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Structural Change in China: Implications for Australia and the World

Structural Change in China: Implications for Australia and the World



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Introduction

John Simon

Between 2000 and 2015, China moved from being Australia's eighth largest trading partner to its largest. Iron ore exports rose from 33 million tonnes per year to 624 million tonnes. The fact that Australia weathered the global financial crisis without experiencing a prolonged slowdown is commonly attributed to our close economic relationship with China. Australia is not alone in this respect. Many small, open economies, particularly in Asia, have become increasingly integrated with the Chinese economy as it has grown rapidly over the past decades. China is now the largest trading partner for 45 economies around the world, including the majority of Asian economies.

Reflecting this importance, and to advance our knowledge of the large Asian economies in our region, the Reserve Bank established an Asian Economies Research Unit in 2009. Part of its brief was to conduct in-depth research on the Chinese economy. Of course, research from an office in Sydney can only get you so far in understanding a complex economy like China's. In recognition of that, the Bank also established an office in Beijing in 2011 to complement the work of our Sydney-based researchers and provide a flow of information from those 'on the ground'. Despite what we have learnt about China, there is still much that we do not know. The papers presented at our 2016 conference and collected in this volume represent an attempt to fill some of these gaps.

These papers set out the views of pre-eminent experts on the Chinese economy – their analysis of the past and their thoughts on the future. Notably, while there is much they disagree on, there was agreement that China is at a critical juncture. The Chinese economy, after growing strongly for many years, is now going through a period of transition. The growth and investment associated with China's rapid industrialisation is slowing. There are many important policy decisions to be made in the near future and the potential for economic disruption is rising. Will China be caught in the 'middle-income trap'? Or will it continue its development like Japan and South Korea have done before it? Will the economy successfully rebalance from its heavy emphasis on investment towards consumption-led growth? And what might the implications of success on this front look like for economies that have grown dependent upon supplying China with the raw materials for its investment spending?

The first set of papers in this volume focus on what has been happening in China over recent decades. They look at the process of reform and rebalancing that has occurred and provide some thoughts on likely future developments. Harry X Wu presents new estimates of productivity growth across industries in China and finds that such growth has been quite slow. Furthermore, he finds that productivity growth has been lower in industries most affected by government intervention. Thus, he concludes that 'disentangling government from business and allowing the market to correct the cost structure of industries is the key to solving China's structural problems'.

Nick Lardy takes a different approach to analysing growth in China through the reform era, which started approximately four decades ago, but, nonetheless, reaches similar conclusions. He

documents the significant contribution of private firms to growth in China over the past decades and notes two worrying recent trends. First, private investment has slowed significantly. While some of this is likely to have been due to slowing growth, he notes that the slow reduction in barriers to entry is also a significant factor. Second, he notes that there is a large productivity gap between the state and private sectors, which has increased since the returns on the assets of state companies began falling precipitously in 2008. He notes that this has been associated with a rapid increase in indebtedness for state-owned companies over the same time frame and that this should be a real source of concern.

Similarly, Barry Naughton starts by noting the significant challenge faced by China in grappling with the end of its rapid growth phase. He argues that there is little evidence of significant reform in recent years and that the opportunity to pre-emptively rebalance has largely been missed. Thus, the task faced by policymakers is much harder than it could have been. While he cautions against being too pessimistic, he makes it clear that the challenge is large.

Finally, among the first set of papers, Wing Thye Woo considers the possibility that China will succumb to the 'middle-income trap'. He identifies a number of different reasons why a country might fail to escape the 'trap' and discusses what he sees as the most significant risks for China. Along with Harry X Wu and Nick Lardy, Wing advocates for faster convergence to a modern market economy and an encouragement of private sector entrepreneurship. But he also points to a significant risk associated with rising inequality and a breakdown of social cohesion. It is a risk, he emphasises, that has already been implicitly acknowledged by the Chinese Government through its emphasis on promoting a harmonious society. He suggests that addressing this challenge will require an increasing use of free elections, monitoring by a free press and adjudication by an independent judiciary.

The second set of papers in this volume turn their attention outwards to the likely implications in other countries of rebalancing and reform in China. Roberts, Saunders, Spence and Cassidy focus on China's effect on commodity markets and the likely consequences for Australian trade. They start with a detailed discussion of a number of commodity markets and China's role in them. They then project possible changes in Chinese demand for commodities based on historical patterns seen in other similar countries. They conclude that the demand for iron ore is likely to fall in coming years while the demand for energy and food is likely to increase. The net effects on Australia and other trading partners of these changes are unclear but they suggest, contrary to more pessimistic views, that there is likely to be significant ongoing demand for Australia's exports from China.

Turning from commodity markets to financial markets, Alfred Schipke of the International Monetary Fund (IMF) presents some work on the possible effect of Chinese capital account liberalisation on global investment flows. He first notes that, compared to countries at similar levels of per capita income, China has a relatively closed capital account. Thus, he suggests, it seems reasonable to expect substantial changes in China's openness over coming years. He notes that the typical experience when a country liberalises their capital account is for there to be substantial net outflows. Given the size of China's economy and financial system, this could have significant implications for the rest of the world. To help manage this process, Alfred points to the recommendations the IMF has issued on capital account liberalisation, which, he notes, China has largely followed to date.

The final two papers both take a much broader look at the possible effects of Chinese reform and rebalancing on the global economy. They look at the linkages between domestic rebalancing and China's external position. Ma, Roberts and Kelly consider the likely effects of China's rebalancing for its trade patterns, while Golley, Tyers and Zhou use a dynamic numerical model of the global economy to consider the implications of changes in Chinese fertility and savings that might flow from recent policy reforms.

Ma, Roberts and Kelly find evidence that rebalancing from investment-led growth to more consumption-led growth is already occurring in China. Using input–output tables they show that this rebalancing could increase China's current account surplus under a number of scenarios. Using global input-output tables they suggest that, without a significant reorientation of international trade flows or prices, domestic rebalancing could generate substantial headwinds for exports to China by its major trading partners.

Golley, Tyers and Zhou consider the effect of changes in Chinese fertility and saving patterns for both Chinese and global growth. They find that success in raising fertility or lowering savings is a double-edged sword. While GDP might be higher with higher fertility, GDP per capita is lower. While a rebalancing of the economy towards consumption might seem like an opportunity for trading partners, and see a reduction in China's external imbalance, the long-run effect – when combined with the demographic changes – is to lower total consumption. They find that, while most regions of the world would be modestly worse off under these scenarios compared with a baseline, India stands to benefit.

Many of the themes raised in the individual papers were drawn together in a panel discussion at the end of the first day of the Conference. The panel addressed a number of the challenges facing China in the coming years from demographic transition, through the rebalancing from investment towards consumption to deregulation of the financial sector. While all panellists agreed that the challenges were significant, there was a diversity of opinion on the likelihood of the challenges being successfully surmounted. A summary of that discussion is included in this volume.

On balance, the papers presented at the Conference depict a sobering picture of the future. Many things might go wrong as China navigates the transition from rapid industrially led growth towards a more consumption-led economy. Even success on some policy fronts might have unanticipated consequences. But, as noted by one panellist, China has overcome many such challenges in the past so there is some basis for being optimistic about the future. This is an important perspective when considering the implications for trading partners like Australia. Not only has China navigated policy challenges associated with its rise, but so have its trading partners. And if we have managed these, we should have some confidence that we can navigate China's maturation as well. But doing so will not be effortless. In that respect, it is hoped that the papers in this volume provide some insights that can make that task a little more manageable.

China's Institutional Impediments to Productivity Growth

Harry X Wu*

1. Introduction

The objective of this paper is to use a productivity approach to understand the institutional problems that may obstruct China's future growth. There have been numerous examples to show that, despite a series of reforms over the past three decades, the government still heavily intervenes in the Chinese economy (Wu, HX 2008). Nonetheless, unlike in the planning period that relied on centralised, comprehensive and mandatory controls through state ownership, local governments have been playing an important role in the reform era under a 'regionally decentralized authoritarian' regime (Xu 2011). The driving force is competition among localities over growth. Since local GDP growth is used by upper authorities to assess political performance, local government officials are highly motivated to engage in a growth tournament with their peers in other localities (Li and Zhou 2005). Consequently, their restless search for new growth engines has resulted in increasing government interventions in resource allocation and business decisions (Wu and Shea 2008; Xu 2011; Huang 2012).

There have been several investment waves in which local governments played a very important role. In the 1990s, local governments competed to attract foreign direct investment (FDI). This resulted in huge surplus capacity of labour-intensive manufacturing industries, which was ultimately worked through following China's accession to the World Trade Organization (WTO) in 2001. Second, since the early 2000s, led by coastal provinces, new growth contests began with local urbanisation and industrialisation concentrating on heavy machinery and chemicals (Wu, J 2008). Finally, government dominance in resource allocation was further enhanced in the wake of the global financial crisis in 2008–09 with a CNY4 trillion stimulus package from the central government, accompanied by CNY18 trillion worth of projects funded by various local governments' financing platforms.

The central authorities were caught between two distinct policy choices, with one emphasising the speed of growth and the other underlining the quality of growth. Academics, think-tank economists and the mainstream media have been divided in the debate over the importance of the speed of growth and, hence, the role of government in promoting growth; although both

* This is a preliminary update of my earlier paper (Wu forthcoming). I am indebted to helpful discussions from James Laurenceson, Yong Wang, Xuehui Han, John Simon, Yiping Huang, Wing Thye Woo, Yanrui Wu, Rod Tyers, Peter Robertson and Ligang Song as well as participants at conferences and seminars at the RBA, Australian National University, University of Western Australia, Hong Kong University of Science and Technology, Asian Development Bank Institute, International Development Enterprises and Asia KLEMS. The results reported in this paper are interim results of the China Industrial Productivity (CIP) Database project supported by RIETI's East Asian Industrial Productivity Project and IER at Hitotsubashi University. The author is solely responsible for any errors.

sides criticise the repetitious industrial projects and widespread window-dressing constructions that result from local governments' heavy involvement in resource allocation. Since 2013, the new Xi-Li Administration has appeared willing to allow the market to play a fundamental role in resource allocation and transform the Chinese economy from an input-driven to a more productivity- and innovation-led growth model. This could occur via further structural reforms, albeit still emphasising 'the dominance of the public ownership' and 'the leadership of the state economy' (CPCCC 2013).

However, what has been missing in the debate is a proper analysis of the sources of growth and productivity trends. The government's heavy involvement has, so far, successfully solved China's growth problem, but it remains unclear to what extent and in which sectors this has taken its toll on the economy's efficiency and productivity. Ultimately, productivity improvements are the key to efficient and sustainable long-run growth in any economy.

To analyse China's productivity performance and the role of government, it is essential to have an industry perspective because government interventions are often made through industry-specific policies. In addition, interventions in upstream industries – those that deliver intermediate goods and services, such as energy and telecommunications – may affect downstream industries through the input-output linkages of the economy. This means that we need a methodological framework that accounts for both the contribution of individual industries to the aggregate productivity performance of the economy and the linkages between them.

The present study benefits from a newly constructed economy-wide industry-level dataset for the Chinese economy that follows the KLEMS principle in data construction.¹ Methodology-wise, this study adopts the Jorgensonian aggregate production possibility frontier (APPF) framework. As an extension, we incorporate the Domar aggregation scheme to account for contributions of individual industries to the growth of aggregate inputs and output (Jorgenson, Ho and Stiroh 2005b). This approach relaxes most of the restrictive assumptions of the widely used aggregate production function approach. That is, that all industries are homogenous with the same value-added function and facing the same input and output prices.

The rest of this paper is organised as follows. Section 2 discusses the role of government in the Chinese economy from an industry perspective. Section 3 introduces the APPF framework, incorporating Domar weights for aggregation. Section 4 briefly introduces the CIP database. This is followed by Section 5, which reports and interprets the empirical results. Finally, Section 6 concludes this study.

2. Sectoral Productivity Growth and the Role of Government

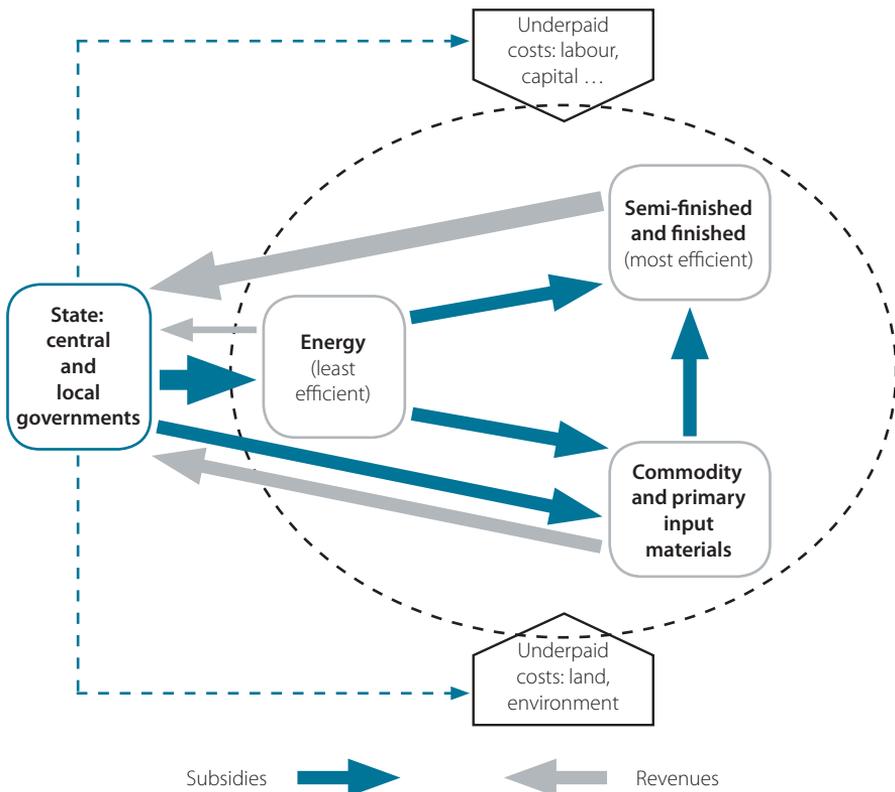
To explore the role of government we may consider distinguishing industries that are subject to different types of government intervention, directly and indirectly through their use of output from regulated industries.

¹ KLEMS is used as an acronym for **K**(C)apital, **L**abor, **E**nergy, **M**aterials and **S**ervices that are used to produce any product. By the same token, the gross output of an industry equals the total costs of 'KLEMS' and the gross output of an economy equals the sum of the costs of KLEMS of all industries. See O'Mahony and Timmer (2009) for an introduction to the EU KLEMS database. The ongoing CIP Database project is integrated with the World KLEMS initiative based at Harvard University.

During the reform era, government interventions have become less all-encompassing than they were in the central planning era, when markets were completely ignored. They have become more industry specific through subsidisation or administrative interference, or some combination of both. Subsidies can be made directly or indirectly. Indirect subsidies intend to reduce the producer cost of inputs including energy, land, environment, labour and capital (Huang and Tao 2010). By contrast, direct subsidies come with administrative interferences aiming to compensate for output losses. Administrative interferences serve the state interests or government strategic plans by controlling or influencing output prices and business operations ranging from managerial personnel to the choice of technology.

We argue that whether, or to what extent, the government uses administrative interference or different types of subsidisation depends on the distance of an industry from the final demand, especially the international market. Indirect subsidies have been mainly used by local governments to promote export-oriented manufacturers that make semi-finished and finished goods. Most of these downstream industries are labour intensive and therefore crucial for China to reap its demographic dividend in a timely manner. However, the government tends to directly get involved in upstream industries such as energy and primary input materials that are deemed strategically important in supporting downstream industries (Figure 1).

Figure 1: 'Cross Subsidisation' in Chinese Industry – An Exploratory Flow Chart



Notes: 'Revenues' are taxes paid by enterprises and 'Subsidies' are the use of revenues to support enterprises; the width of the arrows indicates conceptually the relative importance of industries in providing revenues and receiving subsidies

Considering the behaviour of enterprises in such a policy environment, we conjecture that industries that are mainly supported by indirect subsidies could be more efficient and productive than those receiving direct subsidies. In the former case, enterprises may still behave like true market competitors even though their competitiveness is arbitrarily enhanced.² Upstream industries are traditionally dominated by state-owned enterprises and do not conform to China's comparative advantage. Their assumed strategic importance gives them strong bargaining power in negotiating for government support. In return they have to accept controls from the authorities. This distorts their behaviour and reduces their incentives to innovate and find efficiency gains.

Figure 1 shows that the nature of the government interventions and subsidies is a kind of 'cross subsidisation'. The key to sustaining it is that downstream industries must be able to grow faster and relatively more efficiently than upstream industries and the public revenues generated from downstream industries must be able to cover direct subsidies. However, the cost of negative externalities, i.e. the cost that cannot be internalised due to subsidies, has to be borne by the public. Resource misallocation is an additional negative externality that results from government intervention.

To investigate the total factor productivity (TFP) performance of industries we categorise the 37 industries in the CIP database into 8 groups, guided by the degrees of government intervention, either directly or indirectly (see Table 1; details in Table A1).³ Within the industrial sector, the energy group is monopolised, if not completely owned, by large, central government-owned enterprises due to its strategic importance. It can easily access public resources, but is subject to strong administrative interference. The commodities and primary input materials (C&P) group is also considered important for downstream industries and hence heavily influenced, though not completely owned by the government. Finally, the semi-finished and finished goods (SF&F) group consists of all downstream industries, including not only private enterprises and foreign invested enterprises, but also state-owned enterprises (particularly in heavy machinery industries). However, its competitive nature makes it difficult for the government to directly interfere in business decisions. On average, SF&F is more labour intensive than the other groups, hence more in line with China's comparative advantage. Therefore, we may conjecture that the productivity growth of SF&F is faster than that of energy and C&P. The position of the agricultural and construction industries is less obvious. The agricultural sector not only serves final demand, but also provides intermediate inputs to food processing and manufacturing industries and, as such, can be an important channel for indirect policies. Construction also delivers both investment and consumer goods.

2 This is conditional on whether they can repeatedly negotiate for benefits regardless of their true performance. Here we assume that this is not the case.

3 Strictly speaking, as suggested by Marcel Timmer, the effect of government interventions or regulations on individual industries should be examined by some policy proxies and its impact should be investigated through input-output table analysis.

Table 1: Industry Groups

Sector	Group	Description
Agricultural	Agriculture	
Industrial	Energy	Coal mining, petroleum and utilities
	Commodities and primary input materials (C&P)	Metals, chemicals and building materials
	Semi-finished and finished goods (SF&F)	Wearing apparel, electrical equipment and machinery
Construction	Construction	
Services	Services I	State-monopolised services of important intermediate input industries, such as financial intermediaries, transportation, and telecommunication services
	Services II	Covers market services not included in Services I; these are mainly final demand providers
	Services III	Non-market services including government administration, education and healthcare

3. Accounting for Industry Origin of TFP

The widely used aggregate production function approach to TFP analysis is implicitly subject to very stringent assumptions. First, the value-added functions across industries can only vary by a scalar multiple. Second, there can only be one price for the different types of capital and labour within each industry (Jorgenson *et al* 2005b). Given heavy government interventions and institutional set-ups that cause market imperfections in China, this approach is inappropriate for the Chinese economy. This study adopts Jorgenson's APPF framework instead, incorporating Domar weights to account for contributions of individual industries to the growth of aggregate inputs and output.

The APPF approach in growth accounting relaxes the strong assumption that all industries are subject to the same value-added production function to account for the industry origin of aggregate growth (Jorgenson 1966). The Domar-weighted aggregation was introduced into the APPF framework in Jorgenson, Gollop and Fraumeni (1987) to exercise direct aggregation across industries to account for the role of American industries in the changes of aggregate inputs. It has been used in Jorgenson and Stiroh (2000) and Jorgenson, Ho and Stiroh (2005a, 2005b) to quantify the role of information technology (IT)-producing and IT-using industries in the US economy. This approach has now become the international standard and has also been applied to the Chinese economy in Cao *et al* (2009).

To illustrate this methodology, let us begin with a production function where industry gross output is a function of capital, labour, intermediate inputs and technology indexed by time. We use individual industries as building blocks which allow us to explicitly trace the sources of the aggregate productivity growth and input accumulation to the underlying industries. Focusing

on an industry-level production function given by Equation (1), each industry, indexed by j , purchases distinct intermediate inputs, capital and labour services to produce a set of products:

$$Y_j = f_j(K_j, L_j, M_j, T) \quad (1)$$

where Y is output, K is an index of capital service flows, L is an index of labour service flows, M is an index of intermediate inputs, purchased from domestic industries or imported, and T is the level of TFP. Note that all input variables are indexed by time but this is suppressed for notational convenience.

Under the assumptions of competitive factor markets, full input utilisation and constant returns to scale, the growth of output can be expressed as the cost-weighted growth of inputs and technological change, using the translog functional form:

$$\Delta \ln Y_j = \bar{\nu}_j^K \Delta \ln K_j + \bar{\nu}_j^L \Delta \ln L_j + \bar{\nu}_j^M \Delta \ln M_j + \nu_j^T \quad (2)$$

where $\bar{\nu}_j^K$, $\bar{\nu}_j^L$ and $\bar{\nu}_j^M$ are two-period averages of nominal weights of input $\nu_j^K = \frac{P_j^K K_j}{P_j^Y Y_j}$, $\nu_j^L = \frac{P_j^L L_j}{P_j^Y Y_j}$ and $\nu_j^M = \frac{P_j^M M_j}{P_j^Y Y_j}$, respectively. Note that under constant returns to scale $\nu_j^K + \nu_j^L + \nu_j^M = 1$, which

is controlled by industry production accounts in nominal terms. Each element in the right-hand side of Equation (2) indicates the proportion of output growth accounted for, respectively, by the growth of capital services ($\bar{\nu}_j^K \Delta \ln K_j$), labour services ($\bar{\nu}_j^L \Delta \ln L_j$), intermediate materials ($\bar{\nu}_j^M \Delta \ln M_j$) and TFP (ν_j^T).

One of the advantages of Equation (2) is that it can better account for the quality of inputs. For example, it can account for labour services provided by different types of labour with specific demographic, educational and industrial attributes, as shown in pioneering studies by Griliches (1960), Denison (1962) and Jorgenson and Griliches (1967). It has relaxed the usual strong assumption that treats numbers employed or hours worked as a homogenous measure of labour input. The growth of total labour input is thus defined as a Törnqvist quantity index of individual labour types as follows:

$$\Delta \ln L_j = \sum_h \bar{\nu}_{h,j} \Delta \ln H_{h,j} \quad (3a)$$

where $\Delta \ln H_{h,j}$ indicates the growth of hours worked by each labour type h (with specific gender, age and educational attainment) and its cost weights $\bar{\nu}_{h,j}$ given by two-period average shares of each type in the nominal value of labour compensation controlled by the labour income of industry production accounts.

The same user-cost approach is also applied to K and M to account for the contribution of different types of capital assets (Z_k) and intermediate inputs (M_m) in production with type-specific, two-period average cost weights defined as $\bar{\nu}_{k,j}$ and $\bar{\nu}_{m,j}$, respectively:

$$\Delta \ln K_j = \sum_k \bar{\nu}_{k,j} \Delta \ln Z_{k,j} \quad \text{and} \quad (3b)$$

$$\Delta \ln M_j = \sum_m \bar{\nu}_{m,j} \Delta \ln M_{m,j} \quad (3c)$$

It should be noted that the equations from (2) through the whole set of (3) also explicitly express the methodological framework for the CIP industry-level data construction that is linked to, and

controlled by, the national production and income accounts. This point will be discussed again when we discuss the data issues in the following section.

Using the value added concept, Equation (2) can be rewritten as:

$$\Delta \ln Y_j = \bar{\nu}_j^V \Delta \ln V_j + \bar{\nu}_j^M \Delta \ln M_j \quad (4)$$

where V_j is the real value added in j and ν_j^V is the nominal share of value added in industry gross output.

By rearranging Equations (2) and (4), we can obtain an expression for the sources of industry value-added growth (i.e. measured in terms of input contributions):

$$\Delta \ln V_j = \frac{\bar{\nu}_j^K}{\bar{\nu}_j^V} \Delta \ln K_j + \frac{\bar{\nu}_j^L}{\bar{\nu}_j^V} \Delta \ln L_j + \frac{1}{\bar{\nu}_j^V} \nu_j^T \quad (5)$$

Growth of aggregate value added by the APPF approach is expressed as weighted industry value added in a Törnqvist index:

$$\Delta \ln V = \sum_j \bar{w}_j \Delta \ln V_j \quad (6)$$

where w_j is the share of industry value added in aggregate value added. By combining Equations (5) and (6), we can have a new expression of aggregate value-added growth by weighted contribution of industry capital growth, industry labour growth and TFP growth:

$$\Delta \ln V \equiv \sum_j \bar{w}_j \Delta \ln V_j = \sum_j \left(\bar{w}_j \frac{\bar{\nu}_j^K}{\bar{\nu}_j^V} \Delta \ln K_j + \bar{w}_j \frac{\bar{\nu}_j^L}{\bar{\nu}_j^V} \Delta \ln L_j + \bar{w}_j \frac{1}{\bar{\nu}_j^V} \nu_j^T \right) \quad (7)$$

Through this new expression, we have introduced the well-known Domar weights in our aggregation (Domar 1961), that is, a ratio of each industry's share in total value added (w_j) to the proportion of the industry's value added in its gross output (ν_j^V).

If we maintain the stringent assumption that capital and labour inputs have the same marginal productivity in all industries we can define aggregate TFP growth as:

$$\nu^T \equiv \sum_j \bar{w}_j \Delta \ln V_j - \bar{\nu}^K \Delta \ln K - \bar{\nu}^L \Delta \ln L \quad (8)$$

However, this assumption is unlikely to hold, especially in China, as argued above. It is therefore interesting to look at the difference of the two measurement approaches. By subtracting Equation (7) from Equation (8) and rearranging, we can show how the aggregate TFP growth relates to the sources of TFP growth at the industry level and to the effect of factor mobility across industries (Jorgenson *et al* 2005b):

$$\nu^T = \left(\sum_j \frac{\bar{w}_j}{\bar{\nu}_j^V} \nu_j^T \right) + \left(\sum_j \bar{w}_j \frac{\bar{\nu}_j^K}{\bar{\nu}_j^V} \Delta \ln K_j - \bar{\nu}_K \Delta \ln K \right) + \left(\sum_j \bar{w}_j \frac{\bar{\nu}_j^L}{\bar{\nu}_j^V} \Delta \ln L_j - \bar{\nu}_L \Delta \ln L \right) \quad (9)$$

in which the *reallocation* terms in the second and third brackets can be simplified as:

$$\nu^T = \sum_j \frac{\bar{w}_j}{\bar{\nu}_j^V} \nu_j^T + \rho^K + \rho^L \quad (9')$$

Equation (9) expresses the aggregate TFP growth in terms of three sources: Domar-weighted industry TFP growth, reallocation of capital and reallocation of labour across industries. This Domar weighting scheme (\bar{w}_j / \bar{v}_j^y), originated by Domar (1961), plays a key role in the direct aggregation across industries under the Jorgensonian growth accounting framework. A direct consequence of the Domar aggregation is that the weights do not sum to unity, implying that aggregate productivity growth amounts to more than the weighted average of industry-level productivity growth (or less, if negative). This reflects the fact that productivity change in the production of *intermediate inputs* do not only have an 'own' effect, but, in addition, they lead to reduced or increased prices in downstream industries, and that effect accumulates through vertical links. As elaborated by Hulten (1978), the Domar aggregation establishes a consistent link between industry-level productivity growth and the aggregate productivity growth. Productivity gains of the aggregate economy may exceed the average productivity gains across industries because flows of intermediate inputs between industries contribute to aggregate productivity by allowing productivity gains in successive industries to augment one another. The same logic can explain productivity losses.

The next two terms reflect the effect on aggregate TFP growth of the reallocation effect of capital (ρ^k) and labour (ρ^l) across industries, respectively. Each of the reallocation terms is obtained by subtracting cost-weighted aggregate factor (capital or labour) input growth from the Domar-weighted input growth across industries. It should be noted that both theoretically and methodologically, when these terms are not negligible, it indicates that industries do not face the same factor costs, which suggests a violation of the assumption of the widely used aggregate approach. One should not expect a significant reallocation effect in an economy where there is a well-developed market system. However, this is a very useful analytical tool for the Chinese case where strong government interventions in resource allocation may have caused severe market distortions.

4. Data and Periodisation

4.1 Data

This study has uniquely benefited from a newly constructed economy-wide, industry-level dataset in the ongoing CIP project. It is beyond the scope of this study to go through a long history of separate database studies.⁴ We refer the interested reader to three working papers (Wu 2015; Wu and Ito 2015; Wu, Yue and Zhang 2015), as well as earlier versions of this work if one wants to trace the development of the data construction ideas (e.g. Wu and Xu 2002; Wu and Yue 2003, 2010, 2012; Wu, HX 2008).

In the CIP project, the principles of industry data construction adhere to the underlying theory and data constraints as expressed in Equation (2) and the set of Equations (3a), (3b) and (3c). This implies that the industry-level data are linked to, and made consistent with, the national production and income accounts of China.

4 The CIP project is based on my China growth and productivity database project, self-initiated in 1995 and heavily involved in Angus Maddison's work on China's aggregate economic performance from 1912 and manufacturing, mining and utility industries from 1949 (see Maddison (1998, 2007); Maddison and Wu (2008)). The CIP project began in 2010, aiming to extend my earlier work to all non-industrial sectors under the KLEMS framework.

Some features of the CIP data should be noted. The classification of industries, in principle, adopts the 2002 version of the Chinese Standard Industrial Classification (CSIC/2002) and reclassifies the economy into 37 industries (see Table A1). The reconstruction of the Chinese national accounts is based on different versions of official national accounts compiled under the Material Product System (MPS) prior to 1992 and the United Nations System of National Accounts (SNA) afterwards. China's SNA input-output accounts, that are available every five years since 1987, and a MPS input-output table for 1981, that is converted to a SNA-type table, are used to construct a time series of Chinese input-output accounts for the period 1981–2010 (Wu and Ito 2015). It should be noted that in constructing industry accounts we are not able to challenge the official national accounts data except for consistency adjustment (concept, coverage and classification). Nonetheless, the widely discussed data problems observed at a macro or aggregate level should be borne in mind when interpreting our industry-weighted results for the aggregations.⁵

The nominal accounts are deflated by industry-level producer price indices (PPI), constructed using official PPIs for the agricultural and industrial sectors, and the consumer price index or its components for service industries (Wu and Ito 2015). However, the work reported in this paper uses the single deflation approach, assuming changes in input prices are the same as changes in output prices, similar to the Chinese national accounts. A double-deflation approach would have been preferred, but cannot be used due to a lack of price data.⁶

For the required labour data, following earlier studies by Wu and Yue (2003, 2010, 2012) which analysed the industrial sector only, CIP has established economy-wide employment series (in both numbers of workers employed and hours worked) and compensation matrices for 37 industries. Workers include both employees and self-employed workers (farming households and self-employed retailers and transporters), cross-classified by gender, seven age groups and five educational levels (see details in Wu *et al* (2015)).

The construction of net capital stock at the industry level proved most challenging. CIP has reconstructed annual flows of investment for the industrial sector groups using official gross capital stock data at historical costs. However, CIP uses the official investment series estimates for the non-industrial sectors. The results are yet to be reconciled with the national accounts gross fixed capital formation data. Industry-specific investment deflators are constructed using the PPIs of investment goods industries and the nominal wage index of construction workers (Wu, HX 2008, 2015). The industry-specific depreciation rates are estimated based on asset service lives and declining balance values used in the US national accounts, following the approach developed by Hulten and Wykoff (1981).

5 China's official estimates of GDP growth have long been challenged for upward bias (see Wu (2013, 2014) for reviews). Alternative estimates have indeed shown slower growth rates than the official estimates, which inevitably also have level effects. The most affected sectors identified are manufacturing and so-called 'non-material services' (including non-market services). Wu (2013) shows that the official industrial output index has substantially moderated the impact of all external shocks. Wu (2014) also shows that the 5–6 per cent annual growth of labour productivity in non-material services based on official data appears to be too fast to be true if considering the international norm in history of between –1 and +1 per cent per annum (Griliches 1992; van Ark 1996).

6 See Wu and Ito (2015) for very preliminary growth estimates at industry level using the double-deflation approach, although our work on prices is ongoing.

4.2 Periodisation

To better examine the effect on productivity of major policy regime shifts, we divide the entire period covered by the current version of the CIP data, 1980–2012, into four sub-periods, namely: 1980–91, 1992–2001, 2002–07 and 2008–12. In most cases, the empirical findings are reported in line with this periodisation. The first sub-period (1980–91) is characterised by de-collectivisation in agriculture and reform in the industrial sector to introduce market pricing.

The second sub-period (1992–2001) began with Deng’s call for bolder and deeper reforms in 1992 and the official adoption of the so-called ‘socialist market economy’ in 1993. Wider opening up to Western technology and FDI drove a new wave of investment in export-oriented manufacturing. Meanwhile, due to deregulation of private activities, new private firms absorbed a huge number of the state industrial employees who lost their jobs in the state-owned enterprise reforms of the 1990s. However, it also resulted in serious overinvestment. The Asian financial crisis (1997–98) hit the Chinese economy hard, and from 1998 China entered a four-year-long deflation period.⁷

The third sub-period (2002–07) begins shortly after China’s WTO entry at the end of 2001. It is characterised by counteracting forces. On one hand, WTO entry induced a further opening up to foreign trade and direct investment. This pushed the Chinese economy further towards the market system. On the other hand, consolidated and enlarged state corporations resurged in the name of protecting national interests in a time of accelerating globalisation. Meanwhile, growth-motivated local governments were pressured to race for rapid urbanisation and heavy industrialisation.

We treat the period 2008–12 as the last sub-period to examine the aftermath of the global financial crisis. The unprecedented fiscal stimulus package from both the central and local governments substantially enhanced the role of state-owned enterprises (SOEs).

5. Empirical Results

5.1 Sources of gross output growth by industry group

We start with an examination of industry-level sources of gross output growth based on the production function expressed in Equation (2) (Table 2; Figure 2). This is a necessary starting point because industries are *building blocks* of the national economy and the originators of the aggregate productivity growth.

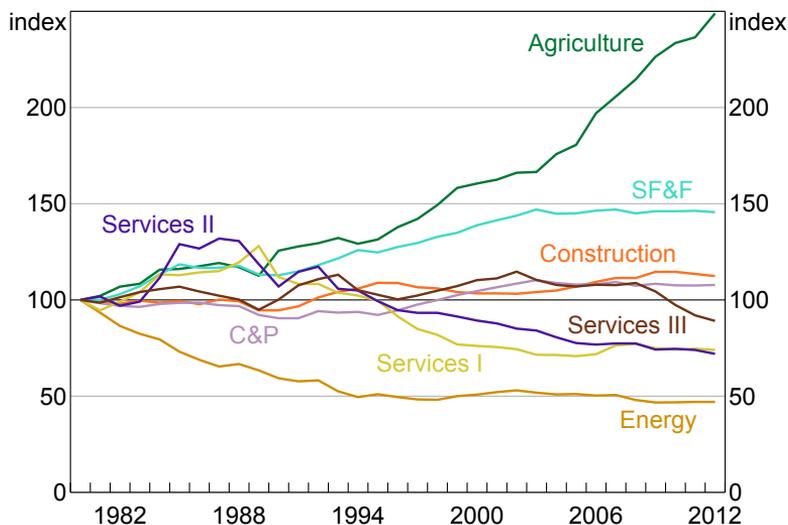
⁷ China’s retail price index (RPI) declined from 380.8 in 1997 (1978 = 100) to 346.7 in 2003, and meanwhile the PPI declined from 315.0 to 299.3 (NBS 2014, p 123).

Table 2: Decomposition of Gross Output Growth by Industry Group
Gross output-weighted annual growth rate, per cent

	Gross output	L	K	M	TFP
1980–91					
Agriculture	6.7	0.8	1.0	2.8	2.2
Energy	0.9	0.5	3.5	1.9	-5.0
C&P	7.9	0.4	2.4	5.9	-0.9
SF&F	13.5	0.2	2.1	9.9	1.3
Construction	7.4	2.0	0.6	5.1	-0.3
Services I	10.9	0.9	6.0	3.3	0.7
Services II	10.6	1.5	2.7	5.2	1.2
Services III	5.5	1.8	1.2	1.9	0.7
1992–2001					
Agriculture	7.3	0.6	0.7	3.5	2.4
Energy	7.0	-0.1	3.4	4.7	-1.0
C&P	11.0	-0.1	1.5	8.0	1.6
SF&F	14.2	0.1	1.6	10.4	2.1
Construction	12.5	1.1	1.4	9.3	0.7
Services I	7.1	0.6	6.3	3.9	-3.6
Services II	9.4	1.5	6.1	4.4	-2.7
Services III	9.1	2.4	1.0	5.4	0.3
2002–07					
Agriculture	3.7	-2.4	0.8	1.4	3.9
Energy	15.0	0.7	3.2	11.7	-0.5
C&P	15.2	0.4	2.1	12.3	0.4
SF&F	17.9	0.7	2.2	14.4	0.6
Construction	13.7	0.3	1.4	10.7	1.2
Services I	12.1	1.1	4.9	5.9	0.2
Services II	10.5	1.3	6.9	4.3	-2.1
Services III	11.4	4.5	2.6	4.8	-0.5
2008–12					
Agriculture	4.4	-1.9	0.5	1.9	3.8
Energy	4.2	0.3	2.4	2.9	-1.5
C&P	13.0	0.1	2.3	10.9	-0.3
SF&F	13.9	0.2	2.2	11.7	-0.2
Construction	8.2	1.1	1.8	5.1	0.2
Services I	14.0	1.4	4.6	8.6	-0.6
Services II	9.8	0.7	7.6	2.8	-1.4
Services III	3.7	7.8	1.8	-2.1	-3.8

Source: Based on Equation (2) using CIP 2.2 data

Figure 2: Total Factor Productivity by Industry Group
1980 = 100



Source: Based on Equation (2) using CIP 2.2 data

China's agricultural sector achieved the best TFP performance of all groups. It maintained strong positive productivity growth throughout the three decades and has had the fastest TFP growth since the 2000s. This was accompanied by a rapid decline in labour input in the more recent periods. In assessing agricultural performance, three factors should be considered. First, although agriculture still received various subsidies in the 2000s, unlike in the planning era, the sector was no longer subject to administrative controls. Second, we adopt the official broad measure of labour compensation that defines the income of the self-employed (including all farmers) as labour income rather than capital income, as suggested by SNA. Third, we are not yet able to measure the contribution by land.⁸

The SF&F and C&P groups are well known as China's growth engines and the backbone of the world's factory. Compared to C&P, as discussed earlier, SF&F received much less direct government interference due to its competitive nature and greater exposure to the international market. As expected, we find that SF&F in general experienced faster productivity growth than C&P. Before the global financial crisis, despite significant increases in input materials, both groups showed positive TFP growth, except for C&P in the 1980s. In the wake of the crisis, both suffered from TFP decline.

The performance of the energy group presents a sharp contrast to the SF&F group. It experienced heavy TFP loss in the 1980s and has not been able to get back to its 1980 level of TFP. This may not be a big surprise because this group consists of industries almost completely monopolised by SOEs and subject to heavy government interventions.⁹

⁸ We are not yet able to include rent-weighted land growth as an input, which would be negative as more and more land is taken out of agricultural production. This may exaggerate the weight on labour, but it is difficult to say the likely direction of the bias in the estimated TFP.

⁹ Here I would like to acknowledge Mun S Ho's important comment that the negative TFP may also indicate some data problem caused by conceptual issues, such as how to properly measure the depreciation of pipelines and exploration costs, which may result in poor capital measurement.

Since the 1990s, China's construction industry has maintained positive, though slow, TFP growth, which is not often observed in other economies. Most market services (I and II) show exceptional acceleration of TFP growth in the 1980s following deregulation after a long period of suppressed service development under central planning. However, it has to be acknowledged that these estimates are only preliminary; overestimation of output and underestimation of output prices due to the political incentives of local governments have led to major measurement problems and complicate productivity measurement in services. Compared to Services II (market), there are more state subsidies and administrative controls in Services I (market monopolies) and III (non-market and 'non-material'; see Wu (2014)). These factors could be translated into different TFP growth rates, but are not easily disentangled. TFP in Services I and II has been declining since the late 1980s, whereas Services III have experienced nearly zero TFP growth on average.

5.2 Sources of value-added growth in the APPF framework

From the above analysis, we have seen that the growth of factors and productivity vary between industries over time. In this sub-section we examine China's aggregate TFP performance in the APPF framework, taking into account that industries (groups) may have different value-added functions (Table 3).

Table 3: Aggregate Value-added Growth and Sources of Growth
Contributions are share-weighted growth rate, per cent per annum

	1980–91	1992–2001	2002–07	2008–12	1980–2012
Industry contributions					
Value-added growth due to:	7.61	9.04	11.00	9.23	8.94
Agriculture	1.75	1.18	0.50	0.65	1.17
Energy	-0.06	0.33	0.74	0.30	0.27
C&P	0.90	1.49	1.57	1.31	1.28
SF&F	1.87	2.65	2.72	2.01	2.29
Construction	0.38	0.64	0.68	0.73	0.58
Services I	0.92	0.64	1.47	1.20	0.98
Services II	1.45	1.74	2.39	2.35	1.86
Services III	0.39	0.37	0.94	0.67	0.53
Factor contributions					
Value-added growth due to:	7.61	9.04	11.00	9.23	8.94
Capital input	5.00	6.15	8.63	9.30	6.71
Stock	5.00	6.22	8.71	9.30	6.75
Capital quality (composition)	-0.01	-0.07	-0.08	0.00	-0.04
Labour input	1.39	1.26	1.19	1.98	1.40
Hours	1.34	0.88	0.71	0.34	0.92
Labour quality (composition)	0.05	0.38	0.48	1.65	0.48
Aggregate TFP	1.22	1.63	1.19	-2.06	0.83

These estimates suggest the Chinese economy achieved average real output growth of 8.94 per cent per annum in 1980–2012. The SF&F group was the top growth contributor before the global financial crisis. In the wake of the crisis, productivity growth in Services II was marginally higher than in SF&F. On average over 1980–2012, SF&F contributed around one quarter of the real output growth, Services II contributed 20 per cent, and agriculture, C&P and Services I together contributed nearly 40 per cent.

The estimated aggregate TFP growth is 0.83 per cent per annum on average. However, TFP performance was highly unstable over time with the highest growth achieved in 1992–2001 (1.63) and the worst in 2008–12 (–2.06).¹⁰

Of the 8.94 per cent annual output growth rate over the period examined, 75 per cent relied on capital input, 16 per cent on labour input and 9 per cent on TFP growth. The contribution of capital input increased from 66 per cent in the 1980s to 78 per cent post-WTO accession and around 100 per cent in the wake of the global financial crisis. On the other hand, the contribution of labour input declined from 18 per cent in the 1980s to 11 per cent post-WTO accession. This trend reversed following the crisis and the contribution of labour input rose back to 21 per cent, which was largely due to quality improvement rather than hours worked. The contribution of the quality of capital was insignificant on average.¹¹

When annual aggregate TFP growth rates are translated into a level index, we observe a volatile TFP performance around its underlying trend (Figure 3). The first TFP drive was clearly observed in the early 1980s, which was associated with China's agricultural reform. As a result, the Chinese productivity performance stayed well above the trend until its collapse following the 1989 political crisis. TFP growth recovered in the early 1990s, but this was only short lived. It began to accelerate again from the late 1990s and exceeded the trend in the early 2000s. In the post-WTO accession period, the resurgence of a fast TFP growth was only observed in 2006–07 before its sharp drop in the wake of the global financial crisis. The most recent significant slowdown in the official GDP growth rate from above 10 per cent in 2010 to below 7 per cent per year in 2015 seems to suggest that China is facing serious challenges in generating positive productivity growth.

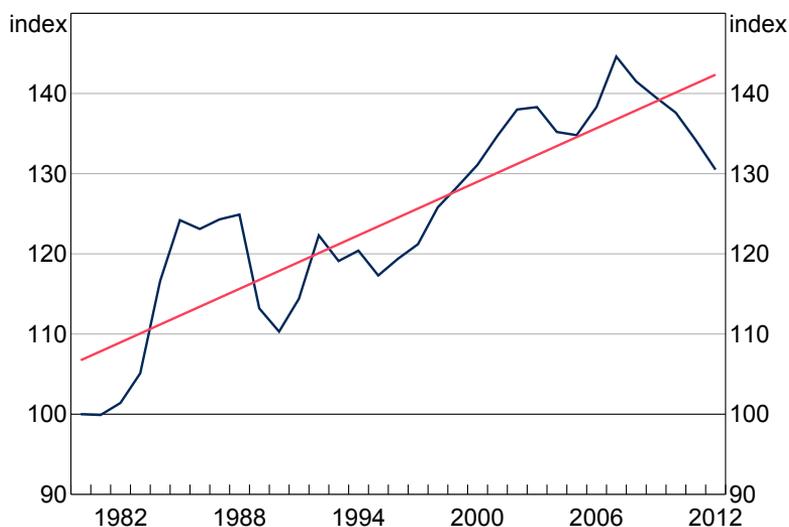
China's aggregate value added can be decomposed into hours worked and value added per hour worked, with the latter reflecting productivity improvements from capital deepening, labour quality and TFP (Table 4). The economy has benefited significantly from the increase in hours worked, which has been referred to as China's 'demographic dividend'. However, the boost from this has declined over time from 2.83 per cent per annum in 1980–91 to 0.73 per cent per annum in 2008–12. Although value added per hour worked has increased, this appears to have been increasingly dependent on capital deepening. More importantly, the growth of labour productivity was not necessarily in line with the pace of capital deepening when comparing the results for 2008–12 with those for 2002–07. This suggests serious disequilibrium and misallocation of resources that was likely caused by increasing overinvestment.

¹⁰ Table A2 reports the details for individual industries.

¹¹ This might be due to the limited set of asset types ('structures' and 'equipment') that is available in the current CIP database. If a distinction between information and communications technology (ICT) and non-ICT assets could be made, a higher measured contribution is to be expected.

Figure 3: Aggregate Total Factor Productivity

1980 = 100

**Table 4: Decomposition of Aggregate Labour Productivity Growth**

Contributions are share-weighted growth rate, per cent per annum

	1980–91	1992–2001	2002–07	2008–12	1980–2012
Growth rates					
Value-added growth	7.61	9.04	11.00	9.23	8.94
Value added per hour worked	4.78	7.29	9.44	8.50	7.02
Hours	2.83	1.75	1.57	0.73	1.93
Factor contributions					
Value added per hour worked	4.78	7.29	9.44	8.50	7.02
Capital deepening	3.51	5.28	7.77	8.91	5.71
Labour quality (composition)	0.05	0.38	0.48	1.65	0.48
Aggregate TFP	1.22	1.63	1.19	-2.06	0.83

5.3 The industry origin of aggregate TFP growth

In order to explicitly account for differences across industries and their effect on China's aggregate TFP performance, we now introduce Domar weights in the exercise, following the studies on the US economy by Jorgenson *et al* (2005a, 2005b). The results presented in the first line of Table 5 are estimated with the stringent assumption that marginal productivities of capital and labour are the same across all industries, which are the same as those presented in Tables 3 and 4. As expressed in Equation (9), using Domar weights, the aggregate TFP growth rate can be

decomposed into three additive components: 1) the change of Domar-weighted aggregate TFP; 2) the change of capital reallocation; and 3) the change of labour reallocation. On average over the entire period 1980–2012, China's TFP growth estimated with the Domar weights is 0.52 per cent per annum, much slower than the aggregate TFP growth of 0.83 percentage points, implying a net factor reallocation effect of 0.31, which will be discussed later. The highest contributor to the Domar-weighted aggregate TFP growth was agriculture, which contributed 0.83 percentage points. The SF&F group also did rather well over time (0.57), as did construction (0.08). The worst performer was the energy group (–0.47), followed by Services II (–0.33) and Services III (–0.18). Such a sharp contrast across industry groups in TFP performance can also be observed over different sub-periods, which clearly suggests that treating individual industries as homogenous in the growth accounting can substantially distort our view of the productivity performance of the Chinese economy.

Table 5: Domar-weighted TFP Growth and Reallocation Effects in the Economy

Growth in per cent per annum and contribution in percentage points

	1980–91	1992–2001	2002–07	2008–12	1980–2012
Aggregate TFP growth	1.22	1.63	1.19	–2.06	0.83
Domar-weighted TFP growth	0.60	1.72	0.54	–2.10	0.52
Agriculture	0.99	0.75	0.82	0.68	0.83
Energy	–0.76	–0.24	–0.32	–0.49	–0.47
C&P	–0.50	0.77	0.20	–0.27	0.07
SF&F	0.30	1.35	0.50	–0.35	0.57
Construction	–0.05	0.12	0.29	0.04	0.08
Services I	0.25	–0.59	0.28	–0.02	–0.05
Services II	0.31	–0.42	–0.79	–0.97	–0.33
Services III	0.06	–0.03	–0.43	–0.71	–0.18
Reallocation of K (ρ^K)	0.28	–0.09	–1.03	–0.01	–0.12
Reallocation of L (ρ^L)	0.35	0.01	1.68	0.06	0.44

Source: Based on Equation (9) using CIP 2.2 data

A closer examination through sub-periods with the background of the policy regime shifts that took place may shed important light on the role of the government. The agricultural sector benefited most from reforms in the 1980s, especially the decollectivisation of farming and deregulation of rural township–village enterprises. Even in the latest period that was affected by the global financial crisis, agriculture was the most important contributor to the Domar-weighted TFP growth, which might come as a big surprise. While its share in nominal GDP was declining over time, its contribution to the Domar-weighted TFP growth remained high throughout the period. This is suggestive of a process in which the agricultural sector is still releasing capital (including land) and labour that have a marginal productivity below the sector's average. By

shedding these surplus factors, the average productivity of the remaining factors is growing. But clearly this cannot be a long-run source of growth as this structural shift is temporary. Future growth must come from the manufacturing and services sectors.¹²

The most rapid TFP growth occurred in the period 1992–2001, at 1.72 per cent per annum using the Domar weights, despite the effect of the Asian financial crisis (1997–98) and the subsequent deflation in 1998–2003. The SF&F group was the most important contributor, followed by the C&P group, thanks to unprecedented state sector reforms and opening up to foreign trade and direct investment, which allowed the market to play an increasing role in resource allocation. The productivity performance of the construction industry also turned positive and the productivity decline of the energy group slowed.

Nevertheless, we find that China's accession to the WTO at the end of 2001 was accompanied by a slowdown, rather than an acceleration of TFP growth. This puzzling result may be partly reflecting the increased interventions by local governments throughout the 2000s, which aimed at promoting local urbanisation and heavy industrialisation (Wu, HX 2008). While the contribution of SF&F and C&P to TFP growth declined considerably between 2001 and 2007, the contribution of construction and state-monopolised Services I (transportation, telecommunication and financial services), increased significantly.

In the wake of the global financial crisis, and a large amount of stimulus from the central and local governments, China's Domar-weighted TFP growth turned to negative, declining by –2.10 per cent per annum. Since most of the projects concentrated on infrastructure development, construction continued to benefit though with nearly zero TFP growth. For the same reason, TFP in Services I did not decline as rapidly as in other sectors. Since 2012, the effect of the unprecedented government injection has likely abated, although there are increasing signs indicating that China's surplus capacity in manufacturing is worsening and may take many years to solve.

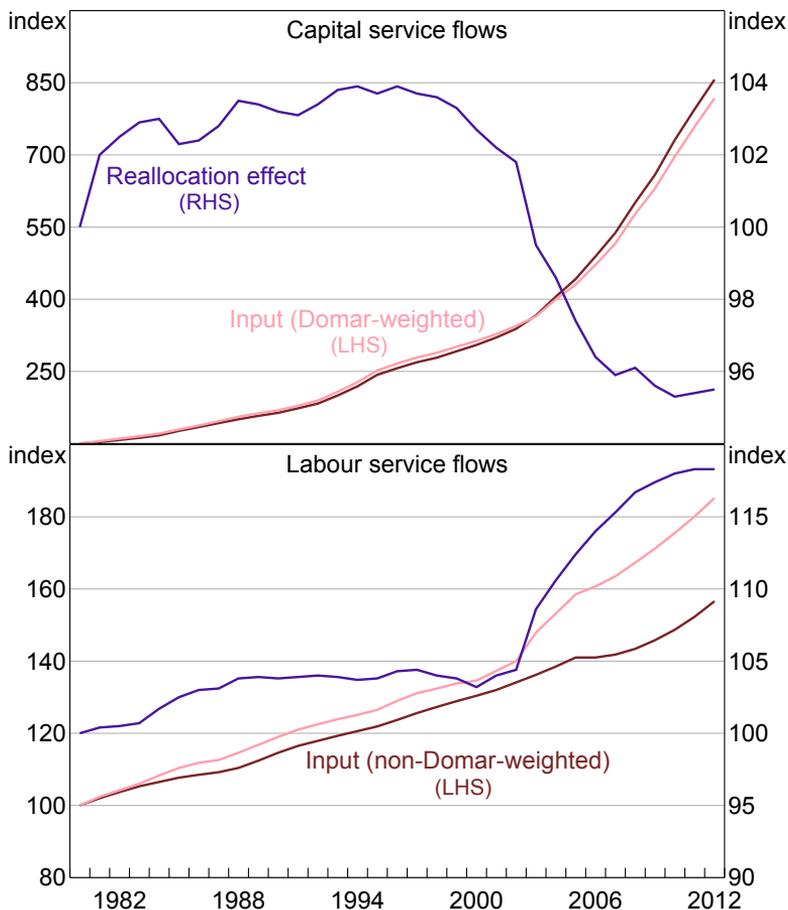
5.4 The effect of factor reallocation

The slower Domar-weighted TFP growth (0.52) compared to the aggregate TFP growth (0.83) implies that around 60 per cent of the aggregate TFP growth is attributable to the productivity performances within individual industries and around 40 per cent is due to the reallocation of capital and labour. This reflects a positive labour reallocation effect (ρ^L) of 0.44 percentage points, which more than offsets a negative capital reallocation effect (ρ^K) of –0.12 percentage points (Table 5; Figure 4).

12 I am indebted to Marcel Timmer for the discussion of the role of Chinese agriculture in the productivity performance of the aggregate economy.

Figure 4: Factor Input Indices and Reallocation Effects

1980 = 100



It should be noted that such a magnitude of reallocation effect is typically not observed in market economies. For example, based on their empirical work on the US economy from 1977–2000, Jorgenson *et al* (2005b) showed that the reallocation effect was generally negligible. For the sub-periods where the reallocation effect was non-negligible, the capital and labour reallocation effects generally moved in the opposite direction to each other. Jorgenson *et al* (1987) also reported that the reallocation of capital was typically positive and the reallocation of labour was typically negative for the US economy for the period 1948–79. This is because capital grew more rapidly in industries with high capital service prices, hence high returns on capital, whereas labour grew relatively slowly in industries with high marginal compensation.

In the case of China, the much larger magnitude and unexpected sign of capital and labour reallocation effects have two important implications. First, individual industries indeed face significantly different marginal factor productivities, suggesting that there are barriers to factor mobility which cause misallocation of resources in the economy. The flip side of this finding is that corrections to the distortions can potentially be productivity enhancing, which might be good news in terms of the much-talked-about and long-awaited structural reforms.

We find that the effect of labour reallocation remained generally positive over time. This may suggest that reforms improved the efficiency of the labour market. But this is not the case for the capital market. Notably, the most significant gain from labour reallocation was experienced during the post-WTO accession period, which may have been driven by the rapid expansion of export-oriented, labour-intensive industries that was in line with China's comparative advantage.

The case of capital reallocation is different. The early reform period was the only period that saw a positive effect of capital reallocation, possibly due to partial removal of the distortions inherited from the central planning period. However, the effect turned negative following China's WTO entry, likely because of the enhanced role of the government that supported the state sector resurging in upstream industries.

Nevertheless, the results for the post-crisis period (2008–12) deserve greater attention. During this period, the reallocation effect in both capital and labour became close to zero, a distinct contrast to the earlier periods. This rather unusual observation likely reflects the government's efforts to keep the economy insulated from the external shock. If this finding is true, the unprecedented government stimulus package did not change the structure of the economy in terms of resource allocation.

6. Concluding Remarks

Using the newly constructed CIP database this study examines the industry sources of growth in the Chinese economy for the reform period 1980–2012, based on the aggregate production possibility frontier approach in the Jorgensonian growth accounting framework. As an extension, we used the Domar aggregation approach to separately identify the within-industry productivity changes and the productivity changes due to labour and capital reallocation.

Our preliminary results show that China achieved a TFP growth of 0.83 per cent per annum for the entire period 1980–2012. This means that TFP growth accounted for about 9.3 per cent of the 8.94 per cent per annum growth of industry-weighted value added. This result is much smaller than all previous productivity studies on the Chinese economy based on the aggregate approach. For example, Bosworth and Collins (2008) and Perkins and Rawski (2008) estimated that TFP accounted for around 40 per cent of GDP growth. Compared to the only work in the literature that applied the same approach for the period 1982–2000, our finding is about one-third of their result (Cao *et al* 2009). The differences could come from data construction, measurement, classification or coverage (for example, we have 11 services sectors whereas Cao *et al* had 1 services sector).

At the industry group level, we do find that, in general, industries less prone to government intervention, such as agriculture and the SF&F manufactures, tended to have higher TFP growth rates than those industries subjected to direct government interventions, such as the energy group. The fact that the SF&F group maintained a positive TFP growth while the energy group experienced persistent TFP declines suggests the existence of cross-subsidisation between upstream and downstream industries, in which the government plays different roles to serve its strategy.

We also found strong effects of factor input reallocation across industries, which significantly address the key issue of resource misallocation in the ongoing policy debate. The large magnitude of the reallocation effect on the one hand reflects barriers to factor mobility in the economy and on the other hand also suggests potential gain from market-driven reallocation. Institutional deficiencies in the Chinese economy that allow governments at all levels to affect resource allocation at their discretion are responsible for resource misallocation. Therefore, disentangling government from business and allowing the market to correct the cost structure of industries is the key to solving China's structural problems. Indeed, restructuring for healthy and sustainable growth is the most crucial and challenging pillar of Liconomics. Nevertheless, there is no such thing as the 'right structure' without allowing more market-based resource allocation across industries.

Appendix A: Data

Table A1: CIP/China KLEMS Industrial Classification and Code

CIP code	EU-KLEMS code	Grouping	Industry	
1	AtB	Agriculture	Agriculture, forestry, animal husbandry and fishery	AGR
2	10	Energy	Coal mining	CLM
3	11	Energy	Oil and gas excavation	PTM
4	13	C&P	Metal mining	MEM
5	14	C&P	Non-metallic minerals mining	NMM
6	15	SF&F	Food and kindred products	F&B
7	16	SF&F	Tobacco products	TBC
8	17	C&P	Textile mill products	TEX
9	18	SF&F	Apparel and other textile products	WEA
10	19	SF&F	Leather and leather products	LEA
11	20	SF&F	Sawmill products, furniture and fixtures	W&F
12	21t22	C&P	Paper products, printing and publishing	P&P
13	23	Energy	Petroleum and coal products	PET
14	24	C&P	Chemicals and allied products	CHE
15	25	SF&F	Rubber and plastics products	R&P
16	26	C&P	Stone, clay and glass products	BUI
17	27t28	C&P	Primary and fabricated metal industries	MET
18	27t28	SF&F	Metal products (excluding rolling products)	MEP
19	29	SF&F	Industrial machinery and equipment	MCH
20	31	SF&F	Electric equipment	ELE
21	32	SF&F	Electronic and telecommunication equipment	ICT
22	30t33	SF&F	Instruments and office equipment	INS
23	34t35	SF&F	Motor vehicles and other transportation equipment	TRS
24	36t37	SF&F	Miscellaneous manufacturing industries	OTH
25	E	Energy	Power, steam, gas and tap water supply	UTL
26	F	Construction	Construction	CON
27	G	Services II	Wholesale and retail trade	SAL
28	H	Services II	Hotels and restaurants	HOT
29	I	Services I	Transport, storage and post services	T&S
30	71t74	Services I	Telecommunication and post	P&T
31	J	Services I	Financial intermediation	FIN
32	K	Services II	Real estate services	REA
33	71t74	Services II	Leasing, technical, science and business services	BUS
34	L	Services III	Public administration and defence	ADM
35	M	Services III	Education services	EDU
36	N	Services III	Health and social security services	HEA
37	O&P	Services II	Other services	SER

Notes: This is based on Wu's series of works to reclassify official statistics reported under different CSIC systems adopted in CSIC/1972, CSIC/1985 and CSIC/1994 (Wu and Yue 2012; Wu and Ito 2015); the current Chinese classification system CSIC/2011 largely conforms to the 2-digit level industries of the ISIC (rev 4) and can be reconciled with the EU-KLEMS system of classification (Timmer *et al* 2007)

Table A2: Industry Contributions to Value Added and Total Factor Productivity Growth
1980–2012

	Value added			Total factor productivity		
	Weight	Growth	Contribution to growth	Domar weight	Growth	Contribution to growth
AGR	0.197	5.32	1.17	0.310	2.85	0.83
CLM	0.016	7.55	0.12	0.032	1.02	0.02
PTM	0.018	-2.65	-0.04	0.026	-9.79	-0.25
MEM	0.005	10.99	0.06	0.014	1.19	0.01
NMM	0.006	9.38	0.05	0.013	2.07	0.03
F&B	0.027	10.84	0.29	0.126	0.22	0.02
TBC	0.012	7.97	0.09	0.018	-4.79	-0.11
TEX	0.026	7.38	0.19	0.110	-0.04	-0.03
WEA	0.009	12.60	0.11	0.035	0.67	0.03
LEA	0.004	11.40	0.05	0.020	0.43	0.01
W&F	0.007	12.61	0.09	0.026	1.12	0.03
P&P	0.011	10.09	0.12	0.039	0.46	0.02
PET	0.011	0.14	-0.01	0.043	-3.92	-0.14
CHE	0.036	10.58	0.38	0.134	0.42	0.05
R&P	0.012	12.10	0.14	0.048	0.61	0.03
BUI	0.025	9.50	0.23	0.077	0.43	0.04
MET	0.032	7.83	0.24	0.135	-0.47	-0.07
MEP	0.012	12.09	0.15	0.050	0.97	0.04
MCH	0.035	10.96	0.38	0.119	1.76	0.19
ELE	0.015	13.99	0.20	0.065	0.78	0.04
ICT	0.015	16.55	0.23	0.075	1.14	0.02
INS	0.003	17.91	0.05	0.009	3.60	0.03
TRS	0.018	16.27	0.29	0.074	2.12	0.12
OTH	0.015	15.10	0.22	0.043	2.52	0.11
UTL	0.027	6.99	0.20	0.104	-1.14	-0.10
CON	0.055	10.51	0.58	0.206	0.36	0.08
SAL	0.078	12.11	0.89	0.140	1.79	0.19
HOT	0.019	11.66	0.21	0.053	-0.05	0.00
T&S	0.052	8.05	0.42	0.102	-1.12	-0.11
P&T	0.013	14.93	0.18	0.023	1.80	0.05
FIN	0.041	11.04	0.38	0.061	1.92	0.02
REA	0.039	9.05	0.33	0.054	-8.10	-0.46
BUS	0.023	10.67	0.26	0.054	0.68	-0.02
ADM	0.032	10.78	0.36	0.060	-0.31	-0.04
EDU	0.025	4.05	0.11	0.042	-2.42	-0.09
HEA	0.012	5.92	0.06	0.031	-1.29	-0.05
SER	0.017	8.05	0.16	0.035	-2.29	-0.04
Sum	1.000		8.94	2.610		0.52

Notes: See Table A1 for industry abbreviations; growth rates are annualised raw growth rates in per cent; industry contribution to growth is weighted growth rate in percentage points; see Equation (9) for Domar aggregation

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Discussion

1. James Laurenceson

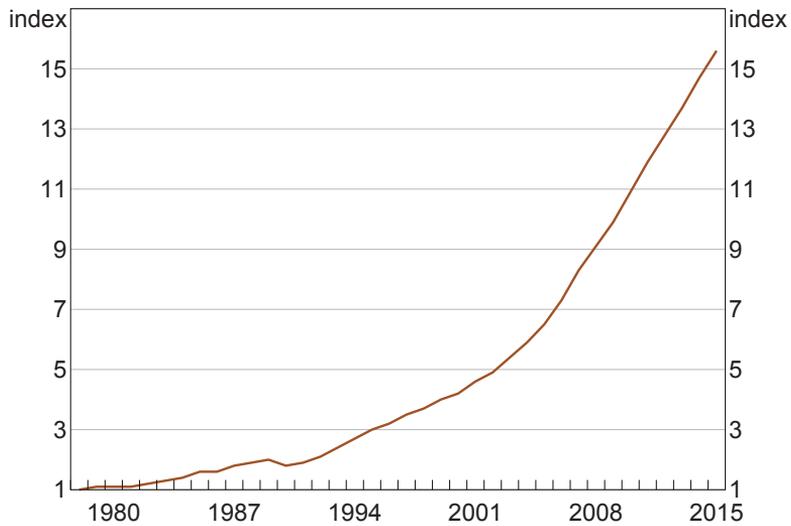
Harry Wu's paper presents a sombre assessment of China's total factor productivity (TFP) performance. Between 1980 and 2012, the average annual growth rate of TFP is estimated to have been just 0.83 per cent, accounting for only 9 per cent of the growth in output. Moreover, TFP growth has been on a declining trend. It averaged 1.63 per cent over 1992–2001, fell to 1.19 per cent over 2002–07, and then dropped sharply to –2.06 per cent over 2008–12. Aside from providing new estimates of TFP growth, the paper also makes a valuable contribution to the literature by attempting to disaggregate China's TFP performance by sector. Some sectors were found to have performed far worse than others. For example, in 2012 the level of TFP in the energy sector was less than half that in 1980. Wu attributes China's poor TFP performance to government interference in resource allocation, particularly at the local level, and inefficient state-owned enterprises (SOEs). I offer two points of reflection that I hope will promote further discussion of what is a well-constructed and thought-provoking paper.

