, to which it was incapable of fully adjusting. These shocks led to declines in employment in some key sectors, especially manufacturing and construction, but the slack was not taken up by expansion elsewhere. The general slowdown in employment growth led to a sharp rise in unemployment duration, which has not since been reversed.

In answer to the second question, the sources of persistence appear to be different for women and men. The persistence of female unemployment is almost entirely supply driven: employment growth has been strong, but so has been the growth of

⁴⁰ Female employment grew by 27 per cent over the six years to 1989, almost double the growth rate of male employment. Over the same period, however, the female participation rate increased from 44 per cent to 51 per cent, while the male participation rate fell slightly.

the female labour force. The persistence of male unemployment appears to have been due, in large measure, to sectoral mismatch. Male unemployment was slow to fall over the 1980s because most of the employment growth occurred in sectors where women are dominant (such as community services); moreover, much of this growth was in part-time jobs, which again are mainly filled by women. Long term unemployment of men, as a result, has become a serious problem. For women, this problem is not so apparent, largely because women have a much greater tendency than men to leave the labour force rather than remain unemployed for extended periods of time. Consistent with these facts is a view of recessions as periods of accelerated structural change; for example, the general slowdown in activity in 1982-83 led a permanent decline in employment in most of the manufacturing sector, and the same may be true of the current recession.

Associated with these structural changes has been a large increase in the proportion of jobs that are held by part-time workers. This change has reinforced the rise in the equilibrium unemployment rate as part-time workers are much more likely, over any given period of time, to become unemployed than full-time workers. Although there has been no trend increase in the rate of inflow to unemployment from either full-time or part-time employment, the compositional shift towards part-time employment has increased the entry rate into unemployment for the economy as a whole.

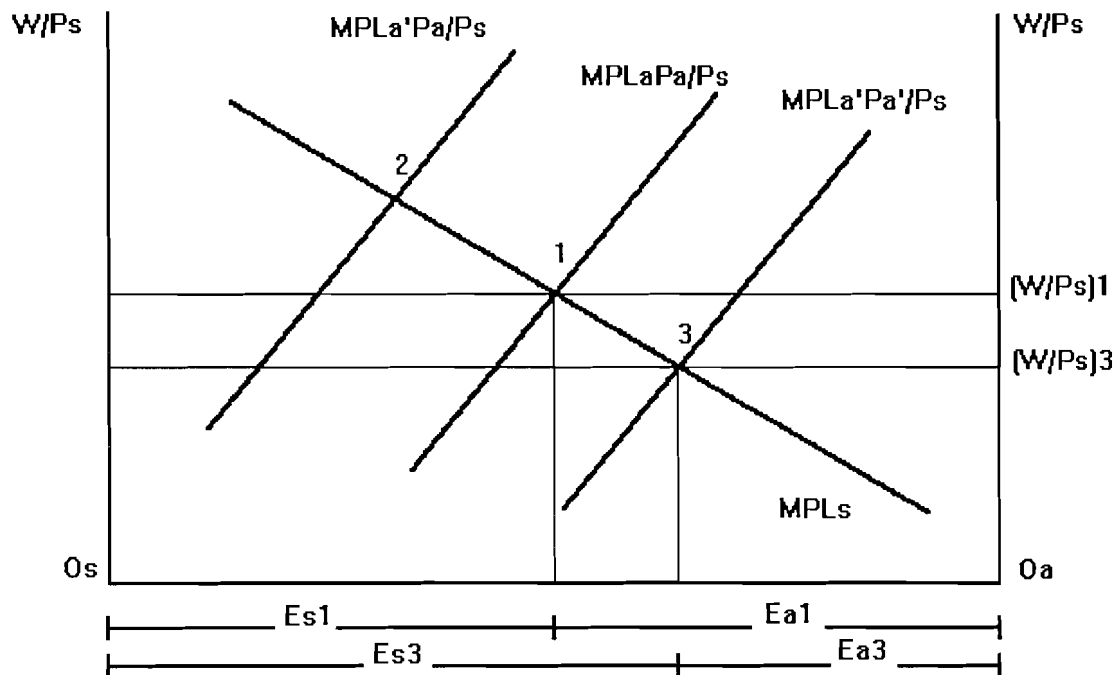
We conclude by noting that further large falls in full-time employment, especially of men, have occurred in the current recession. Most ominously, as in 1982-83, the structural changes associated with this recession have led to a sharp fall in the probability of unemployed men finding a full-time job. If past experience is any guide, this fall will not be reversed during the recovery. It appears that persistently high levels of unemployment will be a feature of the Australian economy for many years to come.