First, in the Chinese context, TFP isn't everything. Krugman (1994) observed that: 'Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker'.

Output per worker, or labour productivity, is the measure of productivity that defines living standards. In China, labour productivity has increased 15-fold since 1978 (Figure 1). Moreover, its growth rate has hardly slowed. This is confirmed by Wu, who shows that between 2008 and 2012 labour productivity increased at an average annual rate of 8.5 per cent, faster than in any previous sub-period apart from 2002–07.

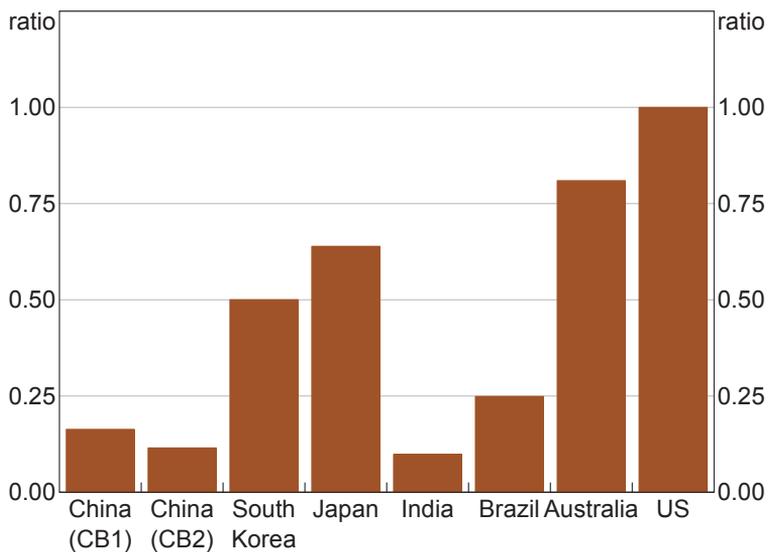
Yet even with this rapid growth, China's potential for further 'catch up' is evidenced by the fact that in 2015 labour productivity had still only reached around one-eighth of that in the United States and one-third of that in South Korea (Figure 2). It also lags behind other large developing countries, such as Brazil.

Figure 1: Labour Productivity
1978 = 1



Note: Index of real output divided by index of total employment
Sources: Author's calculations; National Bureau of Statistics of China

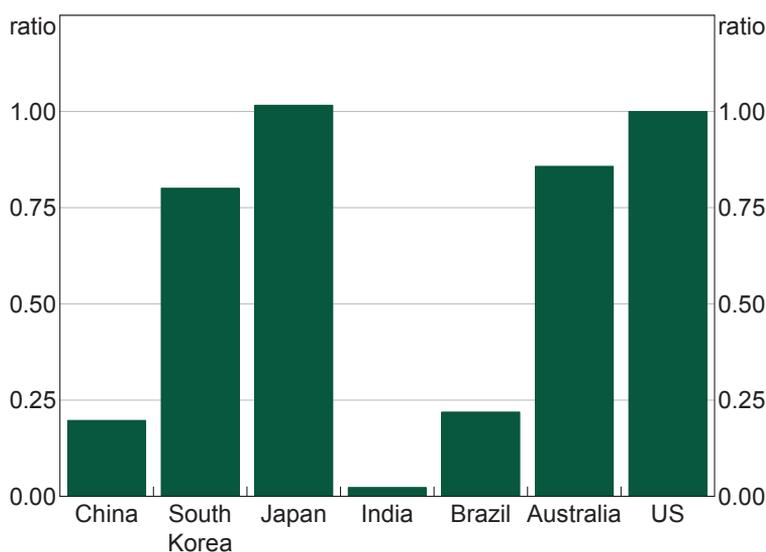
Figure 2: Labour Productivity for Selected Countries – 2015
Relative to the US



Note: The Conference Board provides two estimates of labour productivity in China that use datasets of different construction
Sources: Author's calculations; The Conference Board, Total Economy Database™ (September 2015)

Given China's stage of development, there is nothing unexpected or inherently wrong with improvements in labour productivity being driven in large part by increases in capital per worker (i.e. capital deepening) rather than TFP. Indeed, one of the main reasons that labour productivity in China lags behind higher income countries is because capital per worker remains relatively low. In 2011, capital per worker in China was just one-fifth of that in the United States and one-quarter of that in South Korea (Figure 3). For countries that already have a high capital-per-worker ratio, diminishing returns to capital means that TFP is the key to delivering additional improvements in living standards. But Figure 3 suggests that China may not be in this situation yet.

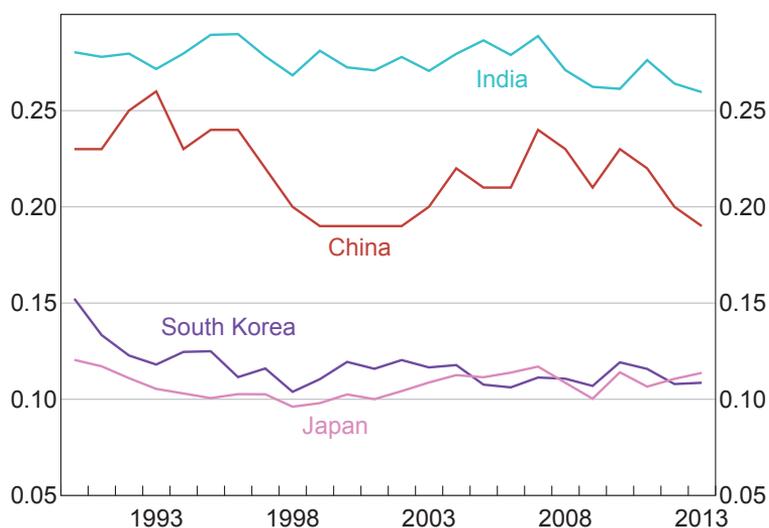
Figure 3: Capital Stock per Worker – 2011
Relative to the US



Sources: Author's calculations; Penn World Tables 8.1 (Feenstra, Inklaar and Timmer 2015)

To further illustrate this point, if the aggregate economy can be represented by a Cobb-Douglas production function, then the marginal product of capital (MP_K) – the extra output from one additional dollar of investment – can be estimated as the ratio of output to the capital stock, multiplied by the capital share of output (Dornbusch *et al* 2013). Figure 4 shows that while the MP_K in China has fallen in recent years, it is still not abnormally low in a historical context and, as economic theory predicts, remains much greater than in countries such as Japan and South Korea, where the capital-to-worker ratio is higher. This is not to say that investment in China has always been productive: examples of capital misallocation can easily be found. What Figure 4 points to is that the fundamental returns potentially on offer for investment remain substantial.

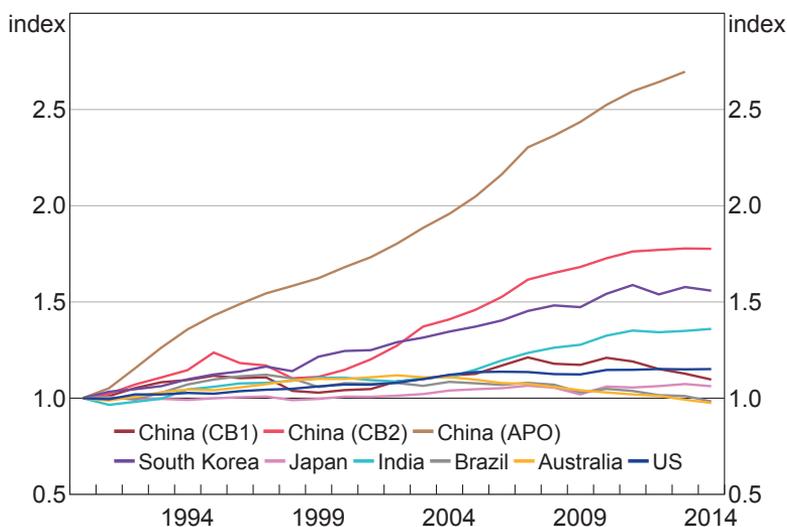
To summarise the above argument, China does not so much need to invest less and obsess over TFP. Rather, it needs to focus on investing more efficiently. Of course, faster TFP growth would also be desirable. It would, for example, contribute to an improvement in living standards without the huge environmental costs that have accompanied rapid growth in the past.

Figure 4: Marginal Product of Capital

Note: Capital share of output is estimated as 1 minus labour share of GDP
 Sources: Asia Productivity Organization, Productivity Database (2015 Version 1); Author's calculations;
 The Conference Board, Total Economy Database™ (September 2015)

A second point of reflection is that, unlike labour productivity, TFP is notoriously difficult to measure and highly sensitive to the selection of data and methodology. This has proven to be the case when TFP has been estimated at the national and provincial levels in China (Laurenceson and O'Donnell 2014). Figure 5 presents a range of TFP estimates for China and several other economies. Wu estimates that the level of TFP was around 18 per cent higher in 2012 than it was in 1990. The corresponding estimates by others are 9.7 per cent for the first Conference Board measure, 77.6 per cent for the second Conference Board measure and 170 per cent for the Asia Productivity Organization estimate. Aside from the huge variation in TFP estimates for China, the other salient observation is that even the lower estimates of China's TFP performance do not stand out as being particularly abnormal in an international context.

Figure 5: Total Factor Productivity for China and Selected Countries
1990 = 1



Sources: Asia Productivity Organization, Productivity Database (2015 Version 1); Author's calculations; The Conference Board, Total Economy Database™ (September 2015)

Faced with such a divergence in TFP estimates, it is useful to take a step back and consider whether those at the lower (or upper) end of the spectrum appear plausible given what else we know about China's economic development experience. Wu is surely correct to assert that elements of government intervention and inefficient SOEs have acted as a drag on China's TFP performance. But Lardy (2014) also documents that it is now private sector firms that produce more than two-thirds of GDP, have accounted for all of the growth in employment since 1978 and that generate a rate of return on equity several times higher than SOEs. These private firms face hard budget constraints. Lardy (in this volume) adds the important point that the private sector has continued to grow in relative importance in recent years. By 2014, state firms were only responsible for 8 per cent of investment in manufacturing, down from 11 per cent in 2012. The share of investment by state firms in services was higher at 43 per cent, but still down from 45 per cent in 2012.

McMillan and Naughton (1992) also noted that a key lesson to come from China's reform experience is that what matters for improving productivity is not the privatisation of SOEs but subjecting them to competition. In some sectors of the economy, such as in upstream oil and gas, telecommunications and finance, SOEs retain monopoly positions. But in other sectors they now compete fiercely with each other and with private sector firms. Lardy (2014) cites the example of the coal industry, which in 2011 comprised 880 SOEs and 4 420 private companies. At an aggregate level, the degree of business concentration in many sectors of China's economy is now lower than in the United States (World Bank and DRC 2013). Such stylised facts are hard to square with estimates of TFP that show only marginal improvement.

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2. General Discussion

The estimates of TFP presented in the paper were generally well received by participants, with discussion focused primarily on the interpretation of the paper's results. In response to the discussant's comments, Harry Wu emphasised his view that TFP growth is necessary and important for long-run growth. He noted that weak TFP growth in recent years should encourage Chinese authorities to undertake more structural reforms.

One key topic of discussion was the role of government intervention and structural reform in influencing TFP growth. One participant mentioned that the timing of shifts in industry-level TFP growth does not always line up with the timing of reforms in that sector. For example, agricultural TFP was relatively flat through the reforms of the agricultural sector in the 1980s and growth of energy sector TFP has been weak since the SOE reforms began in the 1990s. Similarly, another participant argued that it is difficult to reconcile the recent strong TFP growth in the agriculture sector with the idea that government is a major cause of low TFP growth, as the effective protection rate and government intervention in the agricultural sector has increased during this period. Another participant wondered if strong growth in TFP in the agricultural sector was a result of catching up to advanced economies or if the growth of TFP in this industry was normal by international standards. Professor Wu replied that measurement of the agricultural sector is difficult, particularly due to issues around quantifying land productivity and the treatment of the self-employed. He suggested it was plausible that true TFP growth in this sector could be lower than his estimates and that more work should be done in this area.

Several participants commented on the result of a decline in TFP since the global financial crisis. One participant noted that the result of weak TFP growth in China since 2007 is not surprising, but there are several different interpretations. This participant suggested that most observers view

DISCUSSION

negative TFP growth as the result of ongoing distortions in factor prices caused by government intervention and conclude that China's growth model could be 'running out of steam'. An alternative explanation was that, as China is approaching the 'middle-income trap', sectors that previously drove growth (such as heavy industry) are becoming less efficient, experiencing substantial overcapacity and contributing to weak productivity growth.

This participant questioned the notion that local governments were responsible for the recent negative TFP growth, noting that their incentives have been largely unchanged since the 1990s. Along these lines, the participant suggested that the paper could be improved by including some quantitative measure of government intervention at the industry level or by providing a narrative of government intervention.

Another participant discussed possible effects of the macroeconomic stimulus in response to the global financial crisis on TFP growth. Firstly, the participant wondered how the large increase in infrastructure spending by governments in this period would influence long-run growth in China. Secondly, the participant questioned whether the effects of the housing boom are fully captured in the Chinese GDP data (given the difficulty of accurately capturing components such as housing services) and therefore how downwardly biased estimates of the level of GDP would affect the paper's results.

One participant questioned what negative TFP growth in recent years could imply about the health of the private sector. The participant suggested that either the state sector's negative TFP growth has overcome the private sector's positive TFP growth; or that TFP growth in the private sector is also negative (having been led into inefficient industries by local governments). In response to the general comments about the effect of government intervention, Professor Wu explained that the dataset cannot give an exact measure of state or non-state ownership, although he is working to add this dimension in the future. He also noted that many private sector firms were also subject to government intervention in China, even if indirectly.

One participant wondered if the recent negative TFP growth in China can be explained in part by China's recent focus on environmentally friendly growth. If the authorities have directed investment into less efficient, but more environmentally friendly energy-producing technology, an additional unit of output would require more capital than otherwise, implying lower observed TFP growth.

As a historical comparison, one participant noted that this debate mirrors the debate around east Asian TFP growth in the 1990s. The participant argued that weak TFP growth implies that the return to capital and labour should be low or falling and that this is difficult to reconcile with data presented by the discussant, which showed a high and relatively stable return to capital.

Finally, another participant asked if technology embedded in capital imported into China will be reflected in these estimates of productivity. Professor Wu explained that this embedded technology would be captured in his measure of capital stock. The participant also posited that state intervention into some sectors, such as energy, could be positive, as it creates lower intermediate input prices and thus supports rapid capital accumulation.

The Changing Role of the Private Sector in China

Nicholas Lardy

1. Introduction

The relative roles of state and private firms, indeed the relative importance of the state more broadly, in explaining China's rapid economic growth in the past four decades continues to be debated. I have previously argued that the expanding scope of markets, and the growing role of private firms operating in these markets, has been a major (if not the major) source of economic growth in the reform era (Lardy 2014). The role of markets in China has certainly expanded since the early 1980s. China has moved from a system in which almost all important prices were set administratively, with scant attention to underlying supply and demand, to one in which markets determine the prices of virtually all goods and services and, more recently, most factors of production as well. In this increasingly market-driven environment, private firms have become the dominant source of the growth of output, employment and exports. On the other hand, other studies have emphasised the continued centrality of state planning and state-controlled firms (U.S.-China Economic and Security Review Commission 2015). This paper summarises the views expressed in my earlier work, assesses whether private firms have continued to expand relatively rapidly since 2012 and explores what this implies for China's growth in the future.

2. State and Private Enterprises in China

The distinction between the state and private sectors is not straightforward in China, so it is useful to define each of these categories. The universe of state firms began to expand from the more traditional state-owned firms after the passage of the 1993 Company Law, which allowed the formation of various types of shareholding companies, such as limited liability companies and shareholding limited companies (the latter sometimes translated as joint-stock companies). As a result, a growing number of traditional state-owned companies converted to become limited liability or shareholding limited companies. A significant subset of these firms listed on equity markets, meaning that the extent of state ownership of these firms was diluted. That gave rise to the concept of state-controlled companies, shareholding companies in which the state is the sole, majority, or dominant owner (Lardy 2014, pp 47–48) (Table 1).

Table 1: State Firms
2014

	Description	Number of firms
State-owned firms (全民所有制企业 or 国有企业)	Enterprises owned by the people	133 132
State-controlled firms	Limited liability or shareholding firms in which the state is the sole, majority, or dominant owner	130 216
Absolutely state-controlled	The state has contributed 50 per cent or more of the paid-in capital or capital stock	
Relatively state-controlled	The state has contributed less than 50 per cent of the paid-in capital or capital stock but has contributed more than any other single shareholder	
Consultatively state-controlled	Those in which the state's capital contribution is less than that of one or more other shareholders, but in which the state exercises control by virtue of agreement with these other shareholders	

Source: Lardy (2014)

Throughout this paper, data on output and investment of state companies includes the broad universe of traditional state companies plus shareholding companies that are state controlled. In addition, investment in all projects undertaken by public institutions (事业单位) and state administrative units (行政单位) are included within the scope of state-controlled investment (NBS 2016a). In contrast, the data on private companies is limited to registered private companies and does not include shareholding companies that are privately controlled, with the exception of the data on investment and bank credit. In 2014, there were 7.26 million registered private companies and 1.77 million privately controlled limited liability companies (NBS 2015, pp 22–23). However, the return on assets and the returns of private registered companies are arguably good proxies for the broader universe of private companies (Lardy 2014, p 97, fn 52).

3. The Record to 2012

3.1 Output

The state's share of output declined across a range of sectors since the late 1970s. Agricultural production, but not formal land ownership, was privatised early in the reform era. The direct role of the state in farm production is now limited to state farms, and accounted for only 1 per cent of the agricultural labour force and 3 per cent of the value of farm output in 2011 (Lardy 2014, p 62). The state continues to have a dominant role in the provision of rural infrastructure, since it undertakes and finances almost all investment in irrigation projects.

In the industrial sector, which includes manufacturing, mining and utilities, state-owned firms accounted for almost 80 per cent of the value of gross industrial output in 1980. By 2011, this share had shrunk to just 25 per cent. In manufacturing, which accounts for the majority of

industrial output, the share of output produced by state firms had declined to only 20 per cent by 2011. The state share of production in mining, and particularly in utilities, has remained much more elevated (Lardy 2014, p 75).

The decline in the role of state firms in construction is similar to that in the industrial sector. In 1980, state firms accounted for around three-quarters of both the value of construction and employment in the sector. Collective construction firms, which were typically owned by, or had close links with, local governments, accounted for the remainder of both employment and construction value. By 2010, the share of construction value contributed by state and collective firms had fallen to less than 40 per cent; the balance was the result of construction activity by private firms (Lardy 2014, p 79).

In the services sector, there are no comprehensive data on the share of value added by state and private firms. However, there is limited information available for some of the components of the services sector. For wholesaling and retailing, historically the largest component of the services sector, the data are very clear. Private firms accounted for 0.1 per cent of both wholesale and retail sales in 1978, but expanded their shares to half of both categories by 2008 (Lardy 2014, pp 80–81). The transformation was similar in catering, where private firms accounted for only 7 per cent of employment initially, but expanded to 80 per cent of employment and two-thirds of catering revenue by 2008 (Lardy 2014, p 81). The state retained substantial limitations on entry by private firms into services other than wholesale, retail and catering. Restrictions were particularly severe in modern business services such as information transmission, software and information technology; financial services; business and leasing services; and scientific research and technical services. Furthermore, as is the case in most market economies, the state has continued to play a dominant role in the provision of services such as education, health, and public management.

3.2 Employment

China's aggregate employment data are among the most problematic for two major reasons.¹ First, it is difficult to obtain an accurate split between state-owned and private firms in the employment data. The Ministry of Human Resources and Social Security continues to publish data almost exclusively on the basis of the registration status of firms, whereas most Chinese agencies now publish data disaggregated by ownership (based on the concept of control).² For example, employment data are available for shareholding companies, but within this category there is no split between privately and publicly controlled firms.

The second problem with official employment data is that the disaggregation of the number of workers into various registration categories is incomplete. If one adds up all of the official urban employment data for 2011 by registration status (including data on the self-employed) the sum falls 96.8 million workers short of the reported 359.1 million urban workers (NBS 2012, p 125). This discrepancy arises because total urban employment is estimated based on the most recent national population census and an annual labour force sample survey, whereas data on employment by registration status are based on reporting by enterprise units. These

1 The services sector figures quoted above do not suffer from the same issues as the aggregate data.

2 Much of the employment data included in the annual *China Statistical Yearbook* is compiled by the Ministry of Human Resources and Social Security rather than the National Bureau of Statistics of China.

employment data reported by enterprises exclude informal urban workers who do not have stable employment contracts, do not make contributions to various social insurance funds and do not receive social benefits.

Using more granular data from a variety of sources, I have constructed a time series of employment in the private and public sectors. I estimate that employment by private firms in urban areas has expanded from 150 000 (0.2 per cent of urban employment) in 1978 to 253 million (about two-thirds of China's urban labour force) in 2011. More impressively, the growth of urban private employment is estimated to have accounted for 95 per cent of the growth of the urban workforce between 1978 and 2011 (Lardy 2014, pp 84–85). On the other hand, employment in state-owned and state-controlled companies declined from 59.8 million (just over one-quarter of the urban workforce) in 1999 to 45.1 million (12.5 per cent of the urban workforce) in 2011.³

In summary, this analysis strongly supports two broad conclusions with respect to employment since reform began. First, the growth of the private sector accounts for virtually all of the growth of urban employment between 1978 and 2011. Second, employment in state-owned and state-controlled companies has declined significantly since the late 1990s, not only as a share of the urban workforce but also in absolute terms.

3.3 Exports

Another indicator of the rise of the private sector and shrinkage of the economic role of state firms is the evolution of the sources of China's exports. In the mid 1990s state firms produced about two-thirds of China's exports and foreign affiliates about one-third. By 2013, the share of state firms had fallen to just 11 per cent; the foreign affiliate share rose to almost 60 per cent by the middle of the 2000s and then fell to 47 per cent by 2013. Private firms, which were not in the export space at all in the 1990s, were producing 39 per cent of China's exports by 2013 (Lardy 2014, pp 86–88).

4. Explaining the Rise of the Private Sector

At least three important factors explain the rise of China's private sector: the evolution of state policy; the greater efficiency of private firms; and the increasing commercialisation of the financial sector.

In the early years of reform, the policy environment and legal framework for private non-agricultural businesses was basically hostile. A constitutional amendment passed by the National People's Congress in 1978 authorised family businesses, but regulations restricted employment to no more than seven non-family members. The government did not promulgate regulations allowing private corporations until 1988, a full decade into the reform process, and even then only allowed private sole proprietorships. The absence of limited liability tended to restrict the size of these firms. The possibility of limited liability companies was introduced by the

³ Even this time series is problematic because of a reclassification of public institutions into enterprises (事业单位企业化). Starting more than five years ago, public institutions such as publishing houses, state guest houses and other institutions with obvious revenue streams were reclassified, presumably as part of an effort to reduce the flow of public fiscal funds supporting these units. Thus, the data for more recent years are not strictly comparable with those for earlier years and the time series I have constructed understates the decline in employment in state enterprises.

1993 Company Law, but single person limited liability firms were not legal until the Company Law was amended in 2006 (Lardy 2014, pp 89–92).

The state expanded the scope of businesses open to private firms only gradually. Family businesses were quick to take advantage of the early opening of opportunities in retail, catering and construction, but private entry into manufacturing was initially slower. And, as discussed above, key parts of the economy are still reserved for state companies.

The second key explanation of the rise of the private sector is the higher productivity of private firms. These firms have consistently generated higher rates of growth of total factor productivity that, in turn, have been reflected in a higher return on assets. This was not so important in the 1980s, when a large share of investment was financed through the state budget and channelled mostly to state-owned firms. But reforms put into place in the 1980s allowed firms to retain a growing share of their profits and, as a result, the share of investment financed through the budget shrank dramatically. By 1997, for example, only 3 per cent of the investment of industrial firms was financed through the state budget (Naughton 2007, p 304). More broadly, the share of investment by non-financial corporations financed from retained earnings grew significantly over time, reaching an average of about 70 per cent in the years from 2000 to 2008 (Lardy 2014, p 96). Private firms on average generated much higher return on assets, meaning they had larger retained earnings relative to the size of the assets they controlled. These profits were mostly reinvested, thus the assets of these firms grew more rapidly than state firms, in turn generating faster output growth. This is the fundamental process that led to the gradual decline in the share of output produced by state firms in the domains of China's economy that were open to private firms.

The third key factor underlying the growth of the private sector is the increasing commercial nature of bank lending. Through the mid 1990s the financial system was dominated by four large state-owned banks that lent predominantly to state-owned companies. In the mid 1990s, loans to state-owned companies accounted for 60 per cent of renminbi-denominated loans outstanding extended by all financial institutions (Lardy 1998, p 83). This share fell to only 30 per cent by the end of 2012 (Lardy 2014, p 107). While detailed data on lending to enterprises disaggregated by the ownership status of the borrower have become available only in recent years, the share of the annual increase in loans outstanding to state-owned *and* state-controlled enterprises has fallen from 48 per cent of all loans to non-financial enterprises in 2010 to 35 per cent in 2013 (China Banking Society 2014, pp 341–342; Lardy 2014, p 105). I believe that this increase in the share of loans flowing to private enterprises largely reflects the fact that private firms, on average, are more creditworthy than state firms. This is confirmed by a common metric of creditworthiness, the interest coverage ratio, which is simply the ratio of a firm's earnings before interest and taxes to its interest expense. In the industrial sector, where this ratio can be calculated from official data, private firms have been twice as creditworthy as state firms in recent years (Lardy 2014, p 110). No doubt state banks, particularly the largest ones, are sometimes required to lend money to support state-owned firms, but they apparently have some flexibility and a growing share of bank lending is undertaken by smaller shareholding banks and city commercial banks that direct a much smaller share of their loans to state-owned firms. As a result, an increasingly larger share of corporate loans is going to private firms.

5. Recent Developments

The rising importance of the private sector in output, employment and exports through the Hu Jintao–Wen Jiabao era is fairly clear. What about more recently? Have long-term trends continued, faltered or even reversed?

In recent years, there has been an acceleration in the formation of private enterprises, both registered private companies and limited liability companies that are privately controlled (Table 2). The increase in the number of limited liability companies was particularly noticeable in 2013 when the minimum capital requirements to register a limited liability company, an individual limited liability company or a shareholding limited company were eliminated (Lardy 2014, p 145). In addition, the number of workers employed in individual family businesses (个体工商户), which are not classified as enterprises, continue to expand. In China's labour statistics, workers in these businesses are classified as self-employed. In urban areas, the number of self-employed workers expanded from 150 000 in 1978 to some 56 million by 2012 and then expanded by an additional 25 per cent in the ensuing two years, reaching 70 million by the end of 2014 (Lardy 2014, p 83; NBS 2015, p 112). The number of rural, non-agricultural, self-employed workers has also continued to rise in recent years.⁴

Table 2: Private Firm Formation
By type, number

	Registered private companies	Privately controlled limited liability companies
2010	4 683 851	442 587
2011	5 254 870	537 232
2012	5 917 718	634 331
2013	5 603 917	1 456 079
2014	7 266 188	1 761 500

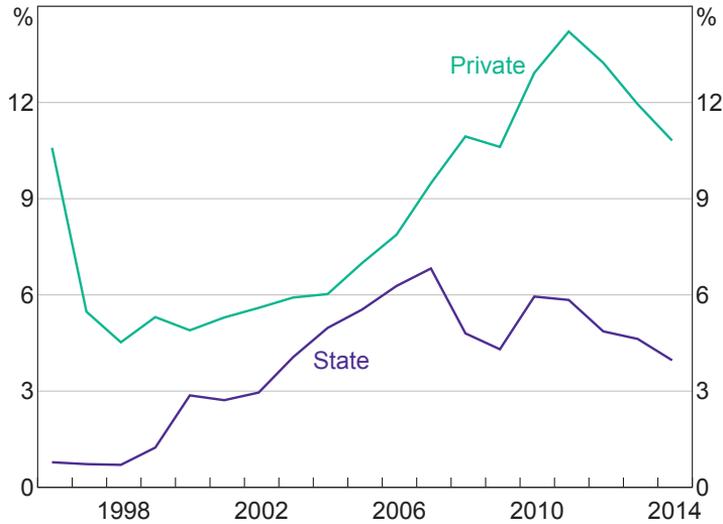
The financial performance of state firms relative to private firms continues to be very weak, particularly in the industrial sector. Private firms have recorded much stronger growth of profits in recent years, a trend that was even more obvious in 2015 when the profits of all above-scale industrial firms fell by 2.3 per cent. But for state firms, the fall was much sharper at 21.9 per cent. In contrast, profits of private firms rose by 2.3 per cent. As a result, in 2015 the profits of private industrial firms were CNY2.32 trillion, more than twice those of state firms at CNY1.09 trillion (NBS 2016b).⁵

⁴ The number of rural self-employed individuals is only about half the number of urban areas, presumably because a large share of rural individuals wishing not to engage in agriculture have become migrant workers.

⁵ These figures understate the difference in absolute profits of state and private industrial firms for two reasons. First, the figures for state firms include shareholding companies in which the state is the sole, majority, or dominant owner while the profits of private firms are for registered private firms only and thus do not include profits of privately controlled shareholding companies. Second, the data include only the profits of firms with annual revenue over CNY20 million. State firms on average are much larger than private firms so this threshold excludes a relatively larger share of private than state firms.

The same conclusion can be drawn by looking at official data on return on assets of state versus private industrial firms (Figure 1). Returns for both types of ownership have fallen as industrial growth has moderated in recent years, but the returns of private firms continue to be almost three times those of state firms.

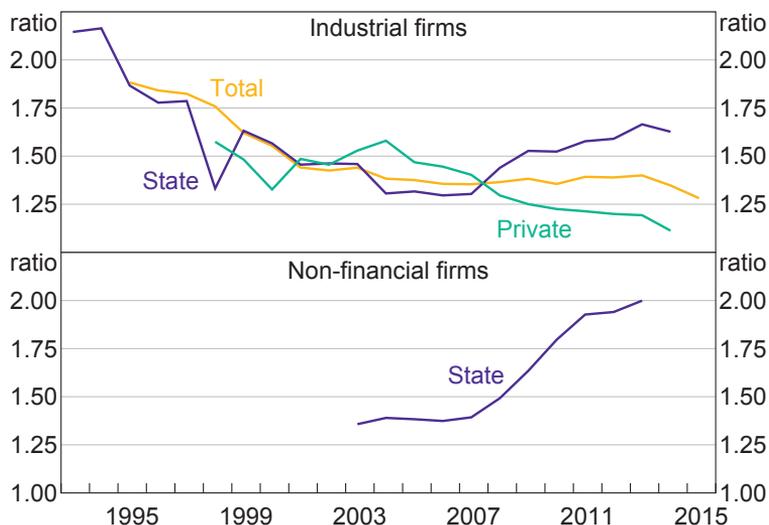
Figure 1: Return on Assets of Industrial Firms by Ownership



Source: National Bureau of Statistics of China

The relative inefficiency of state industrial firms is also reflected in other financial data related to the rapid build-up of debt in China since the global financial crisis. While the debt-to-GDP ratio has soared, including a huge increase in the debt of industrial firms, this has not resulted in a noticeable increase in the leverage ratio (the ratio of liabilities to equity) of these firms (Figure 2). The leverage ratio was relatively flat for the decade to 2013 and has since fallen. When we disaggregate this universe of firms by ownership, however, a very different picture emerges. The leverage ratio of state industrial firms has risen significantly since 2007, meaning that their liabilities are growing much more rapidly than their equity. This is consistent with the relatively low return on assets earned by these firms. Private industrial firms, on the other hand, show a very different picture. As noted earlier, private firms borrow more from the banks than state firms, but they generate much higher returns, in turn leading to higher retained earnings. These earnings are reinvested so that the equity of these firms grows more rapidly than their liabilities, and therefore, in aggregate, the leverage ratio of these firms is declining.

Figure 2: Leverage Ratio of Firms by Ownership



Note: Liabilities-to-equity ratio
 Sources: National Bureau of Statistics of China; State-owned Assets Supervision and Administration Commission of the State Council (SASAC), the People's Republic of China

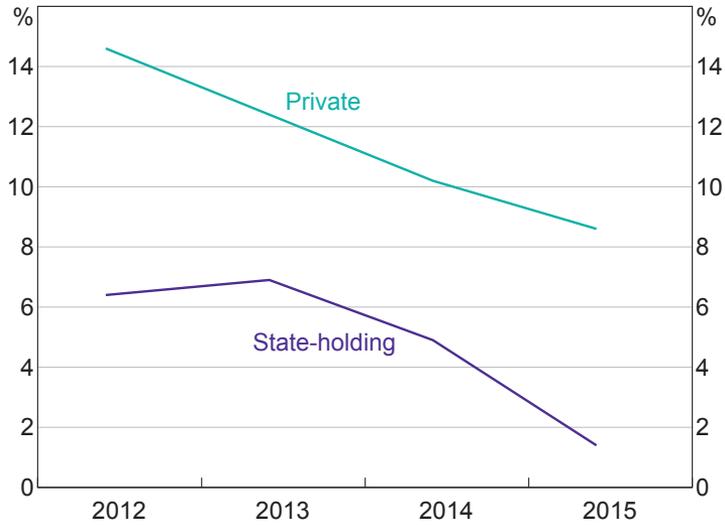
An even starker picture emerges when the services sector and local government platform companies are included. The leverage ratio of all state firms has risen much more rapidly and is substantially higher, at around 200 per cent in 2013. The picture that emerges is consistent with the hypothesis that the growth of borrowing by state companies is explained increasingly by their need to roll over their previous borrowings (including capitalising the interest payments due on these prior loans) and to finance wage payments, social security contributions and pay for inputs, rather than by their exploitation of profitable investment opportunities. In short, there appears to be a significant subset of state firms that fall into the category popularly known as zombie firms.

Turning to the question of the evolving relative importance of state as opposed to private firms, data considerations make the analysis of trends in output by ownership easiest in the industrial sector.

The contribution of state firms to industrial output continued to shrink after 2011. The output of private firms, as measured by value added, has grown on average over twice as fast as state firms throughout this period (Figure 3).⁶ This margin widened further in 2015 when overall industrial value added expanded by 6.1 per cent; state firms barely grew at all, expanding by only 1.4 per cent and private firms expanded six times as fast. The declining role of state firms in industry is also reflected in data on investment by ownership (Figure 4). By 2014, private firms accounted for 77 per cent of investment in manufacturing, up 3 percentage points from 2012, while the share of state firms slid to only 8 per cent, down from 11 per cent in 2012.

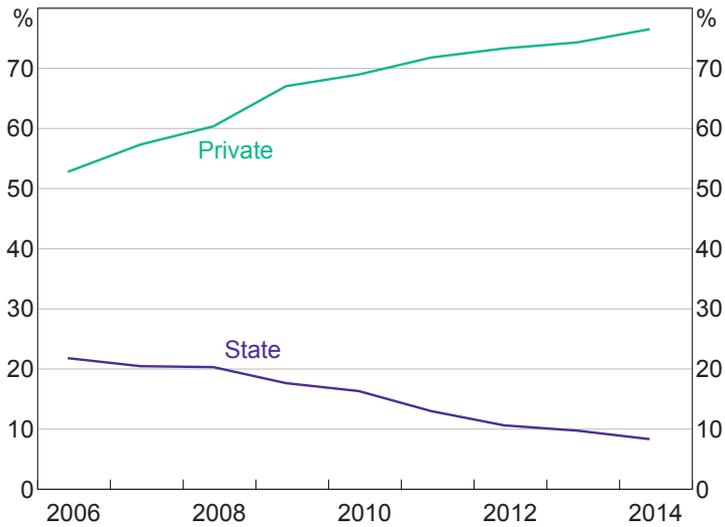
6 The average annual growth of value added for private firms in 2012–15 was 11.5 per cent; for state firms 4.9 per cent.

Figure 3: Industrial Value Added by Ownership
Year-average growth



Source: National Bureau of Statistics of China

Figure 4: Investment in Manufacturing by Ownership
Share of total



Source: National Bureau of Statistics of China

State firms continue to be a far more important source of investment in the other components of industry. In 2014, state firms accounted for 45 per cent of investment in mining (which includes upstream oil and gas) and 66 per cent of investment in utilities (NBS 2015, pp 322–323).

Data on value added, disaggregated by ownership for the various components of the services sector, continue to be extremely limited. Detailed results from the 2013 economic census, a source that would probably have a breakdown of private and state output for most of the components of the services sector, are not yet available.⁷ In the absence of such data, the best indicator of the evolving role of private and state ownership in the services sector is investment. As already noted, the role of the state and state firms in services sector investment has eroded much more slowly than in industry. By 2012, the state still accounted for 45 per cent of all investment in services, twice their share of investment in industry and four times their share in the manufacturing component of industry. While private firms had largely displaced state firm investment in wholesale & retail trade and catering, the state continued to dominate investment in transportation, health, education and public management, where its share of investment remained between two-thirds and three-quarters.

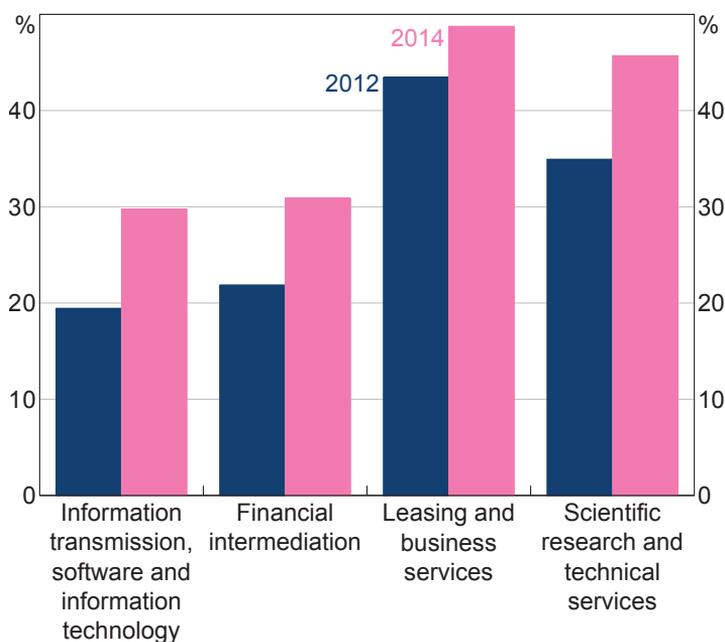
Overall the state share of investment in services continued to erode slowly after 2012, reaching 43 per cent in 2014. This small additional erosion was largely because the share of private investment in modern business services continued to rise significantly (Figure 5). The 10 percentage point rises between 2012 and 2014 in the shares of private investment in the categories of information transmission, software and information technology; financial intermediation; and scientific research and technical services are particularly noticeable. The effect of expanding private investment in these domains on the total share of state investment in services, however, is modest since the share of these three components in total services investment is relatively small.⁸

While the contribution of state firms to industrial output continues to erode, these firms' share of China's exports through 2015 held steady at 11 per cent. The share of exports produced by foreign affiliates fell 3 percentage points to hit 44 per cent between 2013 and 2015, while the share produced by private firms rose 4 percentage points to reach 43 per cent over the same period. Thus, private firms continue to be the dominant source of the growth of exports, a position they have had since 2009.

7 The previous economic census provided data on assets and profits disaggregated by ownership for 10 of the 14 components of the services sector.

8 In 2014, investment in these three components of the services sector accounted for only 3.5 per cent of all investment in services.

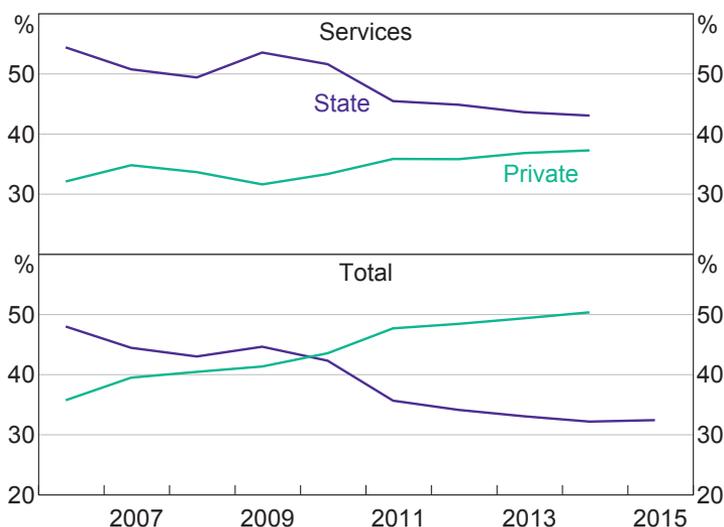
Figure 5: Private Investment in Modern Business Services
Share of total



Source: National Bureau of Statistics of China

While the contribution of state firms to industrial output continues to decline, the shares of both services sector investment and overall fixed asset investment undertaken by the state and state firms have declined only slightly since 2012 (Figure 6). This is a sharp change in the historical pattern. The share of state investment was 82 per cent in 1980 (Lardy 2014, p 115). After declining for three decades at an average pace of 1½ percentage points, why has the pace of decline in the state share of investment moderated to only about two-thirds of a percentage point in recent years? There are several, non-mutually exclusive, possible explanations.

The first is that, by 2012, private firms had already taken advantage of most of the liberalisation of entry that the state has allowed over the years, and a further significant increase in the share of investment undertaken by private firms would require eliminating or substantially reducing the barriers to entry that constrain private firms in key parts of the economy. In the sector where entry has been the most liberalised for the longest period of time, wholesaling and retailing, as well as manufacturing, the share of state investment now is under 25 per cent and 10 per cent, respectively (NBS 2015, pp 322–325). But in other domains the state continues to highly restrict entry by private firms and the share of investment undertaken by state firms is quite high. For example, in 2014, the state accounted for 92 per cent of investment in upstream oil and gas, 70 per cent of investment in electric power generation, and 96, 86, and 73 per cent of investment in rail, air, and pipeline transport, respectively (NBS 2015, pp 322–323).

Figure 6: Fixed Asset Investment by Ownership

Source: National Bureau of Statistics of China

A second explanation is that a significant share of the state's investment in services is in domains in which the role of the state is high not only in China but in most market economies as well, such as health, social security and social welfare; management of water conservancy, environmental and other public facilities; education; and public management. While there has been a very modest increase in private investment in education and health in recent years, state investment is likely to continue to be very dominant in these domains.

A third possible explanation is that as China's growth has moderated in recent years and profit-oriented private firms see fewer attractive investment opportunities, so their share of investment has levelled off.

A fourth possible explanation of the very slow pace of reduction in the share of investment attributed to the state is the heightened role of infrastructure investment, a large share of which is undertaken by the state. Sharply rising infrastructure investment raised the share of state investment slightly in 2009 (Figure 6). These expenditures continue to rise more rapidly than overall investment, and thus have sustained the state share of investment above the level that otherwise would have occurred.⁹

6. Conclusion

A major source of China's growth in the reform era has been the increasing share of investment undertaken by private firms that have been able to generate a return on assets as much as three times that of state firms. Two recent trends are worrying. First, the rate of expansion of the share of investment undertaken by private firms has moderated dramatically to a pace far below the first three decades of economic reform. Part of this is probably due to the moderation in China's

⁹ For example, in 2015, infrastructure investment rose 17.2 per cent; overall investment rose 10.0 per cent. Infrastructure investment accounted for almost a fifth of all investment (NBS 2016a).

economic growth that has slowed the pace of investment growth by more profit-oriented private firms. But it seems likely that the slow pace of reduction in barriers to entry by private firms in critical domains is also a significant factor.

The second worrying trend is that the productivity gap between the state and private sectors has widened substantially over the past decade, largely because the return on assets of state companies declined precipitously beginning in 2008, while return of private firms continued to rise through 2011 and then fell more modestly. The net result has been that the returns of state firms since 2007 (with the single exception of 2010) have been persistently below the cost of capital (Lardy 2014, p 126).

Both these trends have contributed to the slowdown in China's growth that has been evident over the past few years. The rising productivity gap also helps to identify what should be the real source of concern associated with the rapid rise in the ratio of debt to GDP in China over the same period – the rapid increase of indebtedness of state-owned companies.

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Discussion

1. Ligang Song

The paper presented by Nick Lardy at the conference touched upon a significant issue relating to the transformation of the Chinese economy, namely the rising private sector. If we can use one single measure gauging the progress of transition from a centrally planned to a market economy, that measure is the changing share of the private sector as compared with the share of the state sector in the economy. Lardy began by arguing that the expanding scope of markets and the growing role of private firms operating in these markets have been a major source of economic growth in the reform era. He then asks whether or not the earlier trends of such developments have continued in recent years and what this implies for China's growth going forward.

Lardy presents data on total output, employment and exports to show the rise of the private sector relative to the state-owned sector. He then provides explanations as to why the private sector dominates these measures, including: the evolution of state policy towards accommodating private sector development – in part through constitutional amendments; the greater efficiency of private firms as measured by the higher total factor productivity growth and a higher return on assets; and financial measures indicating that private firms have been twice as creditworthy as state firms in recent years.

Lardy also shows that the long-term trends have largely continued in more recent developments. Notwithstanding this, the author points out two worrying trends in the Chinese economy in more recent times. The first is that the rate of expansion of private firms' share of investment has moderated to a pace far below the first three decades of economic reform; and the second is that the productivity gap between the state and private sectors has widened substantially over the past decade, largely because the return on assets of state companies declined while that of private firms continued to rise. Lardy argues that the rapid increase of indebtedness of state firms poses a real concern.

My first question about the paper relates to the estimated employment figures. Lardy points out that China's employment data are among the most problematic. He has gone to great effort to estimate employment for private firms, and for state-owned and state-controlled firms in urban areas. According to these estimates, private firms employed 253 million workers in 2011 (about two-thirds of China's urban labour force), while state firms employed 45.1 million workers (12.5 per cent of the urban labour force). Together the two categories account for 78.5 per cent of the urban workforce. It is unclear whether the remaining share is made up of self-employed workers and how the large number of migrant workers fit into the calculations.

The second question relates to the interest coverage ratio (the ratio of a firm's earnings before interest and taxes to its interest expense). According to the calculation, in the industrial sector, private firms have been twice as creditworthy as state firms in recent years. However, the calculation is based on the official data, which could substantially underestimate the interest expense paid by

DISCUSSION

the private firms, as the funds may be borrowed from the informal financial sector, which charges much higher interest rates than the major banks.

The third question is related to the leverage ratio, which is the ratio of firms' liabilities to equity. The data show that the leverage ratio of state industrial firms has risen significantly since 2007, while on average the leverage ratio of private firms is declining. This is because private firms have had much higher returns, which in turn led to higher retained earnings. However, during the current economic slowdown, many private firms have also performed poorly. That may alter the pattern of the relative performance of private and state firms' leverage ratios.

Finally, I think the paper would benefit from some more exploration of why state-controlled firms performed worse when compared with other types of firms according to the estimates of the paper.

Overall, I agree that the moderation of the rate of expansion of private firms' share of investment is a key concern. To further increase the share of the private sector in the economy, I believe that China needs to create an environment in which entrepreneurship can flourish (Song 2015). To do this, the authorities need to further reform government–business relations, the financial and regulatory system, and market conditions. This would allow the 'creative destruction' process to take place, such that private entrepreneurs can devote their efforts to more 'productive' rather than 'unproductive' or even 'destructive' activities. The development of entrepreneurship is also influenced by cultural factors such as risk tolerance and patience. This raises an issue as to whether generations of single children (due to the family planning policy) will become more entrepreneurial and aid the rise of the private sector in China.

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2. General Discussion

Discussion initially focused on the allocation of credit to private firms in China. Some participants noted that anecdotal evidence of private firms having difficulty gaining access to credit in China contrasts with the finding in the paper that the share of credit allocated to private firms is increasing. One participant noted that banks have an incentive to lend to state-owned enterprises (SOEs) rather than private companies. The participant also questioned how attempts to control the growth of shadow banking might affect the cost of capital for the private sector, given it is thought that this type of financing is more common for private firms.

Another participant noted that while the financial services sector has grown as a share of the Chinese economy and is approaching the level of advanced economies, there continues to be excess demand for credit from the private sector. The participant also noted that recent growth in bank assets may provide further evidence of growth in credit extended to the private sector. In that context, they questioned whether the focus on deleveraging should be reduced if a larger share of credit is being allocated to productive private firms.

Nicholas Lardy agreed that the conventional wisdom was that banks only lent to state companies but asserted that while this tended to be the case in the past, it was no longer true. He did, however, note that SOEs may still be getting too much credit relative to their contribution to output. Dr Lardy added that bond issuance was still more heavily weighted to the state and that limited access to credit was an issue often raised by private firms. However, he recognised that this was also a common complaint of small private businesses in market economies.

One participant queried how the decline of the state sector should be interpreted. In particular, the participant suggested that even though the share of the state sector was declining, its effect on the overall macroeconomy was not. The participant believed that the state sector's contribution to output had been declining even faster than the proportion of the resources it was using, particularly financial resources. Dr Lardy agreed that, while the share of the state has been declining across a range of measures, it has become a bigger drag on economic growth. He also suggested that poorly performing 'zombie' firms should be subject to more competition with private firms.

On the current economic environment, one participant raised the notion that if a new round of stimulus were implemented in order to boost the economy, then the private sector might be squeezed out by the state sector, as seemed to be the case in the last round of stimulus. Dr Lardy disagreed that private companies were squeezed following the global financial crisis, pointing out that the share of lending going to private companies continued to increase in 2010, 2011 and 2012.

Participants also commented on reform. It was noted by one participant that although the government has spent considerable resources and energy to reform SOEs, the policy focus should instead be on creating a better environment for the expansion of the private sector. Another participant questioned whether the private sector could continue to expand and whether the reforms of SOEs seemed to be reaching a limit.

A number of participants commented on the productivity of state and private firms in China. One participant questioned whether the decline in total factor productivity (TFP) in the 2007–12 period presented in Harry Wu's paper (this volume) was due to declining TFP in the state sector, the private sector or both. The participant suggested the possibility that the private sector is increasingly led by government regulations and incentives to move into particular industries, which do not necessarily have the highest TFP. Another participant suggested that outsourcing of the most profitable activities of state firms to private firms could be contributing to the difference between their productivity.

Finally, one participant questioned how the distinction between state and private control of a firm was made when the state owned less than half of the company, but was the largest single shareholder. Dr Lardy provided details about how he distinguished between state control and private control as set out in his paper. Dr Lardy argued that the methods used to define who controlled a firm in his paper were sensible and that the role of state-controlled companies in the economy would not be understated.

Restructuring and Reform: China 2016

Barry Naughton

1. Introduction

Since 2010, China has been grappling with the consequences of the end of the miracle growth era. Economic conditions are changing extremely rapidly. It is obvious that the potential growth rate has been declining for several years, but the associated changes flowing through the economy are complex. The challenge for policymakers is to respond to these dynamic and multidimensional changes, helping to unlock new sources of demand while buffering the shock to declining industries. We know from the experience of Japan and South Korea that adapting to the end of miracle growth is challenging and that finding the appropriate policy mix in this transition is extremely difficult. Indeed, we probably know more about how such policy responses *fail* than about how they *succeed*.

Ideally, during this period of slowing growth, policymakers assist the transition with a combination of structural and reform policies. Structural policies should help shift the structure of demand and, to a lesser extent, supply in order to facilitate a new sustainable medium-to-high speed growth phase. The reform policies should adapt institutions and liberalise access to resources in order to facilitate the structural shifts and unlock new sources of growth. Policy is important but, of course, most of the adaptation is achieved by companies and households responding to changing opportunities and prices. Sometimes the most important requirement for effective policy is that it not obstruct the adaptation of business and households. In China, with growth still moderately fast, technology changing quickly, entrepreneurship high and relative costs (especially of labour) changing rapidly, we should expect structural change to be rapid at both the macro and micro levels. The starting point of this paper is the assumption that it would be very surprising indeed if there were no evidence of major changes in the composition of output, that is, no evidence of structural change at the broadest aggregate level.

While there is a fairly widespread view of the Chinese economy that asserts that this kind of structural change is now well under way, this paper critically examines recent data to see whether it does indeed provide evidence of robust structural change. Typically, advocates of this view rely on two types of data: national accounts that show that services produced more than 50 per cent of GDP for the first time in 2015, and employment data showing rapid job creation in the services sector. Section 2 of this paper examines those two data sources and shows that they do not reliably show substantial structural change. In fact, evidence of large-scale structural change is remarkably weak, and this is quite surprising. The paper then discusses the policy background to this apparent lack of restructuring. The focus is on economic reform policy over the past two years. Selecting state enterprise reform and local government debt restructuring, I demonstrate a pattern of inconsistent and unsuccessful economic reform policymaking.

The paper does not demonstrate a link between reform policy failure and slow restructuring, and perhaps such a causal link would be impossible to prove in any case. However, there is a plausible broad relationship between the two. Moreover, new ‘Supply-side Structural Reforms’ were introduced in late 2015/early 2016 precisely in order to accelerate the restructuring process. I argue that the adoption of this policy is a logical response to the failure of existing reform and restructuring. The new policy mix is an improvement, but it is unlikely to result in significant structural change by itself. However, the fact that Chinese policymakers are still adaptable and learning from experience means that we should not be too pessimistic.

2. The End of ‘Miracle Growth’ and Structural Change

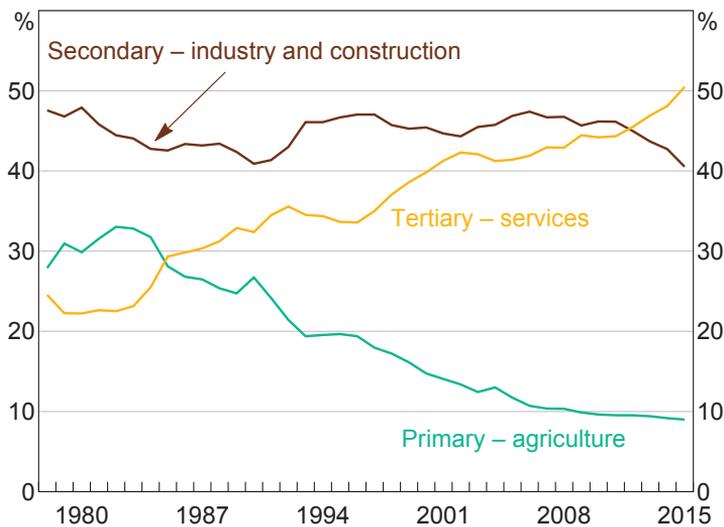
The end of a period of miracle growth presents enormous challenges to policymakers. Even the adjustment that should be easiest – lowering growth expectations – flies in the face of normal human habits and aspirations. These adaptations proved very difficult for policymakers in Japan and South Korea at the end of their growth miracles. For China, with 2015 purchasing power parity GDP per capita just over US\$13 000 (in 2011 prices), or around 26 per cent of the GDP per capita of the United States, a lot of room for catch-up remains. However, offsetting this positive factor, China faces the difficulties of an especially abrupt and complex transition. The Lewis turning point, the point at which surplus rural labour declines to zero, has just been reached, while at almost the same time, the working age population has begun to decline. As these two important changes kick in, the share of labour force entrants with college educations has soared. In earlier miracle growth transitions, such as in Japan and South Korea, these changes took place more than 20 years apart. Externally, trade has dropped, so the growth generated by export growth has vanished, even though China’s share of world exports has not declined. These changes mean that investment profitability (and productivity) must also be changing very rapidly. Certainly we would expect the growth rate of investment to drop dramatically and the composition of investment to change. Taken together, these forces mean that the Chinese economy is undergoing extremely rapid changes in factor supplies, the structure of demand and, probably, productivity growth. It would not be surprising to see rapid structural change right now.

Broadly speaking, there is agreement about the type of structural change needed: demand should shift to domestic sources, consumption should increase as a share of GDP; a larger share of growth should come in services and high technology sectors; and there should be an improvement in productivity. Of course, at the micro level, there are many sectors where structural change is taking place. In 2015, cement production declined 5.3 per cent, while international air travel increased 34 per cent; electricity production grew only 0.3 per cent, while data transmission on China Mobile’s network grew 152 per cent. There is no question that, as in any economy, some businesses are booming even as others decline. Among this constant change, it is reasonable to ask whether a broad-based restructuring is in fact taking place. The Chinese Government has been releasing data which, to some, show that these transitions are already underway. On closer inspection, however, the data are too limited to support this claim.

2.1 National accounts data

The national accounts data are often used to argue that China has shifted to services sector-driven growth (Figure 1). At first glance, the data appear to strongly support the assertion since between 2011 and 2015 the services sector share of GDP jumped from 44.3 per cent to 50.5 per cent. However, a look at the longer-term trend should alert us to the danger of this type of reasoning: the services share has been increasing since 1980, when it was an extraordinarily low 22.2 per cent of GDP. The steady increase of the services sector share since 1980 would seem to indicate that China's miracle growth has *always* been driven by services sector development. In fact, looking at current price shares of GDP can be extremely misleading.

Figure 1: GDP by Sector
Current prices, share of GDP



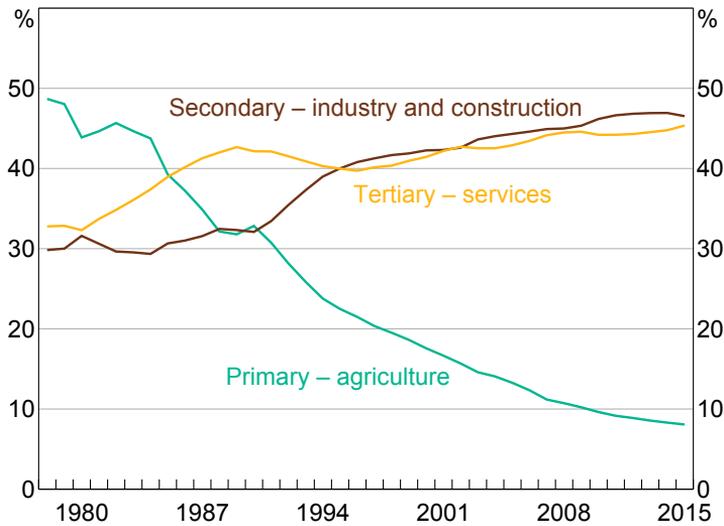
Source: National Bureau of Statistics of China

The reality is that the increased services sector share is almost entirely the result of changing relative prices. Between 2011 and 2014, the implicit price deflator for services was just over 5 percentage points higher than the deflator for the secondary sector, and in 2015 the gap was almost 8 percentage points. Industrial ex-factory prices have been falling for the past four years, and the secondary sector implicit deflator has been falling for the past two years. Meanwhile, prices of services have continued to increase, just as we would expect in a labour-intensive sector during a period of rising wages.

The difference in price trends accounts for almost all of the change in the nominal share. Based on constant price data, the increase in services sector share between 2011 and 2015 is only 1.2 percentage points (Figure 2). From 2011 to 2015, less than 20 per cent of the increase in the services sector share of GDP was driven by differences in real growth rates, and over 80 per cent was driven by changes in relative prices. (In fact, the official data indicate similar real growth rates of industry and services over this period, so the change in shares must be a price phenomenon.)

The only long-run generalisation supported by the data is that, since 1993, the share of agriculture has fallen steadily while the shares of industry and services have both grown. This will surprise no one.

Figure 2: GDP by Sector
2010 constant prices, share of GDP



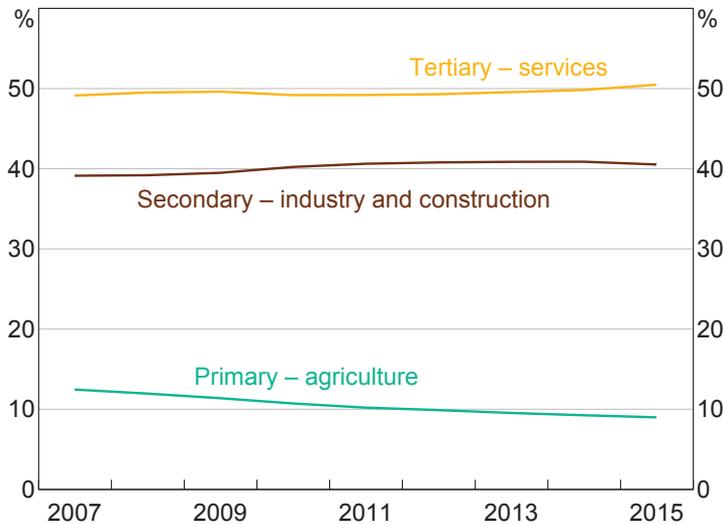
Source: National Bureau of Statistics of China

This pattern of relative price changes itself deserves comment. It is, in some respects, a positive development, since it indicates that the relative profitability of investment in services is probably increasing and the profitability of investment in industry is almost certainly decreasing. These relative price changes will contribute to the impetus for future structural change. However, it is the reverse of what one would expect to see if a healthy structural transformation were already underway. Generally speaking, productivity growth is more rapid in fast-growing sectors, so that current price changes in structure are *less* marked than constant price changes.¹ The fact that this is not true in China *might* suggest that structural change is only occurring gradually.

The lack of structural change is even more striking when using 2015 constant prices and focusing in on the period from 2007 through 2015 (Figure 3). Despite the enormous changes sweeping the Chinese economy, almost no change in the constant price relative share of the three large sectors can be seen.

¹ Indeed, this is why the current price share of industry in China did not increase between 1978 and 2008: productivity growth was rapid and the relative price of industrial goods was declining.

Figure 3: GDP by Sector
2015 constant prices, share of GDP



Source: National Bureau of Statistics of China

To be sure, there are problems with China's national accounts. While they are adequate for rough generalisations, perhaps they are not sufficiently accurate to support broad conclusions about structural change. After all, the discussion here depends on the quality of the deflators used. However, from the limited information we have about the deflators used in calculating services sector growth, it appears that, if anything, they are biased in a way that overestimates real growth of the services sector.² That is, they tend to overstate structural change toward the services sector in constant price terms.

Generally speaking, China's statisticians calculate national accounts by collecting income (revenue) data and then deflating through various expediciencies.³ Among services, the two largest sub-sectors are retail and wholesale trade (9.8 per cent of GDP in 2014) and financial services (7.3 per cent in 2014). In both of these sub-sectors, the deflation procedures that are used appear to understate inflation. In the retail and wholesale trade sub-sector, value added is deflated by the retail goods price index. In an economy where wages are rising while ex-factory prices have been falling since February 2012, the resulting deflator is obviously biased downward and real growth therefore biased upward.

Financial services has four sub-components: money and banking services, capital market services, insurance services and other. For capital market services, value added is calculated based on income data and an implicit deflator is then backed out using a physical output indicator (this is the procedure Chinese statisticians use in many sectors). In 2015, the only physical output indicator used was the volume of turnover on the stock market. For 2015, when stock market

² These following two examples come from the vice-head of the National Bureau of Statistics, Xu Xianchun (Xu 2016).

³ This is why they are able to produce GDP estimates so quickly. They attempt to double-deflate as much as possible, but often resort to single deflation.

turnover exploded, this measure overstated the real growth of capital market services as a whole. This is because, while the volume of nominal business grew rapidly, the physical output indicator doubtless grew even more rapidly, since there are economies of scale in stock market trading, and this would lead to a low or negative implicit deflator which is then applied to the whole sub-sector. To compound the problem, the capital market implicit deflator is then also used in the insurance sub-sector, where the deflator is calculated as a weighted combination of the capital market services deflator and a 'consumption-investment price index'. Again, a low deflator biases real growth of that component upward. These problems are large enough to make a difference. Real financial services growth was officially calculated at 15.9 per cent in 2015. It is a significant part of the overall services sector growth, and indeed accounted for 1.5 percentage points of 2015 GDP growth (NBS 2016a). It is striking that nominal wages (which are rising rapidly) are never used as part of the deflation strategy for these two labour-intensive services sub-sectors. Overstatement of growth in retail and wholesale trade plus financial services would significantly exaggerate the pace of structural change in real terms.⁴

To be sure, there are services sub-sectors that are growing rapidly, particularly those related to internet services and sales. It is entirely possible that Chinese statistics undercount these services, and no doubt there are errors in various places that could offset the overstatement in wholesale-retail and financial services. But a quick search does not turn up any obvious examples. Indeed, the National Bureau of Statistics recently published the following remarkable statement: 'Among above-scale service sector firms, the business income of those in high technology services, technology consulting services, strategic emerging services, and cultural and related services grew in 2015 by 9.4 per cent, 8.6 per cent, 12.0 per cent and 11.1 per cent, all higher [sic] than the 9.5 per cent growth rate of all service sector firms' (trans by author).⁵ Such relatively small growth rate differentials for the (small) highly dynamic sectors are not going to drive major structural change.