APPENDIX 1: A MODEL OF EMPLOYMENT AND PRODUCTIVITY IN AGRICULTURE

As discussed in the text, rapidly rising productivity, falling employment, and falling terms of trade have been prominent recent features of the Australian agricultural sector. These stylised facts are consistent with the following model.

Suppose the economy consists of two sectors, agriculture and services. The mobility of labour ensures that the real wages are equal across sectors; moreover, the labour market is competitive and the real wages are equal to the marginal product of labour, and all labour is employed. This economy is depicted in Figure A1.1. The demand for labour in the service sector is shown by the curve MPL_S , the marginal product of services, while the demand for labour in agriculture is shown by the curve $MPL_a \cdot P_a/P_s$, which is the value of the marginal product of labour in agriculture divided by the price of services. Equilibrium is at point 1, the intersection of the two curves. Employment in agriculture is E_{a1} and is E_{s1} in services. The real wage, in terms of the price of services, is $(W/P_s)_1$, in both sectors.

Figure A1.1: Two Sector Economy - Agriculture and Services



Suppose there is an increase in the marginal productivity of agricultural labour. The demand for labour curve shifts out (away from O^a origin) to MPL'_a . The real wage increases in agriculture, and draws labour away from the service sector. A new equilibrium is established at point 2, with more labour employed in agriculture and less in services. Suppose, however, that in addition to this increase in productivity, the price of agricultural goods falls relative to the price of services. The demand for labour in the agricultural sector shifts back to $MPL'_a \cdot P_a / P_s$, as the value of the marginal product of labour falls. Equilibrium is established at point 3, with employment levels E_{a3} and E_{s3} in the two sectors. Compared to the original equilibrium, employment in agriculture is lower, productivity is higher, and the relative price of agricultural goods has fallen.

APPENDIX 2: A MODEL OF EMPLOYMENT AND PRODUCTIVITY IN MANUFACTURING

Like agriculture, the manufacturing sector has been characterised by rapidly rising productivity and falling employment. Unlike agriculture, however, the relative price of manufactures has not been generally falling, and so the model outlined in Appendix 1 cannot be used to explain the pattern of employment and productivity in that sector. In this appendix, we outline a model with two factors (labour and capital) and two sectors (manufacturing and services) in which labour-saving technological progress in the capital-intensive sector (assumed to be manufacturing) leads to decreased employment in manufacturing, provided the elasticity of substitution in production in each of the two sectors is not too large.

Case 1: No Factor Substitution in Either Sector

To begin, we assume a fixed-coefficient (Leontief) production function in each sector i.e., there is no possibility of substituting one factor for another as relative factor prices change. This is shown in Figure A2.1. The two isoquants, labelled manufacturing and services, reflect our assumption that manufacturing is relatively capital-intensive. The slopes of the two rays OM and OS are the degree of capital intensity in manufacturing and services, respectively. The equilibrium factor price ratio, labelled w/r , is tangent to each of the two isoquants.[#]

[#] Strictly speaking, since Leontief production functions are not differentiable, the tangent does not exist.

Suppose a labour-saving technological innovation occurs in manufacturing. The manufacturing isoquant will shift to the left, such that, to produce a given output, less labour is required in combination with the same amount of capital. The capital to labour ratio increases to OM' and the wage-rental ratio falls to $(w/r)'$.