2.2 Employment data

China has reported some impressive numbers on employment creation. Before considering them, we should note that China's overall employment data have always been a relatively weak part of the statistical reporting system. While precise numbers are collected from large firms that report directly to statistical authorities, coverage of the small-scale economy is spotty and inconsistent. For example, there have been large revisions in the categories of 'other' urban workers and some series reported in the *China Labour Statistical Yearbook* were discontinued in 2012 (Naughton 2007, ch 8).⁶ In early 2016, Chinese spokesmen regularly claimed that China had created 13.1 million jobs in 2015, following on from the successful performance in 2013 (13.1 million) and 2014 (13.2 million). These figures should be immediately discarded. They are not net figures: they are the aggregate of all local labour bureaus reporting the results of their

4 Note that a faster growing implicit deflator would result *both* in slower real services sector growth and higher inflation in the services sector, strengthening both sides of the argument presented here.

5 Above-scale firms report their revenue data directly to the State Administration for Industry & Commerce (NBS 2016a). It is extremely unusual for a release from the National Bureau of Statistics to contain an internal inconsistency in a single sentence, as this one does.

6 Moreover, the government encourages confusion caused by the rapid increase in newly registered businesses, most of which come from previously unregistered informal sector businesses.

work supporting employment. Not only are they subject to reporting bias – since they are a success indicator for an agency of government – they are also irrelevant, since we are interested in net job growth, not churn.

A more useful set of numbers is the overall employment data (Table 1). Again, these data highlight what seems to be a remarkable achievement, namely the addition of 14.8 million jobs in the tertiary sector in 2015. This implies new services sector jobs accounted for almost 2 per cent of the 797 million employed persons. However, these data also raise some troubling questions of consistency and plausibility. First, the population at working age (15–59) is now declining rapidly, by some 4.9 million in 2015 (and even more during 2011–14). Together with a net increase of 2 million employed persons, this implies that over the past five years, China has drawn 10 million workers a year from increased labour force participation. This is quite an unusual pattern and it is not strongly supported by other types of data. For example, actual retirement ages remain young in the city and female labour force participation has not obviously increased in recent years.

Table 1: Change in Labour Force and Employment
Millions

	Working age	Employed	Primary	Secondary	Tertiary
2011–14 average	–8.3	2.8	–12.7	1.9	13.6
2015	–4.9	2.0	–8.7	–4.1	14.8

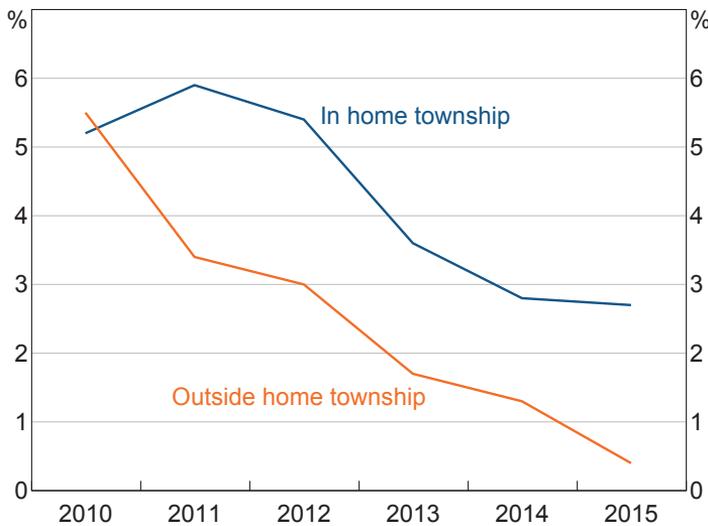
Source: National Bureau of Statistics of China

Second, the data show that the secondary sector lost over 4 million jobs in 2015. While it is obvious that some of China's traditional heavy industries – especially coal and steel – suffered contractions in 2015, a net drop of 4 million workers is surprisingly large. If this number is correct, we may have underestimated the degree of distress currently being experienced by China's rust belt workers.

Third, the largest source of tertiary sector workers is rural workers leaving the agricultural sector. The official employment data indicate that almost 9 million farmers left agriculture in 2015. To be sure, it is well known that the exodus from Chinese agriculture has been huge, the largest mass movement of people in history. Still, these numbers are very large, as many as during the 2003–07 peak, and the fastest ever in percentage terms. Agricultural labour, by this accounting, declined 18 per cent in the four years to 2015, compared with 16 per cent in the four years to 2007, when workers were flooding into export-oriented manufacturing. This is unlikely to be true. There is substantial evidence that migration from the Chinese countryside began to slow after 2011; in part this is due to the demographic factors that are producing a declining population of working age and, in part, because so many young people have already left the villages.

An alternative source of labour data is based on a large-scale household-based survey of migrant workers, and is relatively transparent (Figure 4; Table 2). The data have been collected since 2008, initially in response to worries about the effect of the global financial crisis.⁷ The survey covers 235 000 workers in stratified samples of 8 930 villages in all 31 of China’s provinces. The survey includes information on wages, housing conditions and location, and is grossed up to estimate national totals. In my judgement, this data is preferable to the aggregate employment data. The methodology is straightforward and transparent. Unlike the other employment data, collection is not linked to a local bureaucrat’s success indicators and the results are consistent with the 1 per cent national population sample survey conducted in 2015. These data show structural change slowing dramatically after 2010–12, presumably due to the combined effect of slower labour force growth and weaker labour demand.

Figure 4: Non-farm Labour Force
Year-average growth



Source: National Bureau of Statistics of China

Table 2: Change in Non-farm Workforce
Millions

	2009	2010	2011	2012	2013	2014	2015
Out-migrant	4.92	8.02	5.28	4.73	2.74	2.11	0.63
Local	-0.56	4.43	5.27	5.10	3.59	2.90	2.89
Total	4.36	12.45	10.55	9.83	6.33	5.01	3.52

Source: National Bureau of Statistics of China

⁷ Specifically, whether a collapse in exports would lead to the reverse flow of a mass of unemployed migrants back to their home villages. In the end, this did not happen.

In 2015, according to the survey data, the increase in non-farm labour could not have surpassed 3.8 million (3.52 million plus a small adjustment for migrants who engage in agriculture in locations away from their own home town) (NBS 2016b). This is a far cry from the 8.7 million said to have left agriculture in the employment data. In short, the pace of change suggested by aggregate employment data is simply not supported by other, superior, survey data. Of course, we should not expect data coming from very different collection channels to be completely consistent. But in this case, the household survey data seems to be preferable. The alternative view, in which a very large increase in services sector jobs is 'explained' by very large reductions in agricultural *and* secondary sector jobs, *plus* a big increase in labour force participation, seems implausible. This suggests the possibility that the number for services sector jobs is just wrong.

At present, the most that can be said about employment growth is that labour force conditions are fairly stable in most parts of the country. Other than troubled rust belt and coal mining towns, there is no evidence of widespread distress in labour markets. Job vacancies are substantial, and by some measures more numerous than job seekers. However, we should keep in mind that labour markets provide lagging indicators. If labour demand flags below shrinking labour supply, this will occur after problems are already apparent in other indicators.

2.3 Data summary

Both the national accounts and employment data describing growth in China have notable deficiencies. Some of these indicators of structural change are simply spurious, while others do not stand up to closer scrutiny. Of course, it cannot be said that the available data prove the *absence* of structural change. The data currently available are probably not robust enough to do this in any case. However, none of the available data demonstrate robust structural change. This should be quite surprising. The Chinese economy is very dynamic and relative costs are changing quickly, yet structural change at the macro level is almost imperceptible.

The next sections look at both the macroeconomic and microeconomic policy environments for corroboration of the picture of limited structural change suggested by the data considered above.

3. The Macroeconomic Policy Environment

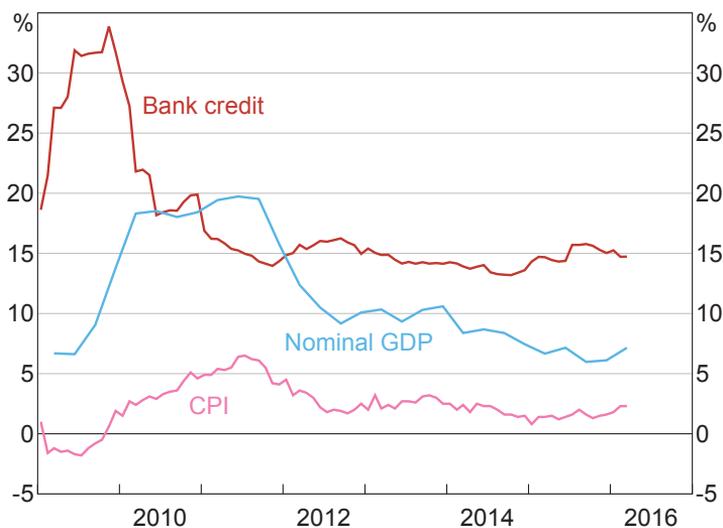
The macroeconomic policy environment in China is consistent with the picture of limited structural change sketched in the previous section. Despite enormous attention paid to the reform agenda and the adaptation of policy to the 'new normal', the actual macroeconomic policy environment has been relatively slack. Of itself, this would not be sufficient to drive major changes in behaviour. But, as is discussed in subsequent sections, neither have the microeconomic reforms.

Figure 5 shows some of the main macroeconomic variables: credit growth, nominal GDP growth and consumer price inflation. The credit stimulus of 2009 succeeded in pulling up nominal GDP growth (approximated using quarterly real GDP growth grossed up with the annual GDP deflator). Policy became moderately tight during 2011, as the People's Bank of China (PBC) sought to drain excess liquidity from the system and inflation looked worrisome.⁸ Credit growth

⁸ Growth of bank credit is not the only component of credit or monetary policy, to be sure, but the intent here is to establish a macroeconomic policy baseline for the discussion of economic reform.

fell below nominal GDP growth for the only time this decade. However, since 2011, nominal GDP growth has fallen steadily, while credit growth has remained roughly constant around 15 per cent in year-ended terms, even accelerating somewhat from its low point in mid 2014. The result is that credit growth was about 5 percentage points above nominal GDP growth in 2014, and the gap increased in 2015. Considered alone, credit policy has been broadly accommodative, and arguably is becoming more so. If credit growth remains high in 2016, even the modest restructuring pressures evident in 2015 may be rolled back.

Figure 5: Credit, Nominal GDP and CPI
Year-ended growth



Sources: National Bureau of Statistics of China; The People's Bank of China

4. Reform Policy

If the macroeconomic policy environment has not been sufficient to induce structural change, we must look at the microeconomic policy environment for the necessary forces. It is to that task that the next two sections turn.

It is now more than two years since a broad program to revitalise market-oriented economic reforms was laid out at the Third Plenum in November 2013. Important steps have been taken in many areas.⁹ Nevertheless, I argue that, *generally speaking*, the implementation of reforms has been disappointing. In many cases, reform outcomes have been modified during the implementation process in a way that reduces or eliminates the pressure that reforms could potentially have created for more thorough restructuring. That means that reforms are not driving the kind of productivity improvement and creation of new growth drivers that we would like to

⁹ I would highlight steps to simplify the registration and oversight of private companies; and steps toward liberalisation of capital markets as broadly successful. However, missteps in implementation of the liberalisation of capital markets mean that important aspects of the reforms have been suspended, so our ultimate judgement will depend on the speed with which reforms are reinstated.

see. To be sure, firms and local governments are under pressure anyway from the rapid slowdown of growth and changing prices. However, the actual outcome of these reforms, so far, has been to buffer local governments and firms, especially state-owned firms, against the restructuring pressures created by rapid economic change.

4.1 State enterprise reforms

The November 2013 Third Plenum document laid out a number of important, challenging, but vague, principles for economic reform. To the surprise of many, it included a large section on state enterprise reforms that addressed fundamental issues of state enterprise governance in fresh ways that potentially had real significance. The document suggested shifting to a form of capital management, perhaps exercised through investment or wealth funds, combined with an emphasis on mixed ownership. There were tensions, imprecisions, perhaps even contradictions between some of the ideas floated in the Third Plenum document, but they at least suggested the possibility of a new opening in state-owned enterprise (SOE) reform, and generated some real excitement.

It took almost two years for the ideas in the Third Plenum document to be expressed in an official document called a 'guiding opinion', which outlines broad principles to guide implementation (CPC and State Council 2015). Since then, more than 10 implementing regulations have been issued. This pattern has been dubbed '1 + N' because there are several more implementation regulations still in the pipeline, and no one is sure what the ultimate 'N' will be. The implementing regulations are necessary, because the guiding opinion is vague and contradictory, even by the standards of this type of document. Nevertheless, it is sufficiently concrete that we can now evaluate the overall program of SOE reform.

It makes sense to think of SOE reform, as expressed in the guiding opinion, as consisting of two broad parts. The first part of it is essentially the resumption of a program to normalise the management of state enterprises. It calls for dividing SOEs into commercial and public service classes; transforming nearly all SOEs into corporations; clarifying relations between the government, the agency that exercises the powers of ownership, investment companies, and firms; strengthening Boards of Directors *and* Communist Party control; and inviting in non-state investors under certain conditions. These are mostly sensible things to do. In fact, many of these were on the government's agenda from 2003 until approximately 2005 or 2006 and then faded away.¹⁰ In my opinion, this is an advantage of a relatively fluid policy environment that good ideas from the past can be resurrected.

The second part of the document consists of an effort to remake the hierarchical structure of management and incentives in which SOEs are embedded. These efforts are newer, harder to evaluate and embed more compromises that have not yet been fully worked out. However, when we examine the provisions incorporated in this part, we find a highly problematic set of

¹⁰ For example, the document calls for organising 'virtually all' SOEs as corporations under the company law and piloting listing some top-level conglomerate companies and strengthening Boards of Directors. The reorganisation of SOEs under the company law has been policy for 23 years since the Company Law was passed in 1993, and both listing top-level conglomerates and strengthening Boards of Directors were pilots in 2005–06, notably with Baoshan Iron & Steel. For example, October 2005, the State Asset Supervision and Administration Commission announced 11 state wholly owned corporations, with outside directors on the Board of Directors, led by BaoSteel.

initiatives that add up to a major disappointment of the hopes that were raised in the wake of the Third Plenum of 2013. To understand the new measures, we can simplify the complex program and isolate three crucial steps in the new management system: first, the division of firms into competitive and non-competitive; second, the creation of investment companies with ‘missions’ to manage, especially, the non-competitive firms; and third, a proliferation of missions, both in number and in assigned policy importance.¹¹ These have the potential to create a state enterprise management system that is much worse than the existing system.

4.1.1 Enterprise classification

The classification of enterprises begins with a straightforward differentiation between commercial and public services enterprises, which are to have different management and incentive systems. Among commercial enterprises, however, there is a further distinction that is much less straightforward. One sub-group of commercial enterprises consists of those whose main business is in fully competitive sectors: these firms should accelerate corporatisation, they may take in outside investors even to the extent of allowing state ownership to become a minority ownership position; and they should list on stock markets (SASAC, MoF and NDRC 2015). This is a step forward, and it may be combined with measures to separate stages of the production chain where competition can be introduced (such as electricity generation). However, many firms do *not* fall in this sub-group: any firm whose main business is in sectors that relate to national security, the commanding heights of the national economy, or important sectors are excluded. These firms should be provided with incentives to ‘better serve important national strategies and macroeconomic control’ and specifically ‘develop forward-looking strategic sectors as well as any specially assigned responsibilities’ (trans by author) (SASAC *et al* 2015). In other words, pretty much any firm can be placed in an ill-defined and ill-demarcated ‘other’ sub-group. Moreover, the big national SOEs, the ones run by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) are massive, multidivisional firms with thousands of subsidiaries (17 000 subsidiaries for the 110 central SASAC firms). Firms that are designated competitive will only be a few carve-outs within the complex hierarchical firms that, almost by definition, must remain non-competitive.

The extremely elastic and decentralised definition of this ‘other than competitive’ class of enterprises is of real practical importance. First, the government is supposed to maintain a controlling stake in any firm in this category (CCP and State Council 2015). Second, the incentive structure for this category is supposed to contain a substantial element reflecting the special tasks and social responsibilities the firm has, in contrast to firms in the ‘competitive’ category, for whom the incentive structure is supposed to be based predominantly on profitability and increased asset value (SASAC *et al* 2015). That is, the SOE reform agenda specifically carves out a category of SOEs that will stay state controlled and will increase the attention they give to political objectives and reduce the importance of profitability in their objectives.

Who makes this important discretionary decision? The answer is clear: the ‘owner’ makes the decision, meaning initially the asset supervision agency. The designation should be ‘relatively

¹¹ This selection of features reflects my own biases and subjective judgements. This is a complex program that is changing with the process of implementation. Many different perspectives will be possible over the next few years.

stable', but should be 'dynamically adjusted' to accord with changing conditions, including changes in economic development, national strategies, and enterprise capabilities (SASAC *et al* 2015). When they are ready, this decision can be delegated to a new body, the investment company.

4.1.2 Investment companies

The reforms introduce a new – and newly important – layer of management into the state enterprise sector, the state capital investment and/or operations companies (SCIOs) (State Council 2015). When this type of investment company was first suggested in the Third Plenum document, there was speculation that it would refer to a relatively passive, investment-return-oriented entity like a sovereign wealth fund. The explicit incorporation of the word 'operation' in their titles, however, shows that these investment companies are expected to take on an activist role, rather than a passive investment-oriented role. In fact, everything in this 1 + N package is designed to allow an active role for 'investment and operation' companies. The SCIO is to be set up beneath the asset management agency (i.e. below SASAC or the regional SASAC-type agencies). In addition, pilot projects will test eliminating 'asset supervision agencies' altogether and delegating ownership powers directly to the SCIOs.

If the SCIOs are not to become sovereign wealth funds, what will they do? SCIOs are expected to play an active role, but the way the role of other-than-competitive firms is described in official documents is incredibly elastic. In truth, an SCIO can clearly define any SOE that it wants to as other than competitive, because there will always be some important or emerging role it can play.

4.1.3 Mission proliferation

The fact that SCIOs have missions is particularly important right now because China is engaged in an extraordinary effort to promote innovation and high technology enterprises as the key to the growth transition. Everyone knows that China has invested enormous, perhaps unrealistic, hopes in the development of new technology: this is the part of restructuring that the government can engage directly in. The policy emphasis, already strong, has been ramped up in the Thirteenth Five-Year Plan. This means that every local government will be under a certain amount of pressure to show they are contributing to the technology effort by establishing an SCIO company and having it be actively engaged in concentrating state capital in key sectors. For example, Gansu province – not generally regarded as a hotbed of the start-up economy – has outlined the following in its SOE reform program: increasing the amount of state capital in one of five named development zones, supporting the provincial industrial policy and developing five strategic emerging industries (information technology, biopharmaceuticals, smart manufacturing, new energy and new materials). More than 80 per cent of the increase in state capital should be in 'strategic emerging industries, infrastructure, public services, and the externally oriented economy' (trans by author).¹² Clearly, the SCIOs are expected to be the instruments of this policy.

In general, SCIOs are supposed to be under trial implementation in 2016. SASAC is ready: they have designated two existing SASAC top level firms as state capital operation companies

¹² The document even gives aspirational targets for the number of provincial firms reaching specific thresholds of internationalisation (GPPC and Government 2016).

(note that SASAC choose to call its designated instruments ‘capital operation’ companies and *not* ‘investment’ companies). These are the China Chengtong Holdings Group and the Guoxin Tendering Group. Both of these firms have been in existence for a while. China Chengtong was formed in 1992 out of the subordinate companies of the old Ministry of Material Supply. When SASAC was formed in 2004, Chengtong was made into a pilot asset management company. SASAC favoured it as an instrument for restructuring SOEs, using it to purchase and restructure ailing subsidiaries of other central SOEs. It had a flurry of activity in the mid 2000s, but then became much less active, and concentrated on its ongoing logistics and packaging businesses. Guoxin was set up by SASAC in 2010, and was supposed to clean up the assets and liabilities left over as the big SASAC firms were listed on the stock market. Again, after initial activity, Guoxin subsided into a status quo place-holder. Both China Chengtong and Guoxin have an odd mix of subordinate companies that include firms that sell goods and services as well as an asset management business. Both were favoured instruments of SASAC in the past, who gained experience in restructuring distressed assets, but never played the larger roles that had been expected of them. Now they have returned.¹³

The restructuring of the state enterprise system needs to be put in the context of initiatives emerging from other parts of the policy apparatus to foster technological innovation. Numerous new state-owned ‘private equity’ funds are being set up to foster dynamic industries. In the most advanced and highest priority case, integrated circuits, these government private equity firms are expected to total about US\$150 billion, including some contributions from private investors. Already, Beijing Municipality has put up US\$10 billion and the national government has advanced US\$30 billion for two different investment company buyout funds. These buyout funds are expected to be flexible, to be willing to take risks and bear losses, but also to emerge with (state-owned) stakes in the successful firms. They are conceived as playing a similar role to the SCIOs, but arriving there by a different route. Moreover, as we will see in the following section, ‘Supply-side Structural Reforms’ were launched in late 2015 and are a primary policy emphasis in 2016. Again, SOEs will play an important role leading the capacity restructuring that is at the heart of supply-side reforms.

4.1.4 Evaluation

The envisioned role of the SCIOs as proactive drivers of change is deeply problematic. Government is to withdraw from all operational decision-making, but those decisions will be delegated to the SCIOs, which are intended to act as developmental institutions, internalising the developmental objectives of the government.¹⁴ SCIOs set the evaluation and reward functions for their subordinate enterprises, but who sets the evaluation and reward functions for the SCIOs? Implicitly, the superior asset supervision agency does so, but the process and principles of this are not addressed in any of the documents. In the initial 2013 Third Plenum document, there was some hope that the SCIOs might function as a type of sovereign wealth fund, with multiple funds benchmarked by total returns. As the reform has evolved, it is quite clear that this will not happen. On the contrary, as SCIOs proliferate, so will their missions and evaluation benchmarks.

¹³ This is one of many signs that the fully elaborated state enterprise reform strongly reflects the positions and interests of SASAC.

¹⁴ In the first step, this delegation is to the asset supervision agency, which in turn delegates to the SCIO. But pilot programs will explore removing the asset supervision agency from the equation.

We should anticipate the emergence of (literally) thousands of well-resourced SCIOs, seeking to rationalise the distribution of state capital by developing a broadly defined array of priority sectors and industries. Oversight is likely to be weak. Just as insider control is now a problem in state enterprises, insider control will become a major problem for SCIOs.

In addition, the implementation process very much privileges the existing government departments that exercise ownership rights over state firms. All the key decisions about classifying firms and sectors are made in-house. This is particularly clear from the case of SASAC, since the identity of the first two SCIOs is so intertwined with SASAC's past and personnel. It is clear that this is an approach that conserves and utilises existing expertise, but also that it is a reform that entrenches existing interests. There will be no radical shake-ups, and nobody will be under great pressure to change existing behaviours.

For firms judged to be in competitive industries, the current wave of reforms will likely improve transparency, clarify accountability and contribute to the development of equity markets. In essence, China is finally getting around to completing the SOE reforms initiated between 1996 and 2006, and this will have productivity benefits. However, there simply are not that many state firms left in the really competitive sectors, since they have already been out-competed by private firms, so the total efficiency gains may be limited.¹⁵ Moreover, the new regulations may actually encourage the extension of SOEs into competitive markets where they do not currently have a presence. The document interprets 'mixed ownership' as encouraging state capital to expand its investment in, and control of, private firms. Ownership stakes in private firms are encouraged, and multiple forms are permitted (CCP and State Council 2015; GPPC and Government 2016). So long as a sector can be designated 'strategically important' or unusually dynamic, SOEs can 'support' (by buying into) dynamic firms. SCIOs in this vision will serve as platforms for buyouts, taking strategic stakes, forming incubators, co-investment, strategic partnerships, and generally 'compensating for market failures'. SCIOs with preferential access to capital will expand into the private economy. At the same time, local government decision-makers will perceive that the 'action' is in displaying dynamic commitment to national goals, foremost among which is the promotion of high technology emerging industries. They are likely to devote far more of their time and energy to encouraging plausible interventions in those 'new' sectors than they are to restructuring or liberalising existing sectors.

4.2 Local government debt restructuring

Local government debt restructuring was an ambitious program drafted by the Ministry of Finance in 2014. It had three interrelated objectives: to stabilise and lower the debt burden on local governments; to credibly signal to local governments that they would henceforth have harder budget constraints; and to contribute to the development of capital markets by jump-starting a market for municipal bonds. Local government debt restructuring began in earnest in October 2014, when the Ministry of Finance issued substantive policies requiring local governments to update debt figures to the end of 2014, cap their total debt, and then receive

¹⁵ To be sure, in some localities where policymakers are more reform-minded, the program may give them the go-ahead to initiate more rapid restructuring. The broad framework of the SOE reforms, combined with delegation of operational decision-making to localities, may provide a window for some regional policymakers, if they decide to move aggressively ahead with the restructuring of the competitive sector.

quotas to swap existing debt for municipal bonds. The ministry was seeking to update and improve the accuracy of the figure for local government debt calculated by the National Audit Office as of the end of June 2013 (CNY10.89 trillion, or just over 19 per cent of GDP). Provinces were instructed to self-report and update the debt figure to end 2014. However, provinces had an incentive to *maximise* reported debt (since this might maximise their access to bailout funds). As a result, the total debt reported by localities jumped 47 per cent to CNY16 trillion (or 25 per cent of GDP) (Du 2015b; Sina Finance 2015).¹⁶ There was never agreement on the final number, but in the meantime, at least CNY1.85 trillion in debt was coming due in 2015, and had to be dealt with.

The original program called for the distribution of CNY1 trillion in municipal bond quota among the provinces, based on their debts coming due. The quota was progressively expanded throughout 2015 and, ultimately, the quota was set at CNY3.2 trillion by the end of the year. Provinces would then prepare debt offerings and sell them in the market, with customers including investment banks and mutual funds, and even the National Social Security Fund. Beyond these municipal bond sales, local government debt was to be capped, with additional borrowing quotas to be distributed (carefully) by the national government. However, in April 2015, the very first municipal bond offering failed, when Jiangsu offered CNY64.8 billion and found no takers. Local governments wanted low interest rates to reduce their funding costs, while the market wanted to be compensated for the risk and uncertainty of these new products with high interest rates. After all, why should anybody buy low-interest bonds when there were still plenty of medium-to-high yielding ‘urban construction’ bonds with implicit guarantees?¹⁷

The program was dramatically revised after this setback. Within two weeks, cooperating with the PBC and China Banking Regulation Commission, the Ministry of Finance rolled out a revised and very different version of a debt swap.¹⁸ Instead of debt being offered on the open marketplace, the new debt was allocated to those who held the existing bank loans. The principle was ‘whoever cooked it, eats it’. Existing debtholders, overwhelmingly banks, were responsible for taking the bonds that replaced the loans they had originally extended and hold them on their books for an unspecified period. Regulations specified benchmarks for the range of acceptable interest rates: the new debt was to be priced with interest rates between central government bonds and China Development Bank bonds, that is, at interest rates consistent with low risk levels. The government threw in some important sweeteners: government deposits were placed at banks that participated, and the PBC declared that the new bonds would be accepted as collateral in any future relending or repo operations.

Under these conditions, the debt swap proceeded rapidly. By year-end, a total of CNY3.2 trillion in new municipal debt had been issued. Moreover, figures floated at the National People’s Congress confirmed that another CNY5 trillion in municipal debt would be placed in 2016. The program as revised has a much bigger bailout component. Local governments receive much lower interest rates and longer repayment periods, without having to worry about packaging and disclosing their debts and making them attractive to the market. Banks, on the other hand, surrender high

¹⁶ Details of the process are described in Naughton (2015a, 2015b).

¹⁷ There are CNY3.4 trillion in circulating ‘urban construction’, so-called *chengtou*, bonds. These are the most important subset of local government financing vehicles (LGFVs) fixed-income securities. Their average interest rate in April 2015 was 5.63 per cent.

¹⁸ There is already a large literature on this policy. The account here draws mainly from Du (2015a), MoF (2015) and Xu (2015).

interest short-term debt for an illiquid low interest asset. To be sure, there are some upsides for the banks: the new local government debt has only a 25 per cent weighting in risk-adjusted asset classifications, so the banks can hold less capital and still satisfy capital requirements.

As realised, the debt swap did nothing to differentiate between prudent and reckless local governments. The debt is issued by the local governments themselves (rather than the corporate LGFVs that in many cases initiated the debt). China is not a federal system: local governments are subdivisions of the central government. Moreover, the whole process of issuing the bonds had been set up by the central government and structured from the top down. All local government bonds clearly have the implicit backing of the central government. For instance, Moody's rated the bonds AAA, the highest investment grade, explicitly because of the central government backing, rather than the fiscal soundness of the individual provinces (Yi 2015). To be sure, the Ministry of Finance will attempt to institute procedures to prevent additional debt, but the implementation of the program does not subject local governments to significant restraint or oversight (Shang 2015).

The program tends to undermine the financial standing of the banking system. In principle, there should be no aggregate effect on the size of the bank's assets, only a reduction in the rate of return. In practice, however, the program seems also to have expanded the banks' balance sheets. Bank holdings of fixed income securities increased by CNY5.27 trillion in 2015, increasing from 11 per cent to 12.8 per cent of bank assets; more than CNY2 trillion of this would be new municipal bonds. In theory, this CNY2 trillion should have been exchanged for CNY2 trillion in bank lending that would be retired, which would have been 2.5 per cent of loans outstanding at year-end 2014. Credit growth at the end of 2014 was running at 13.6 per cent in year-ended terms; if CNY2 trillion in bank debt had been swapped for bonds in 2015, then credit growth for 2015 would have dropped to 11.1 per cent all else being equal; instead, it accelerated to 15 per cent.

It's not clear exactly what happened with these municipal bond offerings. There is anecdotal evidence that, in some provinces, cash-strapped local governments simply did not turn all the money they received from the bond sales over to the banks. However, this is unlikely to account for the bulk of the expansion of credit. Also unclear is what will happen in 2016: will the sale of CNY5 trillion of municipal bonds end up injecting an equivalent amount of liquidity into the economy?

5. Supply-side Structural Reforms

Following on from the reforms initiated at the Third Plenum discussed above, supply-side reforms have been given a great deal of attention, particularly since November 2015. They figured prominently in the March 2016 National People's Congress meeting. Supply-side reforms may prove to have an important effect on the Chinese economy and it is difficult to predict how the bundle of interrelated programs will evolve in the face of serious economic challenges. What should be apparent is that supply-side reforms have no roots in the Third Plenum reform program. They are an innovation, a change of policy course. It is reasonable to conclude that supply-side reforms are a response to frustration with the existing policy mix: ineffective demand-side policies and bogged-down institutional reforms have not produced the structural changes desired.

5.1 Main components of supply-side structural reform

Supply-side reforms have been given the highest policy priority for 2016 and, as such, are a new bundle of policies that will evolve in the process of implementation. Formally, supply-side reforms include five elements:

1. Eliminating excess industrial capacity
2. Reducing the stock of unsold housing
3. Deleveraging
4. Reducing costs
5. Strengthening weak points.

The first four points are closely related: the fifth point seems included as a compromise, legitimising proactive interventions in emerging sectors, as discussed in the section above. Each of the first four elements is straightforward conceptually, but practically full of challenges and difficulties.

5.1.1 Excess capacity

As the Chinese economy has slowed, heavy industrial capacity has continued to grow, and the result has been massive overcapacity in many sectors. Reductions in excess capacity have been given clear priority over the other elements of supply-side reform. Coal and steel production have been earmarked as the first targets for reduction in capacity. The State Council on 1 February 2016 promulgated two documents on steel and coal industry restructuring (State Council 2016b, 2016a). The steel industry document stresses that the reduction of capacity is to be driven by five regulatory standards: pollution, energy consumption, output quality, occupational safety and technology (effectively a minimum size requirement). The coal program lacks the strong emphasis on regulatory standards, and presents a much more differentiated program of different local governments improvising programs.

The proposed approach involves the central government providing modest subsidies to facilitate the closing down of capacity. With this funding as a sweetener, local governments are being pressed hard to (a) fulfil quotas for closing down capacity; (b) stop subsidising money-losing firms; and (c) concentrate on assisting laid-off workers through welfare and job-switching programs. A particular focus of this approach is on closing down ‘zombie firms’, that is, companies with debts and no profits that are kept alive by local government support.¹⁹

In the case of steel, the government has established an ‘industrial structure adjustment fund’ and a target of 100 to 150 million tonnes of capacity reduction.²⁰ This will provide about CNY20 billion in subsidies to close down 40–50 million tonnes of capacity annually for about three years. For coal, problems are much more regionally differentiated. The provinces of Henan, Shandong and Anhui are taking the lead, but their problems are less severe; later Inner Mongolia, and eventually Shanxi and Shaanxi will tackle the most intractable problems. It is expected that a special national policy will be enacted for them (Li Huiyong quoted in *Securities Times* (2016)). After steel and

¹⁹ The concept of zombie firms was initially popularised by the economist Takeo Hoshi, who demonstrated their harmful effect on the Japanese economy in the 1990s.

²⁰ Capacity is about 1 050 million tonnes, so this would amount to approximately 14 per cent reduction in capacity (Golden State Policy United Industry 2016).

coal, overcapacity is to be tackled in cement, electric power and non-ferrous metals, with other sectors, such as petroleum refining and petrochemicals, and even export sectors like garments, cued up for a later round.

5.1.2 Reducing stockpiles

Reducing stockpiles conceptually covers getting rid of any kind of surplus but, in practice, is centred on reducing stocks of unsold housing in second- and third-tier cities. While housing markets in top-tier cities like Beijing, Shanghai and Shenzhen are relatively healthy, smaller cities still have an enormous backlog of housing. Policies under this rubric have not yet been fleshed out, but they include efforts to make them affordable to rural–urban migrants. An interesting approach is to create local housing authorities and fund them to purchase housing in order to rent to low-income residents (including, but not limited to, migrants) (Yang 2016).

5.1.3 Deleveraging

Deleveraging means restructuring debt. It is an enormous task. Not only is China's debt burden huge and worrisome, nobody is entirely sure where in the economy this debt is held and by whom. The banking system is certainly at the centre of the debt problem, but many other financial markets are also involved. Shutting down zombie firms means writing off their debts, including debts to banks, to local governments, and other obligations in other capital markets. Exactly how this is to be achieved as part of supply-side reform is far from clear.

5.1.4 Lowering costs

Closing redundant capacity and restructuring debt would allow firms to reduce their costs. This additional element refers to further policy measures that would help firms reduce costs and increase competitiveness. These could include tax reductions, reductions in burdensome regulation and reductions in social security contributions.

5.2 Evaluation

Despite the priority given to closing excess capacity, the supply-side reform program is consistently presented as a comprehensive, coherent program. Moreover, supply-side reforms are consistently presented as a justification for a moderate relaxation of monetary policy because supply-side reform is expected to have a somewhat contractionary effect and because funds are necessary to finance restructuring and labour reallocation. Most obviously, supply-side reforms are predicated on the notion that there is an overhang of capacity as well as an overhang of debt, and both need to be addressed together.

However, while the different strands and objectives of supply-side structural reforms are related conceptually, they are not at all related in terms of the institutions, procedures and policies needed to implement them. This is most obvious by looking at the relationship between two key planks, closing excess capacity and 'deleveraging' or restructuring debt. Closing down excess capacity is a traditional activity of the Chinese state. Since 1978, there have been several rounds of excess capacity consolidation, some predominantly market-driven, some predominantly administrative. In either case, there are bureaucratic instruments to hand that are accustomed to

the operation. In essence, two things are done: the planners (today, the National Development and Reform Commission (NDRC)) target specific low-quality, polluting or backward capacity for closure; and the governmental hierarchy is used to pressure local governments *not* to subsidise or otherwise protect loss-making firms under their jurisdiction. Both of these policies are familiar and have clear institutional channels to make them happen. Indeed, the NDRC has been engaged in significant rounds of capacity reduction for the past three years at least.

By contrast, deleveraging is fraught with difficulties and uncertainties. Writing off debt means assigning permanent losses to one party or another. There is resistance and opposition. Only an authoritative body entrusted with significant power over creditors and debtors can carry out such a deleveraging. It is true that China did this once before, between 2003 and 2005, when a massive write-off of bad SOE bank loans occurred (Naughton 2006). That restructuring was a massive undertaking, beginning years earlier with the creation of asset management companies, and proceeding through to the listing on the stock market of the state-owned banks. It involved nothing less than the mobilisation of all the best economic minds of the Chinese administration across ministries and departments. Moreover, at that time, virtually all the bad debt was concentrated within the traditional banking industry, and a top-down initiative affecting the entire industry was appropriate and feasible. Today, there is no one institution capable of leading or coordinating policies like this in the current environment. Perhaps one can be established, but it would be a prolonged process of institutional creation. The difficulty may be exemplified by the sensitivity of the role of laid-off workers. Both the steel and coal industry programs contain an identical sentence: 'No plan for reassigning workers can be implemented if it is incomplete; if the funding for worker reassignment is not in place; or if the plan has not been approved by the Worker Congress or a discussion by all workers' (trans by author). As in the late 1990s, when lay-offs were large, substantial programs are being rolled out to provide for retaining workers within the corporation (with new jobs), or for channelling them to new jobs or early retirement. Instructed to be highly sensitive to these issues, local governments will doubtless feel themselves squeezed between competing objectives: how seriously are they supposed to get rid of zombie firms?

Thus, while supply-side reform makes some sense as an economic concept, it lacks any coherent implementation structure or framework. Supply-side structural reforms are an important policy initiative. To a certain extent, their adoption reflects the fact that the reform program laid out at the Third Plenum in November 2013 has been failing. Policymakers needed to come up with another approach, and supply-side reform is such an approach. Still, supply-side reform itself has a number of obstacles it needs to surmount. It lacks clear implementation paths for many of its crucial components. There are built-in tensions between the way closing excess capacity (for example) depends on stronger regulation and more powerful market forces, on the one hand, and the fact that its implementation is pushed down onto local governments and Party secretaries through the Party apparatus, on the other. Moreover, the scope of supply-side reform is undefined and open to change as conditions change. It will undoubtedly go through many changes and different versions as implementation proceeds.

6. Conclusion

In the preceding, I have presented a coherent narrative about the fate of economic reforms in China over the past two years, selectively emphasising state enterprise reform, local government debt reform and supply-side reform. I have not discussed other financial reforms, or the equity market, but they could easily be woven into this narrative. In this narrative, economic reforms that were proposed in 2013 with considerable fanfare have failed to generate pressure on economic actors to restructure and adopt new forms of behaviour required to produce sustained medium-high growth in the 'new normal'. Indeed, fears about the growth rate have blocked effective implementation of critical reforms. In state enterprise reform, the desire to maintain state firms as catalytic economic agents (as well as elements of a supportive political system) was fundamental in determining the policy outcome. In local government debt restructuring, the desire to reduce debt burdens on local governments and get them investing again was similarly decisive. Stalled reform is plausibly related to slow progress in restructuring.

The analysis here points to heightened risks ahead for the Chinese economy. In essence, we see a picture emerging in which currently promoted government initiatives now seek to achieve:

1. investment in new high-tech sectors funded by government money;
2. the shutting down of capacity in traditional industrial sectors; and
3. the maintenance of annual GDP growth rates at 6.5 per cent or above.

This configuration of policy objectives points to increased risk ahead. In the first place, financial instruments are increasingly devoted to these objectives, leaving fewer degrees of freedom for responding to crisis, defending exchange rates or other objectives. Moreover, three ambitious initiatives inevitably add up to a government that is increasing its direct intervention in the economy. Rhetoric about letting the market play a definitive role and redefining the boundary between government and market is all to the good, but it simply does not correspond to this new reality.

Of course, restructuring will occur anyway, but given the lack of progress it is much more likely to occur under the pressure of events, rather than initiated by foresighted policy. To be sure, supply-side reform still has the potential to morph into many different variants. Much more aggressive debt restructuring programs are still feasible. Fiscal policy has unexploited potential, including initiatives as simple as expanding the deficit in order to increase outlays for medical services and other public health measures. The Chinese Government has impressive resources of material, finance and human talent. However, they will need to change habits to bring these resources into play. In addition to overhangs of debt and industrial capacity, China today has an overhang of rigid and dysfunctional systemic elements. If these are not taken care of, the challenge of effective restructuring will not be met.

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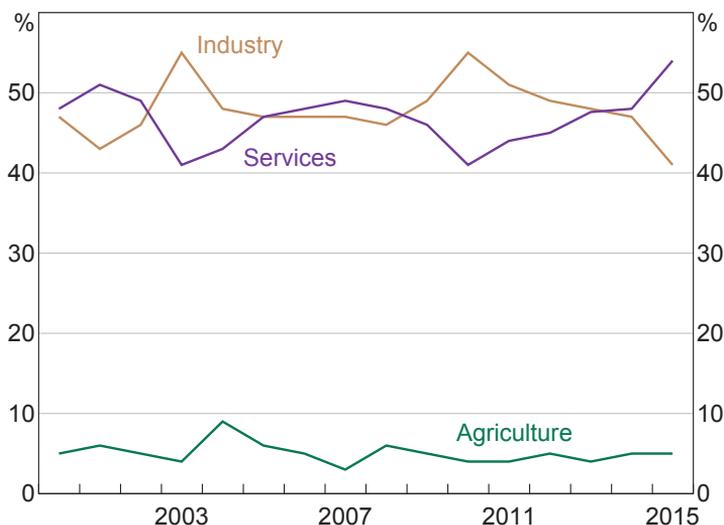
Discussion

1. Yanrui Wu

This paper on China's rebalancing, restructuring and reform by Barry Naughton is very informative and inspiring. Naughton starts with an analysis of aggregate statistics on the Chinese economy and finds no convincing evidence of significant restructuring even though rebalancing has been advocated by the government since 2005. He believes that the lack of rebalancing is due to inconsistent and unsuccessful economic reform policies in recent years. He supports his argument by examining the failure of state enterprise reform and local government debt restructuring. He also argues that the recent adoption of a new policy, 'supply-side structural reforms', is evidence of and a logical response to the past reform and policy failure. Nonetheless, while recent efforts have disappointed, he thinks that Chinese policymakers are adaptable and can learn from their experience.

While some authors have pointed to nominal sectoral GDP shares as evidence that the services sector has expanded steadily in China, Naughton argues that the observed trends are almost entirely due to changing relative prices rather than economic restructuring. Figure 2 in Naughton's paper shows sectoral GDP shares based on 2010 constant prices, which, he argues, show no evidence of structural change. I reproduced this figure and confirmed his observation that recent shares of industrial sector GDP are just above those of services sector GDP.

I used the same dataset to calculate sectoral shares of the change in annual GDP, which leads to different interpretations about rebalancing (Figure 1). I want to make two observations about this figure. First, in terms of incremental GDP shares, the services sector exceeded the industrial sector during 2006–08. This trend was, however, derailed by the economic stimulus package of CNY4 trillion (about US\$586 billion) initiated in 2008. Second, the services sector share bottomed in 2010 and has since maintained an upwards trend. It caught up with the industrial sector share in 2013 and has since been the largest of the three sectors. Wu (2015) suggests this growth in services is driven by faster total factor productivity growth.

Figure 1: Sectoral Shares of Incremental GDP

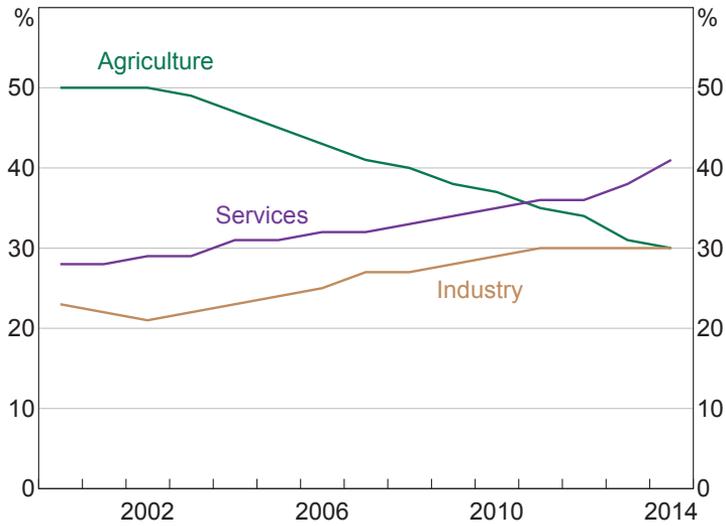
Note: Shares are calculated by using sectoral GDP statistics, which are expressed in 2010 constant prices

Sources: Author's calculations; NBS (2015)

Naughton also supports his argument about the lack of structural change by analysing sectoral employment statistics. The latest official statistics show that services recorded net job creation (17.28 million jobs). By contrast, in 2014 the agricultural sector lost 710 000 jobs and the industrial sector lost 13.81 million (NBS 2015). The author rebutted these job numbers and presented his own estimate of non-farm jobs creation of 5.01 million. While I am not suggesting that official statistics are flawless, I am not convinced about the alternative number proposed by Naughton either. In 2014, urbanisation alone led to a net population increase of 18.05 million in the urban sector, which creates a huge demand for jobs (NBS 2015). In support of his calculations, Naughton pointed to increased enrolment in the higher education sector, which potentially reduces new entrants into the workforce. The higher education sector in China is, however, a substantial source of labour supply. In 2014, 8.1 million students finished high school with 7.2 million being admitted into colleges or universities. In the same year, 6.6 million college graduates entered the job market (NBS 2015). Personally, I think that the employment statistics show clear evidence of structural change in the economy (Figure 2). China's industrial sector employment peaked in 2012, while agricultural employment has been declining since 2003 (NBS 2015).

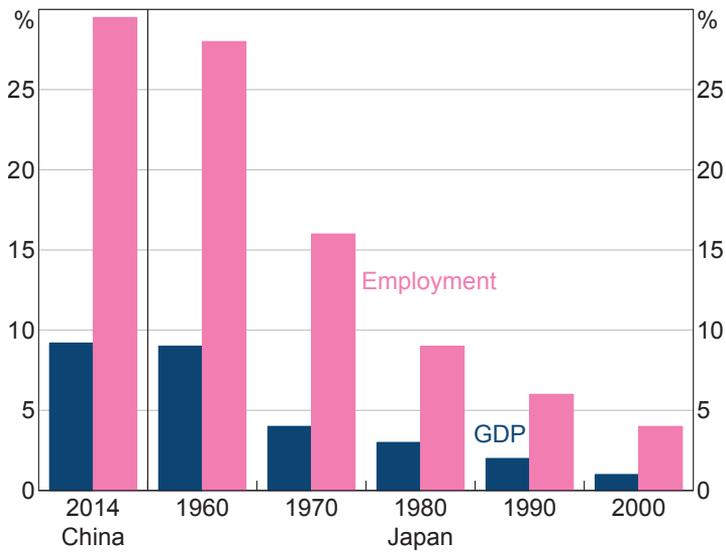
In 2014, China's agricultural sector had a GDP share of 9.2 per cent while its employment share was still 29.5 per cent. China's situation in 2014 is very similar to Japan's in 1960 (Figure 3). The dramatic decline in Japanese agricultural employment after 1960 implies a formidable task for China to create enough jobs, mainly in services, for rural migrant workers. But it is a task that Japan has already accomplished and, therefore, I think the officially reported employment statistics are probably acceptable.

Figure 2: Sectoral Shares of Employment



Sources: Author's calculations; NBS (2015)

Figure 3: Agricultural Sector
Share of total GDP and employment



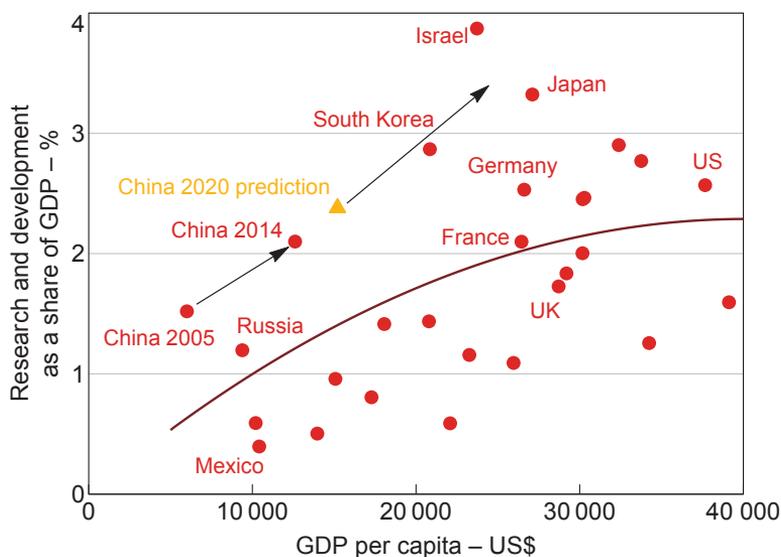
Sources: Author's calculations; NBS (2015); OECD (2009)

I generally agree with the author on China's slow progress in reforming state-owned enterprises (SOEs). The implementation of the 2008 economic stimulus package actually reversed the course of SOE reform. If progress is to be made, further reforms should encourage the growth of the private sector, particularly the participation of private and foreign firms in service provision as services are the main driver of economic growth and job creation (Wu 2015). The recently created state capital investment and/or operations companies (SCIOs) may contribute to this process, but the exact role and function of these SCIOs are yet to be tested.

As for local government debt, I agree with the author that restructuring has not been very successful. However, my own research shows that while we should continue to monitor China's local government debt, it is not yet at an alarming level (Wu 2014). Given the current economic downturn, it is unlikely that the central government will enforce strict local government debt policies. There are actually signs of policies being relaxed to stimulate spending and investment (*The Economist* 2016). In my opinion, there is still room for increasing investment in some areas. For example, services sectors, such as education and health care, have experienced under-investment for a long time in China.

Finally, a discussion of China's economic rebalancing should highlight the importance of innovation. Innovation plays a key role in industrial upgrading and, hence, is critical for China's long-term economic growth. Taking an international perspective, it seems likely that China's innovation development will follow the path of Japan and South Korea. Figure 4 demonstrates that, if it does, there is still huge potential for more investment in this area, which could help China catch up with more developed economies.

Figure 4: Research and Development Intensity and GDP per Capita
2005



Note: Sample includes China, Russia and selected OECD economies
Sources: Author's calculations; NBS (2015); OECD.Stat

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2. General Discussion

Much of the discussion focused on whether rebalancing has been as limited as the paper suggested. One participant questioned the result of a stable share of services in GDP in recent years (in constant price terms). They noted that household disposable income and consumption have risen faster than GDP in recent years and, given Engel's Law, we would expect the services share of consumption to rise. They argued this suggests demand for services should be increasing more rapidly than GDP. The participant also noted that investment in services had increased for at least three consecutive years and accounted for almost 60 per cent of total investment in 2015, which also suggests services have grown relatively rapidly. Another participant agreed that the services share of GDP was unlikely to have been stable in recent years, and questioned whether similar observations could have been made for Japan, South Korea and Taiwan at a comparable stage of their development.

One participant argued that the official data were likely to understate the importance of services, given the difficulties of capturing growth of new sectors, such as e-commerce and internet-related consumer activities. They noted that there has been difficulty in measuring growth of new sectors in the past, with significant upward revisions to growth estimates for 1998–2003 made in 2005 in order to capture new services industries. Another participant agreed there were data limitations in gauging growth in the services sector, with more information available on the industrial sector.

Some participants suggested alternative metrics that could be used to judge the extent of rebalancing. One participant noted that the relative fall in the goods price deflator partly reflected a global decline in capital goods prices, which may have led to an underestimate of the extent of rebalancing in recent years. They suggested an alternative way of assessing rebalancing is to examine the allocation of investment and credit to new industries. Another participant suggested that the share of household income in GDP and the income distribution was a more important metric for assessing the extent of structural change in China. They argued that 2012 was an inflection point for consumption and household income relative to GDP and the Gini coefficient. The participant also noted that this was consistent with strong growth in retail sales, car demand and property demand since 2012. In reply, Barry Naughton argued that he believes there has

been some structural change in recent years, but that the evidence is ambiguous, which suggests serious data issues or institutional problems.

There was also discussion around whether the implementation of reforms in recent years has been as disappointing as suggested in the paper. One participant took a more positive view of recent reforms, noting progress on phasing out local government financing vehicles, despite the risk to investment. The participant also argued that the introduction of deposit insurance, licensing of private banks, and opening of interbank markets had been very positive reforms and were significant for financial development. The participant suggested that allowing the shadow banking sector to grow rapidly had increased deposit rates, thereby benefiting households. Another participant argued reforms could have progressed faster than they had and that SOE reform in particular has been slow. However, they noted that reform in China is typically gradual and that there have been some significant changes in policy in the past two years that should be beneficial – for example, financial liberalisation, the removal of the one-child policy and changes to household registration policies. On the topic of reform, Professor Naughton explained that, relative to the benchmarks announced at the Third Plenum in 2013, reform in the past two years has been slow. He suggested that China is facing many policy challenges as growth slows, but that China still has catch-up potential and can learn from the experiences of other countries that have been through similar transitions, such as Japan and South Korea.

On the topic of local fiscal reform, one participant asked whether failure to impose harder budget constraints on local governments was likely to be a temporary or permanent failure. In response, Professor Naughton argued that the errors are likely to be temporary, but that it was difficult to determine the longer-run effects on growth. Another participant thought that it is too early to assess the consequences of the local government debt swap. They suggested that the authorities' actions highlight that the split between monetary and fiscal policy is not as clear as it could be. The participant noted a preference for tighter fiscal policy than the current stance, since expansionary fiscal policy typically benefits SOEs more than the private sector. They also argued that tight monetary policy can hurt the private sector much more than SOEs. Contrary to this view, Professor Naughton argued that it would be beneficial for fiscal policy to be more expansionary in order to support services sector development. In particular, he suggested that the government should increase health spending to help with the transition to a service-based economy. He also noted that if private businesses are to drive the transformation of the Chinese economy, then the authorities need to show support for those businesses.

The Key Obstacles to Success in Economic Catching Up by China

Wing Thye Woo*

1. The New Normal of Sustainable Development or the Middle-income Trap?

In 2014, after China's GDP had grown by 7.7 per cent in both 2012 and 2013, President Xi Jinping noted that China's economy had entered into a 'new normal' with a trend growth rate of about 7 per cent per year. This was a new trajectory compared to the period between 1978 and 2011, where average annual growth was around 10 per cent. Of course, growth of 7 per cent is still very high by international experience.

Historically, China's growth rate has generally been higher than announced growth targets. Since 1978, economic growth has only once been below target for two consecutive years, and these two years were in the politically challenging period of 1989 and 1990. Right now, China seems to be heading towards setting a new precedent in a rare underperformance in growth. The 2015 growth rate of 6.9 per cent was below the target of 7 per cent and, in April 2016, the International Monetary Fund (IMF) predicted that China's growth would be 6.5 per cent in 2016, 6.2 per cent in 2017, and 6.0 per cent in 2018, 2019, 2020 and 2021.¹

If these IMF predictions were to be realised, then China would just miss its announced target of doubling income growth between 2010 and 2020 (which would require average growth of 7.18 per cent). But if the downward trend of 2011–18 were to continue instead of stabilising at 6 per cent from 2018 onward, could one rule out the scenario that China's growth rate would continue to decline to, say, 4 per cent? In such a case, the development gap between China and the United States would remain practically unchanged between now and the end of the 21st century. While unfortunate, such a scenario is not unprecedented. China would be repeating the experience of Argentina in the 20th century.

The focus of this paper is on how China could avoid having the same fate as Argentina. That is, how could China avoid being caught in the middle-income trap? What does China have to do in order to succeed in closing the development gap between itself and the United States and Western Europe? Can China repeat the successful catch-up experiences of Japan, South Korea and Taiwan?

* I thank my discussant and participants at the Conference for their comments, some of which have been incorporated into this version of the paper. I am deeply grateful to the staff of the Economic Research Department of the Reserve Bank of Australia for great help in revising the conference version for publication. This paper builds on and updates some of my earlier work on the topic (e.g. Woo 2012b).

¹ See the IMF's World Economic Outlook Database, April 2016 edition, available at <<http://www.imf.org/external/pubs/ft/weo/2016/01/weodata/index.aspx>>.

The paper is organised as follows: Sections 2 and 3 propose a way to classify economies as low, middle or high income; Section 4 discusses the main economic challenges that China would have to overcome to become a high-income economy; and Section 5 proposes solutions to these growth obstacles.

2. Classifying the Income Status of an Economy

There are two major considerations when classifying an economy as high income, middle income, or low income (Woo 2012a). The first consideration is how these categories could be defined to have an analytical meaning appropriate to the research topic. The second consideration is where to draw the boundaries of these income categories in the distribution of country income levels.

The definition of income categories must have a built-in dynamic element to take account of the fact that the incomes of the world's richest economies have been rising steadily over the past 200 years due to factors like technological progress and institutional innovation. Therefore, the boundaries of the income categories should not be drawn on the basis of an absolute level of income.

I propose that income categories be defined by the per capita income level of the economy as a proportion of the level of the per capita income in the United States, which is commonly accepted to have been the economic leader of the world, at least since 1920, with per capita income measured in purchasing power parity units to ensure comparability in the standard of living across economies. This share – the catch-up index (CUI) – is constructed using GDP per capita data from the Maddison Project.

After matching the CUI with the generally accepted notion that most Western European countries are high-income economies, and that most sub-Saharan economies are low-income economies, I define:

- high-income economies as those with a CUI greater than 55 per cent
- middle-income economies as those with a CUI between 55 per cent and 20 per cent
- low-income economies as those with a CUI less than 20 per cent.

3. Comparing the Largest Regional Economies

It is useful to compare China with other economies that are similar in scale but are at different stages of growth in order to identify potential barriers to continued high growth in China. I compare China with three regional groupings:

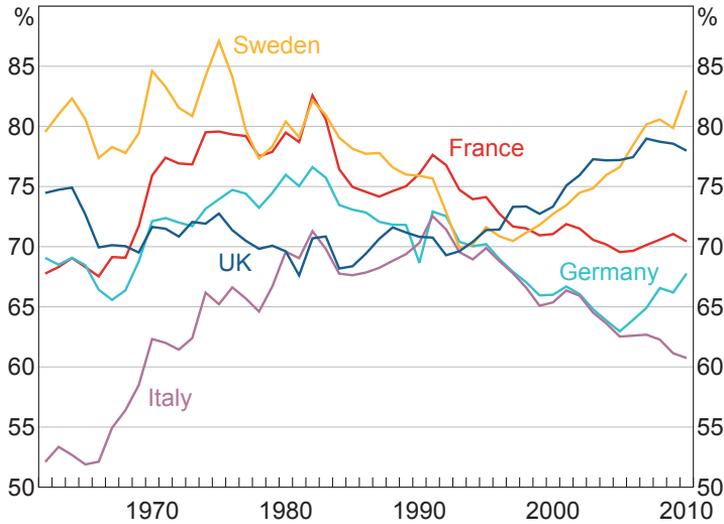
- Europe: France, Germany, Italy, Sweden and the United Kingdom
- Latin America: Argentina, Brazil, Chile, Mexico and Venezuela
- Asia: India, Indonesia, Japan, Malaysia, Philippines, South Korea, Thailand and Taiwan.

The dispersion of the CUI of the high-income European economies narrows from the start of the sample until the mid 1990s, then begins to widen (Figure 1). More amazingly, this group of high-income economies maintained an average value of about 70 per cent throughout this 50-year period.

In Latin America there is a narrowing of the spread of CUIs from a range of about 60 percentage points in 1962 to about 25 percentage points in 2010. This has involved convergence of the

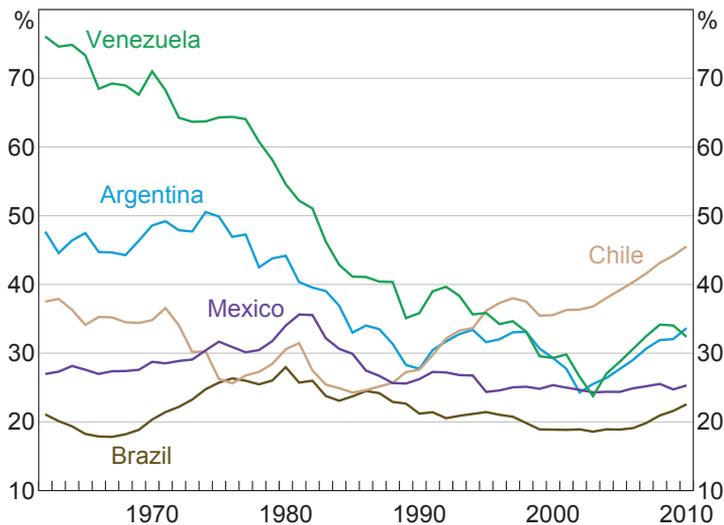
higher-income economies towards the levels of the lower-income economies (Figure 2). The group average CUI is around 40 per cent in 1962, but is 32 per cent in 2010, which means that, as a group, Latin America has fallen further behind the United States.

Figure 1: Europe – Catch-up Index
Share of US GDP per capita



Source: The Maddison-Project, <http://www.ggdgc.net/maddison/maddison-project/home.htm>, 2013 version

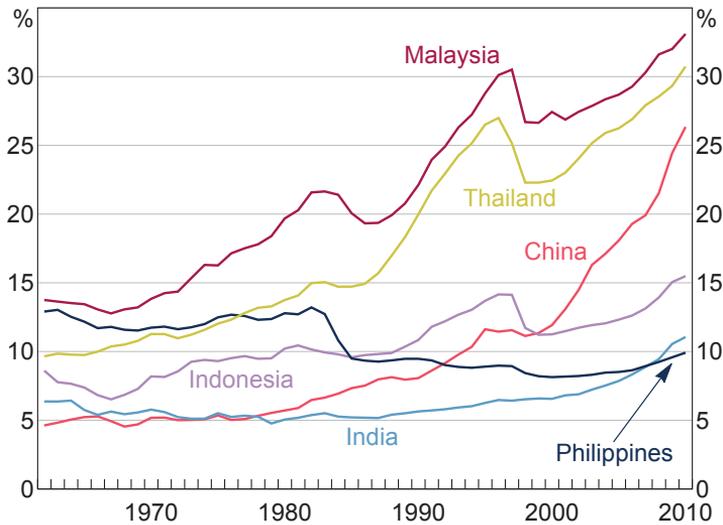
Figure 2: Latin America – Catch-up Index
Share of US GDP per capita



Source: The Maddison-Project, <http://www.ggdgc.net/maddison/maddison-project/home.htm>, 2013 version

Figure 3 shows the CUIs of the developing members of the Asian group: India, Indonesia, Malaysia, Philippines and Thailand, along with China. With the exception of the Philippines, these economies had a higher CUI in 2010 than in 1962, moving the average CUI of the group from 9 to 21. Unlike in the European and Latin American groups, the end result is a widening in the dispersion of CUIs because there were three economies that had very high growth: Malaysia, Thailand and China.

Figure 3: Developing Asia – Catch-up Index
Share of US GDP per capita



Source: The Maddison-Project, <http://www.ggd.net/maddison/maddison-project/home.htm>, 2013 version

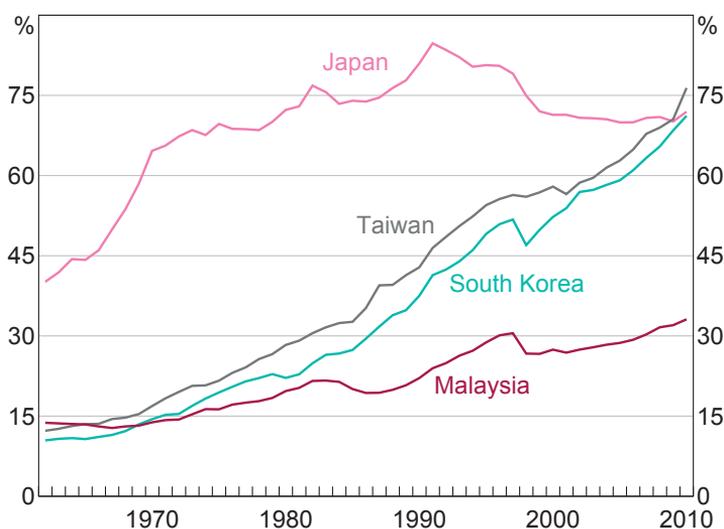
Malaysia has been the star performer of the group: it not only had the highest CUI value in this group throughout the 50 years, but also had one of the biggest increases in CUI, from 14 per cent in 1960 to 33 per cent in 2010. Thailand has also been a strong performer, with CUI rising from 10 per cent in 1960 to 31 per cent in 2010. It is for these reasons that the World Bank (1993) described them as miracle economies. More recently, China has broken away from India, Indonesia and the Philippines and closed the gap with Malaysia and Thailand, with its CUI at 26 per cent in 2010.

While Malaysia's performance looks good, the growth of the high-income Asian economies of Japan, South Korea and Taiwan are even more impressive (Figure 4). In fact, Malaysia was richer than Taiwan until 1965 and richer than South Korea until 1969. Malaysia has had respectable, but not outstanding, economic growth and its CUI has only increased gradually over the past 13 years, from 31 per cent in 1997 to 33 per cent in 2010. The Malaysian CUI has not moved far from 30 per cent for more than a decade – a level that the Latin American economies have been at since at least 1960.²

² Woo (2011) gives the reasons for this outcome in Malaysia. The race-based and over-centralised policy regime was incompatible with globalisation because it enabled inept governance and rent-seeking, while generating a massive brain drain and enormous capital flight. Efforts are being made to address these problems.