The distribution of factors between the sectors is shown in Figure A2.2. The initial equilibrium is at point 1, given by the intersection of the two capital intensity rays O_mM and O_sS . Employment in manufacturing is O_mL_m , and is therefore $L - O_mL_m$ in the service sector. Similarly, O_mK_m capital is used in manufacturing, and $K - O_mK_m$ capital is used in services. The technological innovation in manufacturing increases capital intensity in that sector to O_mM' , unambiguously decreasing both employment of labour, to O_mL_m' and capital, to O_mK_m' .

Figure A2.1: No Factor Substitution

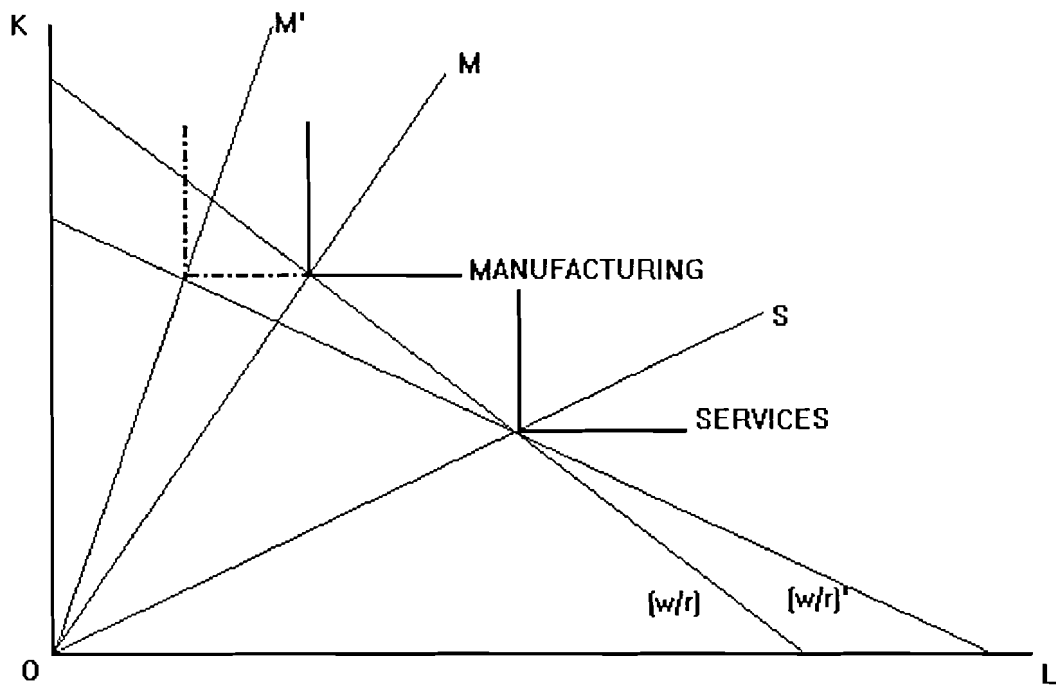
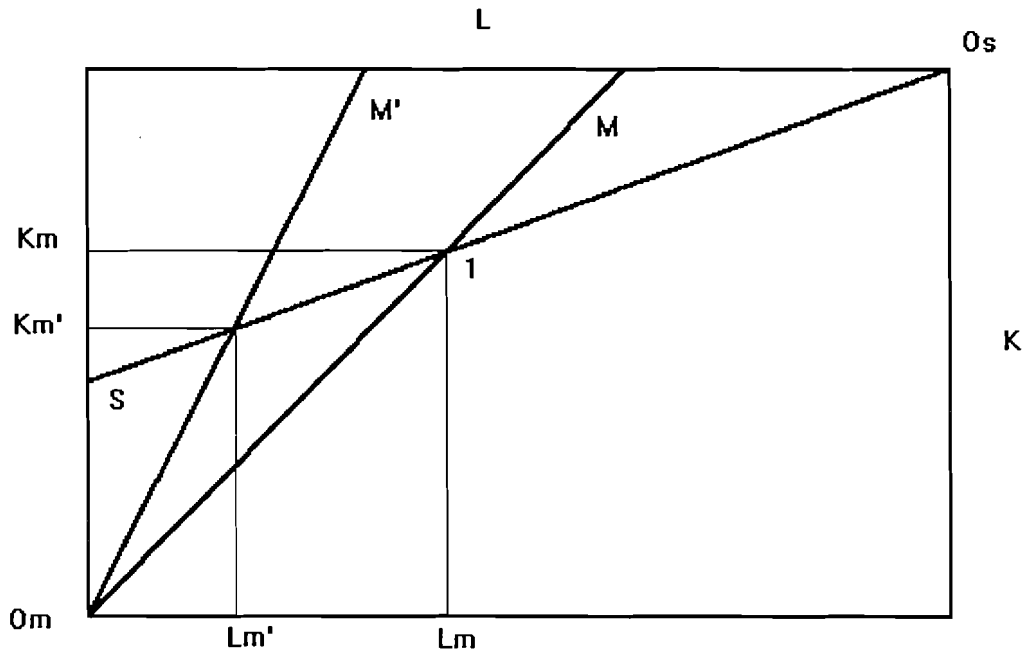


Figure A2.2: No Factor Substitution



Case 2: Factor Substitution in Manufacturing

The result in Case 1 is unambiguous only because of the special nature of the Leontief production function. Suppose that the possibility of substituting labour for capital in manufacturing now exists. This situation is depicted in Figure A2.3, where the isoquant in manufacturing now reflects the possibility of some factor substitution. In this case, the labour-saving technological change leads to a decrease in the capital to labour ratio in manufacturing. The reason is that the incipient excess supply of labour brought about by this technological innovation leads, as before, to a fall in the wage-rental ratio. However, on this occasion the elasticity of factor substitution is sufficiently large for the net effect to be an increase in the amount of labour, per unit of capital, that is employed in manufacturing.

This can also be seen in Figure A2.4, which shows that both the employment of capital and labour increases in manufacturing in this case. This result depends on the elasticity of substitution in production being sufficiently large. For a small elasticity, the net effect of the technological innovation and factor substitution will be, as in the Leontief case, to reduce employment in manufacturing.

Figure A2.3: No Factor Substitution in Services

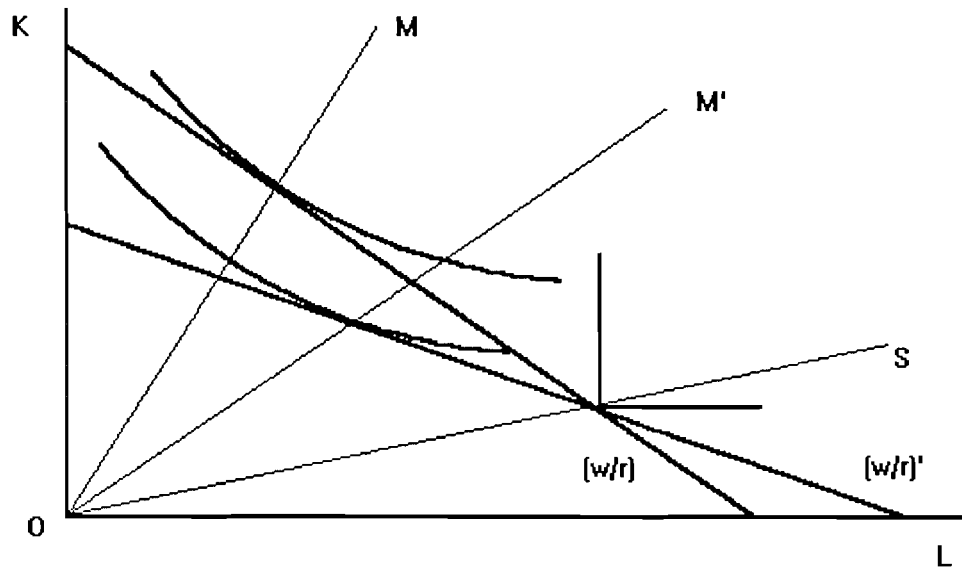


Figure A2.4: No Factor Substitution in Services

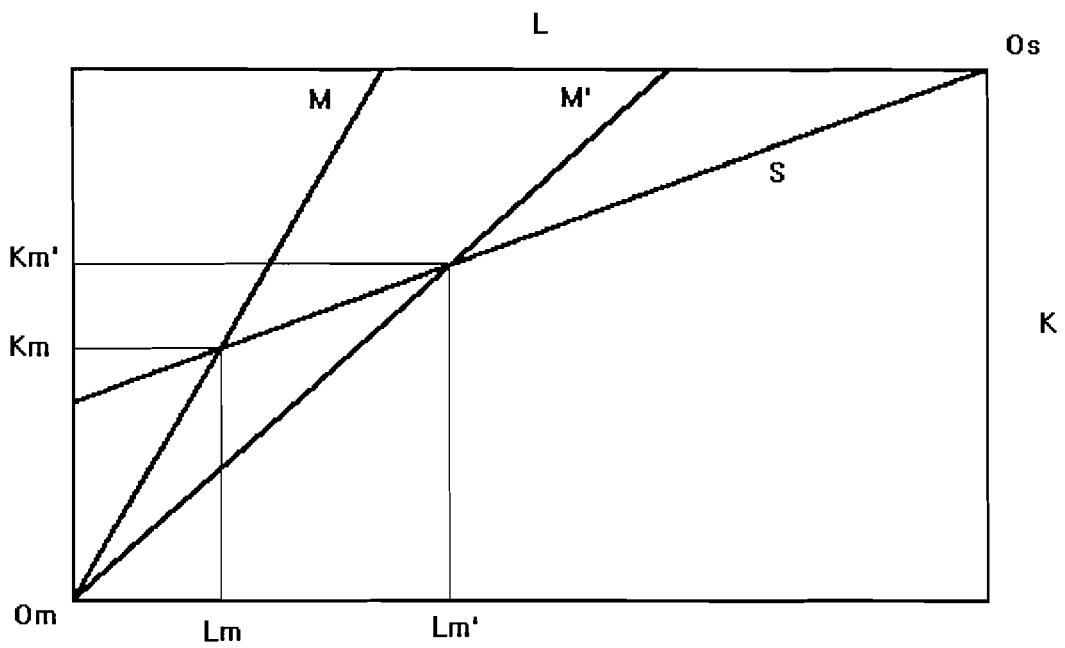


Figure A2.5: No Factor Substitution in Manufacturing

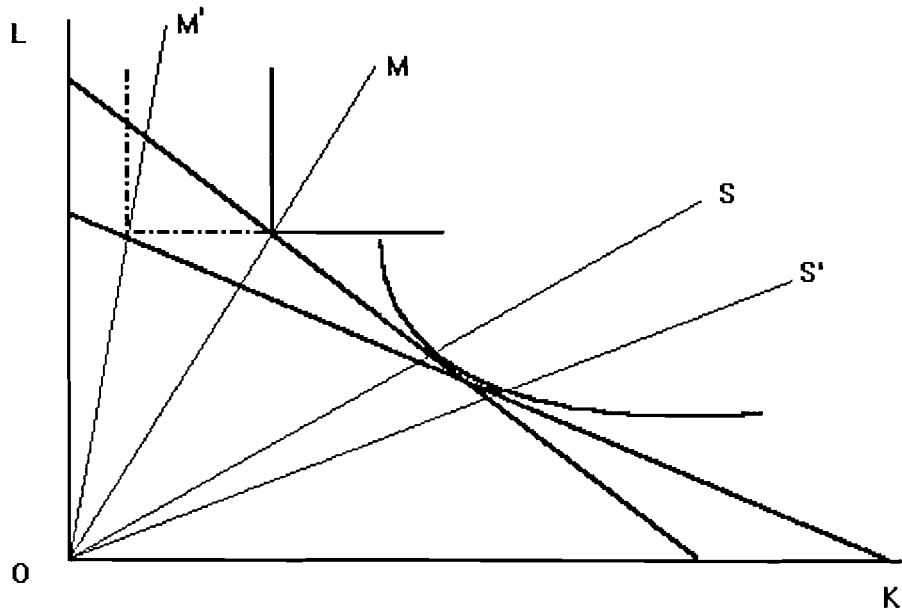
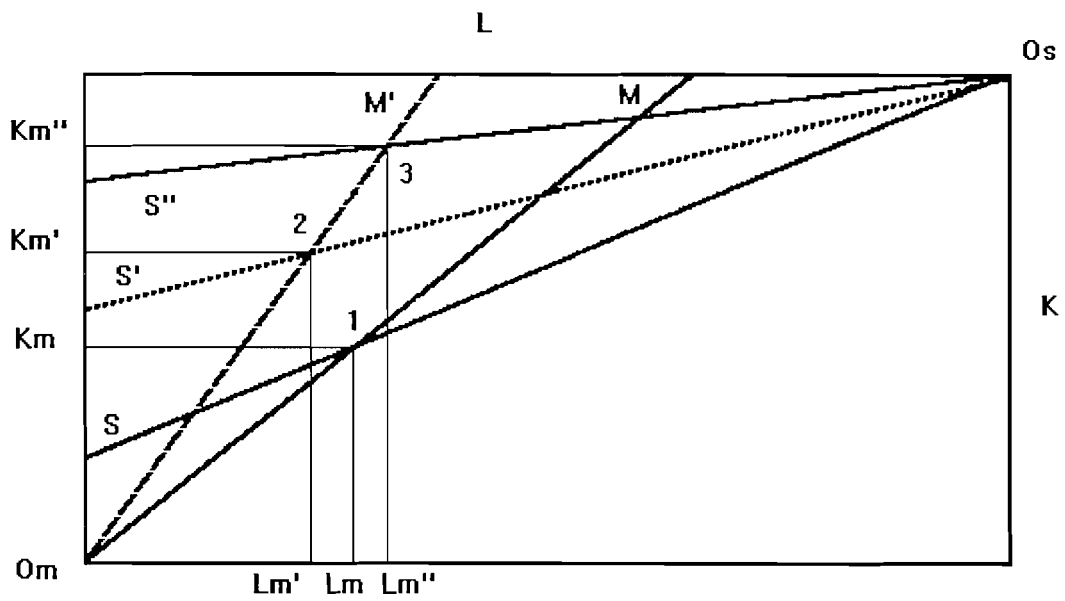


Figure A2.6: No Factor Substitution in Manufacturing



Case 3: Factor Substitution in Services

In this third and final case we show that, even if there is no factor substitution in manufacturing, labour-saving technological change can still lead to an increase in the employment of labour in that sector, provided the elasticity of factor substitution in services is sufficiently large.

This case is illustrated in Figures A2.5 and A2.6. In Figure A2.5 we can see that the technological change in manufacturing leads, unambiguously, to an increase in capital intensity in manufacturing, and a decrease in capital intensity in services, as the fall in the wage-rental ratio induces a substitution of labour for capital in that sector.

However, as we show in Figure A2.6, the effect on the amount of labour and capital employed in each sector is ambiguous. Because the technological innovation increases capital intensity in manufacturing, the ray O_mM rotates to the left, to O_mM' . In terms of what happens in the service sector, there are three sub-cases to consider. The first, which we do not illustrate, occurs when the elasticity of factor substitution in services is small. The qualitative result is the same as Case 1: less labour and capital is employed in manufacturing, and therefore more of each factor is employed in services.

If this elasticity is moderately large, the degree of capital-intensity in services falls somewhat, and the capital-intensity ray for the service sector rotates to O_sS' , with a new equilibrium being established at point 2. Employment of labour in manufacturing falls from O_mL_m to $O_mL'_m$, while employment of capital increases from O_mK_m to $O_mK'_m$. However, if this elasticity is very large, the capital intensity ray rotates to, say, O_sS'' , with equilibrium established at point 3. In this case, employment of labour in manufacturing increases to $O_mL''_m$, despite the labour-saving technological change and the absence of any substitution of labour for capital in that sector resulting from the fall in the wage-rental ratio.

Thus, we have shown that labour-saving technological progress does not *necessarily* lead to less labour being employed in the sector in which that technological progress has taken place. Whether it does so is an empirical question, which depends on the elasticity of factor substitution in each sector of the economy.

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