So, while China has had remarkable growth in its CUI, it remains to be seen whether China can escape the Malaysian malaise of the middle-income trap.³

Figure 4: Asia – Catch-up Index
Share of US GDP per capita



Source: The Maddison-Project, <http://www.ggdcc.net/maddison/maddison-project/home.htm>, 2013 version

4. What Could Cause China to Fall into the Middle-income Trap?

A good guide to the probability of continued high growth in China is found in the discussions of the annual Plenum of the Communist Party of China (CPC) that concluded on 11 October 2006. From 1978 through to 2005, every plenum had ended with the resolution that the primary task of the CPC in the following year was ‘economic construction’, which has been widely interpreted as GDP growth. The 2006 plenum broke with tradition and passed a resolution to commit the CPC to establish a harmonious society by 2020. An obvious implication from this resolution is that the present social, economic and political trends within China might not lead to a harmonious society or, at least, not lead to a harmonious society fast enough.⁴

What led the CPC to change its primary focus from ‘economic construction’ to ‘social harmony’? I like to use the analogy of China’s economy being like a speeding car. The CPC saw that the car could crash in the near future because there were several possible failures that might occur and

³ Thailand is another likely case of being mired in the middle-income trap. Its CUI rose from 27 per cent in 1996 to 31 per cent in 2010, a 4 percentage point rise over 14 years compared to the 12 percentage point increase in the preceding 14-year period of 1982–96 indicating a loss in economic dynamism.

⁴ The proposed harmonious socialist society would encompass a democratic society under the rule of law; a society based on equality and justice; an honest and caring society; a stable, vigorous and orderly society; and a society in which humans live in harmony with nature.

trap China in middle-income status. To be specific, I think there are three classes of failure that could occur that I call hardware failure, software failure and power supply failure.

A *hardware failure* refers to the breakdown of an *economic mechanism*, a development that is analogous to a broken steering column in the car. Probable hardware failures include a banking crisis that causes a credit crunch that, in turn, dislocates production economy-wide, or a budget crisis that necessitates reductions in important infrastructure and social expenditure (and also possibly generates high inflation as well as balance of payments difficulties). When the steering column is broken, it doesn't matter how much you turn it, the car is still going to crash.

A *software failure* refers to a flaw in *governance* that creates widespread social disorder that disrupts production economy-wide and discourages private investment. This is like a car crash that results from a fight among the people inside the speeding car. Software failures could come from the present high-growth strategy – which has increased inequality and corruption that, in turn, might generate severe social unrest and dislocate economic activities – or from the state not being responsive enough to rising social expectations, hence causing social disorder.⁵

A *power supply failure* refers to the economy being unable to move forward because it hits either a *natural limit* or an *externally imposed limit*, a situation that is akin, respectively, to the car running out of petrol or to the car smashing into a barrier erected by an outsider. Examples of power supply failures are an environmental collapse, or a collapse in China's exports because of a trade war. Inability to prevent a climate disaster is a science policy failure and a trade war is a foreign policy failure.

The fact that the CPC chose to emphasise the danger of social disharmony suggests that it regards software failure as having the highest probability of occurrence. The post-2006 emphasis of the government on generating inclusive growth supports this interpretation. However, the global financial crisis (GFC) in 2008 and the prolonged economic stagnation of the G7 economies that followed have made macroeconomic management in China much more challenging and greatly strengthened the protectionist sentiments within the G7. These two developments have raised the probability of hardware and power supply failures. In the following sections I discuss each class of failure and likely precipitating events further.

4.1 Hardware failures

At present there are two hardware failures that are likely, both of which have been exacerbated by the CNY4 trillion stimulus package that the government announced in response to the GFC. The first is the possibility of a rapid increase in non-performing loans (NPLs), which could in turn cause a fiscal crisis as a result of bailing out state-controlled banks (SCBs). A fiscal crisis could then necessitate a reduction in government expenditure in areas such as infrastructure, which have typically supported growth.

As long as the state is perceived as willing and able to bail out the SCBs, depositors would most likely retain their confidence in the SCBs regardless of the actual state of their balance sheets. China began the recapitalisation of the SCBs in 2003 and brought the capital adequacy ratio of the four largest SCBs to about 8 per cent by the end of 2004. However, it is unclear how many more rounds of bank recapitalisation China can afford without generating a fiscal crisis. The simple fact is that fiscal sustainability lies at the heart of whether a banking crisis would actually occur.

⁵ In Marxian terminology, a hardware failure is the breakdown of an important component of the base structure; and a software failure is the breakdown of a key part of the superstructure.

In this respect, an important indicator of fiscal sustainability is the steady-state level of the debt-to-GDP ratio. If the steady-state level is too high it calls into question the sustainability of the current path. To put the issue formally, the evolution of the debt-to-GDP ratio is given by:

$$d(\ln[Debt / GDP]) / dt = r + [GDP / Debt] \cdot [f + b] - y$$

where

r = real interest rate on government debt

f = primary fiscal deficit rate = [state expenditure excluding debt service – state revenue]/GDP

b = NPL creation rate = [change in NPL in SCBs]/GDP

y = trend growth rate of real GDP.

As long as $y > r$, then $Debt/GDP$ will have a steady-state value that is non-zero when the sum of $(f + b) > 0$. Specifically,

$$(Debt / GDP)_{steady\ state} = (f + b) / (y - r) \text{ when } y > r$$

The average long-term growth rate (y) for the 1978–2011 period was a little more than 9.5 per cent. Since the growth slowdown began in 2012, the government has called this a ‘new normal’ economic era, which is usually taken to mean a long-term growth rate of about 7 per cent. The historical value for the primary deficit of the Chinese state budget (f) is 2–3 per cent of GDP. The real interest rate is in the historical range of 3–7 per cent. The NPL-generation process that led to the NPL ratio being 50 to 70 per cent of total loans in 1999 would imply an annual NPL creation rate (b) of 8 to 11 per cent of GDP.⁶ To be conservative, we assume that the historical value of b is 6 per cent of GDP.

In our simulations of the value of steady-state $Debt/GDP$, we also used $b = 3$ and $b = 1$ as scenarios where control of NPL creation has improved greatly from the past. The widely dismissed official estimate of the 1999 NPL ratio being 25 per cent implied $b = 3.9$. Drawing upon the target growth range of 6.5 to 7.0 per cent in the 13th Five-Year Plan (2016–20), we conduct two simulations: the *optimistic scenario* where growth is 8 per cent (higher than the upper limit of the target), and the *‘new normal’ scenario* where growth is 6.8 per cent (in the middle of the target range).

Under the optimistic scenario: $y = 8$ per cent, $f = 2$ per cent, and $r = 3.5$ per cent, we find

- $(Debt/GDP)_{steady\ state} = 178$ per cent when $b = 6$ per cent
- $(Debt/GDP)_{steady\ state} = 111$ per cent when $b = 3$ per cent
- $(Debt/GDP)_{steady\ state} = 67$ per cent when $b = 1$ per cent

6 Foreign financial firms like Deutsche Bank and Standard & Poor’s have estimated that the NPL ratio in the Chinese banking system was 50 to 70 per cent in 1999 (Chang 2001, pp 124). To estimate the average annual creation of NPL, we note that 1985 was a turning point in bank financing of the activities of enterprises. Before 1979, much of the expenditure of the state enterprises was covered by budgetary grants. In 1979, the government reduced grants to enterprises in some industries located in Beijing, Canton and Shanghai, and these enterprises were allowed to borrow more from the banks. In late 1984, the government announced that all enterprises in China would have their budgetary grants replaced by bank loans from the beginning of 2015 (the *bo gai dai* reform). If we assume that NPLs started appearing only from 1985 onwards, then the average creation of NPL (value of b) in the 1985–99 period would have been 7.7 to 10.8 per cent of GDP in each year. If we push the starting date for NPLs back to 1979, the value of b would have been 7.4 to 10.3. In the baseline scenario of our simulations, we have chosen the conservative assumption that $b = 6$ which has caused the NPL ratio in 1999 to be 39 per cent (if we take the starting date of NPLs to be 1985).

Under the 'new normal' scenario: $y = 6.8$ per cent, $f = 2$ per cent, and $r = 3.5$ per cent, we find

- $(Debt/GDP)_{steady\ state} = 242$ per cent when $b = 6$ per cent
- $(Debt/GDP)_{steady\ state} = 152$ per cent when $b = 3$ per cent
- $(Debt/GDP)_{steady\ state} = 91$ per cent when $b = 1$ per cent

In evaluating the results of these simulations, the EU debt-to-GDP benchmark of 60 per cent provides a useful guide. The simulations under the optimistic scenario reveal that the only time that the equilibrium government debt-to-GDP ratio is anywhere close to the EU benchmark is when b is 1 per cent, which is well below the rate recorded when NPLs rose sharply in the late 1990s. The simulations under the 'new normal' scenario emphasise that fiscal sustainability is not assured even with a relatively optimistic outlook for NPLs ($b = 1$) since the lower growth rate of 6.8 per cent has made it impossible for the debt-to-GDP ratio to converge to a prudent value near or below 60 per cent. In short, under the 'new normal' growth rate, the soft-budget constraint must be eliminated completely in order for fiscal sustainability to be possible.

The stimulus package introduced by the Chinese authorities in response to the GFC has increased the risk of a significant rise in NPLs. The central government only provided funding for around one-third of the total stimulus package. As such, Premier Wen Jiabao implicitly gave permission to the state-controlled enterprises (SCEs) to invest more and to the SCBs to extend loans to fund the approved projects. The strategy of using non-profit-maximising state-controlled production and financial units to boost aggregate demand proved successful in offsetting the slump in private sector spending. However, these policies may have increased financial vulnerabilities, particularly because managers of SCEs and the SCBs felt they would not be held responsible should the projects become financial busts.⁷ Therefore, some analysts are concerned that loans extended for unprofitable projects as part of the stimulus program would lead to a large increase in NPLs and that the resulting financial crisis would cause China to crash, as the United States and United Kingdom did in 2009 (e.g. Tasker 2009; Barboza 2010). Other analysts have suggested that the bailout of the SCBs by the government could cause a fiscal crisis that would require large cutbacks on important infrastructure and social programs.

A second possible hardware failure is lower productivity growth. The risk of low productivity growth has also been exacerbated by the stimulus program, with the concern being that SCBs were channelling the flood of liquidity to SCEs and neglecting the increased financing needs of the private sector.^{8,9} For example, pressed for working capital, two well-known large private companies, Rizhao (a steel firm) and Mengniu (a dairy), agreed to be acquired by their state-owned counterparts. As SCEs are generally less efficient and innovative than private firms, the expansion of the role of the state firms has raised the issue of whether Premier Wen's way

7 In testimony before the U.S.-China Economic and Security Review Commission, Woo (2009) predicted that 'The state-owned banks (SOBs) will be happy to obey the command to increase lending because they cannot now be held responsible for future nonperforming loans. The local governments and the state-owned enterprises (SOEs) can now satisfy more of their voracious hunger for investment motivated by the soft-budget constraint situation where the profits would be privatized and the losses socialized. The stimulus package will work well because of the collusion between the managers of the SOBs and SOEs to transfer public assets to themselves.'

8 Herrala and Jia (2015) found that bank loans to non-state firms were drastically curtailed from 2004 onward.

9 The bailing out of unprofitable SCEs by the state has created 'zombie firms' that reduce the fiscal space of the state and the overall efficiency of the economy; see Tan, Huang and Woo (2016).

of imparting the needed boost to capacity utilisation during the GFC would become a drag on future productivity growth (Wheatley 2010).^{10,11}

4.2 Software failures

One possible software failure may arise from inadequate governance. The satisfactory functioning of a market economy requires a wide array of regulatory institutions that range from straightforward law and order administration to complicated legal adjudication. China's strategy of incremental reform, combined with the fact that institution building is a time-consuming process, means that many of its regulatory institutions are either absent or ineffective. The result has been governance failures on many fronts. The most well-known of these are the consumer product scandals: the addition of poisonous substances to toothpaste, cough medicine and animal feed; the application of lead paint to children's toys; and the overemployment of anti-fungal and anti-bacterial agents in fish farming. Most of these abuses only received international media attention because these items were exported to other countries.

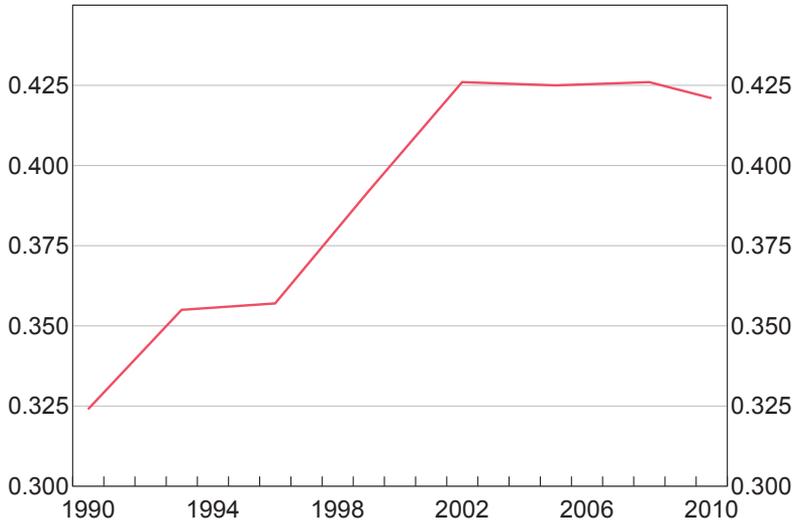
Another possible software failure may be brought about by heightened income inequality. Despite its ability to generate high growth, the present economic development strategy is now generating social tensions. This is because a noticeable rise in income inequality has accompanied the high growth (Figure 5). The Gini coefficient rose significantly through the 1990s and has been well above 0.4 – the level commonly thought to deem severe income inequality – since at least 2002.¹²

A third possible software failure could be caused by the opportunities for embezzlement of state assets, seizure of farmlands for industrial development, and corruption due to the absence of effective mechanisms to supervise government employees. These features certainly make social harmony hard to sustain. This is why '[t]wo days after taking control of the world's most powerful political party in November 2012, Xi Jinping warned his fellow Chinese Communist Party members that their six decades of rule was in jeopardy because of what he saw as endemic corruption eating away at the party's authority and effectiveness' (Forsythe 2016). A vigorous anti-corruption campaign has been in progress since then, and the highest ranked official caught to date is Zhou Yongkang, a member of the previous Standing Committee of the Political Bureau of the Communist Party of China.

10 This debate over the growth of the state firms at the expense of private ones is conducted under the heading of *guojin mintui* (the state sector advances, and the private sector withdraws).

11 Woo (2016) provides details of the appropriate supply-side structural reform programs and also argues for the importance of ending the soft-budget constraint practice of the state.

12 One major contributor is that the trickling-down mechanism in income diffusion has slowed down significantly, and is hence unable to reduce extreme poverty further and improve significantly the rural–urban income distribution and the regional income distribution; see Démurger *et al* (2002) and Woo *et al* (2004).

Figure 5: China – Gini Coefficient

Source: World Bank

Wang and Woo (2011) found that urban residents have substantial unreported (hidden) income (Table 1). The official income per capita and 'true' income per capita in the richest 10 per cent of households in 2008 was CNY43 614 and CNY139 000, respectively; official income being one-third of true income. Total household disposable income in 2008 was CNY14.0 trillion according to the official data but true income was estimated to be CNY23.2 trillion. Since 63 per cent of unreported income went to the richest 10 per cent of urban households, the income of the richest 10 per cent of Chinese households is estimated to be 26 times that of the poorest 10 per cent, compared with the 9 times according to the official data.

The data on social unrest are consistent with the hypothesis of rising social disharmony. The incidence of public disorder, labelled 'social incidents', rose steadily from 8 700 in 1993 to 32 500 in 1999 and then to 74 000 in 2004; and the average number of persons in a mass incident has also risen significantly, from 8 in 1993 to 50 in 2004. The number of mass incidents would have been lower and governance would have been better if the government's actions had been monitored closely by an independent mechanism and the government had also been held more accountable for its performance. The introduction of the Harmonious Society program in 2006 and the launch of the vigorous anti-corruption campaign in 2012 by CPC are acknowledgements that inclusive growth (a more equitable income distribution) and good governance (rule of law) are both necessary to ensure the social stability that will keep the economy on the high growth path.

Table 1: Disposable Income per Capita for Urban Residents – 2008
By income category

Category	Per cent of residents	Official income	'True' income	Distribution of hidden income
		CNY	CNY	
Lowest income	10	4 754	5 350	0.4
Low income	10	7 363	7 430	0.0
Lower middle income	20	10 196	11 970	2.3
Middle income	20	13 984	17 900	5.1
Upper middle income	20	19 254	27 560	10.9
High income	10	26 250	54 900	18.8
Highest income	10	43 614	139 000	62.5
All	100	16 885	32 154	100.0

Note: Hidden income equals total 'true' income less total official income

Source: Wang and Woo (2011, Tables 5 and 6)

4.3 Power supply failure

4.3.1 Environmental collapse

Environmental issues are one possible cause of a power supply failure. The present mode of economic development has given China the dirtiest air in the world, is polluting water resources and is possibly changing climate patterns within China.

The air quality in China is a key concern, from both a health and an economic perspective. The Organisation for Economic Co-operation and Development (OECD) estimates that around 905 000 premature deaths were caused by outdoor air pollution in 2010, with that figure projected to rise to at least 2 million by 2060 (OECD 2016). The OECD also estimates the economic costs of air pollution – due to reduced labour productivity, additional health expenditures and crop yield losses – will be around 2.5 per cent of annual Chinese GDP by 2060.

Water shortages in the north of China are another major environmental threat to China's continued high growth. In 2002, the government began implementation of Mao Zedong's 1952 proposal that three canals be built to bring water from the south to the north: an eastern coastal canal from Jiangsu to Shandong and Tianjin, a central canal from Hubei to Beijing and Tianjin, and a western route from Tibet to the north-western provinces.¹³ This massive construction project has been, and will continue to be, technically challenging, fraught with environmental risks and politically sensitive. For example, the enlargement of the Danjiangkou Dam (in Hubei) to enable it to be the source of the central canal displaced 330 000 people (Cheung 2003).¹⁴

Effective environmental policymaking is a very difficult task as much of the relevant science is unknown. Despite this, the uncomfortable reality for China is that unless ecological balance is

¹³ Information about the South-to-North Water Diversion Project can be found at <<http://www.nsb.gov.cn/zh/english/>>.

¹⁴ A lower estimate of 300 000 is given in Eckholm (2002).

restored within the medium term, environmental limits could choke off further economic growth. And the uncomfortable reality for the rest of the world is that the negative consequences of large-scale environmental damage within a geographically large country are seldom confined within that country's borders.

There is no doubt, however, that the Chinese Government is trying to improve its performance in sustainable development. As noted by Jeffrey Sachs, Special Advisor to United Nations Secretary-General Ban Ki-moon, the newly unveiled 13th Five-Year Plan for 2016–20 is 'highly aligned' with the 17 Sustainable Development Goals that were adopted by the global community in September 2015 (China Daily Asia 2016). The environmental targets for 2020 outlined in the 13th Five-Year Plan include:

- water consumption is to be 35 per cent lower than in 2013
- total consumption of primary energy is to be less than 5 billion tonnes of standard coal equivalent units
- energy consumption per unit of GDP is to be 15 per cent lower than 2015 levels
- carbon dioxide emissions per unit of GDP is to be 40–45 per cent lower than 2015 levels (King & Wood Mallesons 2016).

4.3.2 Foreign relations

A second possible cause of a power supply failure is antagonistic foreign relations. The list of US grievances generated by the large US–China bilateral imbalances has expanded from the loss of US jobs to include the meltdown of the US financial market in September 2008 (Guha 2009). *The New York Times* (2010) indulged in some oxymoronic rhetoric, calling the *fixed* CNY–USD exchange rate 'a textbook example of the beggar-thy-neighbour competitive *devaluation*' (emphasis added). Parallels with the Opium Wars of the 19th century are also being drawn, only with the identities of the aggressor and the victim reversed. According to Lardy: 'The United States is the addict. We are addicted to consumption ... China is the dealer. They're supplying the credit that makes it possible for us to over-consume' (quoted within St. Cloud State University (2009)).

China–US trade tensions have reached a dangerous level as exemplified by the recent accusation by presidential candidate Donald Trump that China was using unfair trade practices (BBC News 2016).

5. The Reform Agenda

5.1 The hardware reform agenda

The potential hardware failures identified in the section above were exacerbated by the authorities' large-scale stimulus package. As a result, different strategies should be used to address the present slowdown in growth. I propose two new interrelated growth drivers that would minimise the trade-off between full utilisation of existing production capacity and viable long-term growth of production capacity. The policies are: the creation of more private entrepreneurs; and urbanisation according to the principle of future home ownership.

First, the authorities could encourage entrepreneurship by mobilising the inland migrant workers (*nongmin gong*) laid off from the coastal provinces. Many of the *nongmin gong* have sufficient work experience to start their own factory or workshops to take advantage of the increased cost competitiveness of the inland provinces, created by the explosive extension of the national transportation network during the GFC. Because the availability of credit is the primary barrier to the emergence of this group of owner-operators, the government should encourage the development of small and medium-sized private banks, which have comparative advantage over the four large state banks in catering to the needs of new entrepreneurs.¹⁵ Farmland should also be privatised so that the new businesses can access collateral. The creation of a large new group of private entrepreneurs will bring three major benefits: expenditure by this new group will support aggregate demand; private firms are likely to have higher productivity growth than SCEs; and these small and medium-sized private enterprises will be more labour intensive than SCEs.

Second, the authorities could encourage further urbanisation based on the principle of affordable future home ownership. The fast growth of the real estate sector over the past decade reflected not just speculative demand but also genuine pent-up demand for housing.¹⁶ The bulk of the new arrivals from the countryside do not qualify for bank mortgages, and so many investors have been buying multiple housing units to rent to the new arrivals with the intention of raising the rents over time in line with the income growth of the renters. In this sense, much of the housing demand has been speculative.

China could study the low-cost public housing schemes in Hong Kong and Singapore and establish a national housing program where the new arrivals rent homes for seven years and then have the first right to buy these units at a price based on construction costs. China can afford a massive public housing program because the expensive part of such programs in other countries is the cost of land, not the cost of the structures, and land in China is mostly owned by the state.

This proposed future-ownership form of urbanisation would support China's growth in three ways: the maintenance of real estate investment to supply required housing and to help maintain the existing level of aggregate demand; the redirection of bank loans to new rural migrants, with a new housing agency acting as an intermediary, to prevent the appearance of NPLs; and the redistribution of income to rural migrants, which helps to reduce the threat of software failure.

These new growth drivers would be mutually reinforcing. The new enterprises of the former rural migrants would inevitably be located in or near towns and cities to take advantage of infrastructure and positive spillovers from higher population density. The institutional adjustments needed to underpin both growth drivers are also the same: privatisation of farmland; termination of the household registration system; and liberalisation of the financial system.

¹⁵ The system of prudential supervision must also be strengthened.

¹⁶ If speculative demand had been the overwhelmingly dominant cause for the property boom, then house rents would not have risen substantially (because the speculative investors would tend to rent out their extra units). Instead, rent in Beijing in March 2010 was 19.6 per cent above March 2009, see Liu (2010).

5.2 The software reform agenda

I agree with the CPC that the probability of a software failure is higher than the probability of a hardware failure. For most hardware problems, China can learn from the experiences of the rest of the world, especially those of the richer economies in east Asia, as long as ideological constraints on methods of economic management continue to wither. The 1868 insight of the Meiji reformists, that success in economic catch-up largely involves a willingness to adopt and adapt to 'best international practices', will continue to apply to China until its per capita GDP converges with that of Japan and Western Europe.

Dealing with software failure is harder than dealing with hardware failure for two major reasons. The first is that policymaking in China has become more challenging because expectations of administrative performance have risen dramatically with income growth and increasing knowledge of the outside world. In this new situation, the greater use of democratic procedures, the establishment of an independent judiciary and the restoration of a free press might be inevitable if China is to successfully accommodate and mediate emerging differences in rising social expectations. A Chinese government that consistently fails to deliver progress towards the Harmonious Society vision fast enough to catch up with the rise in social expectations runs an increasing risk of social instability.

The second reason that fixing software failures is difficult is that successful reconfiguration of institutions requires highly developed political skills, favourable circumstances in the domestic political arena and a benign international environment. What happens in the future will depend on whether the CPC is politically skilful enough to lead the transition to a democratic, equitable and law-based harmonious society and emerge afterwards as the most important political force. The practical issue is whether the CPC can do a better job in political transition than the Kuomintang did in Taiwan during 1983–88.

5.3 Dealing with power supply failure

5.3.1 Failure caused by environmental degradation

Effective environmental policymaking is a very difficult task because much of the necessary science is not yet fully understood. A systems approach to policymaking is necessary because interaction between the different sectoral policies could generate serious unintended environmental damage. A sustainable development policy would require a complete rethinking about the location of population centres and the types of enhanced international cooperation on global environmental management.

In discussing the environmental aspects of the water transfer plan it is important to note that there is public controversy in China involving a key government infrastructure project and that this controversy is not limited to members of the technocracy. The very public nature of the controversy, and the involvement of those outside the fields of science, engineering and economics, reveals how far social attitudes have progressed. The important point is that this change in social expectations will require any government in China to live in harmony with nature. However, any government will have great difficulties in doing so, even if it wants to, because a green growth policy involves a systems approach and scientific understanding of many ecological sub-systems and the nature of their interactions is still rather incomplete.

The global environment is an important area in which China can help to build a harmonious world system.¹⁷ Important progress was made on this front between the United States and China at the 2016 G20 Summit in Hangzhou when 'President Obama and President Xi Jinping of China formally committed the world's two largest economies to the Paris climate agreement ... cementing their partnership on climate change and offering a rare display of harmony in a relationship that has become increasingly discordant' (Landler and Perlez 2016).

5.3.2 Failure caused by trade protectionism

It should be noted that a trade imbalance reflects the economic situation in two countries: China could not have over-saved if the United States had not under-saved. US profligacy is just as much to be blamed for the trade tensions as Chinese thriftiness. Even today, the US Government does not have a credible plan to reduce its budget deficit upon the recovery of the economy. The straightforward implication is that a fair solution to any desired reduction in the trade imbalance would require corrective measures to be implemented by both China and the United States.

There are quite a number of China-centric explanations for China's persistent trade surplus.¹⁸ The two that seem the most important are: the *financial market theory*, which attributes the imbalance to the inability of China's largely unreformed financial system to intermedicate all savings into investment; and the *industrial policy theory*, which attributes the trade imbalance to China's promotion of exports and suppression of imports.

The failure in financial intermediation comes from two main sources. First, the legal status of private enterprises was, until recently, less secure than that of the state enterprises. Second, there was no reliable way to assess the balance sheets of the private enterprises, which were naturally eager to escape taxation. The upshot was that the residual excess savings leaked abroad in the form of the current account surplus. Inadequate financial intermediation has made China a capital-exporting country and put it in conflict with its trade partners (Woo 2008).¹⁹

The industrial policy explanation describes China's chronic trade surplus as the unintentional outcome of the overriding economic and political priority in China to create jobs, and the widespread belief in the efficacy of infant industry protection. The resulting export subsidies, import barriers and undervalued exchange rate worked together to accelerate the simultaneous growth of export firms (which increased exports) and import-competing firms (which decreased imports), and hence kept the trade balance in surplus.²⁰

17 See McKibbin, Wilcoxon and Woo (2008) for an example of an efficient global CO₂ emission compact that China and the rest of the world could adopt.

18 Such explanations are considered 'China-centric' because they ignore the obvious fact that the current account balance is also determined by US conditions.

19 Savings behaviour is not independent of the sophistication of the financial system. An advanced financial system will have a variety of financial institutions that would enable pooling of risks by providing medical insurance, pension insurance and unemployment insurance; and transform savings into education loans, housing loans, and other types of investment loans to the private sector. Other things being equal, the more sophisticated a financial system, the lower the saving rate.

20 The industrial policy theory has been challenged on the grounds that its microeconomic plausibility is at odds with economy-wide constraints. Specifically, in a two-sector general equilibrium model of exportables and importables there could not have been simultaneous growth of the exportable sector and the importable sector because labour would flow from one to the other depending on the relative size of the effective export subsidy rate and the effective import tariff rate. Hence, the trade balance would not be affected by the industrial policy. However, this theoretical reasoning about industrial policy does not hold for China because of the existence of surplus labour in the countryside, which could move into both the exportable sector and the importable sector, and because of the existence of a sizeable non-tradeable sector, for example low value-added service activities and subsistence agriculture, that would release labour to the 'policy-favoured' tradeable sector.

Both factors are likely to have contributed to China's persistent trade surplus and undertaking actions to address these concerns is likely to enhance China's welfare and help prevent a trade war with the United States. Potential policy initiatives to continue developing the financial sector include opening China's capital account further and domestic financial deregulation. To address industrial policy concerns, export incentives and import barriers could be slowly unwound.

US–China trade tensions would be lowered substantially if both countries undertake corrective policies rather than if China acts alone, and the two countries should work together to prevent the World Trade Organization (WTO) free trade regime from weakening. Specifically, China has benefited immensely from the WTO system, but has played a very passive role in pushing the Doha Round negotiations forward. By default, Brazil and India have assumed the leadership of the developing economies in the trade negotiations.

With the United States weakening in its resolve to protect the multilateral free trade system, China should now become more active in the Doha Round negotiations to deregulate world trade further. Such a role will be very much in China's interest because Brazil is now bypassing multilateral trade liberalisation by entering into free trade agreement negotiations with the European Union. A growing number of nations like Brazil 'are increasingly wary of a multilateral deal because it would mandate tariff cuts, exposing them more deeply to low-cost competition from China. Instead, they are seeking bilateral deals with rich countries that are tailored to the two parties' needs' (Miller 2007). It is the time for China to show that it is a responsible stakeholder by joining in the stewardship of the multilateral free trade system. Such a stance in foreign relations would also reduce the threat of this type of power supply failure to China's own growth.

6. Final Remarks

China has achieved middle-income status through the marketisation and internationalisation of its economy. My assessment is that the continued high growth rates that will enable China to catch up with high-income economies can be generated only if China adopts a new development strategy. This new development strategy is based on the recognition that comprehensive supply-side structural reform has to be implemented, that Chinese society has come to possess more and more of the middle-class aspirations common to the industrialised world, and that China has now become an important shaping force of the global economy (McKibbin and Woo 2003).

China should therefore adopt the harmonious society ideal as the primary internal objective and the harmonious world ideal as the primary external objective. The administrative software that will allow the achievement of a harmonious society will require an increasing use of free elections, monitoring by a free press and adjudication by an independent judiciary. China should start adopting the global perspective that is required of a world leader who will work for the protection of the global environmental commons, the global trading system and global security in order to ensure that China's transition to high-income status is not foiled by the physical environment or the international political environment.

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Discussion

1. Huw McKay

It is an honour to have been asked to participate in this important conference. It is, however, a little intimidating having to follow such an entertaining and engaging speaker as Professor Wing Thye Woo.

The question he tackled for us – China’s prospects for avoiding the middle-income trap (MYT) – is an immensely practical one in which we all have a personal as well as an intellectual interest. Personally, I have been thinking about this question from a number of different perspectives over the course of my career – as an academic, as a banker, as a policymaker and now, as an employee of the world’s largest diversified mining company, BHP Billiton. The following thoughts owe something to each of those perspectives.

To begin, my first observation with respect to the MYT is that it is a question in which data constraints loom large. There are two concerns here: the length of the time series and the representativeness of the samples. They are related to each other. As it is a difficult matter to assemble rich economic datasets representing the middle-income phase of economic development in the first- and second-generation industrialisers, researchers tend to fall back on more recent history where such data is more readily available. This inevitably restricts the sample size. This in turn opens up questions regarding sample representativeness.

Limitations related to the sample are often then compounded by the fact that some researchers respond to this challenge by resorting to cross-sectional point-in-time analysis to study MYT issues. Such analyses are very sensitive to sample choice and tend to highlight the reality that at any given time, the middle-income area is lightly inhabited. Successful economies transit the phase rapidly. Few economies enter into the discussion to begin with. Some have entered into the discussion recently by growing into the middle-income region; others have entered into the discussion by falling from grace. These very different paths towards middle-income – recent success and recent failure – are not differentiated in such a framework. In sum, middle-income economies are by definition atypical, being scarce, and are therefore less amenable to empirical rigour than their low- and high-income counterparts.

The most popular and defensible approach from this point is to prosecute a case for why a small sample can be representative and to lean principally on qualitative analysis of the sample constituents, which is what Wing has done. With the east Asian development model on his side, this approach is not particularly controversial. What is more controversial is the way that the various ‘lessons’ of the east Asian path are projected onto China and what examples from outside the region, such as those from Latin America, are seen as legitimate inputs to the discussion.

Here we enter into the zone where political economy, geoeconomics, geopolitics and mainstream economics intersect – somewhat uncomfortably. This is very much the case in one important element of this debate – which Wing left undeveloped in his remarks in favour of the ‘geos’ – that

is, the distribution of income. The income inequality variable has been highlighted as China's most notable divergence from the successful path of Japan and the newly industrialised economies (Feng and Yao 2014). A pessimistic interpretation of this observation is that the Chinese leadership's allowance for the fact that some people might get rich before others was a sound strategy for achieving middle-income status, but not for exceeding it. That position is consistent with the Olsonian view that the rise of distributional coalitions – powerful rent seekers with material macroeconomic reach – is inimical to achieving durable growth (Olson 1982). A more positive approach would be to argue that Kuznets (1955) may have been right after all, and that the distribution of income is a function of the development phase and is not a predictor of future outcomes. A side issue here, of course, is that Kuznets' original hypothesis, put forward in the 1950s, was only really questioned when Japan, and later South Korea and Taiwan, broke the mould. A second side issue is that the original Kuznets curve is an egregious example of the difficulties associated with generalising from a limited sample (McKay 2008).

Returning to the issue of inequality and the MYT, Wing was co-author, along with Xiaolu Wang, of a terrific study of income inequality in China (Wang and Woo 2011). They utilised an independent survey of households to underpin their study and vastly improved our knowledge of this issue. So he has far more direct credentials in this field than I do. Where I may have something to contribute is in the practical application of the best research on MYT questions into forming a coherent view on the likely future growth rate and structure of the Chinese economy, and what it will mean for commodity and financial markets. Here the question is not just related to the probability of China entering the MYT or not – the path towards the MYT is also extremely pertinent.

Let me say very clearly at this point that BHP Billiton does not anticipate that China will fall into the MYT. Our view is that China will gradually converge on frontier per capita growth rates as it continues to benefit from the absorption of technology, which will allow it to ascend the value-added chain as its comparative advantage in labour-intensive pursuits fades and its factor markets are progressively liberalised.

Having put those cards on the table, let me return to hypotheticals. There appear to be two basic theses with respect to China and the MYT. The first is that Chinese economic growth falls in a stepwise fashion from its current level to something resembling that of the frontier economy, the United States, similar to the dynamics highlighted in Barry Eichengreen's empirical work on 'growth slowdowns' (for instance, Eichengreen, Park and Shin (2013)). The second thesis is that China may follow a more disruptive path, whereby the economy falls into recession, experiencing the proverbial 'hard landing'. Following this setback, it is no longer able to consistently grow materially faster than the frontier and is accordingly 'trapped'.

It is very important to emphasise that these are not the only options – they are just the most talked about. We must also recognise that there is a possibility that a recession could occur, but the economy may rebound successfully and ultimately defeat the MYT. In this regard, it is instructive to remember that South Korea's prospects for achieving high-income status were written off twice in the post-WWII era; once in the aftermath of civil war and once after the Asian crisis. And going a little further back, the incidence of 13 canonical financial crises in the United States in the century prior to the establishment of the Federal Reserve System did not prevent that economy from rising to a position of global primacy. All of which is to say that even if a recession were to occur in China before, say, the end of the current decade, that would not necessarily resolve the MYT debate.

And finally, and perhaps somewhat controversially, I note that while we speculate a great deal about the MYT, even the so-called optimists, who do not think that the MYT is a material risk, seem reluctant to project China's ultimate position in terms of relative living standards beyond, say, two-thirds of US levels. Is this a consistent posture? Are the implied constraints that prevent these forecasters from predicting that China will fully converge to US income per capita levels in the long run not also constraints that would impinge upon the successful navigation of the MYT? Decades from now, will we be wringing our hands about a two-thirds or three-quarters income trap, much as we suffer angst about the MYT today? Is there something of a Sinitic glass ceiling for GDP per capita? Some in the long-term projection game would have it so.

While a very wise economist once quipped that in the long run we are all dead, tier one mining assets may have a reserve life that overlaps multiple human generations. Ergo, the hypothetical questions I have run through above are not abstract to BHP Billiton: they are very real problems on which we need to form views. In this regard it is comforting to be able to stand on the shoulders of such scholars as Wing Thye Woo, who tackle the big issues without fear or favour.

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2. General Discussion

Discussion initially focused on the methodology used in the paper. One participant noted that, while the analytical approach of the paper was restricted by the small sample of 'middle-income' economies available, they did agree with Wing Thye Woo that insights could be gained by comparing China's development to the experiences of other economies, particularly Malaysia and the former Soviet Union.

Another participant sought clarification about the definition of the 'middle-income trap'. They believed the notion that countries in different regions can settle at different fractions of the US standard of living, with no strong economic forces pushing them to the frontier, was quite a diffuse definition of the middle-income trap. A third participant pointed out that all measures of the middle-income trap are imperfect. However, they noted that having an analytical measure is

DISCUSSION

important when making judgements about development through time and across economies, and that the measure used in the paper is sufficient for this.

Dr Woo reiterated that defining high- and middle-income groups should be based on a ratio rather than a particular income level. He added that, although there was some confusion among participants, there are three distinct groups of economies along the distribution. These groups of economies have been fairly stable over time and do share common traits. Dr Woo explained that middle-income economies are those clustered around the 30 per cent of US living standards and that there seems to be something about this level that many economies cannot move beyond.

The discussion then turned to the role of political reform in overcoming the middle-income trap in China. One participant pointed out that political commitment to reform is essential for moving beyond the middle-income trap. They emphasised the issues in China around industrial structural change and the devolution of power away from the centre to a more private sector-driven economy. They also highlighted that financial reform is a critical element in every country's effort to move through the middle-income trap and that this is an area where China has actually done quite well.

Related to this, a participant asked Dr Woo whether he thought initiatives proposed by the Chinese authorities, such as the 'One Belt, One Road' initiative or the China-led Asian Infrastructure Investment Bank (AIIB), were possible solutions for the issue of excess capacity of resources Dr Woo described and potential circuit-breakers for some of the dynamics around the middle-income trap. Another participant drew out Dr Woo's point on political consistency being especially important for a country moving into a new stage of development. The participant pointed out that political consistency would be quite difficult for policymakers to maintain if they were to implement the comprehensive set of policies presented by Dr Woo. They stated that while consistency is important, if policy advice is provided to leaders, the focus should be on a central policy issue. The participant believed the key focus should be on enhancing China's ability to upgrade its industry from a low-cost base to a high value-added, high-technology and competitive industry.

To address questions relating to the Chinese government initiatives, Dr Woo agreed that the AIIB would provide a channel through which China could export excess iron and cement, and the construction of an express railway between Beijing and Moscow also has potential to absorb some of the excess capacity. However, Dr Woo stated that it was more important that China expand its trade and build relationships within its geographical neighbourhood. Dr Woo highlighted that, in addition to geopolitical tensions, China's excess production capacity is so high that it tests China's trade relations with the rest of the world.

One participant noted that China achieved strong economic growth over the past decade, despite the many challenges it faced. The participant asked Dr Woo whether, given this evidence, a perfect system is really needed to continue economic growth. Dr Woo agreed that a perfect system is not needed to advance and get beyond the middle-income trap; otherwise no country would have ever moved past it. He highlighted that it is very important that China upgrade its industry by implementing structural reforms and that these reforms are communicated to the Chinese public in a way that minimises any social dissatisfaction or political backlash.

China's Evolving Demand for Commodities

Ivan Roberts, Trent Saunders, Gareth Spence and Natasha Cassidy*

1. Introduction

The slowing of the Chinese economy and falling global commodity prices in recent years have raised questions about the future of China as a stable source of demand for commodities. Many commentators have argued that China's growth will weaken further in the future, chiefly for structural reasons such as declining productivity growth (Wu 2015), a falling return to capital (Ma, Roberts and Kelly this volume) and the reversal of demographic tailwinds (Cai and Lu 2013). Even relatively optimistic analysts see the potential for future growth in China being concentrated in less resource-intensive activities such as services (Lardy 2014). This paper gives an overview of current issues affecting the composition of China's commodity demand and considers the implications of a different pattern of commodity imports in coming years.

China's role in global commodity markets is changing. Over the past decade, the Chinese economy experienced growth averaging 10 per cent per annum, driven by rapid urbanisation, industrialisation and greater openness to world trade. The fundamental drivers of Chinese growth – resource-intensive investment and manufacturing exports – underpinned a considerable increase in its demand for imported raw materials. As a result, the degree of China's participation in global commodity markets and its share of global trade in commodities rose substantially.

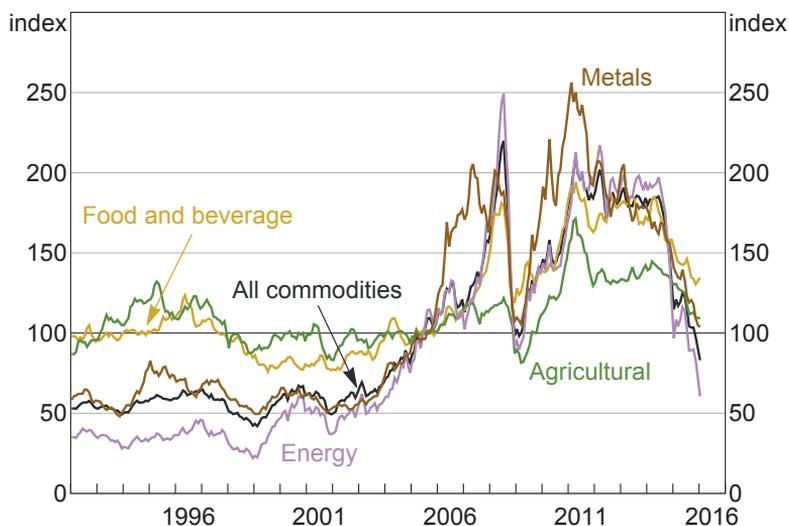
The China-led commodities boom had a tangible impact on many economies. First, during and after the global financial crisis of 2008–09, Chinese demand supported growth in economies that supply commodities, including Australia, Brazil, Chile and Canada. The surge in Chinese demand during this period reflected the government's macroeconomic stimulus, which underpinned rapid growth in residential construction and infrastructure investment and related manufacturing production, giving rise to strong imports of iron ore, coal and base metals.

An additional role that resilient commodity demand from China played in the late 2000s was to mitigate and reverse falls in commodity prices stemming from the unanticipated negative shock to growth in the advanced economies during the crisis (Figure 1). As the positive Chinese demand shock was largely unanticipated by resource exporters, the lagged global supply response for many commodities meant that the upward pressure on prices only began to unwind noticeably in 2011.

* The authors are from Economic Group (Roberts, Saunders and Cassidy) and Risk Management Department (Spence) of the Reserve Bank of Australia.

Figure 1: Commodity Prices

US\$ values; 2005 average = 100



Source: IMF

Sustained downward pressure on metal ore and energy prices in the past few years has in large part reflected expansions in international supply. But slowing Chinese demand has also been an important factor weighing on the prices of many commodities. Excesses in residential property investment that became apparent in the aftermath of China's 2008–09 macroeconomic stimulus generated a large oversupply of housing, which in turn prompted a decline in the growth of building investment and associated demand for steel (and hence iron ore). Chinese merchandise exports, which historically have also been an important driver of commodity demand, have been falling since early 2014 amid subdued global and regional economic conditions.¹ As broader economic activity has slowed in China, electricity consumption growth has moderated across all non-agricultural sectors, placing downward pressure on the demand for coal.

Declining Chinese demand for resource commodities has been augmented by policy efforts to mitigate the harsh effect of resource-intensive investment and production on the natural environment. In the case of iron ore, steel, base metals and coal, growth in bank lending has been curtailed, new investment has been restricted and high-emissions capacity has been forcibly reduced. Air pollution controls that limit coal use have been expanded, and surveillance of high-polluting metal manufacturing operations has increased.

In global oil markets, the effect of Chinese demand has been more subtle. Although China is now the second-largest importer of crude oil in the world (after the United States), most commentators attribute the sharp falls in crude oil prices since mid 2014 to supply-side factors including OPEC's decision to abandon oil price targeting and the impact of shale and tight gas discoveries in the United States and Canada on longer-term supply expectations (e.g. World Bank 2015). In fact,

¹ Evidence of the importance of China's manufacturing export industry as a driver of its demand for iron ore, base metals and coal is provided by Roberts and Rush (2010, 2012), based on findings from input-output tables and a gravity model of trade.

Chinese crude oil import demand surged in 2014, possibly preventing even sharper price falls, but more recently it has slowed in line with domestic economic conditions.²

A consequence of weaker economic prospects in China and policy commitments to reduce carbon emissions is that efforts to predict future growth areas in Chinese commodity demand focus on agricultural products and 'new' energy (e.g. Coates and Luu 2012). On this view, anticipated rises in wealth among households as China develops, a steady movement of the population towards urban areas and the increased policy emphasis on environmental sustainability will shift the composition of demand towards these commodities. In recent years, a rapid turn in Chinese energy policy in favour of renewables and low-carbon alternatives to coal has contributed to a marked increase in renewables capacity and rising imports of natural gas (at least until 2015). Global excess supply, and the effect of lower international oil prices, has placed downward pressure on prices of agricultural commodities and natural gas over the past couple of years,³ but Chinese imports of some agricultural products have also grown strongly over this period.

In this paper, we consider the prospects for such a restructuring of Chinese commodity demand. We use panel techniques to estimate the historical relationship between a country's demand for various commodities and its stage of development. Projections based on the estimated relationships suggest that if Chinese commodity demand follows international historical patterns, and government targets for non-fossil fuels are achieved, an evolution of commodity demand towards food and low-carbon energy is indeed likely. This basic finding is robust to a range of alternative paths for Chinese income per capita.

Our work adds to a growing literature on the sources and implications of Chinese demand for commodities. A range of studies document an inverted U-shape relationship between a country's per capita metal consumption (or metal intensity per unit of GDP) and income per capita (Wårell and Olsson 2009; McKay, Sheng and Song 2010; Döhrn and Krättschell 2013; Jaunky 2014). McKay *et al* (2010) use historical panel data on steel consumption, GDP per capita and a number of other measures of activity for a large number of countries to project Chinese steel demand. Beidas-Strom (2014) uses similar models to assess the trajectory of Chinese metal and energy consumption. An analogous approach has been used to fit the data for food consumption (Cole and McCoskey 2013). We compare our findings to an alternative approach (the panel smooth transition regression method) used in recent efforts to estimate 'environmental Kuznets curves' (Destais, Fouquau and Hurlin 2007; Aslanidis and Xepapadeas 2008; Duarte, Pinilla and Serrano 2013). A contribution of our work is to apply a relatively consistent projection method to a range of different commodities (steel/iron ore, copper, aluminium, nickel, energy and food).

Finally, to draw out potential implications for Chinese–Australian bilateral commodity trade, we conduct a thought experiment in which Chinese imports from Australia move in step with changing patterns of domestic consumption. Assuming no change in relative prices and Australia's market share, these projections suggest that the implied increase in Chinese food and liquefied natural gas (LNG) imports partly offsets slowing growth in metal ore imports, but that resources still account for a larger share of commodity imports from Australia than food in the coming 10–20 years. Relaxing some of our assumptions, however, we argue that there is scope

2 Recent literature has suggested that international crude oil prices are influenced strongly by demand factors (Kilian 2008).

3 Natural gas prices are typically oil-linked (Cassidy and Kosev 2015). Lower crude oil prices have reduced costs in agriculture, which is particularly oil-intensive. Increased supply of low-cost unconventional fuel has also undercut more costly biofuel production, leading to increased supply of certain agricultural products on the global market (World Bank 2015).

for food imports to start eroding the importance of traditional resource commodities within the coming decade.

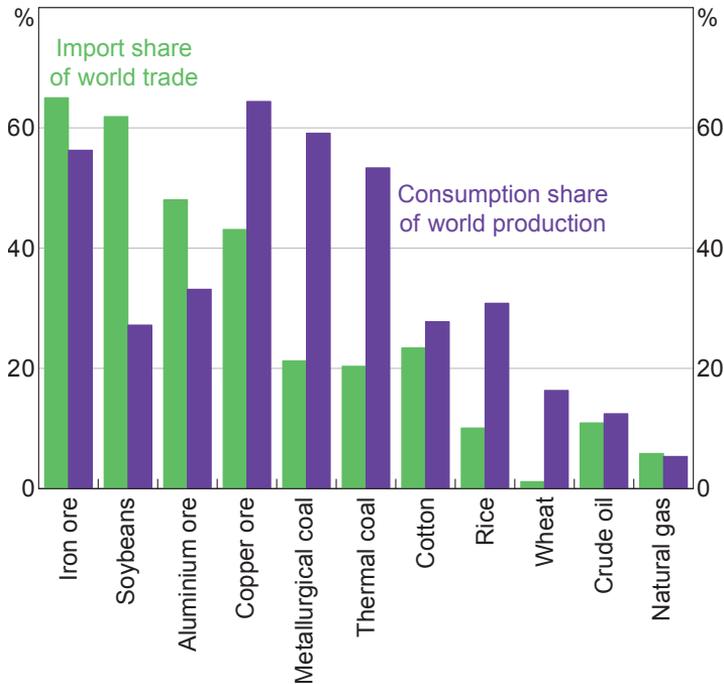
The paper proceeds as follows. The next section gives an overview of recent trends in China's imports and domestic uses of a range of globally traded commodities. It also discusses factors and uncertainties conditioning the outlook for iron ore, base metals, energy and food/agricultural products, and describes how China's evolving policies could influence the trajectory and composition of commodity demand. Section 3 describes our projection method and extrapolates Chinese iron ore, energy and food consumption under a range of hypothetical trajectories for income per capita. Section 4 discusses how the changing structure of Chinese commodity demand may affect the future composition of bilateral Chinese–Australian commodity trade. Section 5 concludes.

2. China's Demand for Commodities: An Overview

China accounts for a large proportion of global trade in natural resources such as iron ore, aluminium ore, copper ore and coal (Figure 2). For some commodities, such as coal, it tends to import significantly less than it consumes, reflecting substantial domestic production. While China is also a large producer of iron ore, the nature and location of its iron ore reserves mean that locally produced iron ore tends to be more expensive than that available on international markets. Similar constraints on local supply mean that China depends on imports for around two-thirds of its copper ore and aluminium ore needs.

In contrast, partly reflecting a policy to maintain self-sufficiency in certain grains, China at present plays a more limited role in global markets for food and agricultural feedstocks. Even so, a substantial import trade supports Chinese consumption of certain commodities such as soybeans and cotton. In energy markets, China has been rising in importance as a consumer and importer of oil and natural gas. But its historical dependence on coal for energy and the high use of other fossil fuels globally means that China accounts for a smaller share of activity in these markets than for many other commodities.

China's commodity consumption and trade have evolved in step with its pattern of development. China's growth since the period of 'reform and opening' was initiated in 1978 has been characterised by rapid growth of heavy industry and associated investment in equipment and buildings. Between 2000 and 2014, China's urbanisation rate rose from one-third to more than one-half, representing an average increase in the urban population of around 21 million per year.

Figure 2: China – Imports and Consumption of Selected Commodities

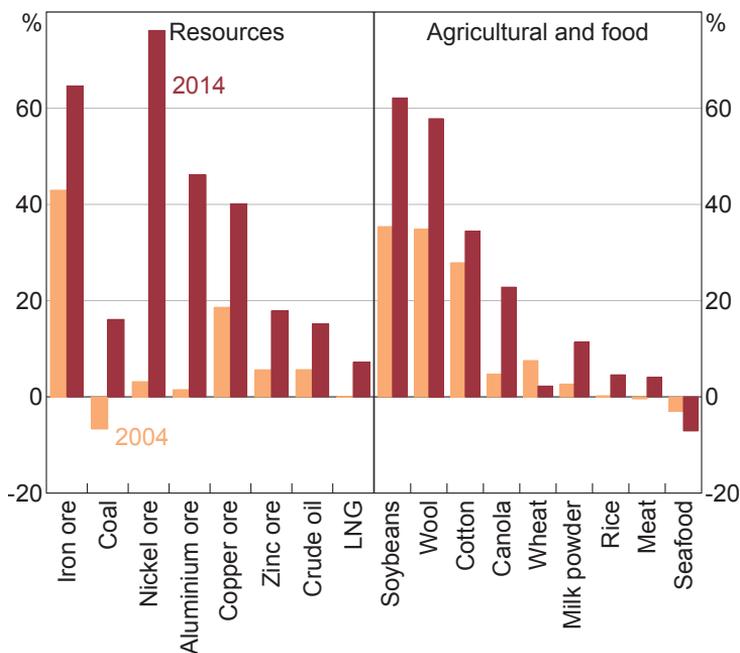
Note: Data for iron ore and energy commodities are for 2014/15, agricultural commodities are for 2014/15, aluminium and copper ore are for 2013

Sources: Authors' calculations; BP; CEIC Data; International Copper Study Group; International Energy Agency; United Nations COMTRADE database; US Department of Agriculture; US Geological Survey; World Steel Association (worldsteel)

Rural–urban migration has supported both urban residential construction and investment in transport and utilities infrastructure to service the needs of a growing urban population, boosting demand for commodities used in this investment. It has also imposed heavy requirements on China's power generation network. At the same time, rising efficiency of agricultural production and the long-term movement of citizens to higher-productivity employment in the non-agricultural sector have contributed to rising incomes and living standards (Brandt and Rawski 2008). This has influenced commodity requirements across a wide range of sectors, including metals, food products and energy.

Chinese imports of resource commodities have therefore grown significantly as a share of global trade since the early 2000s (Figure 3). For some commodities, such as iron ore, copper ore and aluminium ore, the increase in China's share has been a long-term trend, while for others, such as nickel ore, coal, oil and natural gas, the importance of China has become apparent more recently as demand has outpaced domestic production capabilities or as industrial processes have changed.

Figure 3: China’s Share of Global Commodity Trade
 Net import value as a share of world trade



Sources: Authors’ calculations; United Nations COMTRADE database

In the agricultural sector, China has become notably more dependent on imports for a wide range of commodities over the past decade. This tendency has been especially pronounced for oil-bearing crops such as soybeans used in the production of cooking oil, protein-rich animal feed and processed foods such as tofu, as well as wool. In contrast, China’s role in world trade has remained modest for grain, meat, fruit and vegetables, as demand is still largely met by domestic supply. In some cases, however, China’s import demand has increased rapidly from a low base, particularly for meat products and dairy products, such as powdered milk.

Consistent with the above trends, the composition of China’s commodity imports has changed noticeably over the past decade (Table 1). Between 2004 and 2014, metal ores rose in importance in China’s import mix, as domestic output of metal products increased, while the share of metal products in total imports declined. The share of mineral fuel imports increased, led by crude oil and accompanied by a rise in the share of coal and gas imports. Food imports have gradually risen in importance, while the share of other agricultural commodities has fallen.

Table 1: China – Imports of Selected Commodities
Share of total Chinese commodity imports by value, per cent

	2004	2014
Metal ores	11.7	19.8
Iron	8.6	13.7
Copper	1.5	3.2
Nickel	0.0	0.7
Aluminium	0.0	0.3
Zinc	0.1	0.2
Manganese	0.4	0.4
Lead	0.3	0.3
Metal products	31.5	14.1
Iron and steel	19.2	4.8
Base metals	12.3	9.3
Mineral fuels	32.6	46.5
Coal	0.6	2.8
Crude oil	23.0	33.5
Natural gas	0.0	3.5
Food	13.8	14.8
Cereals	1.5	0.9
Meat	0.3	0.9
Seafood	1.6	1.0
Dairy, eggs and honey	0.3	1.0
Beverages, spirits and vinegar	0.2	0.4
Other food	9.9	10.7
Other agricultural	10.5	4.8
Wool	4.7	1.9
Cotton	1.4	0.5
Animal skins, furs and hides	3.3	1.4
Live animals	1.0	1.0

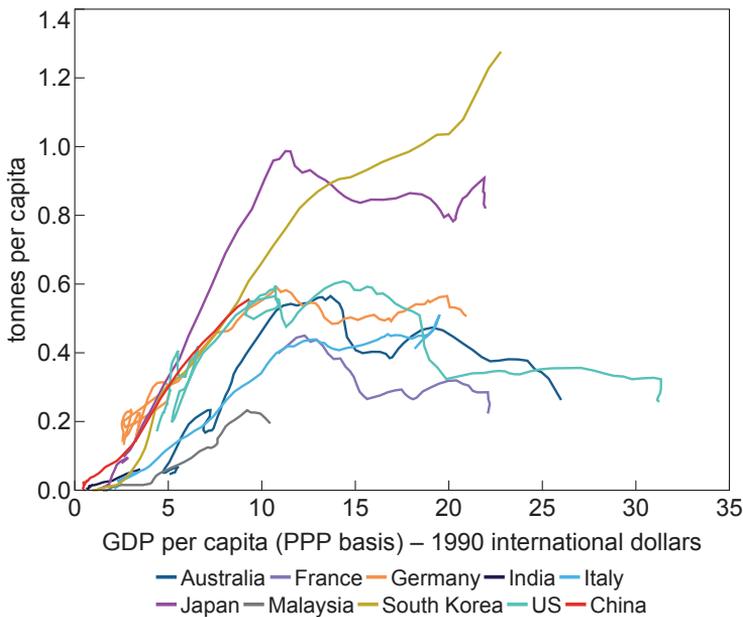
Notes: Total is defined as the sum of the current price value of metal ores, metal products, mineral fuels and selected food and other rural imports (specifically, harmonised codes 1–24, 26–27, 41, 43, 51–52 and 72–81); precious metals are excluded

Sources: Authors' calculations; United Nations COMTRADE database

2.1 Iron ore and steel

Due to the predominance of the blast furnace-basic oxygen converter production technique in China, steel is primarily produced using iron ore and metallurgical (or coking) coal as inputs. Chinese iron ore demand is mainly driven by steel production for domestic use and for the export market. While broadly similar in magnitude to increases that have occurred in other economies that have industrialised, the run-up in steel production (scaled by population) has occurred at lower levels of income per capita than other economies (Figure 4).

Figure 4: Steel Production per Capita
Five-year moving average



Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); World Steel Association (worldsteel)

The primary sources of demand for steel in China are construction (which accounts for more than half) and manufacturing, particularly machinery and automobiles (Table 2). The importance of construction as an end use in recent years reflects China's rapid urbanisation. While growth in urban residential construction is one important source of steel demand, the process of urbanisation is correlated too with the growth of public infrastructure including rail, highways and public buildings, which also involve the intensive use of steel and other metal products.

Table 2: Chinese Steel Consumption by Industry
Per cent of total consumption

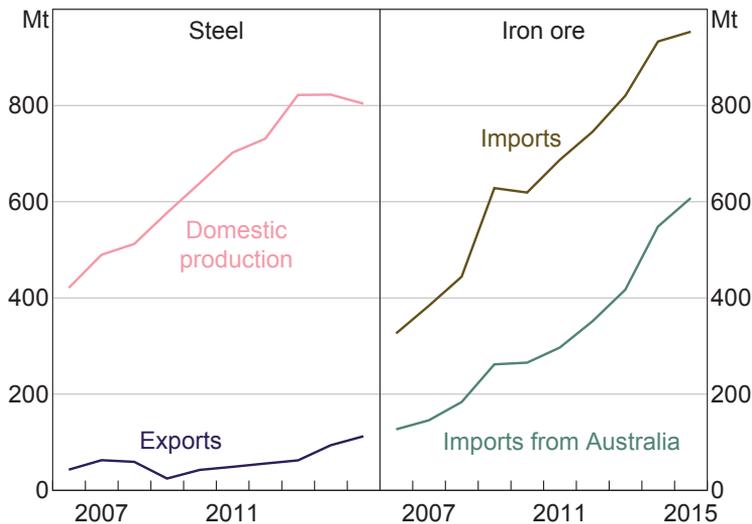
	2000	2010	2014
Construction	56	56	55
Machinery	15	18	19
Automobile	6	7	7
Home appliance	3	1	1
Rail	2	1	1
Energy	7	4	5
Shipping ^(a)	3	5	2
Other	8	8	11

Note: (a) We define 'shipping' as the sum of the 'container' and 'shipbuilding' categories

Source: China Metallurgical Industry Planning and Research Institute, reported by Li (2015)

China is itself a major producer of iron ore and possesses extensive reserves, but these have relatively low average iron content, which increases the cost of processing.⁴ In addition, the location of iron ore reserves in the north and west of China makes it costly to transport ore to steel mills elsewhere in the country. As a result, the imported share of iron ore supply (measured in terms of equivalent iron content) has increased from approximately one-quarter in the early 1990s to at least one-half currently.⁵ Reflecting both the quality and proximity of Australian iron ore production, roughly two-thirds of China's imported iron ore is currently sourced from Australia (Figure 5).

Figure 5: China – Steel and Iron Ore



Sources: Authors' calculations; Bloomberg; CEIC Data

4 According to the US Geological Survey (Tuck 2015), China's iron ore reserves have an average ferrous content of 31 per cent, compared with 43 per cent in Australia, 52 per cent in Brazil, 56 per cent in Russia and 64 per cent in India.

5 There is considerable uncertainty surrounding these estimates as the average ferrous content of Chinese and imported ore have been changing over time. For the present calculation we assume an average ferrous content of 31 per cent for domestic ore and a range of 50–62 per cent for imported ore.

Chinese iron ore imports have grown strongly in recent years, supported by the government's macroeconomic stimulus policies and the falling cost of imported iron ore. But the slowing of activity in China over 2014 and 2015, led by the residential construction and manufacturing sectors, has weighed on steel demand. Crude steel production was flat in 2014, and fell by 2.3 per cent in 2015 despite a strong increase in steel exports. Domestic consumption of steel fell by 5.4 per cent in 2015.⁶ While imports of iron ore have continued to increase (including from Australia), demand for iron ore looks to have fallen as declines in domestic production have outweighed the increase in imports.⁷

The widespread perception that economic growth will continue to ease has raised doubts about the future of Chinese steel and iron ore demand. Thus a view has emerged among analysts in China that steel production has already 'peaked' or is close to peaking, and is destined to fall in the years ahead (Li 2015; Zhang, G 2015). On this view, China's transition to a more consumption- and services-driven economy implies a reduction in its steel intensity. This contrasts with long-term cross-country comparisons suggesting that Chinese steel production and consumption have scope to increase before approaching the (population-scaled) levels of Japan and South Korea. Some analysts argue that such cross-country comparisons are misleading, as the economies to which China is compared have historically exported a much larger share of their steel production than has been the case for China (Batson 2015). In contrast, large iron ore producers such as Rio Tinto and BHP Billiton forecast that steel production will continue to rise for many years, based in part on projected further strength in steel exports (Chambers 2015; Ng and Riseborough 2015).

2.1.1 The outlook for steel and iron ore

In the near-to-medium term, there are a number of reasons for downward pressure on steel production to persist. First, the extent of developers' stock of unsold housing in some regions is large, implying that residential property markets may face conditions of oversupply for a sustained period (Chivakul *et al* 2015; Wu, Gyourko and Deng 2015). Second, industrial output has weakened sharply since late 2014, with particular weakness in industries exposed to residential and non-residential construction. Even aside from the recent property sector downturn, excess capacity in manufacturing has led to a trend slowing in manufacturing investment since 2010. Third, there are doubts about the sustainability of the rebound in steel exports in 2015, as the latter could falter if the business ceases to be profitable (for example, due to continued falls in steel prices) or if importing countries erect trade barriers against China to protect their domestic steel industries. Reflecting these influences, the steel industry experienced declining profitability in 2015 and faces a protracted consolidation.

In the longer term, a number of factors can be expected to support a relatively high level of steel production and consumption in China. One such factor is continued urbanisation. To the extent that this process underpins longer-run growth in demand for residential housing, motor vehicles and manufactured items, it will increase the country's overall steel requirement or help offset declines due to other factors. However, a continued upward trend in the urbanisation

6 Domestic steel consumption is measured as steel production plus net imports less the change in inventories.

7 Consumption of iron ore is measured as domestic production plus net imports less the change in inventories, estimated on an equivalent iron content basis. A range of estimates suggest that iron ore consumption fell slightly in 2015, although magnitudes vary depending on the measure of iron ore inventory used.

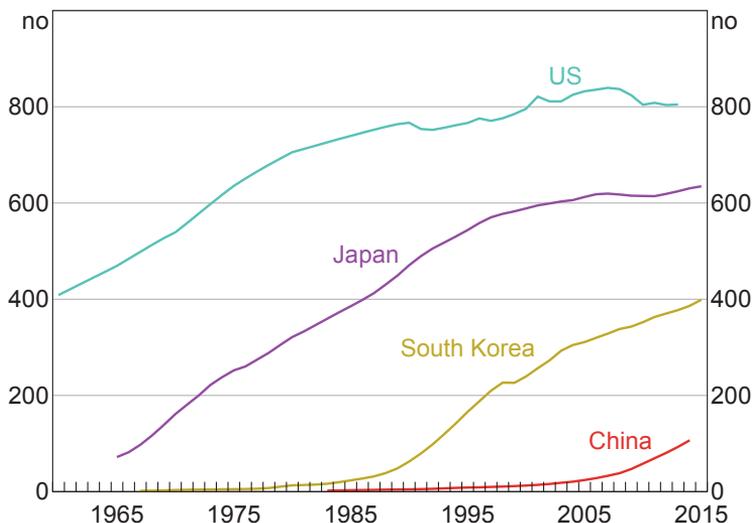
rate cannot be taken for granted, in part because the starting point is clouded by measurement issues. On the one hand, there is evidence that as much as a quarter of reported increases in the urbanisation rate since the 1990s represented the statistical reclassification of areas from 'rural' to 'urban' and adjustment of urban definitions rather than the physical relocation of residents (Chan and Hu 2003; Qin and Zhang 2014). On the other hand, estimates by the OECD (2015) suggest that the share of the population living in 'functional urban areas' within the gravitational pull of major cities could already be as high as 61 per cent. Even if the official urbanisation rate of 56 per cent is accurate, the urbanisation process is responsive to a range of factors including, for example, reform of the *hukou* (household registration) system and the availability of employment opportunities in urban areas relative to rural China.

A second factor that will support the long-run demand for steel is public spending to close gaps in national infrastructure. The share of paved roads in China remains well below that observed in more developed Asian nations such as Japan and South Korea, as does the degree of access to sanitation and water facilities (Wilkins and Zurawski 2014). The government has committed to expand municipal infrastructure investment (which accounts for about one-third of total infrastructure fixed asset investment), particularly subterranean infrastructure such as pipes, sewage works, flood management systems, roads and bridges (State Council 2013c; Government of the PRC 2014). As part of its strategy to develop China's interior, the authorities continue to devote substantial resources to building rail infrastructure, with plans to extend high-speed rail to cover all cities with a population of 500 000 or more by 2020. There is also scope to expand urban rail networks, which are less developed in China's major urban centres than other large international cities (Wilkins and Zurawski 2014).

A third factor is motor vehicle use. While it currently accounts for a modest share of domestic steel consumption, rising automobile use will contribute to longer-run demand for steel. The near-term outlook will be conditioned by the broader impact of slowing growth on consumer demand. Nonetheless, China's highway network has capacity to accommodate expanded automobile use: China has 2.8 million kilometres of paved roads for around 127 million motor vehicles, compared with 2.6 million kilometres of paved roads for 256 million motor vehicles in the United States. International comparisons suggest that per capita vehicle ownership in China would need to increase substantially even to approach levels observed in the United States, South Korea and Japan (Figure 6).⁸

8 For a discussion, see Baker and Hyvonen (2011).

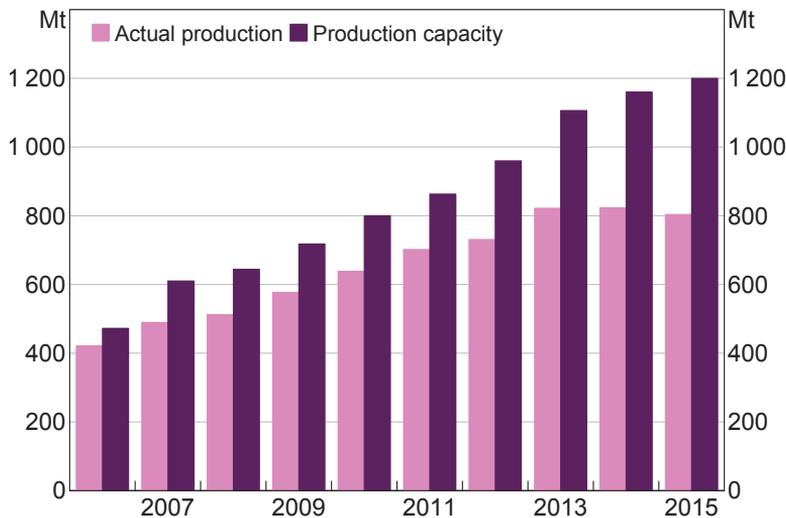
Figure 6: Motor Vehicles per 1 000 People



Sources: Authors' calculations; CEIC Data; United Nations; US Department of Transportation

Notwithstanding the above positive factors, Chinese steel production in coming years will also face countervailing downward pressure from government policies favouring consolidation of the industry. In the past decade, crude steel capacity has increased at a faster rate than actual production (Figure 7). In addition to resolving to reduce excess capacity, in recent years policymakers have also turned their attention to environmental protection given mounting public discontent about pollution and increased evidence of environmental degradation (see Section 2.4). In essence, this involves reducing energy consumption and eliminating energy-inefficient or obsolete production capacity through increased monitoring, forced closures and also by encouraging consolidation of smaller steel enterprises.⁹

⁹ In 2013, the State Council issued plans to reduce obsolete and polluting capacity in selected industries, including the steel sector (State Council 2013a, 2013b). These plans involve the elimination of more than 80 million tonnes of steel production capacity by 2017 (about 10 per cent of total capacity in 2014) and a decision to suspend the approval of new projects. In 2014, the government committed to remove 27 million tonnes of outdated capacity to help meet targets to eliminate all blast furnaces, converters and other steel production processes below specified size limits (NDRC 2014). In early 2016, the State Council separately pledged to cut 100–150 million tonnes of excess capacity in steel over an unspecified time frame (State Council 2016). The government has also sought to eliminate obsolete and polluting capacity through credit policies, with the central bank restricting lending to firms in the steel sector that do not meet environmental requirements (*People's Daily* 2014). Since 2012, the Ministry of Environmental Protection has trialled the use of remote control drones to inspect emissions via aerial photography and sample particulate matter with spectroscopy technology, and has used such methods on a large scale since late 2013 (Zhang, X 2015).

Figure 7: China – Crude Steel Production and Capacity

Note: Production capacity data for 2014 and 2015 are estimates by, respectively, MIIT and CISA

Sources: Authors' calculations; CEIC Data; China Iron and Steel Association (CISA); Ministry of Industry and Information Technology of the People's Republic of China (MIIT)

Aside from factors affecting steel production, future growth in iron ore demand is subject to an independent source of downward pressure: increased secondary production of steel using scrap. Steel mills in the United States and Europe make extensive use of electric arc furnace technology, which allows between one-half and two-thirds of crude steel to be produced using scrap (and other inputs). By comparison, in China more than 90 per cent of crude steel is produced by steelworks using basic oxygen converters (World Steel Association 2015), which require iron ore as a primary input.

The reasons for limited use of scrap in China to date include the fragmented nature of the scrap recycling industry, limited and inconsistent policy support,¹⁰ the high price of domestic and imported scrap relative to iron ore and metallurgical coal, and limited participation by equipment manufacturers in the recycling process.¹¹ Domestic availability of scrap is constrained by the fact that as much as two-thirds of the stock of steel in China was added between 2006 and 2010 and many of the associated appliances, buildings and infrastructure have not yet reached end-of-life (Wübbeke and Heroth 2014). Another reason is the practical difficulty of recycling certain forms of steel that are in common use in China, such as steel bars used to reinforce concrete for buildings (Stanway 2015). Thus, while China's 12th Steel Industry Five-Year Plan (2011–15) called for a rise in scrap utilisation, the ratio of scrap use to crude steel production actually fell from around 14 per cent in 2011 to 11 per cent in 2014 (Bureau of International Recycling 2013;

10 For example, the call to strengthen steel recycling capacity in the 12th Steel Industry Five-Year Plan (MIIT 2011) may have been undermined by the contemporaneous decision to close down small-scale electric arc furnaces and the decision in 2011 to cancel a 70 per cent rebate on value-added tax (and impose a 17 per cent VAT) for sales of recycled steel.

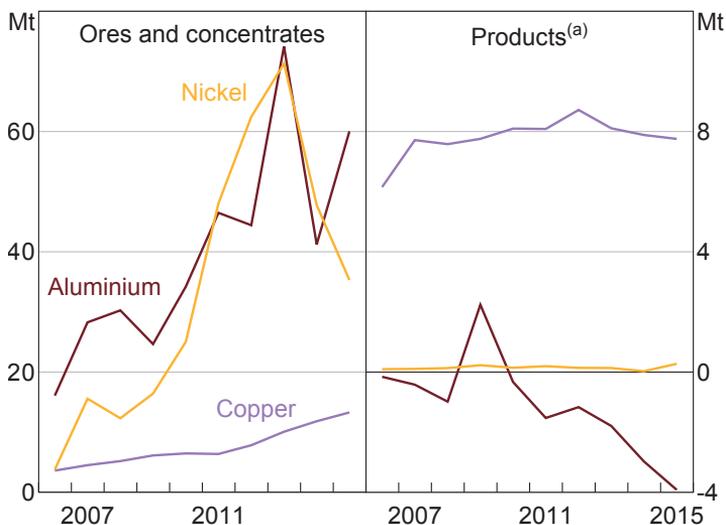
11 The industry consists of a number of large-scale steel recycling enterprises, recycling affiliates of major steel producers and thousands of small privately-run collection shops (Wübbeke and Heroth 2014).

Kong 2015). Nonetheless, policy efforts to improve scrap collection, and the sheer amount of secondary ferrous material that is likely to become available in coming years, are likely to support a gradual increase in the scrap ratio over time towards international levels.

2.2 Base metals

China plays a prominent role in global base metal markets. By value, China’s largest base metal commodity imports are aluminium, copper and nickel ores and products. Overall, similar to crude steel and iron ore, the demand for base metals (especially ores and concentrates) grew strongly in the years following the 2008–09 macroeconomic stimulus, driven in part by residential construction and manufacturing production. More recently, import volumes have declined or their growth has slowed in line with weaker growth of domestic activity (Figure 8).

Figure 8: China – Net Imports of Base Metals Ores and Products



Note: (a) Includes unrefined metal, products and scrap
 Sources: Authors’ calculations; CEIC Data

Base metal product imports and prices have been affected by two additional factors. The State Reserve Bureau (SRB) buys significant (undisclosed) quantities of base metals, including copper, aluminium and nickel (Angel 2012; Els 2013; Yam 2013). The SRB reportedly bought large supplies of base metals after the global financial crisis and has resumed purchases more recently as commodity prices have eased (Farchy 2013). Another practice that has been especially prominent in the post-2008 period is the importing of base metal products by firms to arbitrage international interest rate differentials through collateral financing deals (e.g. Lian and Wong 2014).

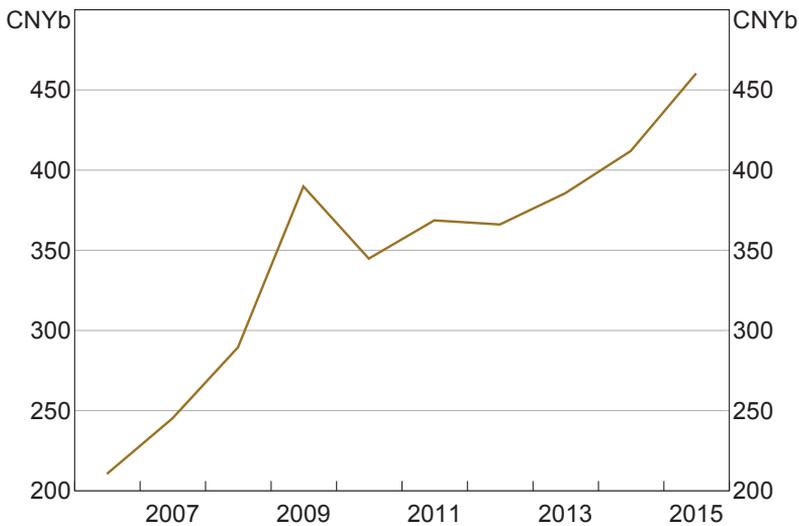
2.2.1 Aluminium

China is the world's largest producer and consumer of aluminium products. The domestic market is generally viewed as oversupplied, and in recent years China has become a sizeable net exporter of aluminium products.¹² Rising domestic aluminium production has led to a sharp pick-up in imports of aluminium ores and concentrates (bauxite and alumina) since the late 2000s. The construction sector is the largest source of demand for aluminium in China, followed by power and electronics, while transportation, household appliances and machinery account for the bulk of the remainder (Tse 2015).

2.2.2 Copper

China has limited reserves of copper and therefore sources the bulk of its supply of copper ore and concentrates from abroad. It also imports scrap and waste copper in significant quantities. Copper is primarily consumed in the power sector, although it is also used intensively in the household appliances, transportation, construction and electronics sectors (Tse 2015). Around 60 per cent of semi-fabricated copper products are used for the purpose of conducting electricity (Trussell 2013). In addition to financial incentives and government-sponsored warehousing, growth in copper demand has over time been linked with power grid construction, which itself has increased in line with the requirements of the growing urban population and heavy industry (Figure 9).

Figure 9: China – Power Grid Investment



Source: CEIC Data

¹² Some commentators attribute domestic oversupply to official efforts to maintain employment and support the coal industry (as most aluminium smelters are coal fired) (Rovnick 2013). Nonetheless, as an officially designated 'overcapacity' industry, the aluminium sector is also subject to efforts by policymakers to limit continued high production (see below).

2.2.3 Nickel

Chinese demand for imported nickel ore has also grown rapidly over the past decade from a very low base. The primary source of demand for nickel ore is stainless steel.¹³ Imported nickel ore is primarily used in China to produce nickel pig iron (NPI) via electric arc or blast furnace techniques. The bulk of high quality nickel ore is produced by Indonesia and the Philippines. Rising utilisation of NPI by Chinese producers as an alternative to (more expensive) pure nickel in the production of stainless steel saw China move from being a relatively minor stainless steel producer to the world's largest manufacturer, accounting for more than half of global production, in the space of a decade. However, the 2014 decision by Indonesian authorities to ban exports of mineral ores (including nickel ore) has contributed to sharp falls in Chinese nickel imports, and has brought into question the sustainability of Chinese stainless steel production.

2.2.4 The outlook for base metals

Although demand for imported base metals is likely to come under pressure as growth moderates, there is scope for official efforts to develop and upgrade power infrastructure to provide some offsetting support. In September 2015, the government pledged to spend CNY2 trillion on improvements to power grid infrastructure over the 2015–20 period. As of mid 2015, construction had begun on four (of an eventual nine) west-east ultra-high voltage (UHV) power lines that would allow more efficient energy transmission over long distances (Xinhua News Agency 2014; Chu 2015).¹⁴ These developments will contribute to demand for both copper and aluminium, as high voltage transmission lines also use aluminium cables and wires intensively (China Aluminium Network 2014). The push by policymakers to develop renewable sources of energy could likewise have a positive impact (see Section 2.3), as renewable energy generation tends to be more intensive in the use of certain base metals, such as copper, than fossil fuel-based generation (Trussell 2013).¹⁵

However, for the aluminium smelting industry, another important factor is that the industry has been marked by the government as an 'overcapacity' sector needing consolidation (State Council 2013a). Combined with the fragmentation of production across many small and medium-sized enterprises, high water and electricity requirements have made aluminium smelting a target for policymakers seeking to improve the environmental sustainability of heavy industry. Efforts to reduce excess capacity in aluminium smelting are being conducted via a number of measures, including credit restrictions, regulation of electricity pricing and a prohibition on local governments providing discounted electricity supply to local smelters (particularly those with geographic access to supplies of renewable energy such as hydro-electricity).

¹³ Stainless steel accounts for around two-thirds of global consumption of nickel ore (International Nickel Study Group 2016).

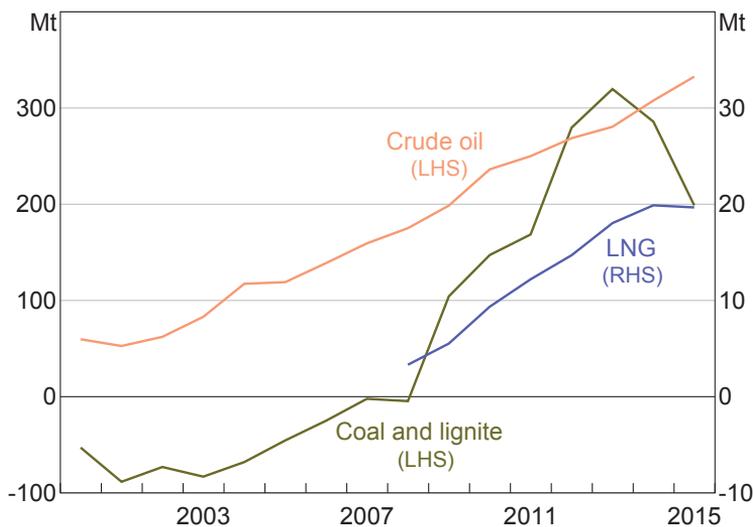
¹⁴ The stated goal of this initiative is to alleviate pollution by increasing the efficiency of energy transmission: energy losses from UHV power lines are reportedly 5–6 times lower than conventional power lines (Chen, S 2014).

¹⁵ Trussell estimates that wind, nuclear and solar power sources contain, respectively, 2 tonnes, 2.5 tonnes and 6.8 tonnes of copper for each megawatt of power generation, compared with 1.3 tonnes per megawatt for a coal-fired electricity station.

2.3 Energy

China imports energy commodities such as crude oil, coal and natural gas in large quantities. Crude oil imports have risen steadily over the past decade, whereas coal and natural gas imports increased sharply in the late 2000s from a low base but have trended lower over the past 1–2 years (Figure 10). By value, crude oil and petroleum account for the bulk of energy imports, but domestic energy consumption is heavily tilted towards coal. China relies on coal for 75–80 per cent of its electricity generation, which is high by international standards.¹⁶ In 2014, coal accounted for two-thirds of domestic energy consumption, while crude oil, hydro-electricity and natural gas accounted for 17 per cent, 7 per cent and 6 per cent.

Figure 10: China – Net Imports of Energy



Sources: Authors' calculations; CEIC Data

2.3.1 Coal

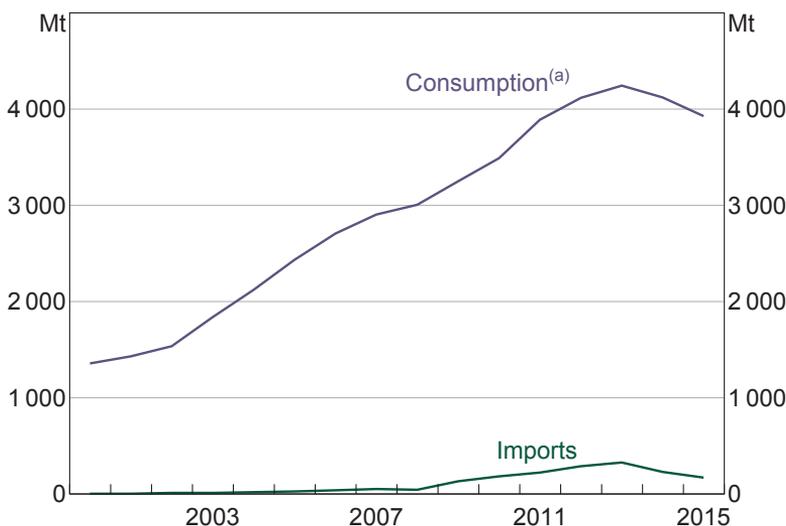
Around 43 per cent of coal consumption is accounted for by large-scale electricity generation, with a similar proportion used in the manufacturing sector, predominantly heavy industry, as a means of onsite power generation.¹⁷ The dominance of coal as a source of energy reflects the country's substantial natural endowments. Prior to the late 2000s, China was largely self-sufficient in coal, and was a net exporter, chiefly of thermal coal. However, by 2009, imports of a range of coal grades had increased sharply. This surge reflected a combination of factors, including the rise in steel production, a significant decline in international freight rates, lower Chinese production of coal due to consolidation in the coal sector, and mine closures or renovations for safety reasons.

¹⁶ The global average is around 40 per cent (Saunders 2015).

¹⁷ These figures are for 2014.

The increased attractiveness of coal imports (relative to domestic production) partly reflected geographic factors that had increased the relative cost of domestic supply. Despite having extensive reserves of coal, the majority of deposits are located in the north and west of the country, which means that coal has typically been transported to the north-east coast and then shipped by sea to southern locations (Tu and Johnson-Reiser 2012).¹⁸ The bulk of coal is still sourced locally, but rising Chinese coal imports have nonetheless had a significant impact on the global coal trade. China’s imports of coal account for less than 5 per cent of domestic coal consumption (Figure 11), yet in recent years they have accounted for almost one-third of the global trade in coal.¹⁹

Figure 11: China – Coal Consumption and Imports



Note: (a) 2014 level is an estimate based on official reported growth, 2015 level is based on data to October reported by China National Coal Association

Sources: Authors’ calculations; CEIC Data; *China Daily* (2015); NBS (2015b)

Official estimates suggest that in 2014, Chinese coal consumption recorded its first annual decline in over a decade, and industry estimates indicate a further weakening in 2015 (*China Daily* 2015). Domestic coal producers have experienced dwindling profitability (a trend which began in 2012) and official data suggest that around a third of coal enterprises are currently making losses. Imports have declined even more sharply than domestic consumption. The falls are consistent with weaker overall growth in electricity demand in a slowing economy, but also the shifting composition of energy demand towards crude oil, natural gas, renewables (hydro-electric, wind and solar) and nuclear power.

¹⁸ The majority of China’s coal reserves are located in the inland western provinces of Shanxi, Shaanxi and Inner Mongolia, which together produce around 60 per cent of the country’s output of coal (IEA 2013).

¹⁹ Based on estimates of Chinese and global trade in metallurgical and thermal coal provided by the World Coal Association (2014).

2.3.2 Oil

In global oil markets, the role of China has also grown over time. China's own proven reserves of crude oil are substantial, and increasing, but domestic production has been outpaced by growth in demand.²⁰ Until recently, total oil consumption was moderate compared to that of many advanced economies. But industrial and automotive use has increased at a time when the larger domestic oil fields are maturing and the growth of production has fallen from earlier higher rates. Imports of crude oil have therefore risen sharply, more than doubling since 2004. China's net imports are now the second largest in the world after the United States, while its oil consumption is two-thirds that of the United States (BP 2015).

Growth in crude oil imports has been supported by official efforts to achieve energy security. To provide a buffer against global supply disruptions, the government has been building a strategic petroleum reserve since the early 2000s. By mid 2015 the official reserves were reported to be 191 million barrels of crude oil (NBS 2015a), equivalent to several weeks of net imports, and there were plans to expand coverage to at least 100 days' worth of net imports by 2020 (China Economic Information Network 2015). The large state-owned oil companies also have sizeable storage capacity, with some estimates in the range of 350 million barrels (EIA 2015).²¹

2.3.3 Natural gas

Chinese demand for imported natural gas has grown strongly in the years since China first started importing the fuel in 2006. Low historical use of natural gas reflected a lack of infrastructure, especially long-distance pipelines connecting gas fields located in the inland central and western regions to major cities in the eastern coastal regions. Up to the end of 2014, LNG and piped gas consumption and imports increased rapidly, driven by industrial use.²² This has prompted efforts to secure large quantities of piped gas from Russia and central Asia and has led importers to sign long-term LNG contracts with a range of suppliers, including Australia. In 2015, however, LNG imports fell in line with the overall slowing of growth in industrial production and energy demand.

2.3.4 The outlook for energy commodities

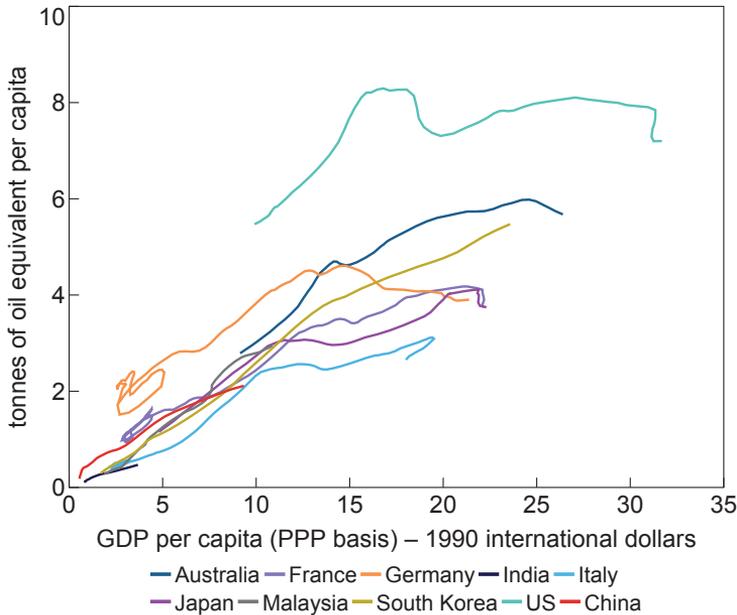
Currently, China's per capita energy consumption is low relative to many advanced economies, suggesting that there is room for expansion as the economy develops (Figure 12). Yet growth of total primary energy consumption has already eased in line with broader activity, falling from over 7 per cent at the start of the current decade to a little more than 2 per cent in 2014. Further moderation of economic growth can be expected to place downward pressure on growth in energy demand, at least in the near term. Likewise, government policies to respond to citizens' concerns about harmful effects on the environment and quality of life are likely to change both the growth and composition of energy consumption in coming years.

20 China's oil reserves were estimated to be 24.6 billion barrels in January 2015, the highest in the Asia-Pacific region (EIA 2015).

21 A caveat, however, to such estimates is that the distinction between strategic and commercial reserves is not clearly defined.

22 China's natural gas imports are currently split evenly between seaborne LNG and piped gas transported overland from neighbouring countries (BP 2015).

Figure 12: Energy Consumption per Capita
Five-year moving average



Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); U.S. Energy Information Administration

In 2006, China overtook the United States as the world's leading source of carbon emissions, and since 2009 carbon dioxide emissions from Chinese coal combustion alone have exceeded national carbon emissions in the United States (Tu and Johnson-Reiser 2012). Per capita emissions are now similar to levels in the European Union. In recent years, the government has moved to restrict carbon emissions and reduce the weight of coal in China's energy mix, including by becoming party to international treaties to reduce carbon emissions, such as the 2015 Paris Agreement to implement legally binding emissions targets.

The government also hopes to achieve these targets through increases in renewable energy generation capacity. The 'Energy Development Strategy Action Plan' released by the State Council (2014) called for large increases in renewable and nuclear capacity, including hydro, wind and solar energy generation.²³ The Plan also stated a target for non-fossil fuel sources to generate 15 per cent of energy supply by 2020 (Table 3), while separate announcements have pledged a 20 per cent non-fossil fuel share by 2030 (White House 2014). Since the late 2000s, the government has introduced a range of support measures (including financial incentives) for solar and wind power industries (Mathews and Tan 2015, pp 99–100). In late 2015, the government further pledged to implement a 'green dispatch' system prioritising (lower cost) renewable energy sources over (higher cost) coal-fired generation on the energy grid (White House 2015).

²³ The government is targeting growth in renewable and nuclear capacity from 447 gigawatts in 2014 to 708 gigawatts by 2020.

Table 3: China – Actual and Target Energy Consumption
Per cent of total primary energy consumption

	2000	2014	2020 ^(a)
Coal	68.5	66.0	62.0
Crude oil	22.0	17.1	13.0 ^(b)
Natural gas	2.2	5.7	10.0
Renewable, nuclear and other	7.3	11.2	15.0

Notes: (a) Official targets

(b) Implied by official targets for coal, natural gas and non-fossil fuels

Sources: Authors' calculations; CEIC Data; State Council (2014)

Moreover, the authorities have implemented direct restrictions on coal use. In September 2013, as part of its 'action plan' for addressing air pollution, the State Council pledged to reduce coal consumption to 65 per cent of primary energy consumption by 2017 (MEP 2013). In March 2014, the government committed to shut down 50 000 small coal-fired furnaces. In late 2015, the government pledged to reduce coal-fired power emissions by 60 per cent by 2020 and to set tighter efficiency targets for electricity production.²⁴

Efforts to address environmental problems and reduce carbon emissions are likely to lead to changes in the composition of China's energy imports and, in particular, place downward pressure on imports of coal and oil over the longer term. The transition away from heavily polluting fossil fuels may also increase demand for imported natural gas, which produces significantly lower carbon emissions than coal or oil.²⁵ But natural gas will face significant competition from renewables, which have seen sizeable increases in capacity in recent years, and have received broad-based government support.

As different types of fuel are often substitutes, China's energy mix will also be affected by international and domestic relative prices. China's retail oil prices have become more closely linked with international prices over time,²⁶ but deregulation of domestic gas prices has proceeded at a slower pace.²⁷ The impact of further energy price deregulation on the extent and composition of energy consumption is uncertain. For example, higher relative urban gas prices could stimulate investment in the sector, but they could also lead to substitution by consumers towards cheaper alternatives.

24 Specifically, the government imposed a nationwide efficiency 'bottom line' of 310 grams of coal per kilowatt hour, compared with average efficiency of 318 grams per kilowatt hour (State Council 2015b).

25 Natural gas produces 370 grams of carbon dioxide per kilowatt hour, compared with 640 grams in the case of crude oil and 720–940 grams for coal (Jacobs 2011).

26 In 2009, the National Development and Reform Commission (NDRC) adopted a pricing system for oil that allowed it to adjust retail diesel and gasoline prices when the moving average of imported crude oil prices fluctuated outside a 4 per cent range around the domestic benchmark price for 22 consecutive working days. In 2013, the NDRC changed this rule so that fluctuations of greater than CNY50 per tonne over 10 consecutive working days would warrant an adjustment to retail prices (EIA 2015). In late 2015, however, the NDRC stated that it would review pricing regulation and delay passing through falls in international oil prices as a means of addressing environmental pollution concerns (NDRC 2015).

27 Reform of natural gas pricing began in earnest in 2011 with a pilot to link city gate (local delivery point) natural gas prices to imported fuel oil and liquefied petroleum gas prices. A series of reforms between 2013 and 2015 resulted in significantly higher average prices of imported and domestic pipeline gas for industrial consumers, although wholesale LNG import prices are not subject to regulation. Non-residential city gate prices were cut significantly by the NDRC in late 2015 (State Council 2015a). Residential gas prices remain tightly regulated (Chen, M 2014; EIA 2015).

Another uncertainty relates to the development of new domestic sources of fuel. China has substantial reserves of coal bed methane and shale gas, which if developed could compete with piped natural gas and imported LNG. In recent years, the government has also approved numerous coal-to-gas conversion projects. Despite the potential for these industries to contribute to domestic energy supply, they remain at an early stage of development, constrained by technical challenges and gaps in transport infrastructure (EIA 2015).

2.4 Food and agricultural products

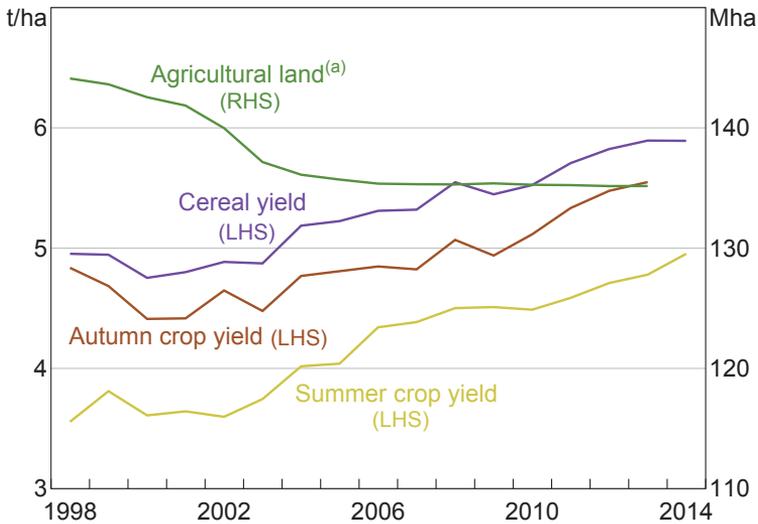
Currently, China plays a more limited role in global agricultural markets than it does in markets for metal ores and energy. The modest reliance on imports of food commodities reflects the fact that the government has historically placed a high value on food security and has a longstanding policy of stockpiling key products in state storage facilities. To maintain basic self-sufficiency in food production, the government subsidises production in the agricultural sector, particularly to support production of grain, oilseeds, hogs and meat products (Li 2014). As part of a suite of policies aimed at supporting the agricultural sector in place since the early 2000s (the *san nong* policies), the government has provided subsidies to farmers for seed, fertilisers, pesticides, feed and energy. The central bank has also created incentives for financial institutions to prioritise credit to the farming sector.

These policies have contributed to rapid growth in domestic supply. Between 2005 and 2015, the annual grain crop has grown by nearly 30 per cent. In contrast, agricultural land has declined as a share of total land due to soil erosion, desertification and conversion for industrial and urban use.

Declining land for agricultural use has coincided with falling growth in the prime-aged agricultural labour force as farmers have migrated to urban areas in search of off-farm work (Park, Cai and Du 2010). Thus, increased agricultural production has been underpinned by increases in yields (Figure 13).

Rising demand for food in China has stemmed from both the growing population and improved living standards, which have led to higher consumption of protein (particularly meat) and a shift in patterns of food consumption towards more western-style diets (Figure 14). Data from the Food and Agriculture Organization of the United Nations (FAO) indicate that between 1990 and 2013, total Chinese food consumption per capita (measured in calories) increased by 24 per cent, while consumption of protein per capita grew by a similar amount, and consumption of starchy foods, such as cereals and tubers, declined. These changing patterns have been correlated with improved efficiency, quality and safety in food supply (through modern food marketing chains and the growth of supermarkets) and increased consumption of meals away from home (Hamshire *et al* 2014).

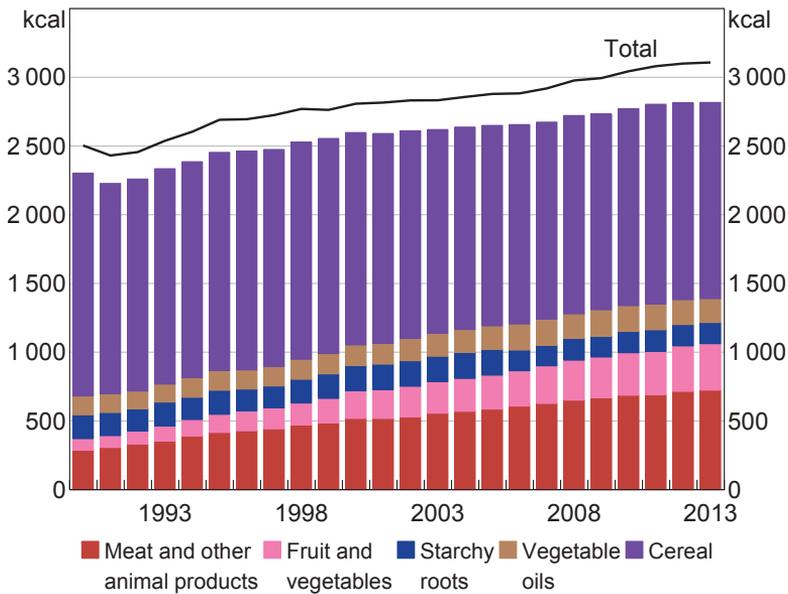
Figure 13: China – Crop Yields and Agricultural Land



Note: (a) Spliced in 2009 using data from the Ministry of Land and Resources
 Sources: Authors' calculations; CEIC Data; Ministry of Land and Resources of the People's Republic of China

Figure 14: China – Food Consumption by Source

Kilocalories per day per capita



Sources: Authors' calculations; United Nations FAOSTAT database

In recent years, the government has made a public commitment to ensuring that China's cultivated land does not fall below a 'red line' of 120 million hectares.²⁸ It has also committed to continue closely managing purchases and stockpiling of grains, edible oils, cotton, sugar, pork and chemical fertilisers. But changing consumption patterns, and the impact of environmental degradation on arable land and food safety, have made China's historically low reliance on imported agricultural commodities unsustainable. Accordingly, the government's revised food security strategy in 2013 acknowledged the need for imports to supplement domestic production and meet changing consumer demand while emphasising the primacy of domestic production as a source of food.

2.4.1 The outlook for food and agricultural commodities

As per capita incomes rise, the consumption of protein-rich foods tends to increase. In China's case, protein consumption has increased rapidly, reaching or exceeding per capita levels exhibited by other countries at a comparable stage of development (Figure 15). While per capita protein consumption may increase more gradually in coming years, continued population growth is likely to underpin strong growth in the total amount consumed, and underpin demand for imported food commodities. Such trends are likely to be reinforced by a series of food safety scandals since 2008 (including cases of contaminated infant formula and meat supplies), which have contributed to strong demand for imported meat and dairy products.²⁹

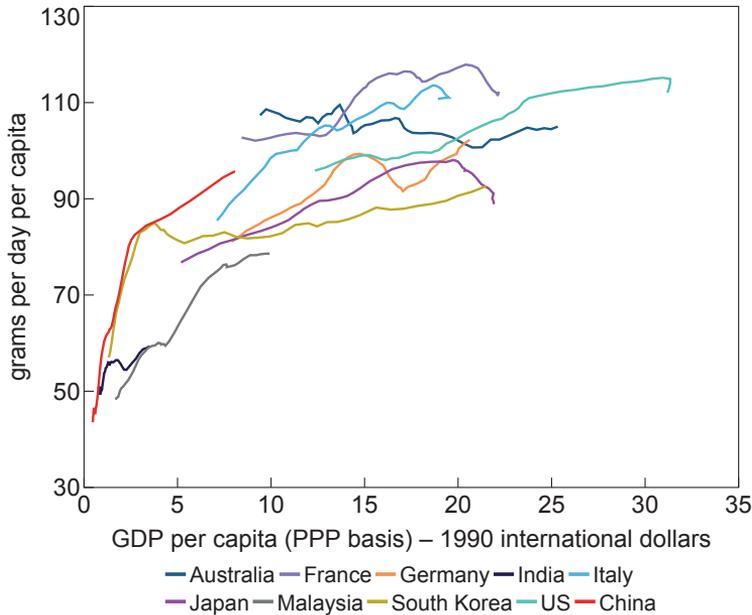
China currently sources most of its meat from domestic production, but a shift towards higher meat consumption has already begun to support increased imports of meat, live animals and animal feed (such as maize).³⁰ Similarly, imports of dairy products have surged over the past decade, with milk powder accounting for half of the increase and other products such as cheese, butter and yoghurt accounting for the remainder.

²⁸ The total sown area of farm crops was 165 million hectares in 2014.

²⁹ In 2008, locally produced infant formula tainted with melamine sickened 300 000 babies and caused 6 premature deaths. Subsequent scandals, often involving the use of diseased or rotten meat, have led to widespread public concern about domestic safety standards (e.g. AFP 2014).

³⁰ Around 80 per cent of China's maize output is used for animal feed (Zhou *et al* 2012).

Figure 15: Protein Consumption per Capita
Five-year moving average



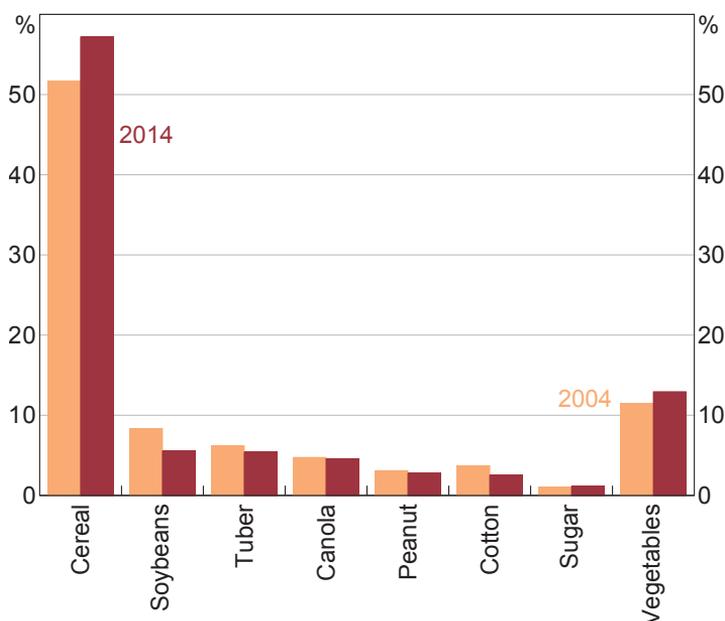
Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); United Nations FAOSTAT database

In a period of flat or declining agricultural land supply, and moderating labour input, continuous increases in yields are needed to expand domestic production of the full range of agricultural crops. As China still lags other countries in the relative efficiency of production for some crops, there is scope for crop yields to continue to grow.³¹ But constraints on land supply could support imports of certain commodities, particularly those crops (for example, oil-bearing crops such as soybeans, canola or peanuts, and cotton) which are already experiencing flat or declining domestic land area sown (Figure 16).

Indeed, the environmental obstacles facing domestic agricultural production could increase the scope for imports of agricultural commodities in coming years. According to some estimates, almost 7½ per cent of farming land is irrigated with polluted water (Xie 2009, p 21). Water is polluted by industrial run-off, widespread overuse of fertilisers in farming and waste from intensive livestock rearing (Ongley and Yu 2013). The Chinese Ministry of Land and Resources estimates that levels of water quality have been falling since 2011. Water at almost 60 per cent of groundwater monitoring stations was classified as 'poor' or 'extremely poor' in 2013, implying high levels of certain minerals including iron, manganese, sulfates and lead (*China Daily* 2014).

³¹ For example, farms in the United States produce higher corn yields with less fertiliser than Chinese farms (Gale, Jewison and Hansen 2014).

Figure 16: China – Land Area Sown with Major Crops
Share of total land area sown



Sources: Authors' calculations; CEIC Data

Soil pollution is also a growing problem: according to the Ministry of Land and Resources and Ministry of Environmental Protection (MLR and MEP 2014) up to 16 per cent of China's soil and 19 per cent of its arable land is polluted with industrial pollutants such as cadmium, nickel and arsenic.³² Recognising the over-exploitation of land and water resources, in late 2015 the government announced an amendment to its strategy for food security, promising subsidies to farmers who allowed crop land to be idled or rotated with legumes to restore nitrogen to the soil during periods of abundant grain supply (*People's Daily* 2015).

3. Projecting Chinese Demand for Commodities

To consider possible future trajectories of Chinese demand for commodities and the sensitivity to different growth paths, we consider a range of simple econometric projections and scenarios. Our projection method embodies two steps.

In the first step, we conduct a cross-country regression of per capita consumption (or production) of a given commodity on some function of GDP per capita. We construct estimates for physical volumes of crude steel, aluminium, copper and nickel, quantities of energy (in tonnes of oil equivalent) and quantities of food (in calories).³³ The time period and number of economies for which we have data differs by commodity, but in general we use unbalanced panels including at

³² China also faces challenges in the use of water in farming; official data suggest that nearly 40 per cent of farmland is irrigated. Hamshere *et al* (2014) argue that inefficiencies in water use in China, if rectified (for example, through use of drip irrigation), could boost the sustainability of farming in coming years.

³³ The reasoning for modelling per capita food demand in terms of calories is to aggregate consumption in homogeneous units.

least 40 economies over a period of no less than 40 years (see Appendix A). In the case of crude steel, we construct estimates for steel production, while for all other commodities our results are for consumption.

The different treatment of steel reflects our interest in steel production as a source of Chinese demand for iron ore. While some countries rely heavily on imports of finished steel or steel scrap to satisfy domestic demand for steel products, China predominantly imports raw inputs for use in blast furnace crude steel production (iron ore and metallurgical coal) rather than steel products or scrap.³⁴ Another reason for modelling production rather than consumption in this case is that China has grown in significance as an exporter of steel, whereas its exports of most other commodities account for a comparatively modest share of global trade.³⁵

Following the literature on commodity demand and the 'environmental Kuznets curve', we choose a non-linear functional form to model the historical relationship between commodity consumption or production and economic development. We consider two approaches to the selection of this functional form.

The first approach utilises a basic panel fixed-effects specification. For most commodities, we use a specification that has, with minor variation, become relatively standard in the literature on commodity demand. In the case of steel, aluminium, copper, nickel and energy we express per capita consumption or production as a quadratic function of GDP per capita. This is consistent with the approaches of McKay *et al* (2010) and Döhrn and Krätschell (2013) for steel production or consumption.³⁶ Beidas-Strom (2014) uses a similar approach for other metal and energy commodities.³⁷ The quadratic functional form implies that after a certain level of income per capita is attained, commodity consumption declines. For aggregate food consumption per capita, we instead apply an inverse functional form, which imposes a less symmetric curvature upon the food intensity and income per capita locus than the quadratic. Our experiments suggest that this specification fits the international data for food consumption better than a quadratic model.

Specifically, for steel, base metals and energy, we estimate:

$$c_{i,t}^j = \alpha_0 + \alpha_1 gdppc_{i,t} + \alpha_2 gdppc_{i,t}^2 + \alpha_3 trend_t + \mu_i + u_{it}$$

and for food we estimate:

$$c_{i,t}^j = \delta_0 + \delta_1 (gdppc_{i,t})^{-1} + \alpha_3 trend_t + \mu_i + u_{it}$$

where $c_{i,t}^j$ is per capita consumption or production of commodity j for country i in physical units, $gdppc$ is real GDP per capita (constant 1990 international dollars at purchasing power parity rates), μ_i is a country fixed effect and u_{it} is an error term.³⁸

34 Steel product imports account for about 1½ per cent of total estimated consumption of steel products.

35 The main exception is aluminium products, of which China has become a major exporter in recent years.

36 McKay *et al* (2010) express their model in log difference form; moreover, they use supplementary regression-based projections of GDP per capita to project future per capita steel output. Wårell and Olsson (2009) use a related approach that regresses steel consumption per unit of GDP on a polynomial function of GDP per capita. Jaunky (2014) estimates the relationship between copper consumption per unit of GDP and income per capita.

37 Beidas-Strom uses a third order polynomial with fixed effects for energy, but for base metals augments the regression with a number of other variables, including the investment share of GDP and the share of durable goods in private consumption.

38 We employ fixed effects in preference to random effects as there is little reason to assume that country fixed effects are uncorrelated with the other regressors in the equation.

We follow the literature by including a deterministic trend, *trend*, to capture the effects of new technology, material substitution and long-run price trends that are correlated with time rather than per capita income. An alternative would be to include time dummies to control for year-specific factors. We find that the in-sample results are robust to the inclusion of time dummies instead of a time trend. Moreover, the use of the time trend is convenient in constructing projections, which would otherwise require assumptions to be made about how year effects are projected out-of-sample.

As a crosscheck on the basic panel fixed-effects approach, we also apply an alternative approach that follows recent work in the estimation of environmental Kuznets curves using flexible non-linear functional forms. Work by Destais *et al* (2007), Aslanidis and Xepapadeas (2008) and Duarte *et al* (2013) recommends the use of panel smooth transition regression (PSTR) models that allow a change in the underlying economic relationship (that is, regime switching) to occur when a certain threshold, such as a level of income per capita, is passed. The technique applied is the basic model of González, Teräsvirta and van Dijk (2005) that features two regimes.

For consumption per capita of each commodity we estimate:

$$c_{i,t}^j = \beta_1 gdppc_{i,t} + \beta_2 gdppc_{i,t} f(gdppc_{i,t}; \gamma, a) + \beta_3 trend_t + \varepsilon_i + e_{i,t}$$

where ε_i is a country fixed effect and $e_{i,t}$ is an error term. We follow González *et al* (2005) by using the logistic specification for the transition function $f(\cdot)$:

$$f(gdppc_{i,t}; \gamma, a) = \left(1 + \exp(-\gamma(gdppc_{i,t} - a))\right)^{-1}$$

where $\gamma > 0$ is a slope parameter that determines the smoothness of the change in the value of the logistic function and hence the speed of transition from one regime to another. The parameter a is the threshold that income per capita must pass to initiate a change in regime, such as a change in the slope of the relationship between the intensity with which a commodity is used and income per capita. We impose $\gamma > 0$ and $a > 0$ as identifying restrictions. The equation is estimated using non-linear least squares.³⁹

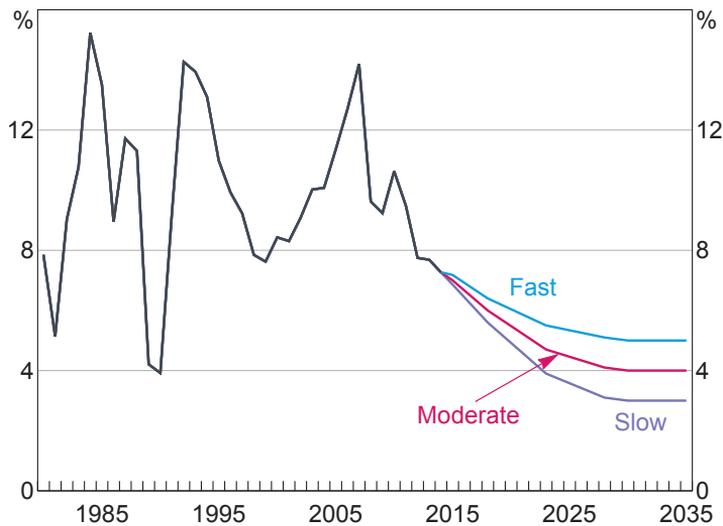
In the second step of our method, we use the above approaches and the estimated country fixed effects for China to project Chinese per capita commodity consumption or production to 2035. To do so we need projections of Chinese population growth and GDP growth. In the case of population growth, we use projections by the United Nations to 2035. For GDP growth, we follow Ma, Roberts and Kelly (this volume) in defining a gently slowing trend in annual growth towards a ‘terminal’ rate in 2030. We consider terminal growth rates of 3 per cent (‘slow’ growth), 4 per cent (‘moderate’ growth) and 5 per cent (‘fast’ growth) as scenarios. We hold these rates constant between 2030 and 2035 (Figure 17).

In constructing our projections, the key piece of information we draw from the panel regressions is the level of GDP per capita at which per capita consumption or production of a particular commodity is predicted to ‘peak’. We then project current actual per capita commodity consumption or production to such a point, using linear interpolation, and allow the data series to follow values predicted by the estimated coefficients thereafter. Thus, for a commodity

³⁹ We initialise the non-linear least squares algorithm using starting values for γ and a obtained from the results of the basic panel fixed-effects regressions described above.

where per capita demand is predicted to peak at a level higher than current actual levels, our projections will embody a rise towards that peak. If demand is predicted to have peaked earlier than suggested by the actual data, we project a gradual transition from current levels towards the 'peak' implied by the cross-country regression. Under a moderate growth scenario, we observe peaks for some commodities (steel and copper) within the projection period, while for others (aluminium, nickel, food and energy) the peak occurs after 2035. If the peak occurs after the end of our projection period, we simply interpolate between the final actual observation and the predicted 2035 observation for demand per capita.⁴⁰

Figure 17: China – GDP Growth
Constant prices, year-average



Sources: Authors' calculations; CEIC Data

It is worth highlighting that the method described above differs notably from a more common practice among commodity analysts, which is to construct forecasts based on a combination of judgement and disaggregated assessments of likely future end-use demand for various commodities. An advantage of our framework is that it relies on relatively few assumptions and can be used to do scenario analysis. While we allow for country fixed effects, a key disadvantage of such a simple approach is that it does not consider the detailed time-varying sources of demand for individual commodities in any given country and may provide a poor forecast if a country's commodity demand has reached, or is about to reach, a turning point at an earlier stage than would be expected based on patterns observed in other countries.

⁴⁰ An attractive feature of this approach is that it isolates the key finding of interest from our regressions and prevents discontinuous jumps that sometimes occur when splicing projected values with actual values. For economies in our cross-country panel regressions whose commodity demand patterns deviate substantially from the average patterns in the sample, a simple extrapolation of predicted values from actual values in some cases creates a discontinuous jump in the first period of projection. The inclusion of country fixed effects limits but does not always resolve this problem, which is particularly pronounced in China's case for aluminium and food consumption.

3.1 Findings

The estimation results for the basic fixed-effects regressions are reported in Table 4.⁴¹ A number of findings are worth noting. For the quadratic specifications, the sign of the squared term is negative, suggesting that per capita commodity consumption (or production in the case of steel) declines when a certain threshold of GDP per capita is passed, consistent with intuition. In the case of food, the coefficient on the inverse of GDP per capita is also negative, implying that food consumption per capita rises at a declining rate as income per capita increases. The China fixed effect varies in sign and magnitude across specifications, but the effects are particularly large and positive for steel, copper, aluminium and nickel, consistent with the unusually rapid growth of China's demand for these commodities. With the exception of the food equation, the coefficient on the time trend is negative, consistent with the hypothesis that technological progress reduces the intensity with which resource commodities are used as economic development proceeds (McKay *et al* 2010).

Table 4: Fixed Effects Panel Regression Results

	Steel	Energy	Copper	Aluminium	Nickel	Food Inverse model
	Quadratic model					
<i>gdppc</i>	63.6***	267.0***	1 421.0***	1 325.0***	105.4**	
<i>gdppc</i> ²	-1.5***	-4.8***	-33.2***	-22.7***	-1.7**	
<i>1/gdppc</i>						-454.0***
Constant	-66.2**	247.0***	-124.9	-3 066.0***	-522.5**	2 952.0***
China fixed effect	119.7***	-7.4	808.4***	2 980.0***	549.3***	-358.1***
Trend	-2.8**	-2.9	-63.9*	-6.4	-8.5***	8.0***
Obs	3 159	4 053	2 393	2 067	1 446	5 134
'Within' <i>R</i> -squared	0.27	0.43	0.25	0.62	0.10	0.46
Hausman (1978) test (χ^2)	6.9*	90.7***	16.4***	6.7*	2.9	36.1***

Notes: ***, ** and * denote significance at the 1, 5 and 10 per cent levels, respectively; standard errors are robust and clustered at the country level

41 The results on statistical significance (that is, standard errors) and the *R*-squared for the regressions with quadratic specifications are reported for reference only and should be treated with caution. As *gdppc* is clearly non-stationary for many countries in the sample, and *gdppc*² is a nonlinear transformation of *gdppc*, the limiting distribution of the ordinary least squares (OLS) estimates, in particular the variance, will be biased, which invalidates standard statistical inference. Ermini and Granger (1993) show that polynomial transformations of I(1) variables behave similarly to a random walk with drift. Accordingly, it is probable that the variables in the commodity consumption/production equations exhibit cointegration. Applying Fisher-type stationarity tests to the residuals, which are proposed by Maddala and Wu (1999) and Choi (2001) for unbalanced panels, we reject the null hypothesis that all panels contain a unit root. Although least squares standard errors will be invalid, Hong and Wagner (2011) explain that for a cointegrated polynomial panel regression the OLS estimator is in general still consistent. Results from simple Monte-Carlo simulations for quadratic functions of I(1) processes support this conclusion. An extension to the approach presented here that might improve the reliability of inference would be to use a fully modified OLS panel estimation as recommended by Hong and Wagner (2011).

For the PSTR specifications, the thresholds for per capita steel production and food consumption were found to be negative if estimated unconstrained and were found to be close to zero if constrained to be positive. We therefore disregard the models for these commodities. For other commodities, in all cases the coefficient β_2 is negative, implying declining per capita consumption above the threshold (Table 5).

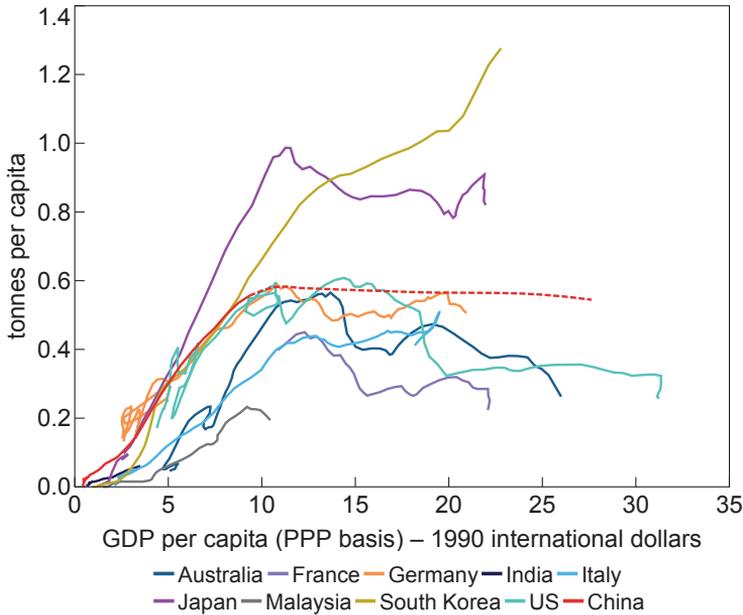
Table 5: Panel Smooth Transition Regression Results

	Energy	Copper	Aluminium	Nickel
β_1	198.8***	1 028.7*	808.8***	69.4**
β_2	-125.5***	-885.2	-214.4***	-26.1**
γ	191.9***	0.2*	1.9	0.5
a	24.6***	14.8***	21.6***	23.2***
China fixed effect	-37.1***	1 747.8***	2 387.4***	301.7***
Trend	-2.0	-27.1*	11.4	-15.5**
Obs	4 053	2 333	2 067	1 446

Notes: ***, ** and * denote significance at the 1, 5 and 10 per cent levels, respectively; standard errors are robust and clustered at the country level

We now consider the results of our projections based on the moderate growth scenario for individual commodities in turn. For crude steel production, results from the basic panel fixed-effects specification suggest that actual steel production per capita (which was nearly 600 kilograms per capita in 2014 and around 585 kilograms per capita in 2015) has already exceeded the 'peak' predicted by our cross-country regression (around 560 kilograms per capita). Steel production therefore falls gradually, in per capita and aggregate terms, from current levels in our projection (Figure 18).

Figure 18: Steel Production per Capita
Five-year moving average



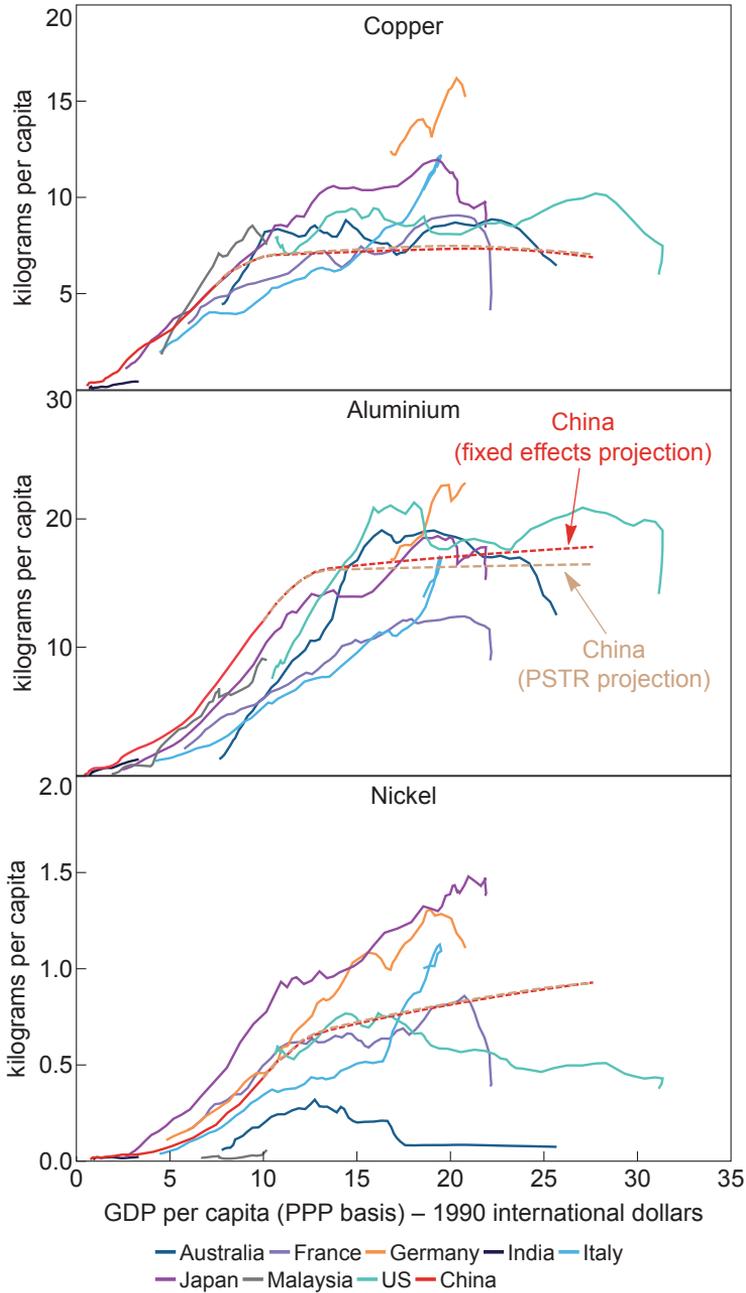
Note: Dashed line indicates the fixed effects projection for China

Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); World Steel Association (worldsteel)

The results for base metals are a little different. In the case of copper, both models predict per capita consumption to peak at similar levels in the mid-to-late 2020s (Figure 19). In the case of aluminium, the models both suggest that consumption peaks after the projection period. Yet they diverge in that the basic fixed effects model estimates that the peak has not yet been reached whereas the PSTR predicts a peak below current actual levels. Thus, in the latter case, aluminium consumption is projected to fall in coming years. As aluminium consumption has grown unusually rapidly in China, in both cases the projected levels of consumption per capita are not dramatically different from current levels.

For nickel, the results of the two approaches are similar for much of the projection period. The main difference is that the PSTR model predicts consumption per capita to peak at a level of income per capita that China is projected to reach in the late 2020s, whereas the basic panel fixed effects model finds a higher peak that occurs after the end of our projection period.

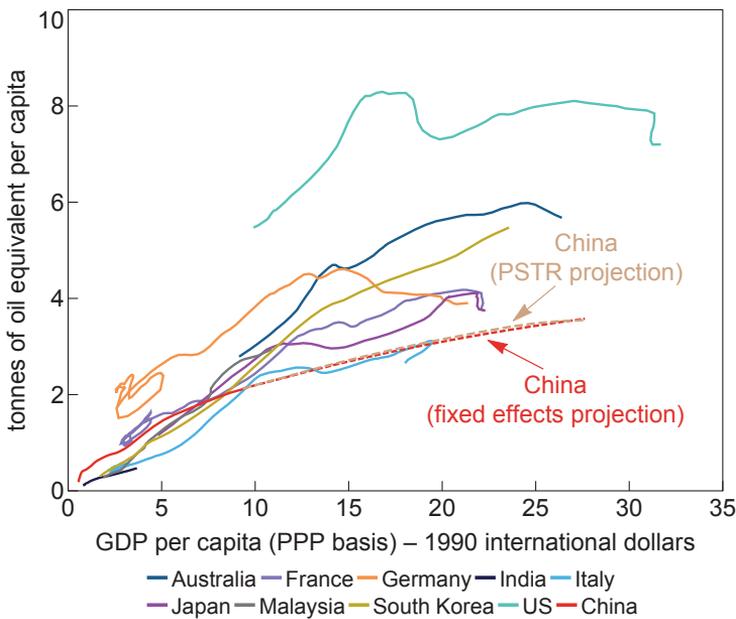
Figure 19: Base Metals Consumption per Capita
Five-year moving average



Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); World Bureau of Metal Statistics

While for base metals, the PSTR technique generally suggests a weaker projection of consumption per capita than the basic fixed-effects specification, in the case of energy the results are more closely aligned. Both models suggest that, if history is a guide, Chinese per capita energy consumption is unlikely to peak within the next two decades (Figure 20). This finding is not surprising given the large gap between per capita consumption in China and other economies in our sample. Indeed, as discussed in the previous section, the more salient issue is likely to be the extent to which the composition of energy consumption changes as government (and public) pressure to reduce the use of fossil fuels becomes more prominent in China.

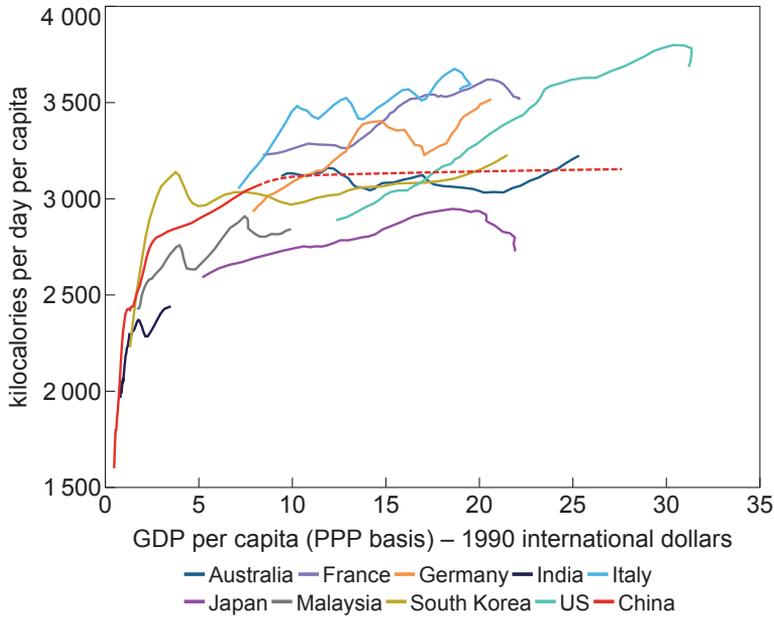
Figure 20: Energy Consumption per Capita
Five-year moving average



Sources: Authors' calculations; BP (2015); The Conference Board, Total Economy Database™ (May 2015); U.S. Energy Information Administration

Finally, in the case of food consumption, the panel fixed effects model suggests a marginal further rise in calorie intake per capita from current levels (Figure 21). Data from the FAO indicate that the ratio of Chinese food consumption by weight (kilograms) to total calories consumed has been rising steadily over time. Thus, the total quantity of food consumed is likely to rise noticeably from current levels, even in per capita terms. However, as per capita consumption has already risen at a faster rate than several developing and advanced economies, the model suggests that future increases are likely to be more moderate than growth in the past.

Figure 21: Food Consumption per Capita
Five-year moving average

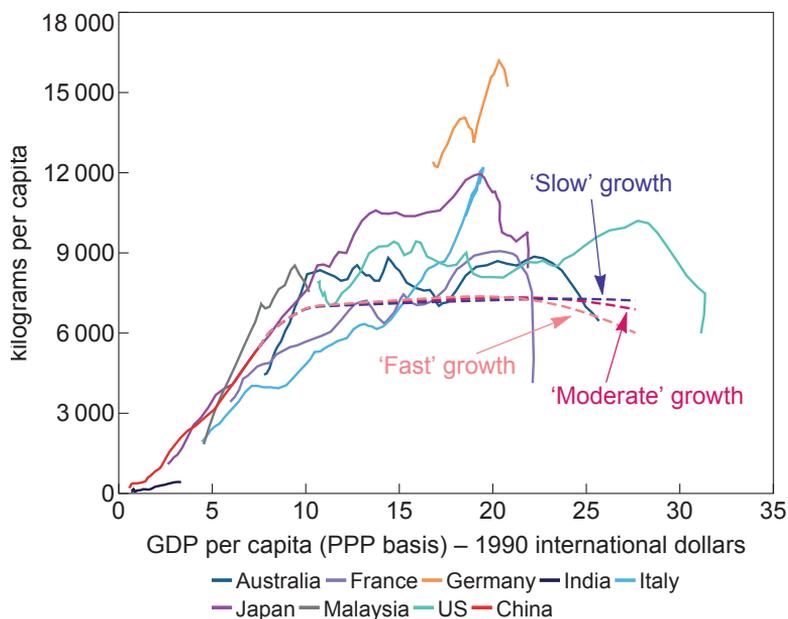


Note: Dashed line indicates the fixed effects projection for China

Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); United Nations FAOSTAT database

The projections described above are linked to a particular ('moderate') scenario for Chinese economic growth, which may prove either too optimistic or pessimistic in practice. To consider the sensitivity to different growth scenarios, we apply the same estimated coefficients to our alternative 'slow' and 'fast' growth scenarios. The results for copper using the basic fixed effects approach can be used as an illustration (Figure 22). The results for other commodities are presented in Appendix B.

Figure 22: Copper Consumption per Capita
Five-year moving average



Source: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); RBA; World Bureau of Metals Statistics

For commodities whose per capita consumption peaks during the projection period, a faster growth projection mechanically brings forward the timing of the peak. Thus, under the 'fast' growth scenario, all commodities except food experience a peak in per capita consumption before 2035. The idea that commodity consumption per capita could peak sooner under stronger growth might seem counterintuitive, and interpreted naively, could create an impression that growing the economy faster (for example, using stimulatory policy measures) would lead to an earlier peak in commodity demand. But such an interpretation would be incorrect. What the projections highlight is that as economies develop, their whole pattern of growth and hence their commodity intensity changes. For example, as a heavy industrialisation phase passes, the economy eventually becomes more focused on less-commodity-intensive activities such as services. Our results suggest that in China's case food and energy demand do not peak until the 2030s at the earliest. Thus, in contrast to copper, a stronger growth scenario is projected to increase per capita consumption of these commodities.

4. Bilateral Chinese–Australian Commodity Trade

In this section, we make some observations about China's bilateral trade with Australia in metal, energy and food commodities and consider some implications of the analysis in Section 3. China is Australia's largest export destination, accounting for 34 per cent of Australian merchandise exports and 30 per cent of Australia's total exports. By value, China's largest commodity import from Australia is iron ore, followed by coal, base metals, food products and other rural products

(Table 6). Over the past decade, China's commodity trade with Australia has been characterised by a sharp increase in the share of iron ore, coal and natural gas imports and a corresponding decline in the share of agricultural products and base metals.

Table 6: China – Commodity Imports from Australia
Share of total commodity imports by value, per cent

	2004	2014
Metal ores	44.3	70.6
Iron	36.4	63.5
Copper	6.6	5.9
Nickel	0.3	0.4
Aluminium	0.0	1.1
Other base metals	5.8	3.6
Metal products	15.7	5.9
Iron and steel	3.1	0.1
Base metals	12.6	5.9
Mineral fuels	12.3	13.9
Coal	4.2	10.5
Natural gas	0.0	1.7
Food	10.4	5.1
Cereals	6.6	2.0
Meat	0.4	1.2
Seafood	0.2	0.1
Dairy, eggs and honey	0.6	0.4
Beverages, spirits and vinegar	0.1	0.3
Fruit and vegetables	0.1	0.1
Other rural	17.3	4.4
Wool	10.1	1.8
Cotton	2.0	1.3
Animal skins, furs and hides	4.0	1.0
Live animals	1.2	0.3

Notes: Total is defined as the sum of the current price value of metal ores, metal products, mineral fuels and selected food and other rural imports (specifically, harmonised codes 1–24, 26–27, 41, 43, 51–52 and 72–81); precious metals are excluded

Sources: Authors' calculations; United Nations COMTRADE database

Although the decline in the share of bilateral food and other rural imports is noteworthy, the absolute value of these imports has more than tripled. China is Australia's largest market for hides and skins and second largest market for live animals, certain types of meat and dairy. Moreover, the relatively modest share of food in Australian exports to China is not matched for Australia's other trading partners. Rural exports account for around 13 per cent of Australia's total

merchandise exports and occupy a greater share of total exports to Japan, South Korea and the ASEAN economies than they do of exports to China.

The future trajectory of Australian bilateral trade with China is highly uncertain. Nonetheless, to consider some possible implications of our projections in the previous section for China's future mix of imports from Australia, we conduct a simple thought experiment. First, we assume that commodity prices are unchanged over the projection period. In practice, this implies that relative prices do not change either, notwithstanding the greater importance of Chinese demand for some commodity markets than for others. While this is clearly an abstraction, the partial equilibrium nature of the analysis precludes the generation of price projections that are consistent with our demand estimates. Second, we assume that China's import demand for Australian commodities moves in line with its consumption demand for those commodities, as projected by our basic panel fixed-effects regressions. In other words, we ignore (for now) the possibility that Chinese import demand might increase or fall at a faster rate than domestic consumption for some commodities and we constrain Australian market shares for individual commodities to be fixed over the projection period. We also abstract from any consideration about relative levels of trade protection facing Australian exporters in specific markets or any domestic infrastructure or natural resource constraints that would prevent Australian producers from meeting all demand from Chinese consumers.

- To project iron ore, we assume a constant ratio of iron ore to crude steel in basic oxygen furnace production of 1.6 kilograms of iron ore to 1 kilogram of crude steel.⁴² We further assume a gradual increase in the use of scrap steel. This is achieved by imposing a decline in the basic oxygen furnace/electric arc furnace ratio from 93 per cent in 2013 to 83 per cent in 2025 and to 73 per cent by 2035. A share of 73 per cent corresponds to the international average in 2013 according to the World Steel Association.
- To project coal and LNG, we assume that China meets its energy targets for 2020. We further allow the increase in the share of non-fossil fuels in the energy mix targeted for 2030 to be accommodated entirely by a decline in coal use. An assumption along these lines may be justified given the rapid growth in renewables capacity in the past few years and recent falls in domestic coal consumption and imports. To proceed, we apply an interpolated profile for the share in total energy for these commodities based on available targets to 2030 and allow demand for both to grow in line with total energy consumption thereafter to 2035.
- As our food projections use data expressed in calories, we apply a conversion factor to express the projections in physical units. We use data from the FAO on the historical relationship between kilograms of supply per capita and calories per capita in China. This ratio has gradually increased over time. We allow it to continue to increase at the 10-year annualised pace recorded between 2004 and 2014 to obtain projections for food demand in tonnes.
- To project base metals, we use data on the relative share of each base metal in China's imports of base metals from Australia and project total base metals assuming that growth follows a weighted average growth rate for these three commodities. For other metal ores and products, we construct projections using a weighted average of iron ore and base metal imports from Australia.

⁴² The World Steel Association estimates a ratio of 1.5 kilograms of iron ore to 1 kilogram of crude steel, but some estimates for China are higher (Holloway, Roberts and Rush 2010).

- All other commodities are projected to grow at the weighted average pace of industrial metal, food and energy imports. We use actual bilateral trade data where possible for 2015.⁴³ These data suggest that, in value terms, bilateral imports of mineral ores, metals and coal declined in 2015 while imports of LNG and food grew strongly. (In some cases, such as iron ore, the volume of bilateral imports increased but the value declined due to falls in commodity prices.)

Making the above assumptions, we project how the mix of Chinese imports of Australian commodities might evolve over time. As the future trajectory of Chinese growth is uncertain, we use the different growth scenarios described previously to generate a range of possible outcomes (Table 7). Given the projected decline in Chinese crude steel production, and the expected rise of scrap metal use over time, under all scenarios the share of iron ore in bilateral trade falls over the projection period. The projected peak in per capita base metal demand, in the mid to late 2020s, places gradual downward pressure on bilateral imports of these commodities from Australia.

Table 7: Actual and Projected Australian Exports of Commodities to China

Share of total commodity exports to China by value, per cent

Commodity	2005	2015	2025	2035
	Actual	Estimated	Projection	Projection
Iron ore	47.3	57.9	51–51½	43–47½
Base metals	25.1	13.2	13	12–13
Coal	4.3	8.7	9½–10	11–13
Natural gas (LNG)	0.0	5.4	10	12–14
Food	5.8	8.6	9	9½–11

Notes: Total is defined as the sum of the current price value of metal ores, metal products, mineral fuels and selected food and other rural imports (specifically, harmonised codes 2–24, 26–27, 41, 43, 51–52 and 72–81); precious metals are excluded; maximal and minimal values of projections do not always correspond to identical growth scenarios and for this reason (and rounding) will not sum to 100 per cent

Sources: Authors' calculations; United Nations COMTRADE database

Meanwhile, growing energy use, combined with government targets to increase the share of natural gas and renewables in the energy mix, sees a gradual rise in imports of both coal and LNG. However, LNG imports increase at a faster pace, overtaking coal by the end of the projection period. Food imports increase at a steady pace, but our assumptions that commodity prices are unchanged and that Chinese import demand follows domestic consumption patterns restrict food from approaching the share of resource commodities in China's imports from Australia over the period considered.

Under a moderate growth scenario for China, the value of projected total bilateral trade increases gradually over the projection period, as rising food and energy imports more than offset falling iron ore imports. For some commodities, faster growth in China implies that the peak in demand is reached sooner, and the commodity's share declines more rapidly (base metals), while for

⁴³ For iron ore, base metals, coal and LNG, we use official data on Chinese imports from Australia, sourced from CEIC. For food, we aggregate Australian exports to China at the two-digit SITC level, sourced from the Australian Bureau of Statistics.

others faster growth generally increases that commodity's share of the basket of imported commodities (coal, LNG and food).

Taken at face value, our thought experiment suggests that the shares of food and LNG imports from Australia would not overtake those of iron ore and coal unless relative prices were to rise sharply or Australia were able to increase export volumes to China at a rapid pace over the next two decades. The latter possibilities should not be ruled out for a number of reasons. First, as we do not directly model bilateral food or LNG imports and we hold prices fixed, our experiment mechanically constrains imports to move in line with domestic consumption trends and Chinese government targets for primary energy consumption. Second, if China's demand for imported metal ores or coal were to weaken dramatically, natural gas, food and agricultural exports would become commensurately more important in the bilateral trade relationship.

There are a number of downside risks to the projections for coal, iron ore and base metals. Policy commitments (both domestically and internationally) to improve environmental sustainability through numerous practical measures could result in a sharper-than-projected curtailment of coal consumption and imports. Imports of coal have already fallen in recent years (both total and bilateral) and the sheer size of China's domestic coal reserves and production means that, should domestic consumption decline sufficiently, the need for imports from Australia and other countries could be correspondingly reduced. Our iron ore projections make a specific assumption about the prospects for steel recycling in China. Greater-than-projected scrap use could weigh further on future import demand. Moreover, the model-based profiles for base metals rely on the basic panel fixed-effects specification described in the previous section, which suggests a stronger outlook for per capita consumption than the alternative PSTR model.

Several other considerations are also relevant. The outlook for LNG depends on factors including competition from pipeline gas, international fuel prices and domestic gas price regulation in China. Notwithstanding falls in aggregate Chinese LNG imports in 2015, the value of imports from Australia grew very strongly. If Australia meets predictions that it will overtake Qatar to become the world's dominant supplier of LNG within the current decade (Cassidy and Kosev 2015), bilateral trade could grow more quickly than projected.⁴⁴ Even if our volume projections for bilateral natural gas imports are accurate, the price paid by Chinese importers for Australian LNG was generally lower than Asian prices in 2015. Given the considerable lags in the process of adjusting prices in long-term LNG contracts, there may be scope for the average value of LNG imported from Australia to rise from current levels.⁴⁵ Against this, if China fails to achieve its ambitious targets for natural gas consumption, our projection could overstate growth in bilateral LNG imports.

Similarly, food imports could grow faster than domestic consumption if domestic supply were constrained or if behavioural shifts described earlier were to lead Chinese consumers to bias their spending towards foreign products. Such a bias could affect the relative prices of certain food and agricultural commodities, and, given the perishable nature of some of these products, it

44 Nonetheless, under an unchanged price assumption, the projections in Table 7 are consistent with the estimate of Cassidy and Kosev (2015) that China will purchase around 20 per cent of Australian LNG exports under contract by 2020.

45 Chinese merchandise trade data suggest an implied price of US\$5.8 per million British thermal units (BTU) for Australian LNG in January 2016, compared with an average price of US\$7.4 per million BTU for all trading partners, and the Asian spot price of around US\$5.8 per million BTU.

could benefit suppliers in close geographical proximity to China such as Australia. Also, a feature of our scenarios is that they say little about the changing composition of food imports, which could benefit some trading partners more than others. If the shift towards higher-protein foods in China continues, and Australian exporters benefit from this trend (as is widely expected),⁴⁶ a sharper rise in the share of food could be observed than that embodied in our estimates.

Indeed, the share of food commodities in Chinese–Australian bilateral trade has already risen noticeably in recent years. If, instead of following the profile suggested by our projection of Chinese food consumption, the value of food imports from Australia continued to grow at its 10-year annualised rate (around 16½ per cent), and holding our other assumed profiles constant, its share in bilateral trade would eclipse that of iron ore (and all other commodities) by the late 2020s. The realism of such a naive projection can be questioned, however, especially if Chinese household consumption slows over the projection period. Moreover, the extent to which Australia could displace other exporters in accommodating China's rising demand would depend, among other things, on the relative efficiency of production, the cost of freight and storage, and the level of the exchange rate. It would also be contingent on the availability of arable land and the efficient utilisation of scarce water resources in Australia. But it is worth noting that even if food imports from Australia were to increase at a more moderate rate of 5 per cent per annum (nearly five times the pace implied by our food consumption projection), and leaving other projections unchanged, these imports might account for a larger share of Chinese imports from Australia than coal or LNG within a decade.

5. Concluding Remarks

China's role in global commodity markets is changing as it undertakes a transition from a growth pattern that is highly intensive in its use of natural resources, driven by investment and the development of heavy industry, to a more sustainable path that uses these resources less intensively. The slowing of the Chinese economy has placed downward pressure on demand for many imported commodities, particularly metal ores and coal, although natural gas and food imports have also not been immune. An analysis of the detailed drivers of Chinese demand suggests that the outlook is weak for some commodities, but for others there is scope for consumption per capita to increase further from current levels.

For mineral ores and metals, the burden of excess capacity in manufacturing and weakness in residential construction has weighed heavily on consumption of these commodities, but in the longer term such factors may be partly offset by efforts to fill residual infrastructure gaps and to meet the remaining requirements of urbanisation. For mineral fuels and other sources of energy, heightened public concerns regarding air pollution and environmental degradation, together with government efforts to meet official commitments addressing climate change, favour growth in demand for renewable energy and natural gas at the expense of more carbon-intensive fuels such as coal and crude oil. The long-term upward trend in Chinese consumption of higher-calorie and higher-protein foods may translate into increased imports as domestic constraints on arable land start to bind and concerns about food safety and soil and water pollution rise in prominence.

⁴⁶ For example, see Australia China Business Council (2015).

To quantify how changing patterns of development may affect China's future commodity demand, this paper exploits the historical relationship between commodity consumption (or production) and income per capita for a large number of economies across a wide range of commodities. We find that, if historical patterns are a guide, the demand for iron ore is likely to fall in coming years. In contrast, our estimates suggest that demand for energy and food commodities will increase even under a relatively pessimistic scenario for Chinese growth.

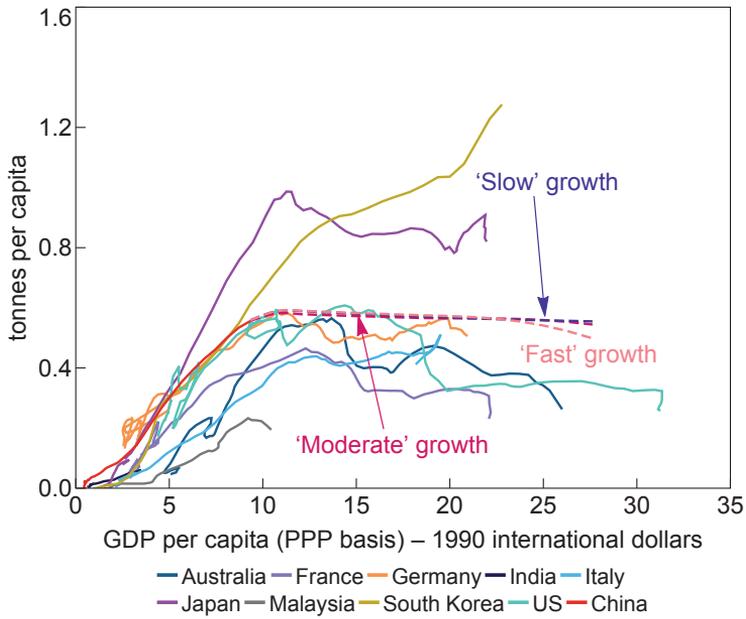
There is great uncertainty about how such developments might affect Chinese imports of commodities from its trading partners. To explore the range of possible outcomes, we describe a thought experiment in which bilateral commodity trade between China and Australia follows patterns dictated by our projections for China's domestic commodity consumption. Such an exercise suggests that the shares of food and LNG are unlikely, in the near-to-medium term, to rise above those of metal ores and coal in the import basket if we assume that relative prices and Australia's export penetration into the Chinese market are unchanged. An implication is that a wholesale shift in the composition of China's commodity imports from Australia may not be a foregone conclusion. However, relaxing these restrictive assumptions unveils a wider range of possibilities, including the prospect that imported Australian food commodities could begin to erode the importance of traditional resource commodities within the coming decade.

Appendix A: Data

Series	Sources	Period	Number of economies
Crude steel production (million tonnes)	World Steel Association, <i>Steel Statistical Yearbook</i> (1978, 1986) World Steel Association, Annual crude steel production per country and region 1980–2013	1967–2013	68
Refined aluminium consumption (million tonnes)	World Bureau of Metals Statistics	1953–2012	43
Refined copper consumption (million tonnes)	World Bureau of Metals Statistics	1953–2012	48
Refined nickel consumption (million tonnes)	World Bureau of Metals Statistics	1970–2012	41
Energy consumption (million tonnes of oil equivalent)	BP, <i>Statistical Review of World Energy: June 2015</i> US Energy Information Administration, International Energy Statistics World Bank, World Development Indicators	1970–2012	105
Food consumption (calories per capita per day)	Food and Agricultural Organization of the United Nations, Statistics Division	1962–2012	115
Gross domestic product (PPP basis, 1990 international dollars)	The Conference Board, Total Economy Database™ (May 2015) The Maddison-Project, http://www.ggd.net/maddison/maddison-project/home.htm , 2013 version	1953–2013	115
Population	The Conference Board, Total Economy Database™ (May 2015) The Maddison-Project, http://www.ggd.net/maddison/maddison-project/home.htm , 2013 version	1953–2013	115

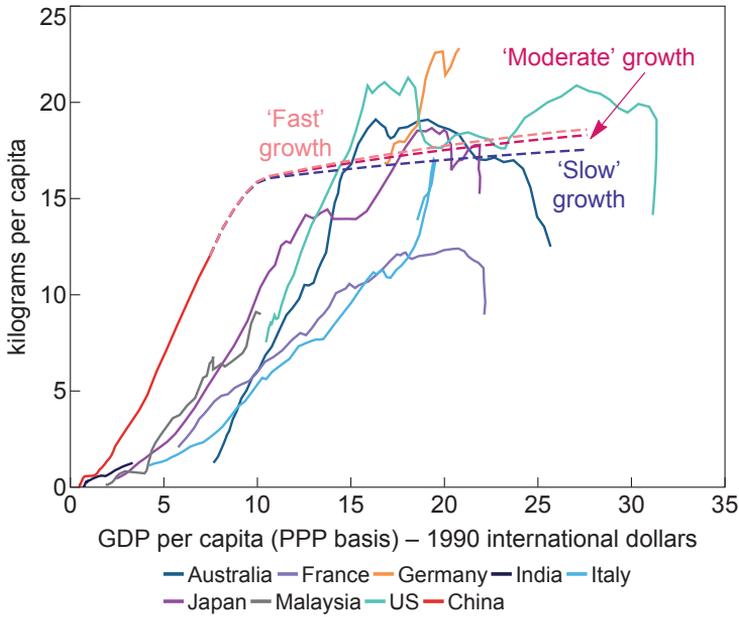
Appendix B: Sensitivity of Projections to Alternative Growth Scenarios

Figure B1: Steel Production per Capita
Five-year moving average



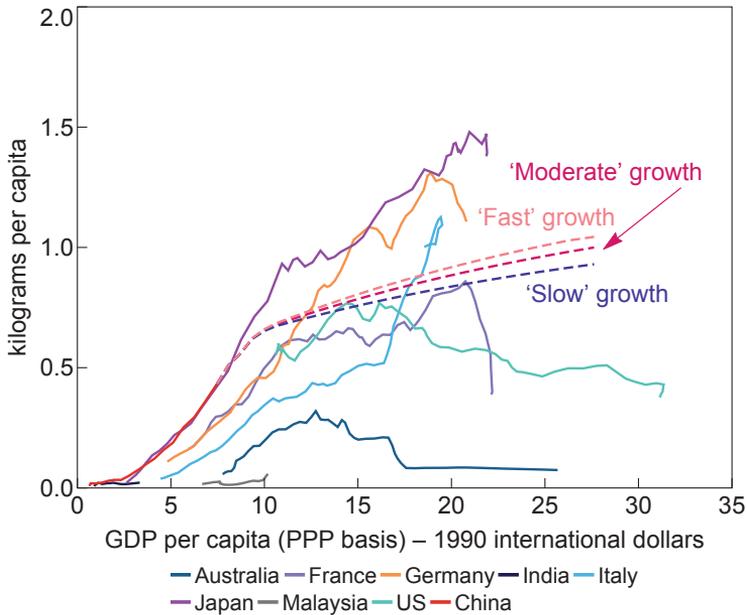
Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); World Steel Association (worldsteel)

Figure B2: Aluminium Consumption per Capita
Five-year moving average



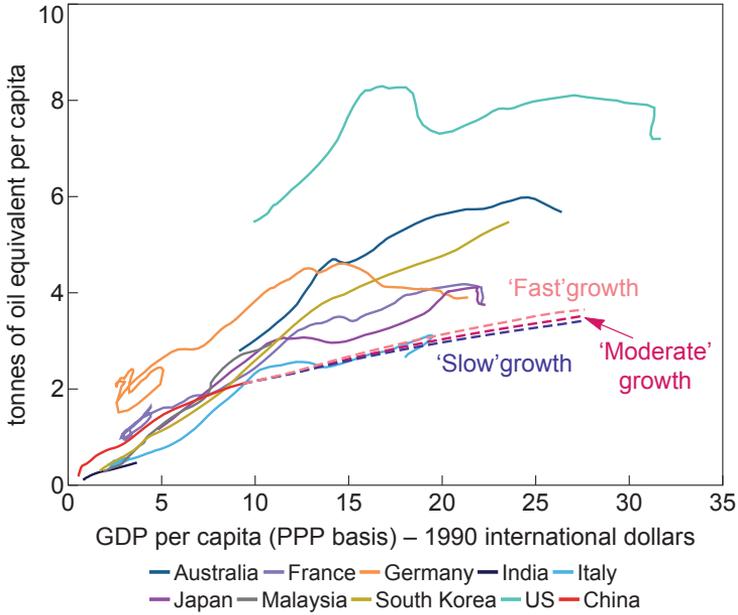
Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); World Bureau of Metals Statistics

Figure B3: Nickel Consumption per Capita
Five-year moving average



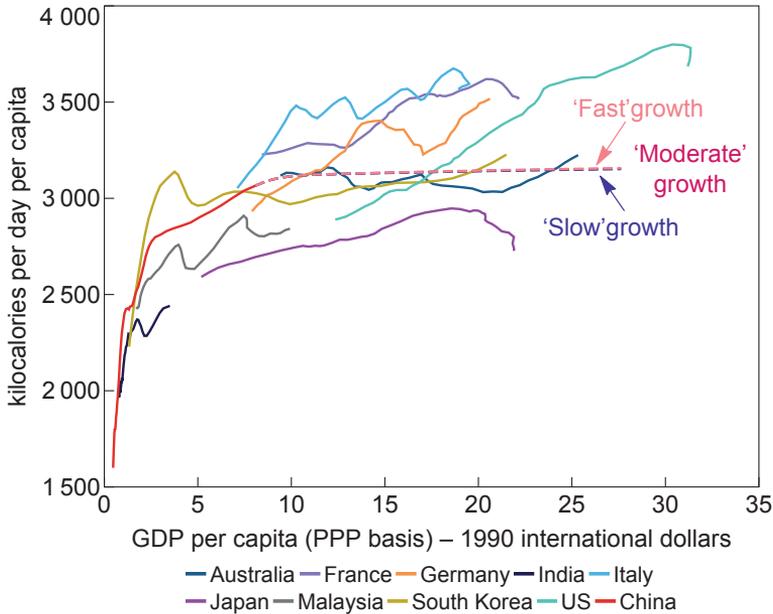
Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); World Bureau of Metals Statistics

Figure B4: Energy Consumption per Capita
Five-year moving average



Sources: Authors' calculations; BP (2015); The Conference Board, Total Economy Database™ (May 2015); U.S. Energy Information Administration

Figure B5: Food Consumption per Capita
Five-year moving average



Sources: Authors' calculations; The Conference Board, Total Economy Database™ (May 2015); United Nations FAOSTAT database

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Discussion

1. Elias Albagli

This paper focuses on China's demand for commodities. While this is a broad topic, the paper sets out to perform three well-defined tasks. First, it gives a comprehensive view of the market specificities for several commodities that China demands, including various classes in the broader categories of metals, energy and food. Second, it builds a rich panel dataset where various countries' demand for different commodities is estimated as a function of each country's economic development, essentially per capita GDP. Third, with the insight of the descriptive section and the quantitative methodology of the empirical exercise, the authors run a scenario to project Australia–China bilateral trade.

My discussion focuses on three main points. First, I will make some general comments on the descriptive part of the paper. Second, I will provide some suggestions for improvement on the empirical section. Finally, I will suggest applying their methodology to forecast the consequences of the surge of India in the demand for world commodities as a possible extension.

As a descriptive section within an empirical paper, the second section seems too long at first glance, taking more than 50 per cent of the paper's main text. However, a closer look at the material validates the size of this section. Indeed, for a reader who is somewhat familiar with some commodities, but not an expert – as was my case – this section is invaluable in terms of summarising the key aspects of various commodity classes. The main takeaway from this section is that the details matter in understanding and forecasting the demand for a particular commodity. Let me give a few examples, starting with an easy one given my background – the case of copper. This metal is mostly used for electricity consumption. How would you try to assess the demand for this particular commodity? It seems natural to use the projected growth of a country's power grid as the relevant metric, in favour of a broader index, such as GDP or population growth.

A less obvious metal to deal with is steel, intensively used by China for construction as well as in manufactured goods for exporting. Steel can be produced from iron ore and coal in blast furnace-basic oxygen convertors, the main technology used in Chinese steel production, but can also be recycled from scrap steel in different types of furnaces. As the paper notes, while there are many upsides to the outlook for steel production and therefore demand for iron ore and coal from other countries, including Australia, there is also the downside risk that the use of scrap becomes more prevalent in China than currently forecast. Indeed, the authors document that other countries rely more on scrap than China. The paper also paints a relatively dark future for coal demand. While around 80 per cent of China's electricity generation requirements are currently met by burning coal, environmental issues have grown more severe in the past decade and there are credible signs that Chinese authorities might start prioritising the development of alternative energy sources.

DISCUSSION

Overall, I believe this section makes for an insightful and entertaining read, and I suggest that the authors keep it this way, perhaps adding a table summarising the main drivers of demand for each commodity and the features of each market.

My second line of comments relates to the empirical exercise. The authors build an impressive panel to estimate the drivers of different commodity consumption levels. For each commodity, the panel has a minimum of 41 economies and 43 years (for nickel), but up to 115 economies and 53 years in the case of food consumption (measured in calories). The estimation method is non-linear ordinary least squares (OLS), where a measure of commodity consumption is on the left-hand side (production in the case of steel), and as explanatory variables they include GDP per capita, with a quadratic specification as well as a time trend. An alternative specification, which allows a more flexible relationship between GDP and demand, uses a smooth transition function instead of the quadratic term and, in a third specification used for food, the inverse of GDP is used.

The authors then highlight a number of results. First and foremost: non-linearity matters. Indeed, demand is hump-shaped in GDP (whether the quadratic or the smooth transition specifications are used). Based on these regressions, the authors conclude that while some commodities have already reached their peak – steel, and aluminium in some specifications – others will continue to increase in the medium term – copper and nickel – and even further in the case of energy demand.

While I believe the exercise performed seems appropriate, in particular the use of non-linear OLS, I do see a potential drawback for the exercise, so a word of caution is in order when interpreting these results. The main limitation of the exercise in my view is that the technologies today are radically different from those available in the 1970s or 1980s. This is important because, with alternative technologies available today, the relationship between development in China and its demand for energy products can be quite different from that of, say, an advanced economy in the 1970s when it reached a comparable GDP per capita level to China today. I do not believe there is much the authors can do about this, besides perhaps estimating the regression for different sub-periods, but it does raise a concern. This should perhaps be mentioned explicitly and the results taken with a grain of salt.

Another suggestion concerns the variables included in the right-hand side of the regression. After all the valuable details discussed in Section 2, one would expect some of the market specificities to show up in the regression. For instance, electric power grid, and not just GDP, could be used to estimate copper demand. I believe the authors chose parsimony over detail in this section, but it strikes me as at odds with the important messages in the descriptive section. Here I would suggest providing alternative regressions with a few extra explanatory variables, chosen specifically for each commodity in line with the previous discussion.

My final set of remarks outlines a potential extension. Looking at the growth numbers in China, one cannot help but wonder if India could provide the next wave of global commodity demand. Indeed, India has the second largest population in the world (1.25 billion) – not far from China's 1.35 billion – but India's current GDP per capita is less than half of China's. Several growth projections (take the Consensus Economics forecasts, for instance) see India's growth outpacing China over the medium run, closing this gap. This will obviously have deep implications for commodity demand worldwide. Indeed, as development catches on, one would expect other gaps to close as well, like the 750 kWh per person energy consumption in India vis-à-vis the 3 500 kWh per person

consumption in China, or steel production per capita, which today in India is about a tenth of the figure in China. While it is perhaps out of the scope of the conference, I can see the estimation of the effect of India's growth on commodity demand worldwide as an extension to this paper or as the basis of another paper.

Overall, I thought this was a well-thought-out paper, with important qualitative insights backed with a very serious empirical exercise that can perhaps be improved and extended by taking these suggestions along with others offered during the general discussion.

2. General Discussion

Much of the discussion centred on the projections of Chinese commodity demand and the econometrics used in the paper. Some participants noted that the econometric framework does not take into account the structure of China's industrial sector. These participants suggested that the authors could include additional explanatory variables in their models to account for differences in the composition of industry across countries. One participant argued that these adjustments would likely result in a stronger projection of Chinese crude steel production, with China's steel intensity likely to be closer to the high levels observed in Japan and South Korea. Similarly, another participant suggested basing the projections on the World Steel Association's estimates of true steel consumption, which adjusts domestic steel consumption for trade in steel-containing goods.

Ivan Roberts noted that the authors could include additional explanatory variables on the composition of industry and that this would be similar to the approach used in various other papers. However, he also suggested that this would complicate the paper's approach to projecting commodity demand, as it is not clear how the authors would construct projections for these additional explanatory variables. He further suggested that a key advantage of the approach used in the paper is that it allows scenario analysis to be conducted in a simple and transparent way.

One participant noted that over the medium to long term, the intensity of commodity use in an economy is largely driven by changes in consumer preferences and technological advancement. The participant suggested that while the paper focuses on changes in preferences, it does not address the issue of technological change. In response, Dr Roberts pointed out that the models include a time trend, which is partly intended to capture the effect of technological change.

Participants also suggested that the paper would benefit from more discussion on the outlook for supply of different commodities, both from China and other global producers. One participant made the point that a large share of state-owned iron ore producers in China have continued to operate despite being loss making. Another participant questioned whether environmental concerns could lead to reduced domestic output of coal, iron ore and steel production. Dr Roberts agreed that these were interesting areas of research, but suggested that addressing these issues was outside the scope of the paper.

There was also discussion on the projections of Australian commodity exports to China. One participant suggested extending the projections to include demand from other economies, such as India and south-east Asian economies. Other participants focused on estimates of demand

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for specific energy commodities and how they were derived from the projections of aggregate energy demand. One participant suggested using the historical relationship between GDP per capita and the composition of energy demand to improve the projections for each of the types of primary energy products. Another participant suggested that environmental concerns may reduce China's demand for coal in the future. This participant also suggested the relative prices of energy commodities would be an important factor in determining China's energy mix.

Another participant thought there were large downside risks to the outlook for Australian coal exports. They noted that the cost of transporting coal in China has declined in recent years, due to large investment in rail infrastructure. The participant also suggested that this increase in the competitiveness of Chinese coal producers largely explains the decline in coal imports in recent years. Dr Roberts agreed that there is considerable downside risk to the outlook for China's coal imports, noting that investment in rail and ultra-high voltage electricity transmission will increase the competitiveness of Chinese coal producers. However, another participant suggested that, while China could be self-sufficient in coal, it is unlikely. This participant suggested that China will continue to import low-cost coal, which will maintain competitive pressure on domestic producers.

One participant suggested the paper would benefit from a distinction between metallurgical coal and thermal coal. Demand for these two types of coal is driven by different factors, with metallurgical coal being used in steel production and thermal coal being used predominately for electricity generation. Dr Roberts pointed out that the authors have only modelled aggregate energy demand and that the projections for coal are then estimated based on Chinese government targets. However, he also noted that the paper could provide a more detailed analysis of the drivers of demand for different types of coal.

One participant also suggested that there was significant upside risk to the liquefied natural gas (LNG) export projections, given the large investments in Australia's LNG export capacity in recent years. However, Dr Roberts suggested that the projections were consistent with previous work published by the RBA that used a bottom-up approach to project Australian LNG exports.

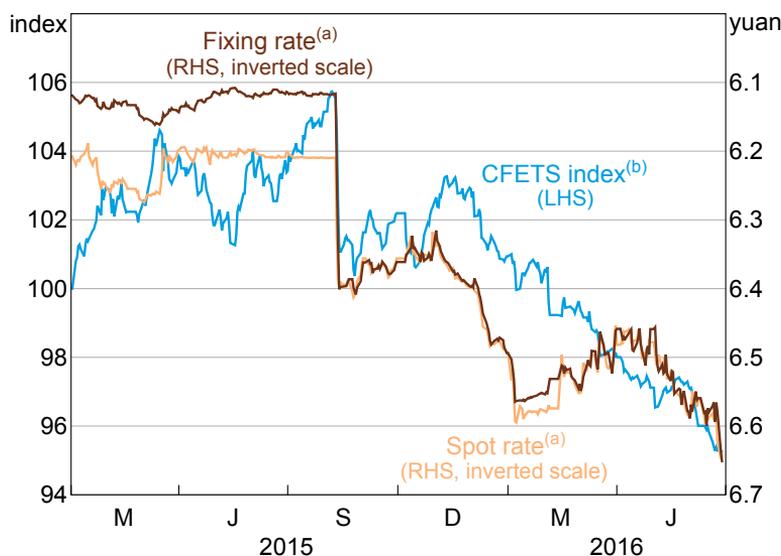
Capital Account Liberalisation and China's Effect on Global Capital Flows

Alfred Schipke*

1. Introduction

In 1993, China announced a plan to fully liberalise its capital account by 2000. That plan was, however, disrupted by the Asian financial crisis. China's capital account liberalisation process has resumed over the past few years, raising the question about the sequencing of capital account liberalisation. The debate gained prominence following the renminbi depreciation in August 2015 and subsequent capital outflow pressures (Figures 1 and 2). This paper provides a brief overview of China's capital account liberalisation, evaluates the effect of a full liberalisation of the Chinese capital account and describes how China's liberalisation process compares with the International Monetary Fund's (IMF) institutional view.

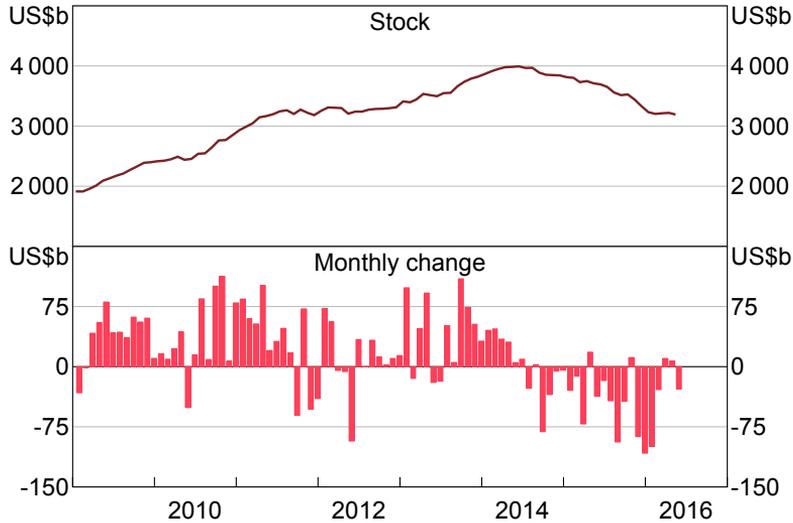
Figure 1: Chinese Renminbi



Notes: (a) Yuan per US\$
(b) 31 December 2014 = 100

Sources: Bloomberg; CEIC Data; China Foreign Exchange Trade System; RBA

* The author is from the IMF. The views expressed here are those of the author and do not necessarily represent the views of the IMF or those of its Executive Board. This paper is based on Bayoumi and Ohnsorge (2013) and Habermeier *et al* (forthcoming).

Figure 2: Foreign Currency Reserves

Sources: CEIC Data; RBA

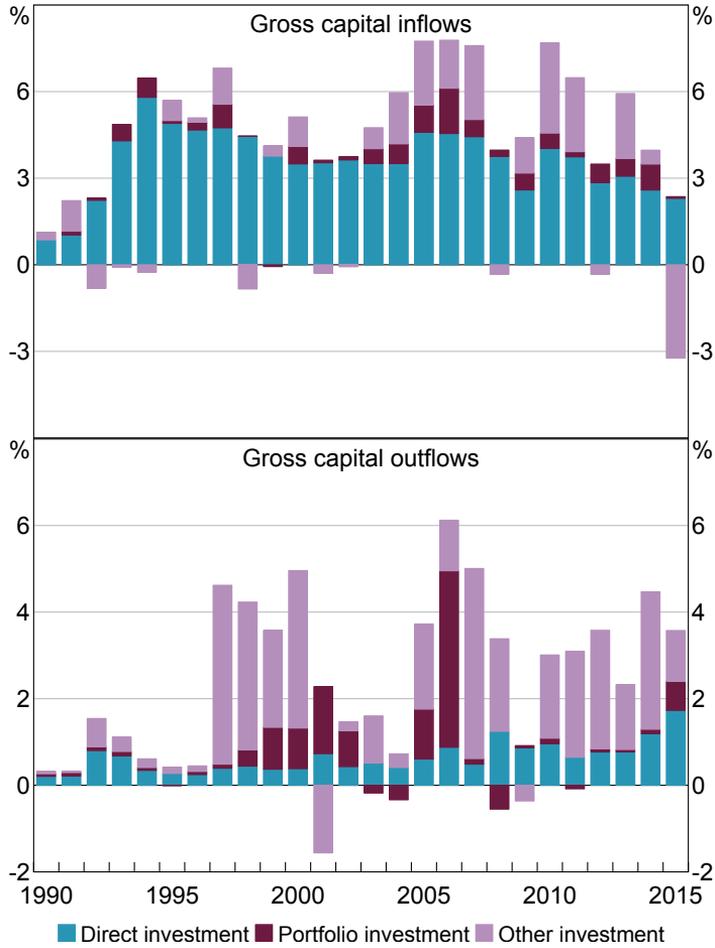
2. Capital Account Liberalisation in China

China has gradually opened its capital account, but considerable restrictions on capital flows remain in place. According to the IMF *Annual Report on Exchange Arrangements and Exchange Restrictions*, 52 out of the 58 items still have some degree of control (IMF 2015).¹ The different types of private capital flows – direct, portfolio investment and other – have been liberalised at different rates and restrictions on inflows have generally been eased before those on outflows. Despite formal restrictions, leakages have increased.

Foreign direct investment (FDI) has dominated capital inflows to China, in part because they have been less restricted than other forms of capital flows (Figure 3). The size of other flows, which are mainly banking related, have increased in recent years and have been a particularly important component of capital outflows. By comparison, portfolio investments remain limited, reflecting greater restrictions on these flows. While portfolio investors have generally been restricted by various schemes, the allowable quotas for these schemes have been gradually relaxed (Table 1).

¹ China's State Administration of Foreign Exchange (SAFE) measures suggest that, of the 40 items in the capital account, 5 are unconvertible and 18 are partly convertible.

Figure 3: Capital Inflows and Outflows
Per cent of GDP



Notes: Gross inflows are defined as the sum of inward foreign direct investment, portfolio liabilities and other investment liabilities in the balance of payments statistics; gross outflows are defined as the sum of outward foreign direct investment, portfolio assets and other investment assets

Source: Thomson Reuters

Table 1: Summary of China's Schemes to Ease Controls on Portfolio Investments

Scheme	Target flows	Start year	Quota limit	Total quotas allotted	Cap on individual quota	Cap on total quotas	Minimum investment required	Currency
QDII	Portfolio outflow	2006	Yes	US\$90b	No	No	No	Any
QFII	Portfolio inflow	2002	Yes	US\$79b	US\$1b	US\$150b	US\$2m	Any
RQFII	Portfolio inflow	2011	Yes	CNY412b	No	No	No	CNY
SHKSC ^(a)								
Southbound	Equity outflow	2014	No ^(b)	na	No	CNY250b ^(b)	CNY0.5m	CNY
Northbound	Equity inflow	2014	No ^(b)	na	No	CNY300b ^(b)	No	CNY

Notes: QDII denotes Qualified Domestic Institutional Investor, QFII denotes Qualified Foreign Institutional Investor and RQFII denotes renminbi QFII

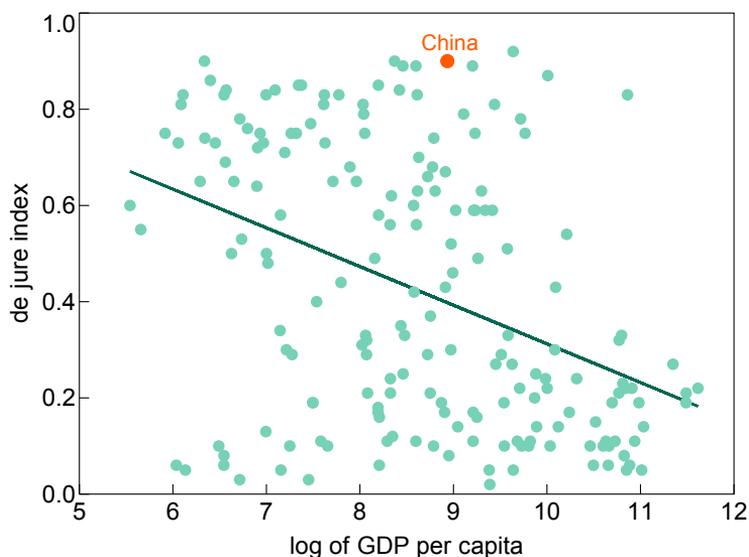
(a) Southbound refers to investment flows from Shanghai (mainland) to Hong Kong SAR, northbound refers to investment flows from Hong Kong SAR to Shanghai (mainland)

(b) Though Shanghai–Hong Kong Stock Connect (SHKSC) investors are not subject to individual quota limits, they are subject to a daily limit and an aggregate quota on total flows; net southbound flows are capped at CNY10.5 billion per day and net northbound flows are capped at CNY15 billion per day

Source: IMF

To gauge the direction of future reforms, it is useful to consider where China stands relative to other economies. Internationally, higher income per capita tends to be associated with a more open capital account (Figure 4). China appears to be an outlier, with a more closed capital account than other countries that have a similar income per capita. Similarly, China has a low level of integration with the global financial system (as measured by the sum of its external assets and liabilities as a share of GDP) given its per capita income. This could suggest that China is likely to become more open and financially integrated with the global economy in the coming years.

Figure 4: De Jure Financial Account Restrictiveness and Income Level



Notes: 185 IMF member countries, including their territories where data are available; data as at 2014 or latest available
Sources: IMF; World Bank, World Development Indicators

3. Recent Developments

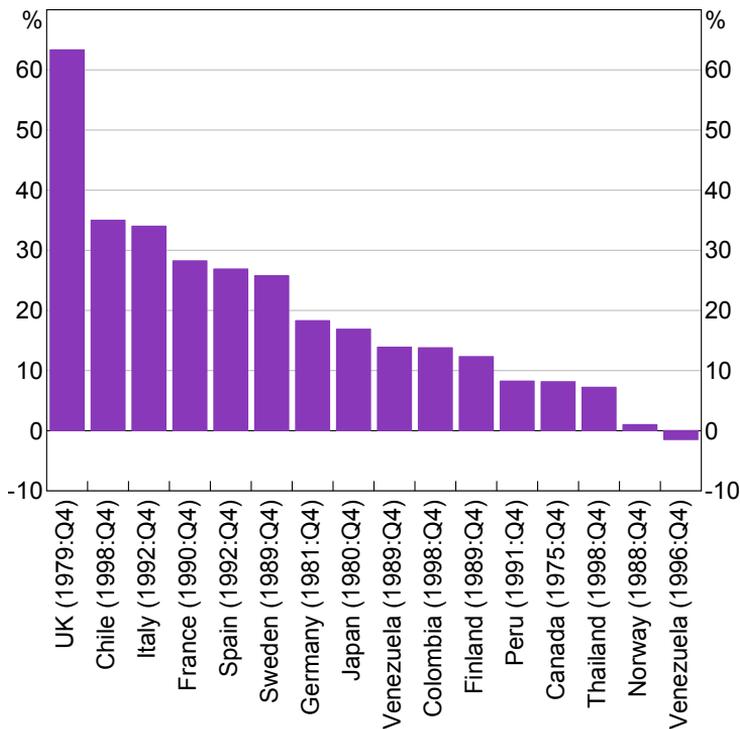
The volatility in foreign exchange markets, capital outflows and the associated decline in foreign currency reserves in late 2015/early 2016 prompted the Chinese authorities to better enforce existing capital account controls and impose some additional measures (such as the 20 per cent unremunerated reserve requirement (URR)).

Nevertheless, the authorities remain committed to capital account liberalisation and the process has continued to move forward. In February 2016, the quota for individual institutions to invest under the QFII program was relaxed and the minimum investment period was reduced from one year to three months (SAFE 2016). Also in early 2016, access to the interbank bond market was expanded for international investors (PBC 2016).

4. Implications of Full Liberalisation

Given that parts of the capital account remain closed, the question arises of what would be the impact of fully opening the capital account in one go. The size and direction of those capital flows could have important implications domestically and internationally. In the past, countries that liberalised their capital account generally experienced a significant increase in both inward and outward capital flows (Figure 5). However, with a few exceptions, outflows were larger than inflows as domestic investors sought to diversify their savings.

Figure 5: Change in Gross International Assets
Five years following capital account liberalisation, per cent of GDP



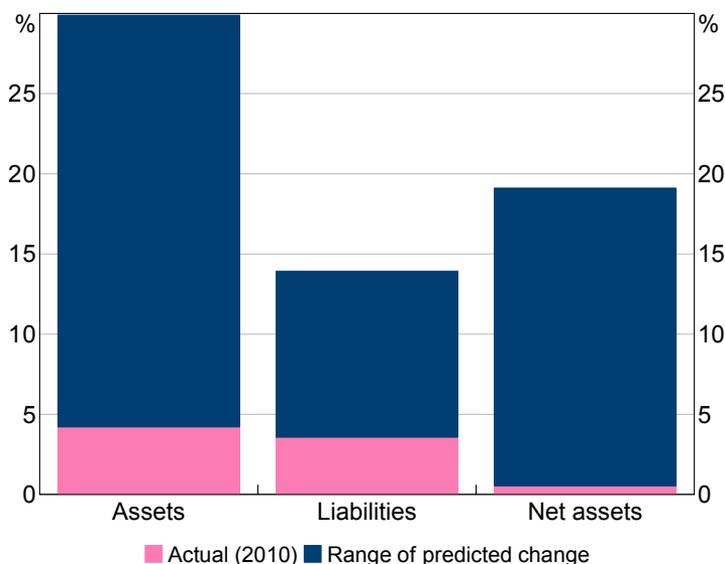
Source: Thomson Reuters

For China, for example, Bayoumi and Ohnsorge (2013) use a portfolio allocation model and data from countries that liberalised their capital account over the past 30 years to estimate the size of capital flows following liberalisation. The authors use a partial equilibrium model that does not take into account other changes in the macroeconomic environment that would occur if the capital account were to be fully opened in one step. Nevertheless, the model's estimates provide a useful starting point to think about what to expect following capital account liberalisation in China. Based on this exercise, capital account liberalisation may be followed by a one-time stock adjustment of Chinese assets of 15–25 per cent of GDP and a smaller adjustment for foreign assets in China (2–10 per cent of GDP; Figure 6). This would imply a net capital outflow of around

11–18 per cent of GDP. He *et al* (2012) and Saadi Sedik and Sun (2012) come to similar results, estimating that net capital outflows would occur following capital account liberalisation in China.

Figure 6: Predicted Impact of Capital Account Liberalisation on China's International Portfolio Assets and Liabilities

Per cent of GDP

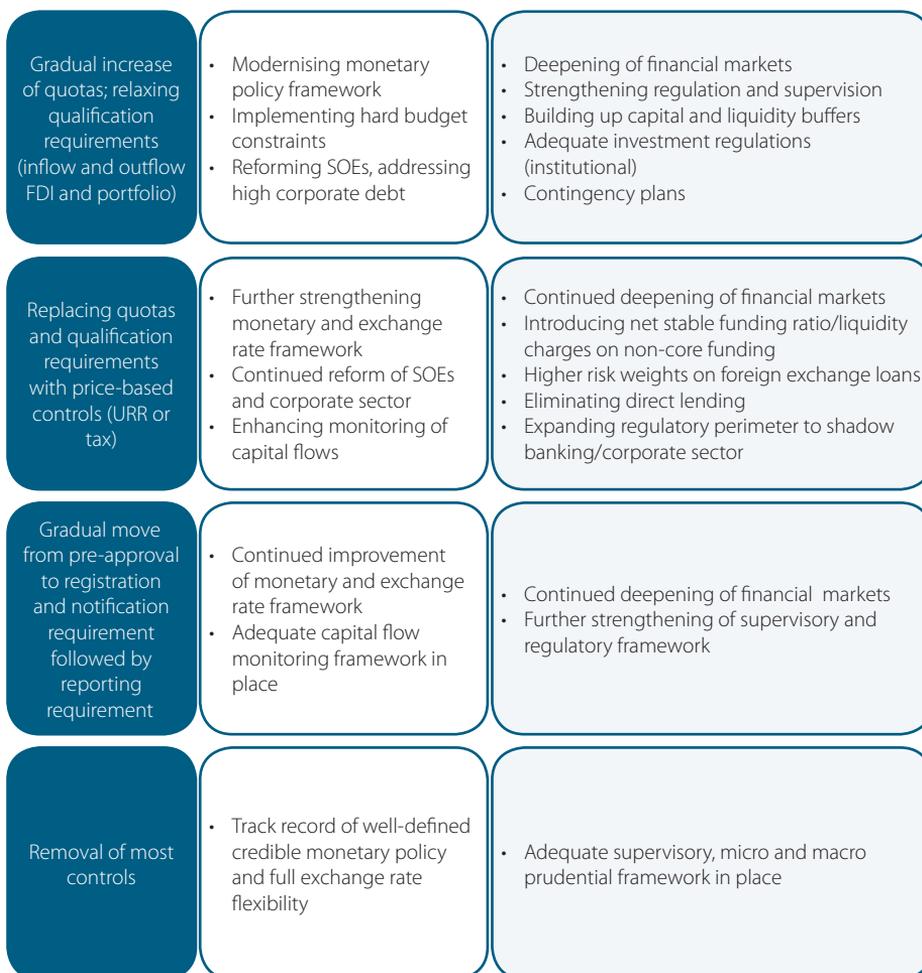


Note: Portfolio assets and liabilities exclude official reserve assets
Source: Bayoumi and Ohnsorge (2013)

5. A Roadmap for Further Capital Account Liberalisation

To date, the sequencing of China's capital account liberalisation has been broadly in line with the IMF's institutional view (IMF 2012) (Figure 7). The liberalisation process has proceeded gradually. China initially implemented quotas focused on specific investor groups with experiments in certain parts of the country and over time these experiments have been expanded. Going forward it would be good to move from quantity-based to price-based restrictions (e.g. Nishizawa 2016).

The process of capital account liberalisation should occur alongside supporting reforms, including reforms to the domestic financial sector. For China, this would involve the ongoing modernisation of the monetary policy framework, imposing hard budget constraints and state-owned enterprise (SOE) reform. Because none of these goals are easily defined, it is difficult to determine the optimal timing of further capital account liberalisation. As a result, further opening up of the capital account is likely to occur gradually and in parallel with other reforms.

Figure 7: Capital Account Opening

Source: IMF

6. Conclusion

China has made considerable progress in opening the capital account in recent years; however, it continues to formally maintain significant capital controls and remains more closed than other economies at a similar level of development. In the future, one would expect China to integrate further into the global financial system.

If China's capital account were to be fully opened, there would be both sizable inflows and outflows. Previous studies suggest that on net there would initially be a capital outflow. In recent years, China has continued to open its capital account and has indicated that its goal is to move toward 'managed convertibility' (Zhou 2015).

So far, China has opened up its capital account in a way that is broadly in line with the IMF institutional view. As this process moves forward, China should move from quantity- to price-based restrictions, and then also from administrative controls to currency-based regulation and supervision. One of the challenges going forward is the increasing difficulty of enforcing the remaining restrictions as the capital account becomes more open and there are more opportunities to circumvent the rules.

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Discussion

1. Lillian Cheung

I think the presentation provides a good overview of the progress on capital account liberalisation in China so far and offers a sense of likely portfolio investment flows upon further opening.

The key messages I took from the paper were that:

- So far, China's capital flows have been driven by foreign direct investment (FDI) flows and banking flows. Portfolio flows have faced more restrictions, but are also being liberalised gradually.
- The author predicts that net foreign portfolio assets could increase by 11–18 per cent of GDP upon capital account liberalisation, up from 0–1 per cent of GDP in 2010. Both portfolio inflows and outflows are predicted to increase significantly. Additionally, both foreign portfolio assets and liabilities are projected to increase from less than 5 per cent of GDP in 2010 to 15–30 per cent of GDP after the capital account is liberalised. Net outflows from China after liberalisation would have significant global effects.
- Going forward, strengthening the policy framework is necessary to further support capital account liberalisation. For example, further development of capital and liquidity buffers and the micro and macroprudential frameworks would facilitate capital account liberalisation.

I think these are all fair points and I tend to agree with most of them. I will supplement these with some comments on the implications for the resulting international investment position (IIP) in China that are likely to flow from capital account liberalisation.

I would like to focus on the composition of the IIP in China as I believe it provides additional insights beyond those gained from looking at the direction or size of capital flows. To date, the foreign asset position has been dominated by official reserves, whereas outward FDI and portfolio assets are still small. Having said that, the percentage of official reserves among total foreign assets declined from 66.5 per cent in 2008 to 60.8 per cent in 2014. Total foreign liabilities also increased significantly, but mostly through inward FDI, and total liabilities remain smaller than total assets. As a result, the private sector has a net foreign liability position. But because of the huge official reserves, mainland China holds a net foreign asset position with global markets.

Despite having a net foreign asset position, the rate of return on investment from abroad has been lower than the rate of return owing to foreign investors. This is because foreign assets, in the form of official reserves, are mostly invested in foreign government bonds, which have low rates of return. Conversely, foreign liabilities were mostly in the form of inward FDI, which would usually have a high rate of return.

So what would happen if China further liberalised its capital account? Here, I would like to point to a piece of research work that my colleagues and I did on China's capital account liberalisation in 2012 (He *et al* 2012). We found similar results to the current paper. In our work, we projected that

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net foreign portfolio assets would increase from 0.6 per cent of GDP in 2010 to around 8 per cent of GDP after China's capital account liberalisation is complete, so it is close to the lower bound of the author's estimate (of 11–18 per cent of GDP).

We projected that both inward and outward portfolio investment would increase. We also expected net portfolio outflows, reflecting relatively faster asset accumulation due to Chinese residents' desire for global portfolio diversification. Our research work also made projections on FDI flows. Given the already large inward FDI position, built up in the past three decades, outward FDI would likely increase by more than inward FDI flows. This would happen as Chinese corporates go abroad, for instance, to facilitate both upgrades along the value chain and to tap overseas markets.

Together such factors would lead to more capital flows coming out of mainland China through direct investment and portfolio investment channels, instead of the current one-way traffic going into mainland China. The result is that the private sector would turn its net liability position into a balanced position and the official sector would reduce its net asset position significantly as a share of GDP. Because of such changes in the composition of the IIP, China would be able to earn higher net investment income from abroad. Overall, we expect China would continue to be a net creditor, with the net foreign asset position as a share of GDP remaining largely stable.

Interestingly, the recent decline in China's foreign exchange reserves is consistent with this shift of foreign asset holdings from the official sector to the private sector. In fact, the recent renminbi (RMB) depreciation and the associated RMB outflows mainly reflected asset-liability rebalancing by mainland residents, rather than cross-border capital outflows by foreign investors.

Over the past few years, the trend of RMB appreciation provided a strong incentive for residents to hold most of their assets in terms of RMB, while Chinese firms increased borrowing in US dollars to benefit from the low interest rates. Now with increased volatility and depreciation expected, mainland residents have been prompted to reallocate their assets by holding more foreign currencies and less RMB. This has been achieved not only by a rebalancing of the portfolio on the asset side, but Chinese corporates have also reduced their foreign currency liabilities by paying off their foreign currency and external debt.

One proxy for the trend of US dollar borrowing by Chinese enterprises is the change in mainland domestic foreign currency bank credit. The latest available data show that the size of outstanding mainland domestic foreign currency bank loans to non-financial enterprises peaked in the March quarter of 2014 and then declined in the second half of the year, following the strengthening of the US dollar (USD). The significant RMB depreciation since late 2015 resulted in another noticeable decline in these borrowings, with the size of outstanding foreign currency loans dropping by another 23 per cent between mid 2015 and January this year. Since the Bank for International Settlements data on external claims and liabilities for all countries are not yet available for the December quarter of 2015, another proxy is the USD loans of Hong Kong banks extended to the non-financial sector of mainland China (excluding loans extended by their mainland subsidiaries), which decreased by about 12 per cent in the second half of 2015.

The listed company data in China also paint a similar picture. For the 52 firms where data for the December quarter of 2015 are available, the size of outstanding USD loans came down by about 45 per cent in the second half of 2015. Meanwhile, mainland Chinese firms listed in Hong Kong

redeemed a total of US\$3.4 billion USD bonds before maturity in the December quarter of 2015, which was one of the largest early redemptions of bonds in recent years.

Finally, to illustrate how mainland China can potentially affect capital flows globally, we can make use of Hong Kong as a case in point. Hong Kong's bilateral capital flows with mainland China have increased at a fast pace and have become more balanced across the different types of capital flows. Although direct investment flows still account for most of the cross-border flows, portfolio investment and banking flows have been catching up. Cross-border banking flows have also increased, along with rising mainland-related lending of banks in Hong Kong.

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2. General Discussion

Discussion began with questions on the speed and sequencing of financial liberalisation in China. One participant noted that, while Chinese authorities appear to have a preference to take a gradual approach to capital account liberalisation, due to the risks associated with opening up too quickly, there are also costs associated with keeping the capital account closed in terms of distortions to the domestic allocation of capital. On the other hand, several participants questioned whether the liberalisation of the capital account had proceeded too fast relative to the liberalisation of the domestic financial system, thereby increasing domestic risks and volatility.

Alfred Schipke responded by noting that the liberalisation process was largely in line with the IMF institutional view. However, he emphasised that a large amount of the liberalisation process was characterised by experimentation and it was important to pause if required. He highlighted three areas of reform that would be expected to move together: reform of state-owned enterprises (SOEs); financial sector liberalisation; and capital account liberalisation. He noted that financial sector and capital account liberalisation had moved hand in hand, but that SOE reform had progressed at a slower pace. He also stated that there can be beneficial effects from volatility in markets for corporates and policymakers, for example, because it aids the development of hedging practices.

Discussion then turned to the measurement of the openness of the capital account. Several participants suggested that China's capital account was already relatively open. For example, the exchange rate appears to have responded to changes in interest rate differentials since the currency was unpegged in 2010. Along these lines, participants pointed to anecdotes of Chinese investors using cash to buy property in other countries as evidence that the official measures understate capital outflows. Several participants noted that some parts of the capital account have been closed again since August 2015, with both Chinese residents and multinational corporations finding it more difficult to move money offshore. Dr Schipke agreed with participants that the official data only told part of the story. He also emphasised that China is highly integrated into

DISCUSSION

the global trading system and, with an increasing number of global companies and investment abroad, the ability of authorities to control capital flows is limited since many flows can be hidden.

Other participants discussed possible price-based policy measures which could be implemented by the People's Bank of China (PBC), such as a Tobin tax or unremunerated reserve requirements. One participant noted that these measures could limit the negative effects of short-term capital flows, which recent research has suggested have tended to be driven by market volatility. The participant noted that this contrasts with previous conventional wisdom that short-term capital flows are important in price discovery. Dr Schipke agreed that the movement away from quantity measures to pricing measures are warranted.

Participants also discussed the recent movements in the exchange rate and policy changes by the PBC. One participant questioned whether the recent change to a reference basket of currencies in the PBC's commitment to a basically stable exchange rate was a sustainable approach. In response, Dr Schipke noted it is important to keep in mind that policy is generally not made by a single institution in China. This arrangement typically results in ambiguous statements given for policy changes, although he noted that there had been improvements in communication recently. He also noted that the move to reference a basket of currencies, in addition to the US dollar, is more sustainable. This approach provided the authorities with more flexibility, particularly given the possibility of further tightening of monetary policy in the United States. He also emphasised that the policy of a basically stable currency against a basket of currencies is likely to be an intermediate step, given the long-term goal of an effective flexible exchange rate system.

Other participants asked whether the renminbi is currently at fair value. It was noted that a small depreciation of the renminbi in August 2015 triggered enormous capital outflows and a spike in financial market volatility. Participants suggested this could be interpreted as a policy mistake, an overreaction by the market or as a sign that the currency had been mispriced. Another participant questioned the authorities' focus on managing the exchange rate, rather than domestic interest rates and independent monetary policy.

Several participants focused on the recent decline in China's official foreign currency reserves. One participant questioned whether the PBC is more concerned with the level of reserves or the pace of decline in reserves. Another participant noted that declining official foreign reserves and increasing private foreign assets was consistent with capital account liberalisation. Dr Schipke indicated that the IMF conducts an exercise for many countries to determine the appropriate level of reserves. While this is an estimate, it is lower than the current level of official reserves in China. He also noted that the PBC has indicated that it is not concerned by the decline in reserves, given that it also reflects rebalancing of assets and liabilities by Chinese residents rather than genuine capital outflows.

One participant noted that resident capital outflows were likely to be persistent given the high saving rate in China and benefits of diversification. The participant noted that this may be balanced by continued efforts to attract capital inflows, such as the recent reforms to the bond market and opening up of the equity market. Another participant questioned the effect of the exchange rate on longer-term projections of the net IIP for China.

A Rebalancing Chinese Economy: Challenges and International Implications

Guonan Ma, Ivan Roberts and Gerard Kelly*

1. Introduction

China's twin imbalances – the high investment-to-GDP and low consumption-to-GDP ratios and the current account surplus – have been a focus of international policy discussions since the mid 2000s. Between 2000 and 2007, China's current account surplus surged from less than 2 per cent of GDP to 10 per cent. The rise in the current account surplus was accompanied by a sharp increase in the household saving rate (31 per cent to 39 per cent of household disposable income) and in the investment share of GDP (33 per cent to 40 per cent). In the wake of China's policy response to the global financial crisis, the investment share of GDP expanded even further, reaching 44 per cent in 2014, although the current account surplus has receded to around 2 per cent.

Multiple explanations have been offered to explain China's imbalances, ranging from the managed exchange rate regime (Goldstein and Lardy 2008), 'financial repression' (Lardy 2008) and broader factor cost distortions (Huang and Tao 2011) to rapid wealth accumulation (Ma, McCauley and Lam 2013), demographic transition (Cai 2011) and even population control policies (Wei and Zhang 2011). The twin imbalances have in turn been held responsible for the 'global savings glut', excessively low global interest rates in the 2000s (Bernanke 2007) and the global financial crisis (Obstfeld and Rogoff 2009). The rise in debt that has accompanied the domestic investment imbalance has also raised concerns that a sudden deleveraging could trigger a financial crisis within China itself (Pettis 2013). Perceived negative implications of these imbalances have led to repeated calls for China to rebalance both its domestic demand structure and its pattern of trade (e.g. IMF 2010, 2015).

The implications of Chinese domestic 'rebalancing' are, *ex ante*, ambiguous for external rebalancing and for the global economy. The relationship between saving, investment and the trade balance can be represented by the identity:

$$Y - C = I + X - M$$

where Y refers to GDP, C refers to consumption, I to investment, X to exports and M to imports. Of course, this accounting identity reveals nothing about the causality between the savings gap

* The majority of this collaboration was completed while Guonan Ma, a non-resident scholar of Bruegel, was visiting the Reserve Bank of Australia in 2015.

$(Y - C - I)$ and China's external surplus $(X - M)$.¹ The rise in China's external surplus in the 2000s coincided with an increase in investment relative to output and an even stronger rise in saving. In an accounting sense, a more balanced domestic demand structure may occur alongside *either* a rise *or* a fall in the external balance, depending on the relative speed with which investment and saving ratios adjust.

Ma *et al* (2013) argue that China's twin imbalances can be understood as the product of large income windfalls that were saved, giving rise to large external surpluses. An advantage of this explanation is that it reconciles rapid growth in both investment and consumption with the rise of the external surplus over the 2000s. Ma *et al* predict that as these windfalls fade and the real effective exchange rate appreciates alongside rising unit labour costs, saving will fall.

In contrast, Huang and Tao (2011) and Pettis (2013) suggest that both internal and external imbalances in China have had a different root cause: labour and capital market distortions that have artificially lowered the cost of labour and capital, repressed consumption and suppressed the value of the renminbi. They argue that both imbalances may be tackled simultaneously by reducing these distortions. Similarly, Obstfeld and Rogoff (2009, p 39) contend that 'if typical Chinese savers had access to relatively safe instruments offering higher rates of return, huge positive income effects would in all likelihood swamp substitution effects, resulting in lower, not higher, household saving. The result would be higher household welfare in China, as well as a reduction in China's foreign surplus.' Yet Fukumoto and Muto (2011) provide an historical counterexample to this claim. They observe that, in practice, a relaxation of factor cost distortions in Japan in the 1970s led to a more rapid fall in the investment rate than in the saving rate, which in turn fuelled a widening of the current account surplus.

To date, domestic rebalancing (defined as a fall in the investment-to-GDP ratio and rise in the consumption-to-GDP ratio) has lagged the reduction of the external imbalance. So a central question is whether, over the next decade or so, China can achieve a meaningful domestic rebalancing while maintaining slower but more sustainable growth, without a much wider external imbalance. In this paper, we make several points about the likelihood of a 'double rebalancing'.

First, we review the literature and empirical evidence regarding the main factors behind the domestic and external imbalances, highlighting the central role of a high, rising and now peaking Chinese saving rate. China's gross national saving has been evolving in response to large shocks from structural forces, institutional transformation and government policy. These shocks, together with new ones, are likely to condition rebalancing in the decade ahead.

Second, we highlight the extraordinary strength of Chinese household consumption in recent years, by the standards of Chinese history and in comparison to other economies. Even if consumption has been 'repressed' by factor price distortions, as argued by many commentators, such comparisons cast doubt on the likelihood that an acceleration of consumption will be the primary driver of further domestic rebalancing. Any meaningful rebalancing will most likely

¹ Here C refers to both household and government consumption. The difference between savings and investment is equivalent to the current account balance, which in addition to the trade balance (net exports), includes the balance on primary income (earnings on investments) and the balance on secondary income (transfer payments). Net primary and secondary incomes represent a relatively small component of China's current account balance, which has closely approximated the trade balance as a share of GDP in recent decades.

flow from a sharp deceleration of investment, further weighing on an economy that is already experiencing slower growth in potential output.

Third, using an approach similar to Bai, Hsieh and Qian (2006), we provide evidence that the return to capital in China has fallen noticeably in recent years. This has been driven by a steep rise in the capital-to-output ratio, amid signs that the sustained downward pressure on the labour share of income may now be easing or even reversing. The decline in the return to capital has occurred alongside an upward shift in the cost of debt funding, with the result that the gap between the two has narrowed sharply and the incentives to invest have fallen. A continuation of this trend points to a further decline in the growth of investment in coming years.

Fourth, we consider quantitative scenarios of rebalancing for the period of 2015–30 to illustrate that a simultaneous resolution of domestic and external rebalances, while maintaining reasonable growth, is possible but quite challenging. Our scenarios underscore the ‘knife-edged’ nature of domestic rebalancing. Even the ‘moderate’ rebalancing and growth scenario that we consider involves a considerable growth slowdown, a rising capital-to-output ratio and a further decline in the return to capital. If the domestic rebalancing is rapid, the implied disparity between the growth of consumption and investment requires both exceptional resilience of consumer spending on the demand side and a swift increase in the efficiency of investment on the supply side. If it is slow, the capital-to-output ratio rises to potentially unsustainable levels and real household consumption per capita falls short of the levels of a contemporary upper middle-income economy, even by 2030.

Finally, the wider effects of domestic rebalancing in China on its trading partners depend on the composition of bilateral trade flows and the extent to which that composition and relevant prices adjust in response to the changing structure of China’s economy. The existing literature does not support an especially sanguine view. Ahuja and Nabar (2013) use a dynamic panel model to assess the spillover effects of an investment slowdown in China. They find that there could be sizeable negative effects for capital goods exporters (such as Germany and Japan) and commodity producers, such as Australia, Brazil and Canada. Mohommad, Unteroberdoerster and Vichyanond (2012) reach similar conclusions using Asian input-output tables, which allow them to account for regional supply-chain linkages.

We confirm and update these findings using broader global input-output tables published by the OECD, building on previous work by Kelly (2014) and Kelly and La Cava (2014). Assuming that the structure of global trade with China remains broadly stable and that relative price adjustments are of second-order importance, our calculations suggest that domestic rebalancing in China will be negative for countries that export resource commodities, including Australia. Regional producers of manufacturing inputs that have been used intensively in Chinese capital formation, including South Korea and Japan, may experience similar effects. Our assumptions can be questioned, but a robust implication is that a large-scale reorientation of production and trade would need to occur to mitigate the negative impact of Chinese rebalancing on these economies.

The paper proceeds as follows. The next section discusses stylised facts about China’s domestic and external imbalances and reviews the evidence on factors underpinning the high saving and investment rates that have occurred historically. Section 3 discusses mechanisms that are likely to be important in facilitating continued rebalancing, while Section 4 constructs scenario

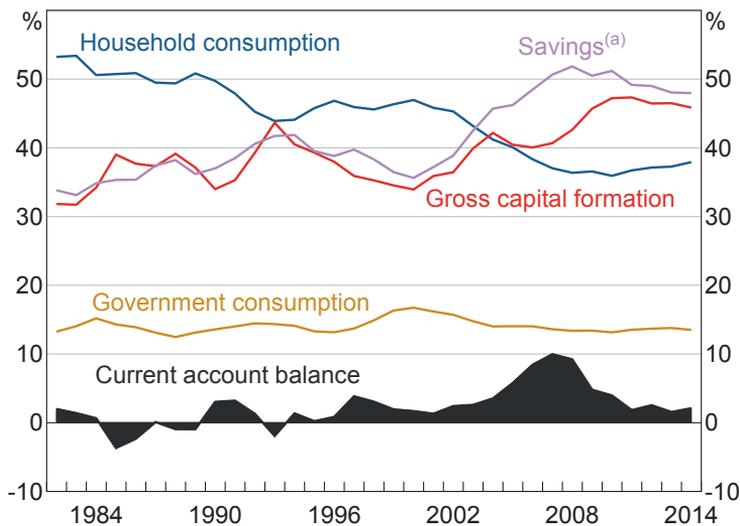
projections for output, consumption, saving, investment and the return to capital to illustrate the likelihood (or otherwise) of a ‘double rebalancing’. We then explore how different rebalancing scenarios could affect China’s trading partners, using data from global OECD input-output tables. Section 5 offers concluding remarks.

2. China’s Twin Imbalances: Facts and Issues

This section highlights some stylised facts about China’s aggregate demand, raises a number of key issues central to its domestic and external imbalances and explores their implications for rebalancing. First, based on an analysis of flow-of-funds data, we argue that conventional analysis understates the role of the household sector in contributing to the high investment share. Second, we stress that consumption growth has been far from anaemic over the past three decades by international standards, suggesting that looking forward the burden of rebalancing will mostly be assumed by investment. Finally, we argue that, while policy changes designed to remove factor price distortions may facilitate rebalancing, it will probably happen as a natural outcome of dwindling income windfalls from earlier productivity shocks, the unwinding of demographic shifts, and maturing housing markets which helped drive the imbalances in the first place.

In the space of three decades, China’s aggregate demand composition has experienced a sea change. From the 1980s to the end of the 2000s, household consumption as a share of GDP fell from more than one-half to a little over one-third, while gross capital formation jumped from one-third to just below one-half (Figure 1). China’s saving rate rose even faster than its investment rate, accompanying a large current account surplus peaking at 10 per cent of GDP in 2007. In short, China experienced both greater domestic and external imbalances during this period.

Figure 1: Aggregate Demand and the Current Account Balance
Share of nominal GDP



Note: (a) Gross capital formation plus current account balance
Sources: Authors’ calculations; CEIC Data

In just a few short years following 2007, the Chinese current account surplus shrank to below 3 per cent of GDP. This rapid external rebalancing was facilitated both by an appreciation in the renminbi and a step rise in the investment rate that coincided with a peaking national saving rate (Ma *et al* 2013). In other words, China's domestic imbalance increased while its external imbalance eased. This was precisely the opposite of Japan's experience of domestic rebalancing coinciding with a wider external surplus in the 1980s (Fukumoto and Muto 2011).

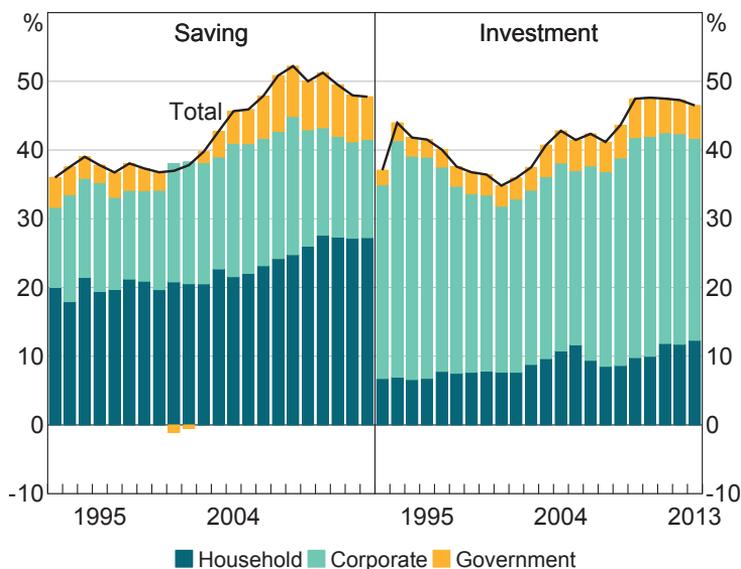
2.1 Who saves and invests in China?

At a more disaggregated level, an analysis of the Chinese flow-of-fund accounts data, which cover the period from 1992 to 2013, sheds some light on the main sources of the rising saving and investment rates. The flow-of-funds data are conceptually consistent with the national accounts on both an expenditure and an income basis while revealing the sectoral breakdowns of these expenditure and income flows by household, corporate and government. The data help answer the question of who consumes, saves and invests – a core issue in any discussion of rebalancing.²

During these two decades, China's gross capital formation as a share of GDP rose by 10 percentage points, yet the national saving rate climbed even more — by 12 percentage points (Figure 2). The saving rate peaked at 52 per cent of GDP in 2008, declining thereafter. By contrast, the investment rate plateaued around 47 per cent in the early years of the current decade, in part owing to the large-scale government stimulus program in the wake of the global financial crisis. The three sectors — household, corporate and government — all contributed positively to China's high and rising investment and saving rates during 1992–2013, albeit to varying degrees.

2 After 2009, the flow-of-fund accounts data started capturing net transactions of land use rights and intellectual copyright across the household, corporate and government sectors under 'acquisition less disposal of other non-financial assets'. Since proceeds from land sales and purchases are not counted as gross capital formation, they do not contribute to value added. Thus, these transactions sum to zero but do alter the income and saving flows among the three sectors. We adjust for such transactions in this paper. In addition, the current flow-of-funds data have not been updated to match the 2015 revision of the expenditure-based GDP data, so minor discrepancies exist between the two sets of data. The release of 2013 flow-of-funds data included revisions to the previous year's data for household and government sector income (based on the third national economic census), but as revisions to all other flow-of-funds series are not expected to become publicly available until late 2016, we continue to use the pre-revised household and government income data for 1992–2012 to maintain consistency.

Figure 2: Saving and Investment by Sector
Flow of funds, share of GDP



Note: Adjusted for 'acquisition less disposal of other non-financial assets'
Sources: Authors' calculations; CEIC Data

2.1.1 Saving

The household sector has been the largest driver of China's gross domestic saving, accounting for around half in 2013 and generating nearly two-thirds of the rise in the national saving rate during the two decades for which we have flow-of-funds data. The corporate and government sectors each contributed roughly one-fifth of the increased saving. As a share of GDP, household saving displayed a steady and relentless climb starting in the early 2000s. After a brief period of dissaving in 2000–01, government saving also increased strongly, while corporate saving peaked in 2008 and has fallen since then. Reported lower corporate earnings are consistent with our estimates of the declining return to capital (see Section 3).

2.1.2 Investment

In contrast, the dominant source of investment has been the corporate sector. In 2013, the corporate, household and government sectors represented 63 per cent, 26 per cent and 10 per cent, respectively, of the nation's gross capital formation, which are comparable to the averages of their OECD counterparts. Unsurprisingly, corporate investment has been most volatile, swinging between a quarter and one-third of GDP and apparently peaking in 2010. By comparison, gross capital formation by the government sector has risen steadily over time, particularly since the early 2000s when government saving also began to increase, before easing off in 2011–13.

A little-noticed fact, however, is that within the space of a couple of decades, gross capital formation undertaken by Chinese *households* almost doubled, single-handedly accounting for well over half of the 9½ percentage point increase in China's investment rate during this period.³ If the rise in the investment share during the two decades is viewed as evidence of 'overinvestment', the Chinese flow-of-funds data suggest that the household sector could be one principal culprit.

There are a couple of reasons why we might observe a rising share of investment by households. The first is capital accumulation associated with self-employment. Between 1992 and 2013, rural and urban self-employment tripled as a share of the nation's total employment, rising to more than 13 per cent. Capital accumulation by households is likely to have accelerated accordingly. Rising self-employment has been an important by-product of China's growing private sector (Lardy 2014).

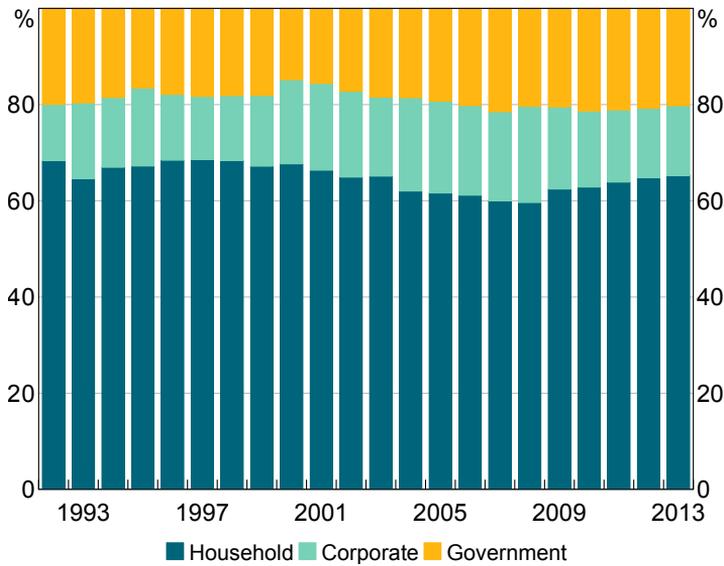
A second explanation for rising household capital formation is that housing-related investment by individuals has increased substantially since the early 1980s. Following the introduction of the household responsibility system to the rural areas in the 1980s, there was a burst of housing construction activities by farmers. In the 1990s, the government initiated a wave of *de facto* state housing privatisation in urban areas, which led to substantial renovation, upgrading and extension of old state housing units that had been of poor condition and low quality. The 2000s witnessed a big leap in the floor space of residential housing built by developers, most of which was ultimately funded by households. In addition, much newly completed urban housing in China is in rough 'shell' form and thus often requires major fitting outlays managed by new home buyers. These three waves of private housing construction and upgrading activity are likely to have contributed to growth in measured investment by the household sector.

2.1.3 Roles of income and saving rate in household consumption

In contrast to its prominent role in driving both China's rising aggregate saving and investment rates, the household sector's share of gross national disposable income fell noticeably through the 2000s, with the corporate and government sectors splitting the implied gain in the remainder (Figure 3). Since 2008, the household income share has started to rise at the expense, in particular, of the corporate income share, but in net terms the household income ratio has remained below its level in the 1990s. As a share of GDP, the decline in household income and the rise in household saving together imply a steep rise in the average propensity to save out of household disposable income.

3 This represents the continuation (and acceleration) of a trend first noticed by Kuijs (2005).

Figure 3: Income by Sector
Flow of funds, share of gross domestic income



Note: Adjusted for 'acquisition less disposal of other non-financial assets'
Sources: Authors' calculations; CEIC Data

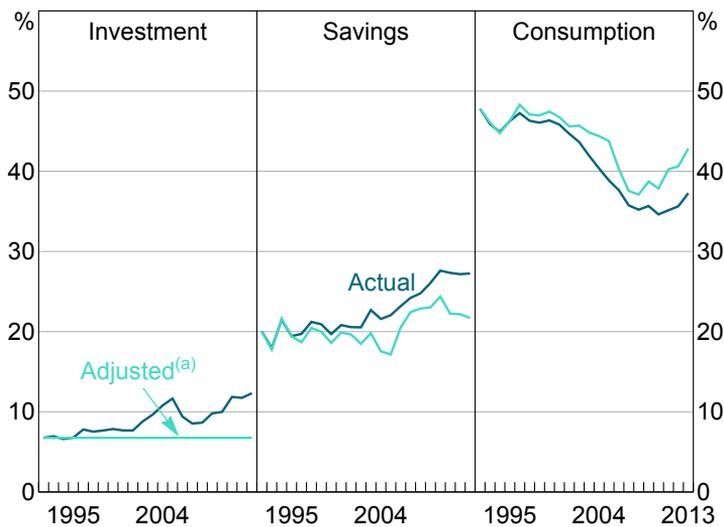
While the literature has emphasised the declining household share of income as the main factor weighing down the household consumption share of GDP (Aziz and Cui 2007; Ma and Yi 2010; Perkins 2015), the Chinese flow-of-funds data suggest that the rise in the average propensity of households to save has been more important in explaining the declining share of household consumption in the Chinese economy. Flow-of-funds data indicate that the decline in the household income share of GDP and increase in the average propensity to save contributed 20 per cent and 80 per cent, respectively, of the observed decline in the household consumption share of GDP during the 1992–2013 period.⁴ We now turn to each of these factors in turn.

There is no shortage of potential explanations for a high and rising *average propensity to save* by Chinese households. Modigliani and Cao (2004) argue that the observed household saving rate can be explained by a life-cycle model featuring dissaving in early life, positive saving in working years and dissaving in retirement, together with China's rising working-age population in recent decades. Blanchard and Giavazzi (2006) and Chamon and Prasad (2010) argue that a rising burden of private health and education expenses in a climate of underdeveloped financial markets has increased self-insurance/precautionary saving motives. Wei and Zhang (2011) attribute increased saving to efforts by young men to purchase housing and signal prosperity in a marriage market characterised by a high male-female gender ratio.

4 Household consumption as a share of GDP can be decomposed as: $C^h/Y = (1 - S^h/Y^h) \cdot Y^h/Y$, where C^h , S^h and Y^h refer to household consumption, saving and disposable income. Using this equation, we can estimate the contributions of household disposable income and the average propensity to save S^h/Y^h to the observed household consumption share of GDP. If we consider the 2000–13 period, the contributions are 24 per cent and 76 per cent, respectively.

To these we can add a complementary and more straightforward explanation. Specifically, as a share of GDP, the increase we observe in household capital formation can itself account for more than three-quarters of the rise in household saving and thus could explain more than half of the reported fall in household consumption during the 1992–2013 period. Put differently, if we capped gross capital formation undertaken by the household sector at the 1992 level of 6.8 per cent of GDP for all subsequent years and allocated the remaining investment to consumption, household consumption would decline from 48 per cent of GDP to only 43 per cent instead of the recorded 37 per cent in 2013. Similarly, household saving would only rise from 20 per cent of GDP to 22 per cent instead of the observed 27 per cent (Figure 4).

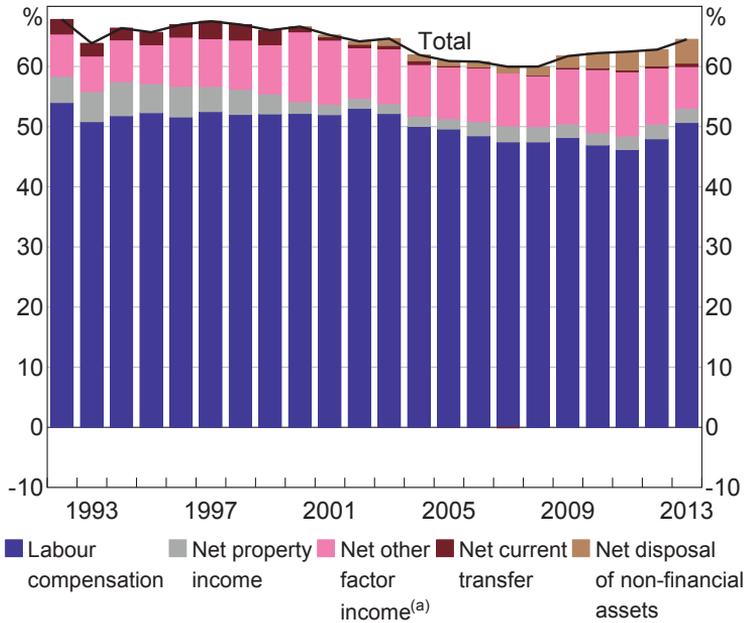
Figure 4: Household Sector – Actual and Adjusted Share of GDP



Note: (a) Investment capped at 1992 level, remainder allocated to consumption
Sources: Authors' calculations; CEIC Data

Flow-of-funds data indicate that, for most of the period since 1992, the *household income share* was primarily weighed down by the falling share of labour compensation, although falls in the shares of net current transfers (consistent with declining social welfare programs) and net property income in the early 2000s also contributed (Figure 5). The falling labour share is attributed by some to the relaxation of controls on internal migration under the *hukou* (household registration) system from the 1980s, which permitted a larger pool of incoming surplus rural labour and allowed urban enterprises to restrain wage growth despite a relaxation of wage controls (Perkins 2015). The less restrictive *hukou* system over the years thus helped enhance allocative efficiency and economic growth but also added to the 'imbalance' of a high investment rate and low consumption rate.

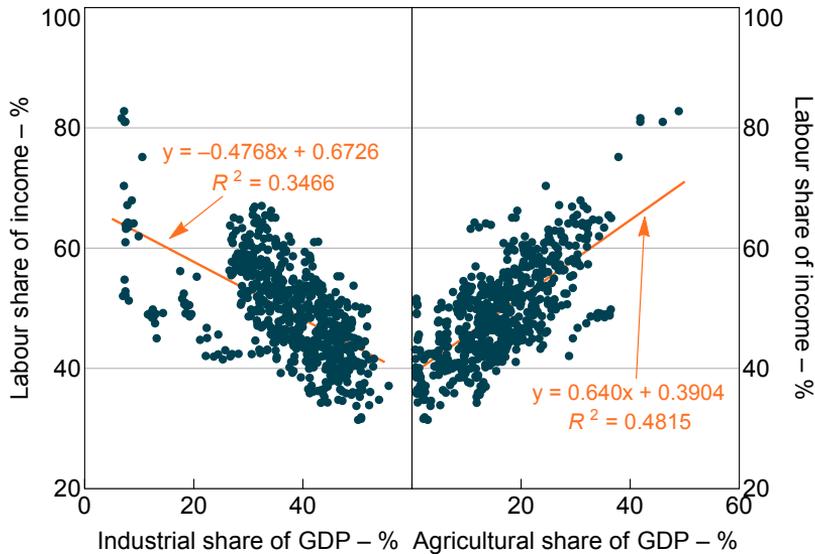
Figure 5: Household Disposable Income
Share of GDP



Notes: Adjusted for 'acquisition less disposal of other non-financial assets'
 (a) Household sector value-added income less payments for labour compensation and production tax
 Sources: Authors' calculations; CEIC Data

As barriers to internal migration were eased, labour also became more mobile across industries and regions. Using econometric methods, Bai and Qian (2010) argue that around one-third of the decline in the labour share in the early 2000s can be explained by a changing labour share within industries, which they attribute to reforms that restructured state-owned enterprise and expanded monopoly power in the industrial sector. But they find that two-thirds of the decline reflected the structural transition from agriculture (where the labour share is very high) to services (which displays a much lower average labour share). This explanation is supported by the negative correlation between the labour share and the share of more capital-intensive industry at the provincial level (Ma and Yi 2010). Indeed, this relationship has been robust through time, and the reverse correlation can also be observed for agriculture (Figure 6).

Figure 6: Labour Share of Income – Industry and Agriculture
1993 to 2013



While the labour compensation share of GDP declined during the 1990s and 2000s, the negative effect on the household income share was partly offset by rising net income from sales of land use rights (reflected in ‘net acquisition of non-financial assets’) and net ‘other factor income’ associated with the rise in the ranks of self-employed, noted above. Interestingly, net income from property has roughly halved since the early 1990s, largely reflecting a drop in net interest income. According to flow-of-funds data, around 80 per cent of the fall in net interest income is attributable to the rise in household interest payments, suggesting that a sizeable part of the decline in the household income share has actually been related to inclusive financial liberalisation rather than ‘financial repression’.⁵

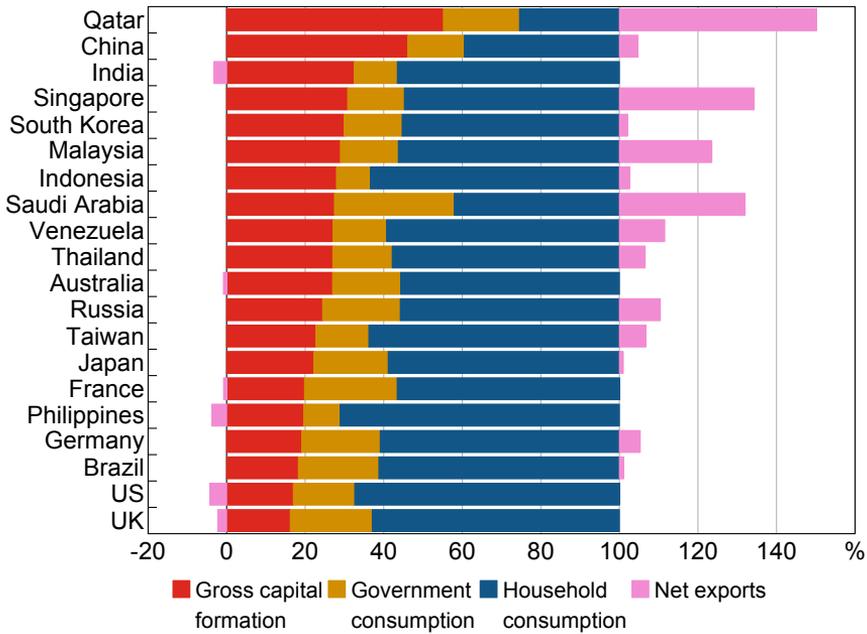
2.2 How unusual is China’s pattern of investment and consumption?

China’s investment has typically been deemed too high and too low at the same time: too high relative to consumption in the context of domestic final expenditure (the domestic imbalance) but too low relative to domestic saving from the perspective of the current account (the external imbalance). Descriptions of China’s consumption, investment and saving patterns as ‘unbalanced’ are usually made with reference to cross-country and historical comparisons. Indeed, China has one of the most unusual domestic expenditure compositions globally, printing one of the highest investment rates and lowest household consumption rates among major advanced

⁵ The decline in net interest income from 4.4 per cent of GDP in 1992 to 1.8 per cent in 2013 is the combined outcome of a decline of gross interest income from 4.4 per cent to 3.1 per cent and a rise of gross interest payment from zero to 1.2 per cent. The increased gross interest payment mostly relates to expanding mortgage loans, credit card use and personal loans.

and emerging market economies (Figure 7).⁶ The sustained gap between investment and consumption rates is exceptionally large and has few parallels outside major oil-exporting countries. Nevertheless, China’s external balance seems quite moderate when compared to many of its international peers, at least when averaged over a run of 10 years or so.

Figure 7: Expenditure Composition in International Perspective
Share of gross national expenditure, 2001–11 cumulative



Sources: Authors’ calculations; Penn World Tables 8.1 (Feenstra, Inklaar and Timmer 2015)

The relatively low consumption share of GDP and its fall over the past few decades raise the question of whether Chinese consumption has been ‘weak’ by international standards or the standards of China’s own history. On average, household consumption growth was the lowest among all the major domestic expenditure components during 1978–2014 (Table 1). But growth has nonetheless averaged 9 per cent for more than three decades, a rapid pace by international standards. The lopsided nature of China’s growth pattern principally reflects the fact that investment had been expanding at an even faster, double-digit, pace until 2010.

⁶ The data come from the Penn World Tables 8.1, which gives ‘real’ expenditure component shares of GDP after adjustments using separate purchasing power parity factors for each component (based at 2005 US GDP). We reverse these adjustments so that the shares are in nominal terms.

Table 1: Growth of GDP Expenditure Components
1978 constant prices, compound annual growth rate, per cent

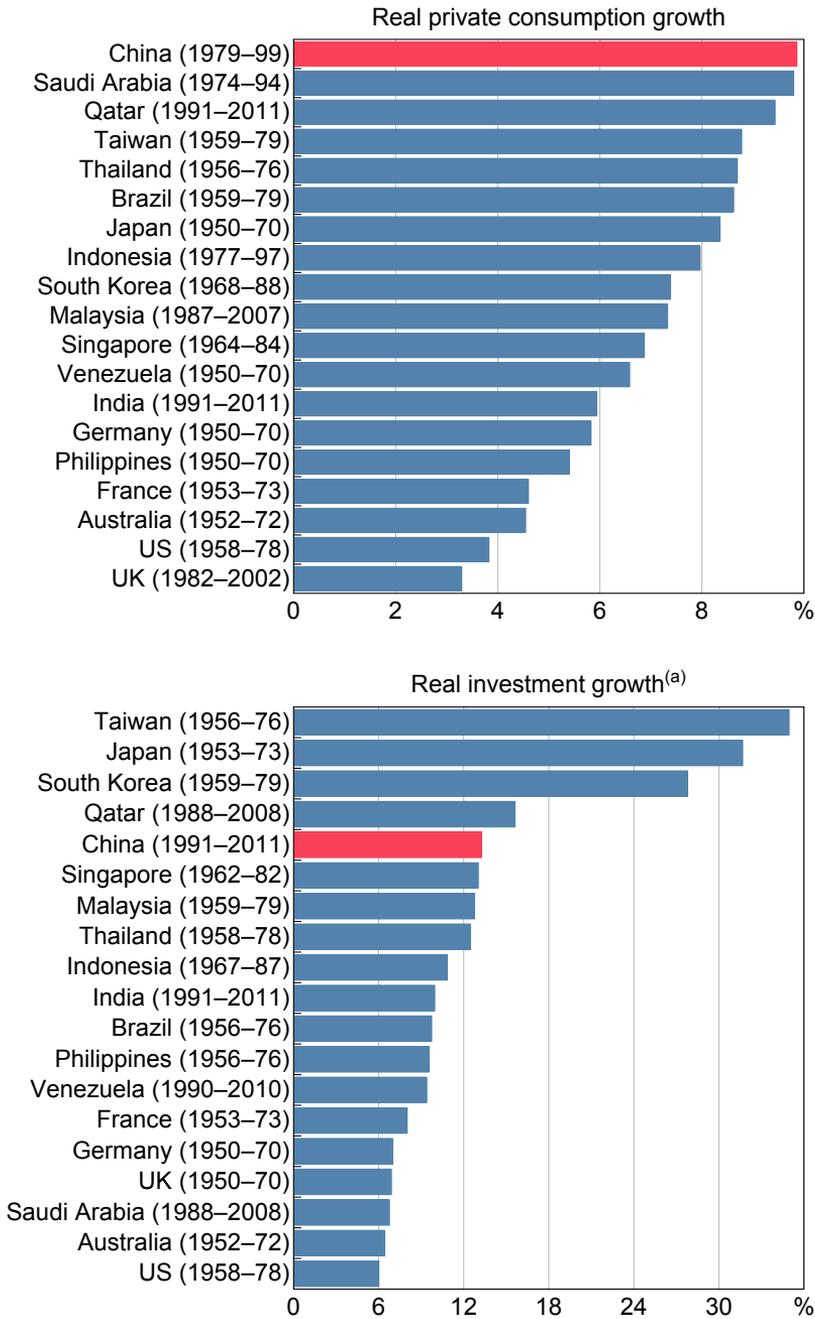
	GDP	Consumption			Gross capital formation	
		Total	Private	Government	Total	Fixed
1978–2014	9.7	9.2	9.0	10.0	10.4	11.1
1978–2007	9.9	9.4	8.9	10.8	10.2	11.1
2000–07	10.8	8.8	9.0	8.4	14.0	14.4
2007–14	8.8	8.7	9.5	6.7	11.2	11.3
2007–10	9.8	9.1	9.8	7.7	15.6	15.7
2010–14	8.1	8.3	9.3	5.9	8.1	8.1

Sources: Authors' calculations; CEIC Data; NBS (2015)

A simple international comparison also helps place China's so-called 'investment-led' and 'consumption-repressed' growth pattern in some perspective. Figure 8 displays 20-year windows for the maximum annualised growth rates for private consumption and investment for selected economies in the post-War era. While high relative to most economies, China's speed of capital accumulation is outstripped by Taiwan, Japan and South Korea's development experiences. In contrast, Chinese private consumption growth has exceeded that of most major advanced and emerging market economies in the period since World War II.

In sum, China's pattern of domestic demand has been quite unusual and lopsided, but it is hard to attribute the big rise in China's saving and investment rates to 'anaemic' private consumption. As we discuss below, we place a greater weight on an alternative interpretation that attributes the imbalances to structural drivers of high saving and rapid investment growth.

Figure 8: Consumption and Investment Growth in International Perspective
Maximum 20-year annualised rate



Note: (a) Gross capital formation
Sources: Authors' calculations; Penn World Tables 8.1 (Feenstra, Inklaar and Timmer 2015)

2.3 Explaining the imbalances

Two competing, but also potentially complementary, hypotheses have been put forward to explain the puzzle of China's sustained surplus saving and unusually unbalanced pattern of domestic demand. One view argues that policy distortions are the principal reason (Huang and Tao 2011; Singh, Nabar and N'Diaye 2013). An alternative view assigns a greater role to structural changes and natural economic forces (Ma *et al* 2013). These views have different implications for the ongoing and prospective domestic rebalancing.

One view argues that policy distortions, mostly in the form of subsidies to depress factor costs, have been the primary drivers behind the rising external and domestic imbalances. These distortions include currency undervaluation, repressed interest rates 'subsidising' corporate investment or the banking system, subsidised costs for land, energy and the environment, and 'artificially' low labour compensation under the weight of the household registration (or *hukou*) system, which restricts the social security entitlements of migrant workers. Collectively, these distortions are viewed as depressing household consumption, stimulating investment and boosting exports relative to an assumed counterfactual, giving rise to the twin imbalances and 'artificially' high growth.

Nevertheless, the effects of these distortions are often more ambiguous than they appear at first glance. For instance, while subsidised energy costs may support a higher rate of investment and production than would be possible at market prices, they may also help explain China's rise as a big net energy importer, which, other things equal, tends to reduce its current account surplus. Similarly, while the *hukou* system impedes rural–urban labour mobility, the effect on aggregate household income growth is ambiguous *ex ante*. Although greater portability of welfare benefits should buoy household incomes and lower the household saving rate, the net effect of *hukou* reform on total income will depend on mobility between industries and different sectoral elasticities of substitution between labour and capital. The relaxation of *hukou* policies may indeed be partly responsible for driving the labour income share *lower* in the 2000s.

Similarly, low regulated benchmark deposit rates are sometimes thought to suppress household consumption in China (Lardy 2008; Pettis 2013). Nabar (2011) uses provincial panel data from 2006–09 to argue for a dominance of income over substitution effects due to target saving behaviour by households. Berkelmans, Kelly and Sadeghian (2016) present time series evidence that deposit demand does not respond positively to increases in deposit rates. However, the available empirical evidence relies heavily on the relationship between saving or deposits and inflation-adjusted regulated deposit rates. To some extent, *de facto* interest rate deregulation since the late 2000s via rapid issuance of wealth management products with market-based interest rates may have offset the effect of regulated interest rates in suppressing consumption growth.

In view of the difficulty of identifying the net effect of factor price distortions on imbalances, Ma *et al* (2013) instead emphasise the central role of China's high saving rate in explaining its twin imbalances. They conjecture that multiple favourable demand and productivity shocks in the 1980s, 1990s and 2000s lifted potential growth of the Chinese economy; in an environment of incomplete financial markets and underdeveloped welfare safety nets, these shocks gave

rise to large income windfalls that were mostly saved, while boosting both consumption and investment spending.

The first two decades of the reform era witnessed at least two significant positive shocks to income growth: the successful rural household responsibility system in the 1980s; and the large wave of employees leaving their state employers to create their own private businesses in the wake of Deng Xiaoping's Southern China Tour in the early 1990s. Moreover, the interactions between a falling dependency ratio and massive rural–urban labour migration kept non-farm wages lower than otherwise, lifting corporate earnings and returns to capital. Wrenching restructuring of state firms reduced job security, improved efficiency, cleared room for the expansion of private firms and lifted corporate earnings, all boosting private saving. The institutional changes in the pension system, private home ownership and the introduction of mortgages also strengthened incentives to save and fuelled a property investment boom. Finally, China's World Trade Organization (WTO) accession in 2001 prompted a wide-ranging market opening, attracted more foreign transfers of technology and secured access to a booming foreign market, all of which supported corporate cash flows.

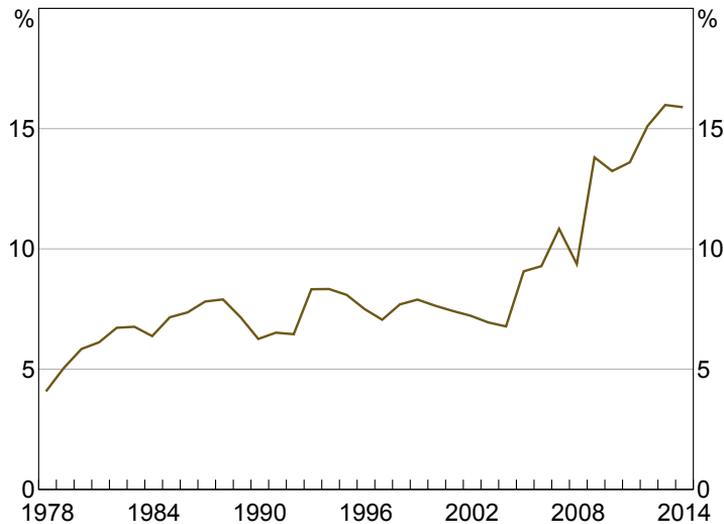
The role played by the development of housing markets in China deserves special emphasis. In 1988, the Chinese constitution was amended to legalise the transactions of land use rights, laying the foundation for private home ownership (Fang *et al* 2016). Throughout the 1980s and 1990s, most of the housing provided by state-owned enterprises to their employees was privatised at a discount to the replacement cost. Mortgages were introduced in 1997, and official mortgage rates were cut five times during 1998–2002 to counter the negative consequences of the Asian financial crisis.

The development and deregulation of housing markets saw residential investment rise sharply starting in the early 2000s to almost 16 per cent of GDP currently (Figure 9).⁷ This housing boom stimulated huge capacity building in many related upstream and downstream industries, including steel, cement, glass, household appliances and financial services. Using data from the 2010 input-output tables and more up-to-date data on value added, Xu, Jia and Li (2015) estimate that, directly and indirectly, residential housing accounted for 29.4 per cent of GDP growth in 2013.

It is likely that the housing boom simultaneously boosted growth, investment and saving in China while subtracting from net household income (through higher mortgage payments). The rise of private home ownership in the late 1990s boosted incentives to save by households strongly motivated to upgrade their housing and to build up private assets, while generating higher investment. As discussed, the rise in household investment largely reflected individual investment in residential construction. The property investment booms in the 2000s further boosted land sales proceeds accruing to local Chinese governments, helping to fund investment in infrastructure. At the same time, the steady rise of mortgage loans as a share of total credit (reaching 12 per cent in 2014) implied larger interest payments by home buyers to financial institutions and a corresponding fall in households' net property income. In turn, this contributed to the decline in the household share of income in the 1990s and 2000s.

⁷ We use the estimates of nominal residential gross fixed capital formation due to Koen *et al* (2013), projected forward using data on real estate fixed asset investment.

Figure 9: Residential Investment
Share of nominal GDP



Sources: Authors' calculations; CEIC Data

The housing boom increased both sales volumes and prices, lifting corporate earnings and the return to capital across many related industries and helping to underpin strong corporate saving and investment until the late 2000s. In sum, the opening of the housing market can be viewed as a prolonged positive demand shock to the Chinese economy, sustaining returns to capital, boosting investment and lifting both private and public saving at the same time (Ma *et al* 2013; Xu *et al* 2015).

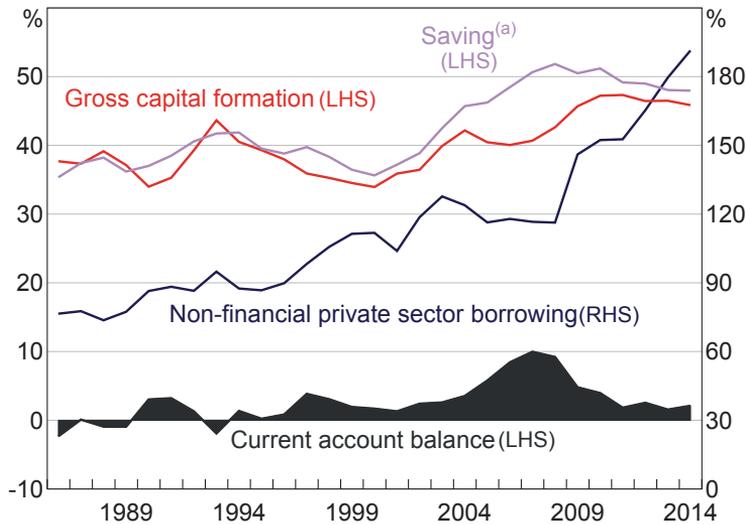
2.4 Prospects for domestic rebalancing

Several reasons have been offered in favour of the view that a more balanced pattern of growth in China would have local and global benefits. Obstfeld and Rogoff (2009) argue that China's current account surplus underpinned global imbalances which contributed to the global financial crisis in 2008–09. Yu (2007) contends that China has misallocated resources by running large current account surpluses. On this view, by running a large capital account surplus and current account surplus simultaneously (accommodated by the accumulation of sizeable foreign exchange reserves), China 'parks' its excess savings abroad in the form of US Treasuries rather than undertaking more profitable and socially beneficial domestic investment, which is already high. A higher consumption share could also be directly welfare-enhancing if it is facilitated by reforms and policies that improve the income distribution and develop the social safety net (Cai and Roberts 2015).

An additional argument in favour of rebalancing is that the high investment share in recent years has been sustained by sharply rising leverage. Rebalancing will therefore help address associated financial risks and reduce the likelihood of a financial crisis occurring (Pettis 2013). Indeed, leverage has had an important role to play in China's unbalanced growth pattern, particularly

since 2008. Prior to this, the foreign sector appeared to have accommodated China's big capacity build-up without much leverage, as the current account surplus surged (Figure 10). Despite the 1998–2008 investment boom, the nation's total credit to the non-financial private sector as a share of GDP rose modestly from 106 per cent to 116 per cent. One possibility is that the rising Chinese investment was mostly 'funded' by retained earnings from a booming export market following China's WTO accession.

Figure 10: Saving, Investment and Leverage
Share of nominal GDP



Note: (a) Gross capital formation plus current account balance
Sources: Authors' calculations; BIS; CEIC Data

In contrast, the shrinking of China's current account surplus from 10 per cent of GDP in 2007 to 2 per cent in 2014 coincided with a rapid leveraging-up. This surplus saving was mostly reduced by a step rise in the investment rate, as Chinese policymakers hastened to boost growth via a massive credit stimulus. Total credit to the non-financial private sector jumped from 116 per cent in 2008 to 191 per cent in 2014. Moreover, the post-crisis boom of investment in the credit-intensive property sector also triggered a compositional upward shift in the indebtedness of the corporate sector (Chivakul *et al* 2015; Zhang *et al* 2015; Roberts and Zurawski 2016). Finally, externally oriented firms with weaker cash flows due to dwindling overseas sales may have been forced to take on higher leverage to fund investment. Thus, the rapid compression of China's external surplus, while reducing global imbalances, probably came at the price of a steep rise in leverage.

Rebalancing may help reduce the risk of disruptive financial dislocations in the future. But more prosaically, it could simply mitigate poor returns to inefficient investment in industries and regions facing conditions of oversupply. The perception by China's government that the existing growth pattern had become 'unbalanced, uncoordinated and unsustainable' led to an official

commitment in the Twelfth Five-Year Plan (2011–15) to seek a more balanced pattern of domestic demand.⁸ This is again reflected in the newly drafted Thirteenth Five-Year Plan of 2016–20.

How might rebalancing play out in practice? The very high rate of consumption growth in recent years suggests that, realistically, any rebalancing to a higher consumption share is more likely to involve a deceleration of investment than an acceleration of consumption. There is historical support for such a conjecture. For this purpose, we define ‘rebalancing’ as a shift from a very ‘unbalanced’ situation in which the investment share of GDP has on average exceeded the household consumption share of GDP for at least five years, to a situation in which the reverse prevails for a subsequent five years. There are relatively few historical examples of such a rebalancing, and it is rarer still for them to be accompanied by an increase in consumption growth from previous rates. In a sample of 167 economies between 1950 and 2011, there are 10 cases of rebalancing on this definition. In the majority of cases, household consumption growth in the five years after such a ‘rebalancing’ was lower than in the five years before (Table 2).⁹

It might be argued that defining rebalancing as a change in the sign of the gap between private consumption and investment shares is too restrictive. After all, the historical rebalancing experiences of Japan and South Korea are excluded on this formulation.¹⁰ But even if we use an alternative criterion (such as an increase in the difference between the household consumption and investment shares of 20 percentage points), the results are similar.¹¹ It should be noted that the reasons behind different rebalancing experiences are diverse. In some cases (such as that of Angola), the timing corresponds to periods of political conflict and famine. For a number of Middle Eastern nations (including Saudi Arabia), the timing may reflect income shocks due to rapid changes in oil prices, or war (as in the case of Iraq in 2003 and subsequent years). Several Asian economies, including Indonesia, South Korea and Thailand, experienced a degree of rebalancing following the Asian financial crisis. Similarly, the timing of rebalancing for the Philippines and some Latin American economies coincides with periods of external debt crisis.¹²

8 This comment was made at a press conference by former Premier Wen Jiabao in 2007 (Xinhua News Agency 2007).

9 The 10 economies experiencing rebalancing episodes according to this criterion are Angola, Brunei Darussalam, Congo, Gabon, Iraq (which experienced two episodes), Oman, Qatar, Saudi Arabia, Uruguay and Venezuela. We exclude microstates (for example, Saint Kitts and Nevis).

10 Japan and South Korea are characterised by a gradual rebalancing of investment and household consumption shares. Moreover, in both cases the initial magnitude of the domestic imbalance (measured by the difference between investment and household consumption shares of GDP) did not approach those observed currently in China.

11 On this criterion, about 30 economies qualify as having rebalanced over the sample period, but of these only about half experienced any increase in household consumption growth at all during the rebalancing process, and only one had an initial high five-year annualised average growth rate exceeding 5 per cent per annum (Botswana).

12 Not all such crises resulted in rebalancing under our definition. For example, the Chilean debt crisis (1982) resulted in a very moderate rebalancing from investment towards private consumption, while Argentina, Brazil and Mexico (also early 1980s) experienced fairly modest changes in their already relatively high consumption shares of GDP.

Table 2: Rebalancing – Selected Historical Episodes
Per cent

	Gross capital formation			
	Share of GDP ^(a)		Growth ^(b)	
	Before	After	Before	After
Angola (1995–2004) ^(c)	33.2	12.2	10.9	–14.5
Brunei Darussalam (1979–88) ^(c)	7.0	11.7	16.7	–0.5
Congo (1981–90) ^(c)	40.6	19.8	8.5	–16.1
Gabon (1984–93) ^(c)	35.4	21.2	–3.6	–7.8
Japan (1970–79) ^(d)	37.0	31.6	6.9	2.7
Philippines (1979–87) ^(d)	33.8	19.9	5.4	–10.4
Qatar (1979–88) ^(c)	20.6	16.7	–7.6	–2.4
Saudi Arabia (1976–85) ^(c)	29.1	26.9	12.8	–2.4
South Korea (1993–2002) ^(d)	36.6	28.7	6.8	1.7
Thailand (1993–2002) ^(d)	40.1	21.8	2.2	–9.1
Uruguay (1966–75) ^(c)	48.6	19.7	19.0	2.2
Venezuela (1978–86) ^(c)	46.1	25.3	–9.1	–4.9
	Household consumption			
	Share of GDP ^(a)		Growth ^(b)	
	Before	After	Before	After
Angola (1995–2004) ^(c)	31.5	42.4	5.1	19.5
Brunei Darussalam (1979–88) ^(c)	6.3	20.6	16.2	11.7
Congo (1981–90) ^(c)	40.2	56.3	12.7	–2.3
Gabon (1984–93) ^(c)	33.2	38.3	–2.4	3.1
Japan (1970–79) ^(d)	49.8	53.7	4.9	5.0
Philippines (1979–87) ^(d)	62.1	69.4	3.5	2.3
Qatar (1979–88) ^(c)	19.6	28.0	–5.8	–1.5
Saudi Arabia (1976–85) ^(c)	26.4	40.9	16.1	10.9
South Korea (1993–2002) ^(d)	52.6	54.3	7.2	3.9
Thailand (1993–2002) ^(d)	51.9	54.1	5.5	2.4
Uruguay (1966–75) ^(c)	46.4	71.5	3.6	1.3
Venezuela (1978–86) ^(c)	40.1	46.6	4.3	2.6

Notes: (a) Five-year cumulative share
(b) Five-year real annualised average
(c) Period refers to five years on either side of a year ('before' and 'after') in which the five-year cumulative investment share of GDP fell below the five-year cumulative consumption share
(d) Period refers to five years on either side of a year ('before' and 'after') that saw a substantial reduction in the investment share

Sources: Authors' calculations; Penn World Tables 8.1 (Feenstra, Inklaar and Timmer 2015)

Indeed, the question of how rebalancing might play out depends on the reasons for the imbalances. In practice, it is likely that a combination of both policy distortions and saved windfalls from positive shocks has contributed to China's imbalances. But the implications of the two hypotheses are different for prospective rebalancing. Factor price distortions that arise as a result of public policy can in general only be removed by policy reversals. Logically, for instance, interest rates need to be raised to stimulate household consumption, according to the target saving argument (Nabar 2011). In contrast, vanishing income windfalls, or the negative consequences of slower reallocation of labour, an ageing population, less low-hanging fruit from market liberalisation and diminishing pull effects from a more balanced housing market, may occur naturally and in tandem with slower potential growth, irrespective of the stance of policy.

In Section 3, we consider how some of the earlier tailwinds to the Chinese economy may now have reversed, weighing on potential growth, lowering returns to capital and thereby forcing a prospective domestic rebalancing through slower capital formation. But a fall in investment growth may weaken growth of private consumption too, due to slower job creation and falling wage growth. A benign form of rebalancing would involve household consumption expenditure slowing, but still growing at a faster pace than gross capital formation. A degree of resilience in consumption matters crucially for an orderly domestic rebalancing, as we illustrate in Section 4.

The role of maturing housing markets may prove to be especially important in triggering internal rebalancing. The housing market has evolved from undersupply 20 years ago to a now normalising and more balanced sector in terms of demand and supply, even with some pockets of oversupply (Chivakul *et al* 2015). The outlooks for urbanisation, demographics and income growth all suggest that, in trend terms, Chinese residential construction may already have peaked (Berkelmans and Wang 2012; Perkins 2015). Wu, Gyourko and Deng (2015) estimate that during the boom decade of 2001–10, housing demand exceeded supply by 14 per cent in aggregate but fell short of it by 10 per cent during 2011–12. Their estimate of the nationwide vacancy rate also doubled between 2002 and 2013. Higher inventories and slower sales should lower returns to capital and investment in real estate and related sectors. Weaker corporate earnings, slower land sales proceeds and slower job creation could in turn combine to trim China's aggregate saving rate as well.

As falling investment growth rather than rising consumption growth is likely to be the main channel through which internal rebalancing will occur, we now consider a key mechanism – namely the decline in the return to capital relative to the cost of funding new corporate investment in China.

3. Mechanisms for Internal Rebalancing

In this section, we revisit and update the estimates constructed by Bai *et al* (2006) of the return to capital in China, using a slightly modified approach. We then compare our estimates to a proposed measure of the average real funding cost facing the Chinese corporate sector.

Bai *et al* (2006) use a method derived from Jorgenson's (1967) neoclassical theory of investment. Their basic equation to obtain a real net rate of return for owners of capital is as follows:

$$R_t = i_t - \dot{P}_t^Y = \frac{\alpha_t (P_t^Y Y_t)}{P_t^K K_t} + [\dot{P}_t^K - \dot{P}_t^Y] - \delta_t$$

where i_t measures the nominal return to capital, P_t^Y is the GDP deflator, P_t^K is the price of capital, α_t is the capital share of income, Y_t is total income, K_t is the capital stock and δ_t is the depreciation rate. In this formulation, the return to capital is composed of three parts: an estimate of the marginal revenue product of capital; a real ‘capital gain’ term (the rate of change in the price of capital in terms of consumables); and a depreciation rate. When the prices of capital and output are the same, the return to capital is equal to the marginal physical product of capital ($\alpha_t Y_t / K_t$) – that is, the product of the capital share of income and the inverse capital-to-output ratio – net of depreciation.¹³

3.1 Components of the return to capital

To estimate R_t , we construct a dataset of its constituents. For GDP, we use official data from the national accounts. To ensure internal consistency between our estimates of the return to capital and the expenditure-side scenarios we present later (see Section 4), we use the National Bureau of Statistics (NBS) expenditure-side estimate of GDP in constant 1978 prices and a corresponding deflator. We derive estimates of real gross capital formation (GCF) and the investment deflator using data on expenditure-side contributions published for the period from 1978 to 2014. These estimates are backcast using data from NBS (2007). Our data on gross fixed capital formation (GFCF; GCF net of inventories) is obtained using the same data sources and a number of assumptions.¹⁴

Data on the aggregate capital stock are required to estimate a capital-to-output ratio. In their original work, Bai *et al* (2006) estimate separate capital stocks and prices for structures and equipment investment using rescaled data on flows of fixed asset investment (FAI).¹⁵ In view of the limited available data on the components of gross (fixed) capital formation and bearing in mind the conceptual discrepancies with FAI data (Holz 2006), we instead assume a single homogeneous type of capital. We construct a capital stock using the perpetual inventory method. The capital stock is initialised in 1978 using a method similar to that of Bai *et al* (2006) and de la Fuente and Donénech (2000).¹⁶ In the absence of reliable information about economy-wide

13 This formulation of the return to capital assumes perfect competition. As Bai *et al* (2006) observe, ignoring the presence of imperfect competition induces an upward bias to estimates of the marginal return to capital. As such, the absolute level of the estimated return to capital needs to be treated with caution. An adjustment could be made to account for this bias by assuming a mark-up over marginal cost. Our comparison of changes over time will still be informative providing that the bias due to imperfect competition has not changed substantially over time in China.

14 To allow alternative estimates of the components of the return to capital to be directly comparable, we use an estimate of GDP net of inventories as the aggregate national output measure when constructing estimates based on GFCF, rather than GCF, data.

15 FAI is a broader (and higher-frequency) measure of Chinese investment than the annual national accounts measure of gross (fixed) capital formation. FAI is defined as the value of fixed assets that are built or purchased, plus the related costs of installation and ownership transfer. The most significant difference is that FAI includes land purchases, existing buildings and structures and purchases of second-hand equipment. Another distinction is that FAI only includes investments larger than CNY5 million (prior to 2011 this lower bound was CNY500 000).

16 Specifically, we assume that the initial capital stock is equal to the 1978 level of investment divided by the sum of the assumed steady-state growth rate of investment (which we take to be the 1978–82 average growth rate) plus the depreciation rate. Our estimates are robust to initialising the capital stock at an earlier date, for example 1952.

depreciation rates, we use a constant rate of 7 per cent, although our results are robust to the range of depreciation rates used in the literature.¹⁷

Holz (2006) and Wu (2015) warn against the inclusion of residential housing in estimates of the capital stock on the grounds that it is a non-productive asset. The importance of housing as an engine of growth in China since the late 1990s, discussed in the previous section, raises doubts about the accuracy of excluding it mechanically from estimates of capital accumulation or the return to capital. But it is still worth considering the robustness of our findings to alternative assumptions about the coverage of the capital stock and GDP. Accordingly, to abstract from housing, we estimate the residential housing stock using an approach similar to that described in Koen *et al* (2013). We estimate GDP excluding expenditure on residential housing by using national accounts data on the consumption of residential housing services.

We estimate the share of payments to capital, α_t , by estimating the labour share of income, $1 - \alpha_t$. As the return to capital that is relevant for the corporate sector is net of taxes, in some variations we also exclude net taxes on production and income from the capital share. We rely on physical transactions data from the flow-of-funds accounts to estimate the labour share of income. A key advantage of these data is that, in theory, they are comprehensive (unlike data on the urban wage bill), and consistent with national accounts estimates of gross value added (unlike provincial compensation of employees data). As the flow-of-funds data are only available from 1992 to 2013, we backcast the labour share for earlier years using aggregate compensation of employees from the gross provincial product data.¹⁸ We project the labour share to 2014 using an estimate of total private (including both private enterprises and self-employed) and non-private compensation in urban areas. We scale this estimate up to the level of total compensation in the flow-of-funds accounts.

We now examine the main constituents of our estimate of the return to capital in detail.

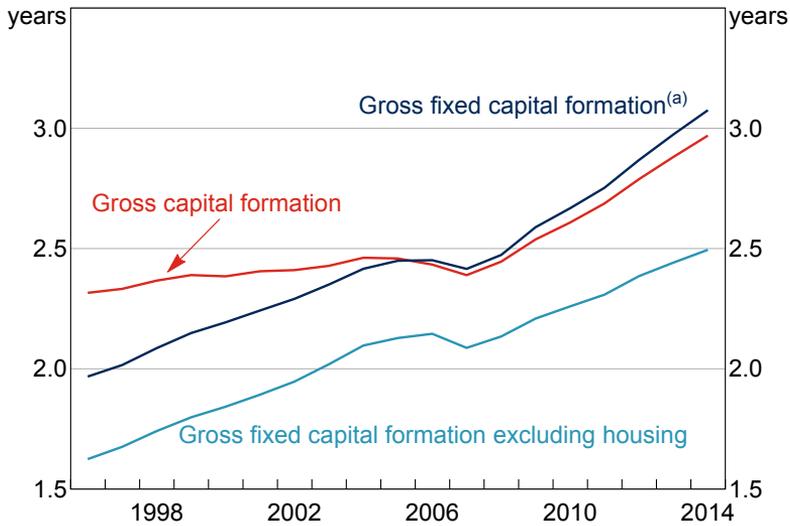
3.1.1 Capital-to-output ratio

The capital-to-output ratio has grown rapidly in recent years (Figure 11). The ratio increased at a slowing pace through the late 1990s and early 2000s, even declining in 2007. But coinciding with the government's macroeconomic stimulus in 2008–09, the capital-to-output ratio began to increase sharply and has maintained a steep upward trajectory since then. Excluding inventories from the investment measure used to calculate the capital stock tends to increase the level of the capital-to-output ratio and sharpen its upward trajectory, due to a declining contribution of inventories to growth in GCF over much of the recent period. Excluding housing tends to lower the capital-to-output ratio, consistent with large net additions to the stock of residential property over the past 16 years or so.

17 In the original formulation of Bai *et al* (2006), constant depreciation rates of 8 per cent and 24 per cent are used for structures and equipment investment, respectively; the changing shares of the different types of investment give rise to a time-varying aggregate depreciation rate. Wu (2015) uses a depreciation rate of 6 per cent. Holz (2006) estimates economy-wide depreciation rates in the range of 3–6 per cent since 1978. Typical estimates used in the literature range from 5 per cent to 7 per cent (Holz 2006).

18 Others have used long-run consistent provincial income time series in preference to splicing with the flow-of-funds estimates (Bai *et al* 2006; Bai and Qian 2010). But Lü (2015) argues persuasively that, in view of the variable quality and inconsistent implementation of statistical standards in the provincial level income accounts, recent vintages of the flow-of-funds data are a preferable data source.

Figure 11: Capital-to-output Ratio



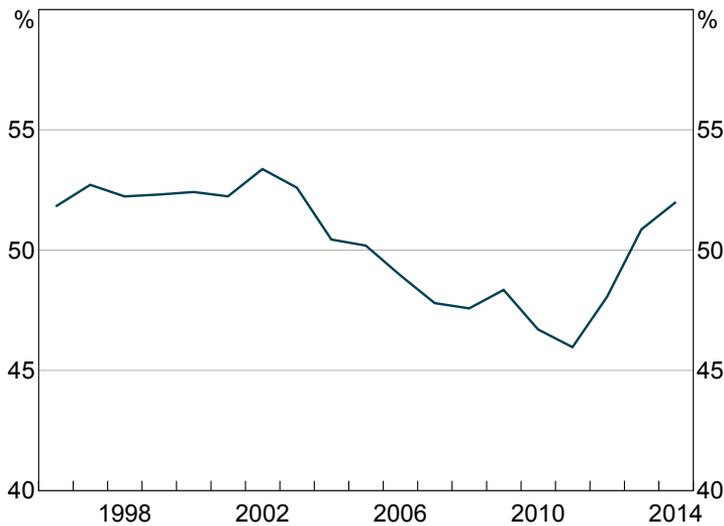
Note: (a) Gross capital formation net of inventories
 Sources: Authors' calculations; CEIC Data; National Bureau of Statistics of China

3.1.2 Labour share of income

The labour share of income in China has generally fallen since the mid 1990s, consistent with global trends and contributing to China's high return to capital until the early 2010s (Figure 12). China's labour share is low at around 52 per cent of GDP, compared to 75 per cent for the United States. In an international context, the long-term decline in the labour share of income is typically attributed to advances in information technology that have led firms to shift from labour-intensive production towards capital-intensive production (Karabarbounis and Neiman 2014). But as discussed in the previous section, in China's case, explanations for the decline have instead focused on changing patterns of labour migration across regions and sectors.

While the estimate for 2014 is a projection based on trends in urban wage data, and must therefore be treated with caution, it provides tentative evidence that, since 2011, the downward trend has reversed. This development is potentially significant from the perspective of rebalancing. Fukumoto and Muto (2011) argue that a rising labour income share played a crucial role in the rise of Japan's consumption share in the 1970s.

Figure 12: Labour Share of Income



Sources: Authors' calculations; CEIC Data

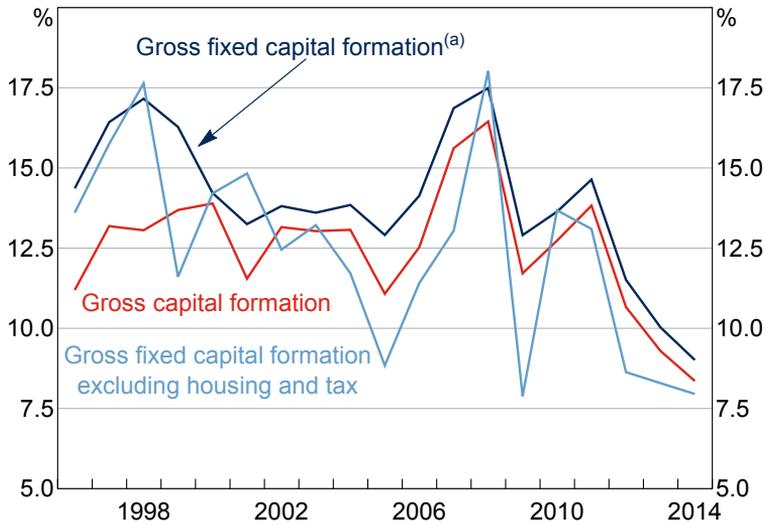
A number of possible reasons for the reversal can be conjectured. China's working-age population has started to decline, placing downward pressure on growth in the labour supply. At the same time, the large-scale migration from rural to urban areas that characterised much of the reform period and depressed urban wages has already slowed substantially, consistent with assessments that the quantity of 'surplus' labour in the countryside has fallen (Garnaut 2010; Cai 2011; Ma *et al* 2013). Industrial structure has also changed noticeably since the early 2000s. While the size of the agricultural sector has continued to decline (which would tend to put *downward* pressure on the labour income share), the share of services industries, in terms of both output and employment, has been rising, largely at the expense of more capital-intensive heavy manufacturing output in total value added and potentially adding to the labour income share.

3.2 Estimating the return to capital

Combining the above ingredients, we obtain benchmark estimates of the return to capital in China (Figure 13). A feature of the estimates is that the return to capital increased in the mid 2000s, but since 2008 has experienced an oscillating decline. This finding is consistent with the falling share of corporate income in GDP (Figure 3) and is robust to alternative measurements of the capital stock and labour share. If we consider the return to fixed investment (as opposed to investment including inventories), we obtain a higher return to capital. The wedge between the two series has declined over time, reflecting a higher real capital-to-output ratio for fixed investment.¹⁹ Adjusting our calculations to exclude residential housing from gross fixed investment and calculating the capital share net of taxes on production and income, the dynamics are a little different, but a similar overall trend decline in the return to capital since 2008 can be observed.

¹⁹ The wedge has remained positive: the reason for this is that the nominal capital-to-output ratio has actually been *lower* for GFCF than for GCF, due to faster growth in the GCF deflator.

Figure 13: Return to Capital



Note: (a) Gross capital formation net of the change in inventories
 Sources: Authors' calculations; CEIC Data; National Bureau of Statistics of China

Mechanically, the decline in the return to capital since the late 2000s can largely be accounted for by a resumption of the upward trend in the capital-to-output ratio combined with a jump in the price of investment goods that explains the sharp increase in 2008.²⁰ Up until 2011, the falling labour share of income offset the deteriorating marginal product of capital, but the reversing labour share tends to reinforce it in the last few years of our sample.²¹

3.3 Corporate funding costs

Business investment hinges on the gap between the prevailing corporate funding cost and the expected earnings from new projects, both on a risk-adjusted basis. Thus, it is plausible that the decline of the return to capital since 2008 has affected the incentives of the corporate sector to undertake new investment. To consider this issue, we treat our estimate of the real return to capital as a proxy for expected corporate earnings and compare it to an estimate of inflation-adjusted corporate borrowing costs.

To avoid taking a strong view about which interest rates and inflation rates are most relevant for the Chinese corporate sector, we average a range of nominal interest rates and inflation rates to derive a proxy for the real corporate cost of borrowing. We proxy the nominal corporate borrowing cost with a weighted average of three interest rates: the weighted average rate on general loans published by the People's Bank of China (PBC); the average collective trust product

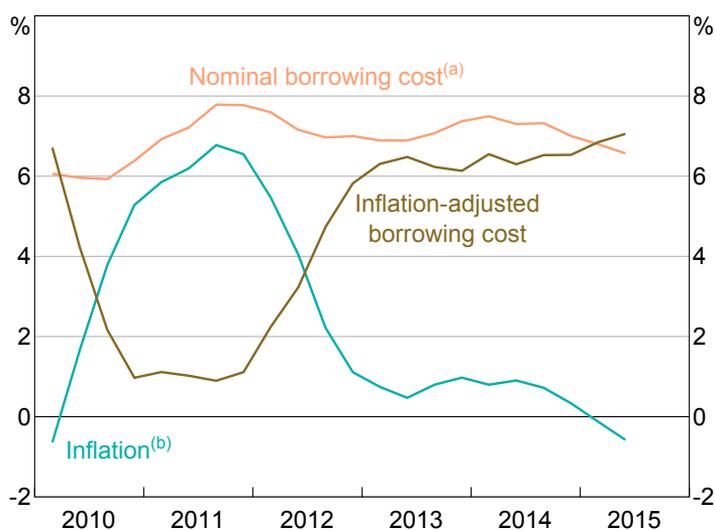
20 Even if we assume that prices of investment goods and aggregate output were the same over this period, a similar downward trend in the return to capital after 2008 is apparent.

21 Trends in the labour share should be placed in some perspective. Assuming a constant labour share (for example, the average over the period since 1978) suggests a more moderate pace of decline in the return to capital in recent years, but the broad picture is similar.

advertised yield (as reported by Wind Information); and the 5-year AA corporate note yield to maturity (sourced from Bloomberg). We choose these interest rates as they are reasonably representative of the medium-term corporate financing cost in a financial system in which banks have a dominant position but the importance of 'shadow banking' and corporate debt securities has grown. The interest rates are weighted together using break-adjusted stocks of credit, trust financing and corporate bond financing from the total social financing statistics published by the PBC.²²

We then adjust the average nominal corporate borrowing cost for inflation using a geometric average of the following three price deflators: the consumer price index (CPI); the implicit GDP deflator; and the producer price index (PPI). These inflation indicators are *ex post*, but the inclusion of an inflation expectations measure, such as the consensus CPI forecast, does not alter the picture substantially. The three inflation indicators have been quite volatile over time and can diverge considerably from each other from time to time. For instance, while both the CPI and GDP deflator grew by about 1½ per cent in 2014, the PPI was deflating over the same period. Nevertheless, all three price measures since 2011 have shared a distinctly disinflationary trend, which has contributed to an upswing in the real corporate financing cost (Figure 14).

Figure 14: Average Corporate Borrowing Cost and Inflation



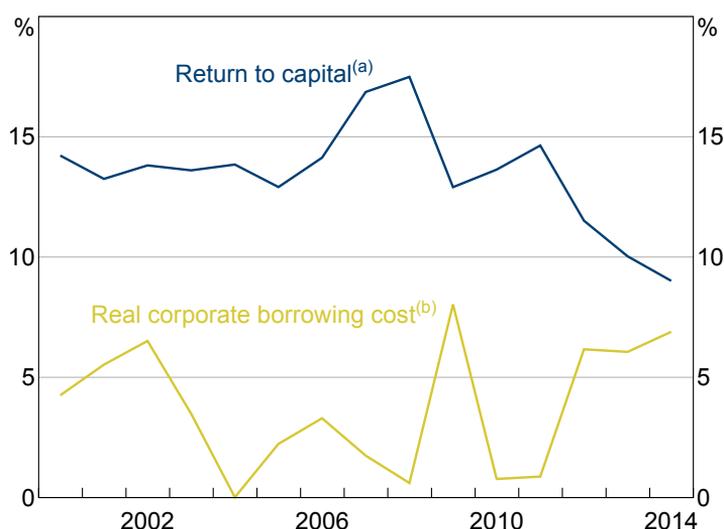
Notes: (a) Average of three nominal yields
 (b) Average of three deflators
 Sources: Authors' calculations; Bloomberg; CEIC Data; WIND Information

²² Due to data limitations that restrict the time series, prior to 2010 we splice this estimate with the regulated nominal benchmark lending rate for loans of 1–5 years' duration. The choice of a regulated lending rate for earlier years may be justified on the grounds that the abolition of restrictions on lending rates was not achieved until 2012. Moreover, trust product and bond issuance accounted for an extremely small share of corporate finance prior to 2010.

3.4 Comparing corporate funding costs and the return to capital

As our estimates of both the return to capital and the real corporate borrowing cost are only rough, and measured with considerable margin for error, the absolute difference between the two series may not be informative. But the broad trends in both series suggest that the gap might have narrowed considerably in recent years (Figure 15). In combination with the easing of macroeconomic stimulus after 2010 and efforts by authorities to keep broad credit growth in check, the narrowing gap may help account for a halving of the average pace of China’s GCF from 15 per cent in the 2000s to 8 per cent in the 2010s (Table 1).

Figure 15: Return to Capital and Corporate Financing Cost



Notes: (a) Based on gross fixed capital formation data
 (b) Weighted average medium- to long-term debt yield, deflated using geometric mean of inflation in the PPI, CPI and GDP deflator
 Sources: Authors’ calculations; CEIC Data; National Bureau of Statistics of China

If it persists, the shrinking gap between the cost of funding and returns to investment will continue to exert downward pressure on investment growth. The behaviour of the real interest rate is hard to predict, as it depends on the stance of monetary policy, the domestic saving-investment balance, the degree of capital account openness and global interest rates, among other factors. But our scenarios (Section 4) suggest little upside for the return to capital in the near future, which, all else equal, should contribute to a process of internal rebalancing.

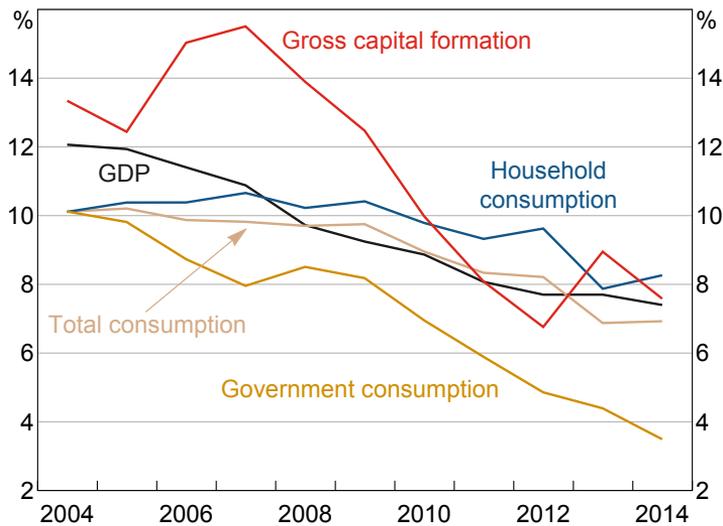
4. Scenarios for Rebalancing

In this section, we argue that China's domestic rebalancing may have started in the current decade. To consider the logical possibilities for continued rebalancing, we then construct rebalancing scenarios and discuss their implications. Our calculations indicate that the case for a meaningful and urgent domestic rebalancing is strong, but that the rebalancing task will be challenging in light of the concurrent slowing in potential growth.

4.1 Has the domestic rebalancing started?

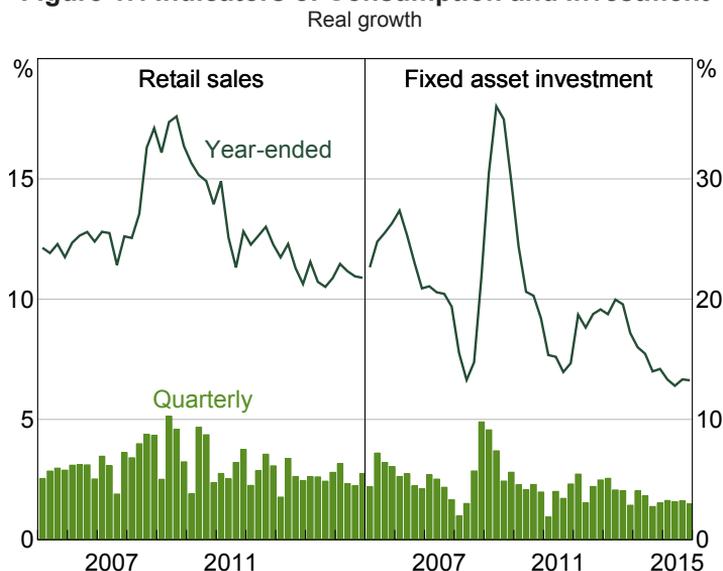
Between 2010 and 2014, the nation's aggregate saving and investment rates both declined from their recent peaks, while the household consumption share of GDP increased from its 2010 trough. Real growth of household consumption outpaced the growth of both investment and government consumption over this period (Figure 16). A similar picture can be gleaned from higher-frequency indicators. Although the growth rates of both retail sales and FAI have moderated since 2010, retail sales growth has been resilient while investment growth has declined (Figure 17).

Figure 16: Real GDP and Expenditure-side Component Growth
Four-year moving annualised average



Source: CEIC Data

Figure 17: Indicators of Consumption and Investment



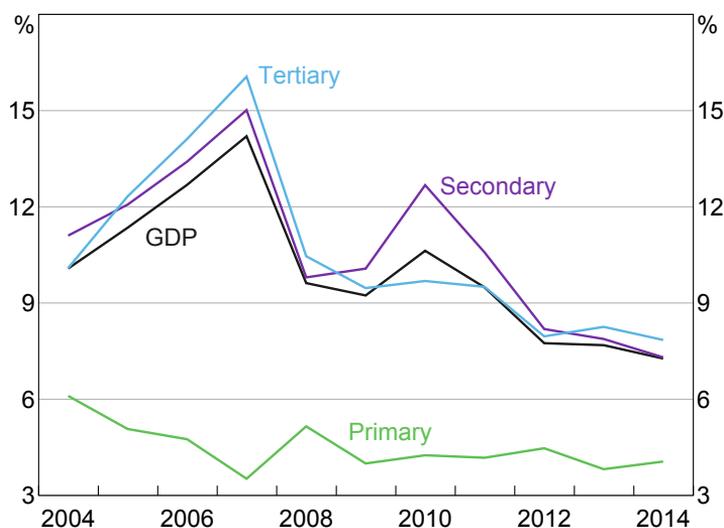
Sources: CEIC Data; RBA

A question remains whether this apparent turn is cyclical or structural. The process of concurrent rebalancing and moderating growth may not always follow a smooth path, with possible cyclical overshoots and undershoots along the way. While cyclical swings cannot be completely ruled out, there are at least two reasons why the economic adjustments over the past five years can be viewed as having structural features.

First, the tailwinds behind the positive income shocks in the past two decades (gains related to economic reform and the ‘demographic dividend’ implied by a rising working-age population) have now started vanishing and may even reverse in the decade ahead. Second, there are signs of a more permanent resource reallocation on the supply side of the Chinese economy. A less capital-intensive services industry finally outgrew the manufacturing and construction sectors in the 2010s, contributing to decelerating investment while sustaining a reasonable pace of job creation (Figure 18).

For the past two years, real growth in the less capital-intensive tertiary sector has exceeded that of the rest of the economy. Productivity growth in services is typically found to be lower than in the industrial sector. To the extent that this is true in China, a bigger services sector may weigh on China’s potential growth, although there is scope for such a compositional shift to support the labour share of national income and cushion employment and consumption during the slowdown. Furthermore, the production- and expenditure-side trends should be mutually reinforcing. The expansion of a less capital-intensive services sector is likely to reduce overall investment growth, while the expansion of the consumption share of expenditure is likely to support growth in the services sector (for reasons to be discussed in Section 4.4).

Figure 18: Real GDP and Growth by Sector
Annual average



Source: CEIC Data

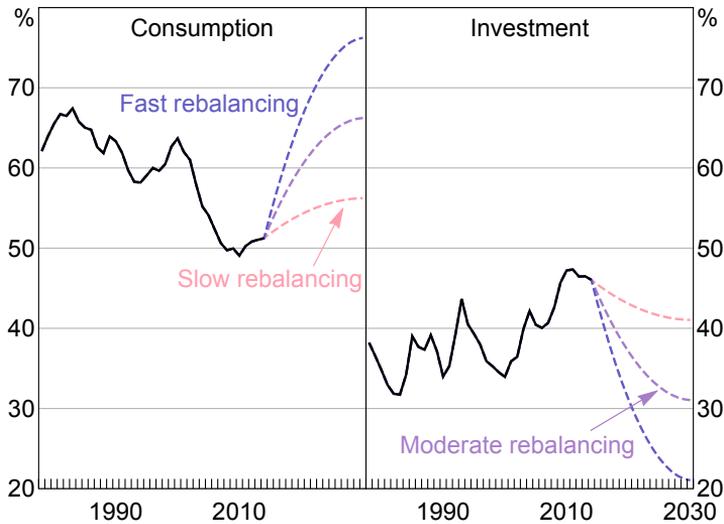
4.2 Possible trajectories and their implications

To consider the prospects for domestic rebalancing, we adopt a simple framework to assess the implications of various rebalancing scenarios for the period of 2015–30. In this section, we frame the prospective domestic demand rebalancing as a one-to-one rotation between consumption and GCF.²³ These rebalancing scenarios are combined with alternative growth scenarios to inform us about the implied growth patterns of key aggregate demand components. For now, we assume that the share of net exports in GDP remains unchanged at its 2014 level; this assumption is relaxed in Section 4.4.

We consider three different scenarios for *domestic rebalancing* over the period of 2015–30, taking the observed 2014 shares of total consumption and GCF in GDP as our starting benchmarks (51.2 per cent and 46 per cent respectively). Our scenario for ‘moderate’ domestic rebalancing assumes a rise of 15 percentage points in the nominal consumption share and a corresponding 15 percentage point fall in the nominal investment share by 2030, with the nominal net export share remaining constant at its 2014 level (2.7 per cent). On average, domestic rebalancing progresses 1 percentage point per annum during 2015–30, unwinding most of the domestic imbalance accumulated over the past three decades and returning China’s domestic expenditure profile to the pattern seen in the first half of the 1980s (Figure 19).

²³ We assume that the proportions of household and government consumption in total consumption are kept constant throughout the whole period. Similarly, the share of changes in inventory in GCF remains constant. Relaxing these assumptions does not materially alter our discussion, although our assumption of a fixed government share of total consumption would imply a significant pick-up in real government consumption growth from that of recent years.

Figure 19: Domestic Rebalancing Scenarios
Share of GDP



Sources: Authors' calculations; CEIC Data

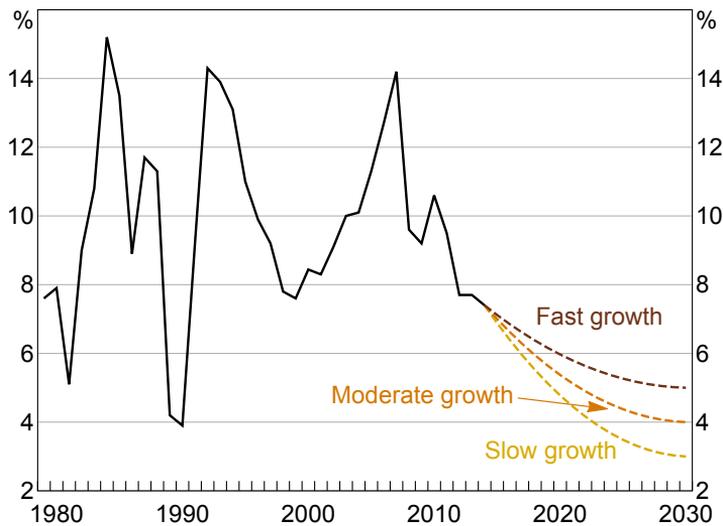
In addition to this 'moderate' rebalancing scenario, we consider an alternative 'slow' scenario, involving a 5 percentage point rotation between consumption and investment shares, and a 'fast' scenario, involving a 25 percentage point rotation (Figure 19). While slow rebalancing only brings China's domestic expenditure composition broadly back to that witnessed around the mid 2000s, a fast rebalancing process would move China to a domestic expenditure pattern that resembles that of an average contemporary OECD economy by 2030. We assume that the rebalancing process is geometric – that is, the component shares converge smoothly to their terminal levels, which are specified in Table 3.

Table 3: Domestic Rebalancing Scenarios
Share of nominal GDP in 2030, per cent

Rebalancing scenario	Consumption			Gross capital formation	Net exports
	Total	Private	Government		
Slow	56.2	41.4	14.9	41.0	2.7
Moderate	66.2	48.7	17.5	31.0	2.7
Fast	76.2	56.1	20.1	21.0	2.7

As Chinese living standards rise and the size of its economy expands, the rate of potential growth can be expected to converge gradually towards that of advanced economies. Any domestic rebalancing will be intertwined with this expected potential growth slowdown in the years ahead. In our scenarios for the period of 2015–30, we consider three different cases for the terminal GDP growth rate in 2030: 4 per cent for the ‘moderate’ growth case, 3 per cent for the ‘slow’ growth case, and 5 per cent for the ‘fast’ growth case (Figure 20; Table 4). These 2030 growth rates are relatively conservative and within the ‘ballpark’ estimates and projections of the World Bank and DRC (2013, 2014), Ma *et al* (2013) and Perkins (2015).

Figure 20: Real GDP Growth Scenarios
Year-average



Sources: Authors' calculations; CEIC Data

Table 4: Real GDP Growth Scenarios
Per cent

Growth scenario	Growth rate in 2030	Average annual growth rate			
		2015–30	2016–20	2021–25	2026–30
Slow	3.0	4.4	5.6	3.9	3.1
Moderate	4.0	5.1	6.0	4.7	4.1
Fast	5.0	5.7	6.4	5.5	5.1

Each GDP growth scenario, combined with a particular rebalancing scenario, will mechanically yield average annualised growth rates for the various GDP components over the scenario period. However, because the scenarios' GDP growth rates are in real terms while the GDP component shares are in nominal terms, the *real* growth of GDP components implied by such a combination is conditional on an additional assumption regarding changes to relative prices. For simplicity, we assume constant growth in the overall GDP deflator from 2015–30, with equivalent growth in both the consumption and investment deflators, such that relative prices remain unchanged.²⁴

Table 5 summarises the average annualised real growth rates in total consumption and investment (GCF) implied by each combination of growth and rebalancing scenarios for the period 2015–30.²⁵ For example, a 'moderate growth and rebalancing' scenario would require annualised growth rates of 5.1, 6.8 and 2.5 per cent for GDP, consumption and investment.

Table 5: Real GDP Component Growth Scenarios
Average annual growth, 2015–30, per cent

Rebalancing scenario	Growth scenario		
	Slow	Moderate	Fast
GDP	4.4	5.1	5.7
Consumption			
Slow	5.0	5.7	6.4
Moderate	6.1	6.8	7.5
Fast	7.0	7.7	8.4
Investment			
Slow	3.6	4.3	5.0
Moderate	1.8	2.5	3.2
Fast	-0.6	0.0	0.7

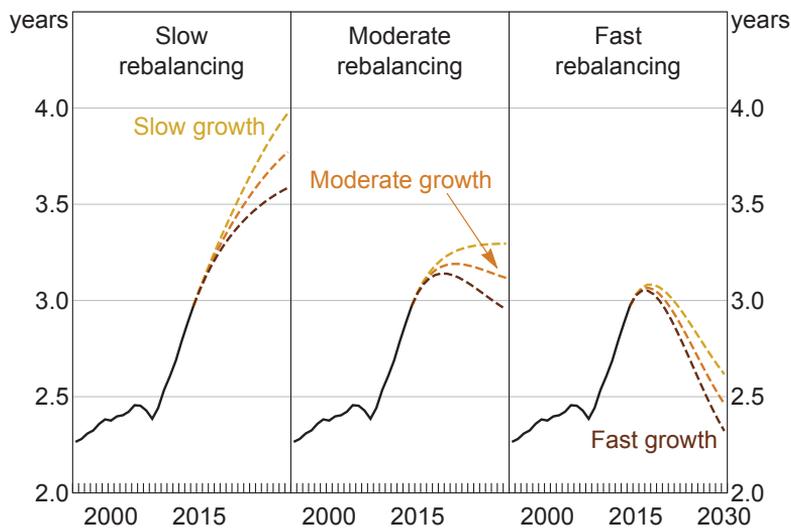
While these exercises tell us little about how or whether a particular investment growth rate can support a particular consumption growth rate, they highlight a couple of key points. First, a fast rebalancing in coordination with rapid growth requires continued rapid consumption growth (more than 8 per cent per annum) and virtually no growth in investment. The discussion of historical rebalancing experiences in Section 2 suggests that there are few precedents internationally for such an outcome. Second, even in the event of slow or moderate growth in GDP, a fast rebalancing requires prolonged weakness in investment and rapid growth in consumption. For this to occur, the impact of radically lower investment growth on household incomes and consumption would have to be very small. In other words, these experiments raise doubts about the likelihood that China's rebalancing process will be rapid.

²⁴ For our purposes, only the relative growth rates of the overall and component deflators in these scenarios are relevant, not their absolute growth rates. The assumption that all relative prices remain unchanged over the scenario period is fairly strong given their volatility in recent years, however, there does not appear to be any consistent 'bias' in relative price growth; average deflator growth over the past 15 years has been similar across components. In any case, relaxing this assumption would not materially change the discussion.

²⁵ Since the net export share of GDP is assumed to remain unchanged, net exports grow at the same rate as overall GDP in all scenarios.

Using the same perpetual inventory method outlined in Section 3, we can estimate the implications of our scenarios for China's capital-to-output ratio, which has surged since the global financial crisis (Figure 21).²⁶ Under a 'moderate' scenario for both growth and rebalancing, the capital-to-output ratio does not stabilise until around 2020, at a level around 3.2 years. By comparison, moderate growth combined with slow domestic rebalancing together imply that the capital-to-output ratio would climb to a level of 3.8 years by 2030 – high by international standards (Berlemann and Wesselhöft 2014) – and continue to rise beyond. Such an outcome would weigh heavily on the return to capital and might be unsustainable, increasing the risks of significant financial stress, misallocation of resources and potentially an abrupt halt to economic growth at some point.

Figure 21: Capital-to-output Ratio Scenarios
Ratio of capital stock to GDP



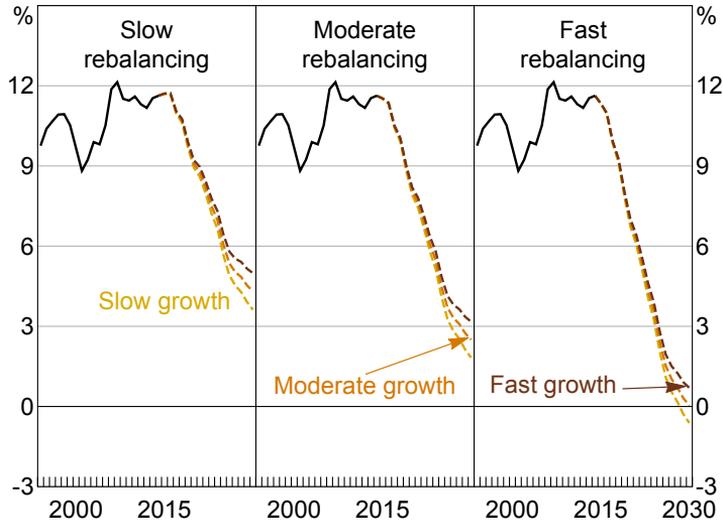
Sources: Authors' calculations; CEIC Data

While such a scenario highlights the urgency of the domestic rebalancing task, it also reveals the extent of the challenge facing policymakers. In all our scenarios, a meaningful deceleration of real investment from its current growth rate (around 7½ per cent) is required to restrain growth in the capital-to-output ratio (Figure 22). Similarly, consumption growth significantly below 7 per cent per annum is unlikely to be sufficient to allow a peak in the capital-to-output ratio by 2030 (Figure 23).²⁷

²⁶ For simplicity, we maintain the assumption of a 7 per cent depreciation rate throughout.

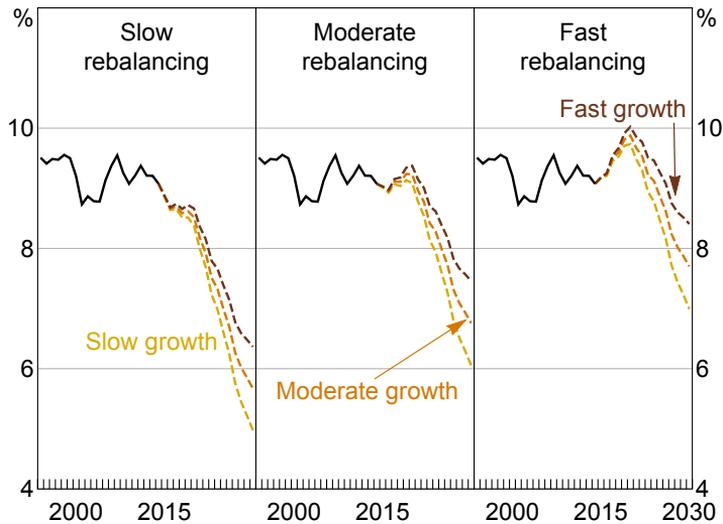
²⁷ Given the assumptions regarding the stability of relative prices and the net export share of GDP, a particular combination of a real growth rate and a nominal rebalancing path will be consistent with a particular combination of investment and consumption growth rates and a particular path of the capital-to-output ratio.

Figure 22: Real Investment Growth Scenarios
Sixteen-year moving annualised average



Sources: Authors' calculations; CEIC Data

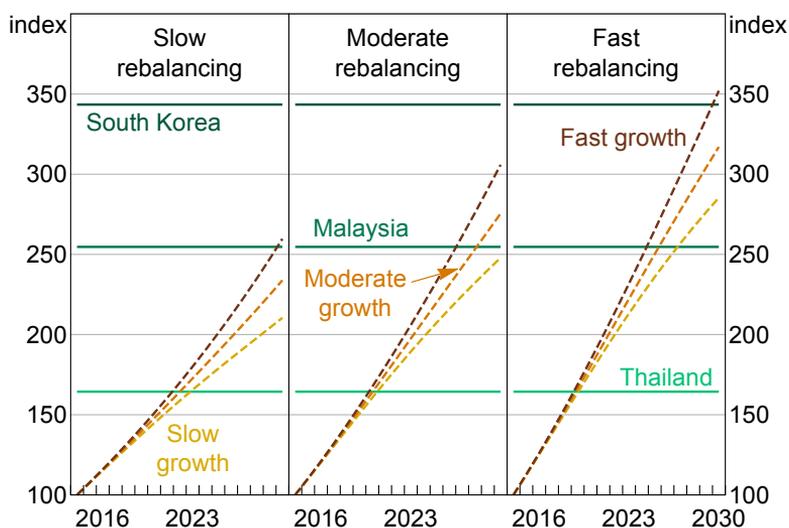
Figure 23: Real Consumption Growth Scenarios
Sixteen-year moving annualised average



Sources: Authors' calculations; CEIC Data

Our scenarios also have implications for the level of household consumption per capita in China. Certain combinations of rebalancing and growth scenarios could see Chinese real per capita household consumption approach or even exceed the current levels of other upper middle-income economies by 2030 (Figure 24).²⁸ However, this still assumes remarkable resilience in Chinese private consumption in the face of difficult rebalancing, as international experiences of consumption growth outstripping investment growth for an extended period are the exception, rather than the rule. While China did undergo a period of strong overall growth outpaced by even stronger consumption growth in the early reform years, the abatement or reversal of the favourable shocks underpinning that episode suggest that it is unlikely to be repeated in the near future.

Figure 24: Real per Capita Household Consumption Level Scenarios
China 2014 = 100

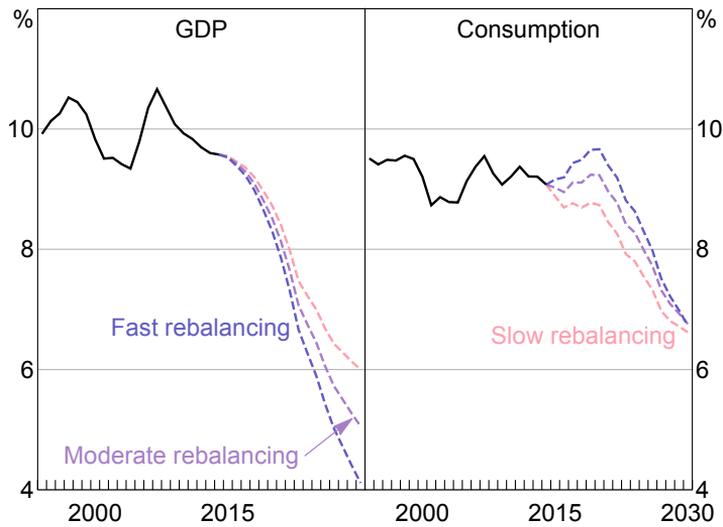


Notes: Levels for South Korea, Malaysia and Thailand indicate 2014 comparisons with China using the purchasing power parity conversion factor for household consumption (2011 international dollars); medium fertility variant population projections
Sources: Authors' calculations; United Nations; World Bank

²⁸ Although China already falls within the World Bank's 'upper middle-income' category by gross national income per capita, the low household consumption share of expenditure leaves Chinese per capita household consumption well below that of other upper middle-income countries (such as Malaysia and Thailand). The average per capita household consumption figure obviously obscures large variation in consumption levels across Chinese regions, particularly between urban and rural areas.

The relationship between a given investment share of GDP and the ‘efficiency’ with which this investment translates into GDP growth gives a further perspective on the plausibility of the various scenarios. Assuming no change in the net export share of GDP, a combination of sustained rapid (or even increasing) consumption growth together with a meaningful decline in the investment share of GDP could only occur if new investment had a relatively immediate, sizeable effect on overall GDP growth, implying constant or increasing returns to China’s stock of capital at the margin and continuously improving allocative efficiency.²⁹ If we instead consider the possibility that the efficiency of new investment is invariant to the degree of rebalancing, it would suggest a relationship between the size of the fall in the investment share and the extent of the slowdown in overall growth. In Figure 25, we take the path of the incremental capital-to-output ratio implied by the moderate growth and rebalancing scenario as an independent variable and let growth become dependent on the degree of rebalancing. The comparison indicates that unless faster rebalancing is matched by more efficient investment, the process may drive a slowdown in overall growth that could largely offset the positive effect on consumption caused by the shifting domestic demand profile.

Figure 25: Real GDP and Consumption Growth Scenarios for Fixed Investment Efficiency
Sixteen-year moving annualised average



Sources: Authors’ calculations; CEIC Data

²⁹ The capital-to-output ratio K/Y is a measure of the ‘efficiency’ of past and present investment, in that its inverse Y/K represents the speed at which the capital stock produces its own value in output. The *incremental* capital-to-output ratio $\Delta K/\Delta Y = I/\Delta Y = (I/Y)/(\Delta Y/Y)$ is a measure of the ‘efficiency’ of additions to the capital stock (i.e. investment), with an inverse equivalent to the ratio of GDP growth to the investment share of GDP.

Our scenarios underscore the challenges involved in reconciling a rebalancing Chinese economy with slowing potential growth, and the role that measures to enhance the efficiency of investment would need to play in this process. They also highlight the 'knife-edged' nature of domestic rebalancing. If rebalancing is too slow, the capital-to-output ratio rises to potentially unsustainable levels, and real household consumption per capita struggles to attain that of a contemporary upper middle-income economy even by 2030. If it is too fast, the required disparity between the growth of consumption and investment would imply both exceptional resilience of consumer spending on the demand side and a swift increase in the efficiency of investment on the supply side. Finding that delicate balance in practice could prove challenging.

4.3 Expenditure rebalancing and the production side

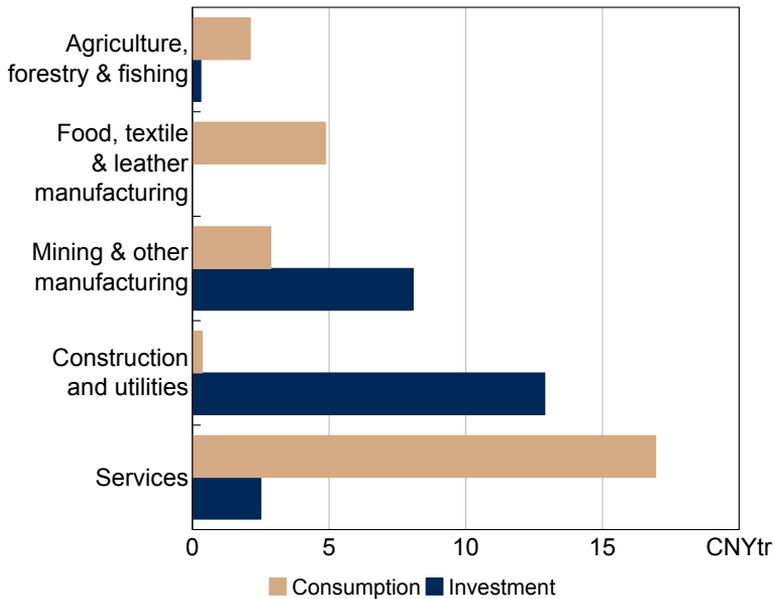
While a general equilibrium analysis of expenditure rebalancing is beyond the scope of this paper, data on inter-industry linkages suggest that a rotation from investment towards consumption may interact with structural change taking place on the production side of the economy. The ongoing shift in the production share towards more labour-intensive services industries and away from manufacturing and construction should mean that, increasingly, less capital expenditure is required to generate a given level of employment and household income growth. At the same time, the rise in the consumption share of domestic expenditure could be expected to reinforce the shift from the secondary to the tertiary sector, due to the differing impacts that consumption and investment demand have for different industries.

Many industries play an important role in producing goods and services for both consumption and investment, either directly or through the production of intermediate inputs. The direct implications of changes in expenditure shares for the demand for different varieties of final products are relatively clear. Investment expenditure is directed largely towards construction and the production of capital goods, while consumption expenditure is directed primarily towards services industries and the manufacture of consumer goods, including textile and food products. However, the implications for upstream sectors depend on the structure of intermediate production, and can only be inferred much more approximately. The most useful data on these inter-industry linkages come from China's official input-output tables. Although not very timely (the most recent is for the year 2012), these data provide a means of exploring interrelationships between the expenditure, production and income sides of the Chinese economy, albeit at a fairly high level of aggregation.³⁰

³⁰ The published 2012 tables are at the 17-industry level. 2010 tables are available at a more disaggregated level, however, the additional detail would make little difference to the discussion.

Figure 26 illustrates the differences between consumption (public and private combined) and investment in terms of total expenditure on various final goods and services by industry. Taking these components' expenditure profiles (as well as that of the exports component of total final demand), and accounting for the sequence of intermediate production linking downstream to upstream industries, Figure 27 splits the gross value added (the difference between the value of an industry's output and the value of its intermediate inputs) for each of the 17 Chinese industries according to the proportions attributable to household consumption, government consumption, investment and export demand.³¹

Figure 26: Expenditure on Final Products
2012

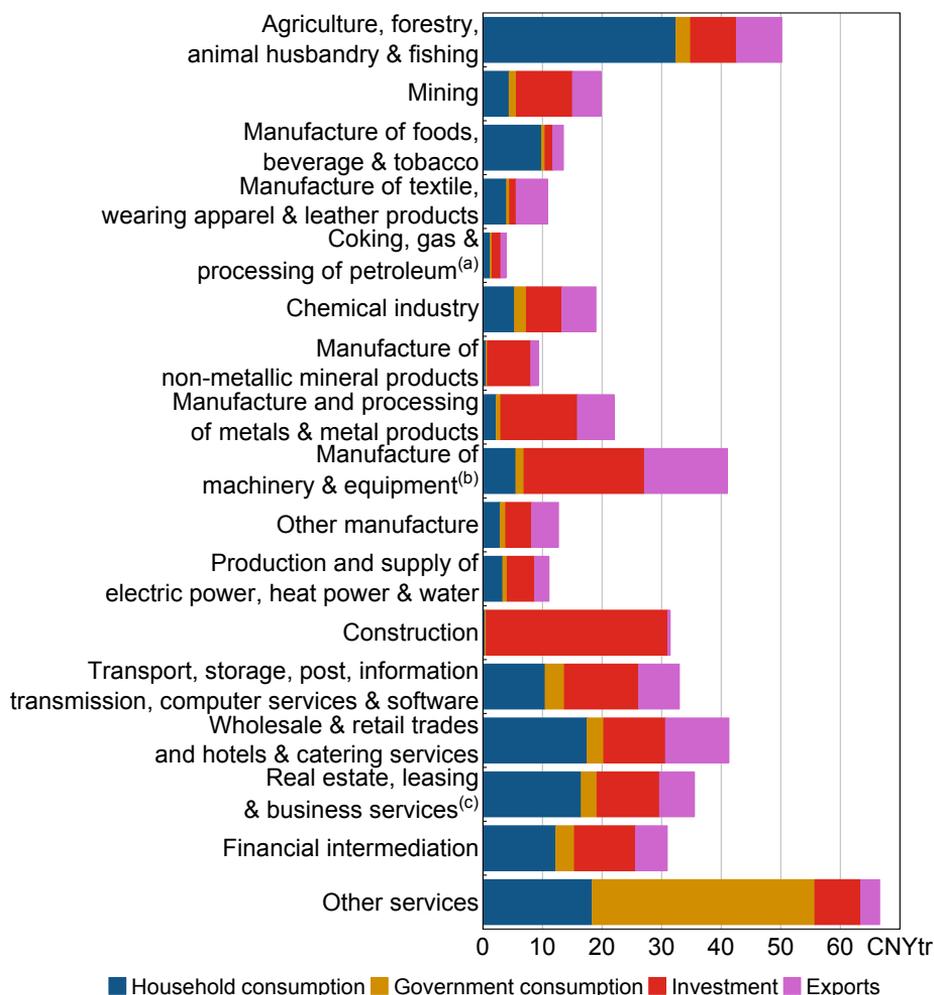


Source: National Bureau of Statistics of China

31 For S industries, input-output tables represent flows of intermediate inputs between industries in an $S \times S$ matrix, which can be used to calculate a matrix of 'technical requirements' representing how many units of input from one industry is required to produce one unit of output in another industry. Calculating the 'Leontief inverse' (the infinite geometric series of this matrix) allows any element of final demand to be related to the total gross output necessary to produce that element as well as its required intermediate inputs – and these inputs' required intermediate inputs – through every stage of production. Mathematically, define \mathbf{Z} as an $n \times 1$ vector of all sectors' gross output, then $\mathbf{Z} = \mathbf{X} + \mathbf{Y}$ where vector \mathbf{X} gives intermediate uses and vector \mathbf{Y} gives final uses. $\mathbf{X} = \mathbf{AZ}$, where \mathbf{A} is an $n \times n$ matrix of technical requirement coefficients between 0 and 1. Then $\mathbf{Z} = \mathbf{AZ} + \mathbf{Y}$, or $\mathbf{Z} = (\mathbf{I} - \mathbf{A})^{-1} \mathbf{Y}$, where $(\mathbf{I} - \mathbf{A})^{-1}$ is the 'Leontief inverse', which can be multiplied by any vector representing elements of final demand to arrive at the necessary gross output. This gross output can be multiplied by the industries' ratios of value added to gross output to relate expenditure to income.

Figure 27: Sources of Final Demand by Industry

Gross value added, 2012



Notes: (a) Includes coke, refined petroleum and nuclear fuel manufacturing
 (b) Includes electrical, optical & transport equipment, manufacturing not elsewhere classified, and recycling
 (c) Includes renting of machinery & equipment

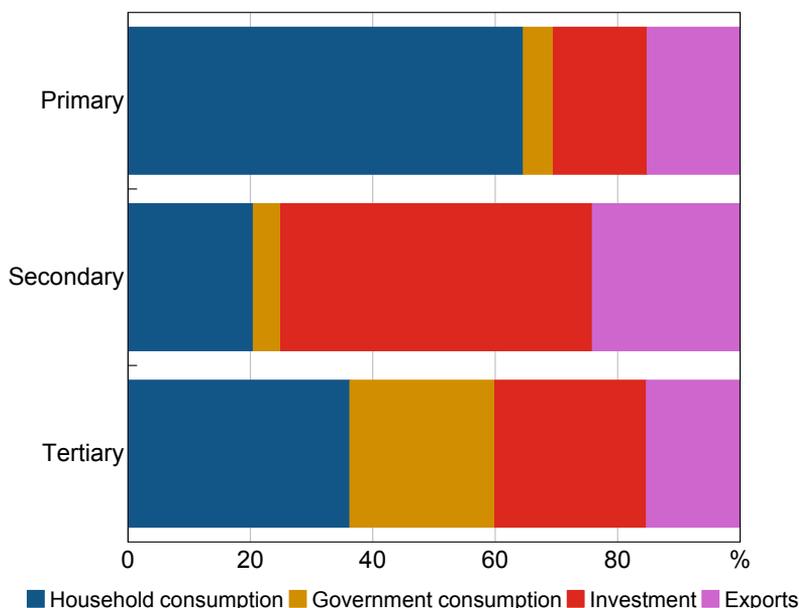
Sources: Authors' calculations; National Bureau of Statistics of China

The drivers of demand vary widely for China's various industries. For instance, investment is the primary source of demand for the construction, machinery & equipment, and metals manufacturing industries, while consumption is, unsurprisingly, a more important driver for agricultural and food production and for the majority of services industries. To simplify the picture, we aggregate the 17 industries into primary, secondary and tertiary sectors, dividing the gross value added attributable to the different expenditure components by each sector's total (Figure 28).³² The primary sector (agriculture, forestry, animal husbandry & fishery) ultimately

³² China categorises the mining industry in the secondary sector rather than the primary sector.

derives about two-thirds of its demand from household consumption, compared to around one-fifth for the secondary sector and around one-third for the tertiary sector. The secondary sector is heavily reliant on investment expenditure (ultimately accounting for about half of demand) and exports (accounting for about one-quarter of demand). The tertiary sector derives about 60 per cent of its demand from consumption, nearly half of which comes from government consumption.

Figure 28: Sources of Final Expenditure
Share of sectoral gross value added, 2012



Sources: Authors' calculations; National Bureau of Statistics of China

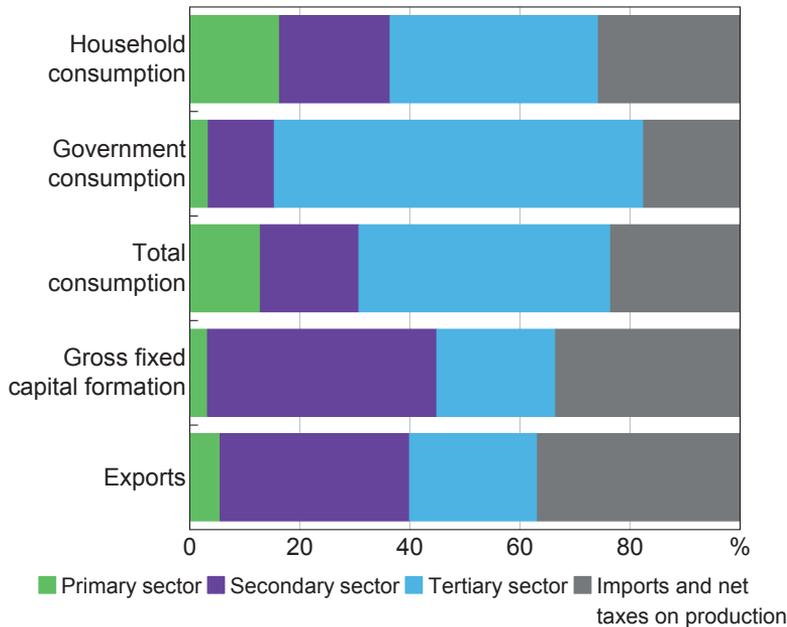
Input-output tables also allow us to illustrate how much production (both final and intermediate) by each domestic Chinese sector is required per unit of expenditure for each component of final demand (Figure 29).³⁴ Each unit of expenditure on investment equates to more than double the amount of value added for secondary sector industries than does each unit of consumption. Conversely, each unit of expenditure on consumption equates to about four times the amount of value added for the primary sector, and more than twice the amount of value added for the tertiary sector, relative to each unit of expenditure on investment. If the broad structure of production and expenditure relationships remain stable, these demand intensities imply that the rebalancing of the expenditure-side of the economy will drive structural change on the production side away from manufacturing and construction towards services, particularly if the rebalancing involves an increase in government consumption relative to household consumption.³⁵

33 Government consumption is the primary source of demand for the 'other services' industry category which includes health, education, public administration and defence (and is the largest of the 17 Chinese industries by gross value added).

34 Here we exclude changes in inventories from the investment component.

35 The rise in income levels is likely to reinforce this effect due to Engel's Law – namely, the observation that the proportion of income spent on basic necessities falls with a rising income, while the proportion of income spent on education, health care and recreation increases.

Figure 29: Sectoral Production per Unit of Expenditure
Value added, 2012



Sources: Authors' calculations; National Bureau of Statistics of China

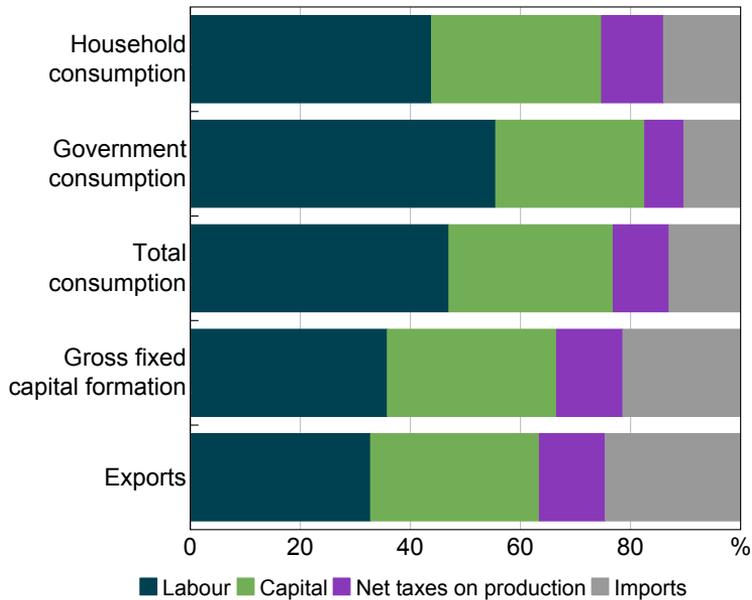
China's input-output tables also separate each industry's gross value added into payments to labour (compensation of employees) and payments to capital (gross operating surplus).³⁶ Labour compensation accounts for almost all of primary sector value added. Payments to labour and capital are fairly evenly divided both in the secondary and tertiary sector in aggregate; however, this obscures wide variation at the more disaggregated industry level.³⁷ The variation of factor intensity within industries with differing exposures to the various final demand components means that the shares of income accruing to labour and capital vary according to the source of expenditure. Figure 30 shows how each unit of expenditure from the various demand components corresponds to different amounts of income for domestic labour, domestic capital, and foreign factors of production.³⁸

³⁶ We discuss returns to capital gross of depreciation, although the NBS tables account for depreciation and operating surplus separately.

³⁷ The tertiary sector is substantially more labour intensive when the real estate, leasing & business services and financial intermediation industries are excluded. Likewise, the secondary sector is substantially more capital intensive when the construction industry is excluded.

³⁸ The latter refers to the proportion of the expenditure that ultimately leaves China due both to imports of final goods and services and imports of intermediate inputs used in the production of domestically produced final goods and services.

Figure 30: Factor Income per Unit of Expenditure
Value added, 2012



Sources: Authors' calculations; National Bureau of Statistics of China

Of the *domestic* value added required for each unit of expenditure, Table 6 gives the percentages corresponding to the payments to labour and capital according to the source of demand. The comparison explains why investment- and export-driven growth can be expected to correspond to a lower labour share of income than consumption-driven growth. Within consumption, government consumption is ultimately significantly more 'labour intensive' than household consumption. An implication is that, other things being equal, rebalancing from investment towards consumption can be expected to support a higher rate of employment growth for a given rate of GDP growth, possibly cushioning the effect of the slowing economy on the Chinese labour market and on household incomes.³⁹ As a higher share of payments to labour than payments to capital are spent on consumption, this may support faster growth of consumption relative to overall growth, reinforcing the process and possibly contributing to the necessary resilience of consumption growth (as discussed in Section 4.2).

Input-output tables also shed light on how demand components differ in their import intensities, or requirements for foreign value added (Figure 30). Investment is more import intensive than consumption, and household consumption is more import intensive than government consumption. This point calls into the question the assumption maintained in the domestic rebalancing scenarios discussed in Section 4.2, where the net export share of GDP is unchanged while the composition of domestic expenditure changes. The next section relaxes that assumption and explores implications of domestic rebalancing for the external balance.

³⁹ A higher labour share of income does not automatically correspond to more demand for labour, but this would be a reasonable inference assuming that average compensation per employee is relatively balanced across sectors.

**Table 6: Factor Shares of Domestic Value Added
by Source of Final Demand**
Per cent

Factor	Consumption			Gross fixed capital formation	Exports
	Total	Private	Government		
Labour	61.1	58.6	67.2	53.7	51.6
Capital	38.9	41.4	32.8	46.2	48.4

Sources: Authors' calculations; National Bureau of Statistics of China

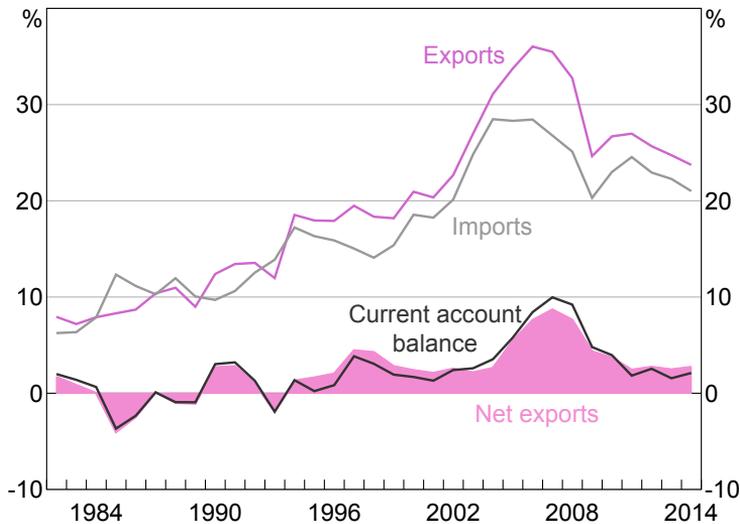
4.4 How might the external balance respond?

While internal rebalancing appears to be at an early stage, China's external rebalancing has been clearly underway since the global financial crisis (see Section 2). Net exports peaked as a share of GDP in 2007 at 8.7 per cent. The share has since declined to below 3 per cent, as a sharp fall in the export share was accompanied by a milder reduction in the import share, reflecting a combination of a rise in China's investment rate and a fall in its saving rate (Figures 1 and 31). In the Section 4.2 scenarios, we assumed that the external balance would remain fixed as the internal balance changed, which implicitly constrained the rate of consumption growth that could accompany a given rate of GDP growth (or a given 'efficiency' of investment). In allowing the external balance to vary we now relax this constraint for two reasons. First, different import intensities may alter the external balance for a given one-to-one rotation between consumption and investment. Second, their rotation may not turn out to be one-to-one in practice.

As discussed in Section 4.3, the different production-side requirements of industries producing for consumption or investment means that internal rebalancing may affect the external balance by changing the composition of demand for imports. Changes to the net export share may be driven either by changes in the export share or the import share (which were 23.7 per cent and 21.0 per cent in 2014). For simplicity, we consider only changes to the *import* share of GDP, leaving the *export* share fixed (the future of external demand for Chinese exports being beyond the scope of this paper).⁴⁰ Specifically, we consider what the various internal rebalancing scenarios outlined in Section 4.2 might imply for the external balance if the 'import intensities' described in Section 4.3 (Table 7) remained unchanged over the period to 2030.

⁴⁰ It is worth acknowledging that the assumption of a fixed export share of GDP implies that the nominal value of Chinese exports will increase at the same rate as China's nominal GDP and that, with China's GDP growth in coming years likely to outpace that of the rest of the world, this would involve Chinese exports rising relative to world GDP.

Figure 31: Exports and Imports
Share of nominal GDP



Sources: Authors' calculations; CEIC Data

Table 7: Import Intensities

Ratio of related imported content to total expenditure, based on 2012 input-output table

Consumption			Gross capital formation	Domestic absorption	Exports	Total final demand
Total	Private	Government				
0.13	0.14	0.10	0.21	0.17	0.25	0.19

Sources: Authors' calculations; National Bureau of Statistics of China

Table 8 compares the implications for the Chinese import share of the slow, moderate and fast rebalancing scenarios from Section 4.2, here recast as shifts from investment to consumption in the respective shares of *domestic expenditure*, rather than as shares of GDP.⁴¹ Due to the higher import intensity of investment relative to consumption, an internal rebalancing towards consumption leads to a modest decline in the import share (and a corresponding increase in the net export share), with overall GDP consequently slightly larger than if the import share had remained unchanged. This suggests that the resolution of internal imbalances can be expected to increase, rather than reduce, external imbalances (and vice versa). Although the scale of this external effect would be small relative to the internal change, it could still be significant enough in absolute terms to have a material impact on China's trading partners, given the large and increasing size of the Chinese economy.

⁴¹ The rebalancing scenarios in Section 4.2 involved rotating fixed percentage points of nominal GDP from the investment share to the consumption share. If we allow shifts from investment to consumption to affect demand for imports (which is a negative component of GDP), we affect the denominator in the GDP component shares, but not in the domestic expenditure shares.

Table 8: Internal Rebalancing Scenarios and the External Balance

Rebalancing scenario	Shift from investment to consumption	Change in import share of GDP by 2030	Net export share of GDP in 2030	Relative difference in nominal GDP by 2030
	Share of domestic absorption	Percentage points	Per cent	Per cent
Slow	5.14	-0.47	3.10	0.39
Moderate	15.42	-1.39	3.85	1.17
Fast	25.70	-2.31	4.58	1.94

A caveat to this analysis is that, conceivably, changes to import intensities *within* final demand components could offset the effects of shifts in expenditure shares *between* components. Such changes would have implications for the potential rate of Chinese consumption growth that could feasibly coincide with a given degree of internal rebalancing. If the fall in China's investment rate is exceeded by the fall in its saving rate, the external surplus would have to decline further (possibly into deficit). In particular, a falling investment share may be compatible with significantly higher rates of consumption growth than suggested by the exercises in Section 4.2 if China were to shift from trade surpluses to deficits, allowing the country to import a larger share of consumption goods and services than currently. This effectively implies a jump in the import intensity of consumption. For example, under the scenario of moderate growth and moderate internal rebalancing, a gradual increase of 5 percentage points in the import share of GDP by 2030 would, if entirely allocated to consumption, raise average annualised consumption growth from 6.8 per cent to 7.2 per cent over that period. Under a scenario of moderate growth and fast internal rebalancing, a similar 5 percentage point reduction in the external balance could shift per capita household consumption levels up to reach those of contemporary South Korea by 2030 (Figure 24).⁴²

It is also worth noting that, if the decline in overall growth is positively related to the fall in the investment share, a trade deficit may present one way of 'cushioning' the internal rebalancing process. A deficit could allow consumption to rise faster than could otherwise be supported by the more gradual growth in the domestic capital stock (although any such benefit would need to be balanced against the implications of a persistent trade deficit for the capital account and the exchange rate). However, considering the higher import intensity of investment and the fact that investment typically adjusts faster than consumption, it is also quite likely that the current account surplus could widen (as occurred in Japan in the 1980s and in China in 2015). In other words, while the investment share of GDP would decline, the consumption share will not necessarily rise by the corresponding amount.

⁴² We continue to assume a fixed export share of GDP. We assume that changes in the import share follow a geometric path from its 2014 level as with the other components. Under such a scenario, in 2030, China would be running a trade deficit of 2.3 per cent of GDP.

4.5 Implications for China's trading partners

In the same way that data on inter-industry linkages can be used to analyse the effects of expenditure-side rebalancing on China's domestic industrial sectors, we can also consider how China's various trading partners (and their own industrial sectors) would be affected.⁴³ To do so, we use the same approach as in Section 4.3, but rely on multi-regional input-output tables that delineate trade and production relationships across industrial sectors in different countries. Specifically, we make use of the June 2015 version of the OECD Inter-Country Input-Output (ICIO) tables, which cover 34 industries and 62 regions for the years 1995, 2000, 2005, and annually from 2008 to 2011.⁴⁴ These data allow the components of Chinese expenditure on final goods and services to be connected to the corresponding incomes (i.e. value added) earned in the industries of countries that contribute to their production, directly or indirectly.⁴⁵ An advantage of the current OECD ICIO tables over previously published multi-regional input-output tables is the distinction made between the different input requirements of equivalent Chinese industries producing for domestic use, non-processing exports or processing exports.⁴⁶

Using these data, the *value-added exports* to China of its trading partners can be distinguished from their *gross exports*. Value-added exports measure trade in a manner consistent with GDP, which avoids double counting by including only expenditure on final goods and not intermediate goods. Value-added exports to China of a given economy: (i) exclude the value of exports to China that are used as inputs into the production of Chinese goods and services that are then exported from China to other countries; (ii) exclude the value of intermediate inputs imported from third countries that are used in the production of exports to China; and (iii) include the value of intermediate inputs produced by the economy in question that are used in the production of exports by third countries to China.⁴⁷

The data indicate that in 2011 gross exports exceeded value-added exports for all trading partners except Saudi Arabia (Figure 32).⁴⁸ Economies strongly economically integrated with China through east Asian manufacturing supply chains – in particular South Korea, Taiwan, Malaysia and Thailand – have a high ratio of gross exports to value-added exports, reflecting the fact that a large share of these economies' exports to China are intermediate inputs used in Chinese

43 Here we are considering the effects of rebalancing on the countries that export goods and services to China. As in the previous section we do not consider changes in Chinese exports to other countries, which we assume to be unaffected by the internal rebalancing process.

44 Kelly (2014) undertakes a similar analysis using the World Input-Output Database (WIOD), which covers 35 industries in 41 regions for every year from 1995 to 2011. Although the OECD ICIO database does not publish tables for every year between 1995 and 2008, it has a wider coverage (62 countries, including many east Asian economies not included in the WIOD). The two data sources yield results that are broadly similar but differ in some details.

45 Unlike the NBS input-output tables for the Chinese economy, the OECD ICIO tables do not distinguish between compensation of employees and gross operating surplus in their measurements of gross value added. The value of taxes less subsidies on production is also included. Factor incomes do not account for capital account flows.

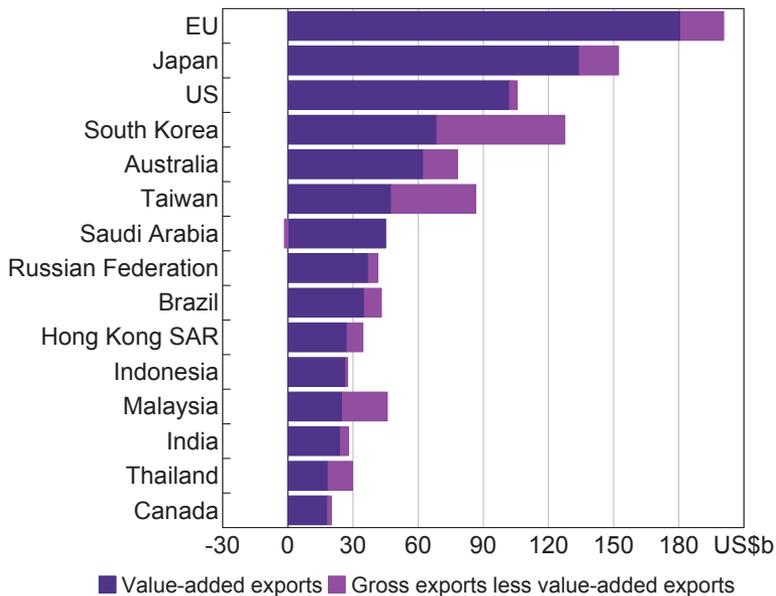
46 Processing trade is likely to use more imported content than non-processing trade due to tariff exemptions. More imported content is used in Chinese production for exports than in Chinese production for domestic use, so the ratio of value-added exports to gross exports is likely to be lower using the OECD ICIO tables than the WIOD.

47 For more details, see Kelly and La Cava (2014).

48 This reflects the unusually large share of Chinese demand that reaches Saudi Arabia indirectly, due to the importance of Saudi Arabian oil as an input in the production of other countries' exports to China.

export manufacturing. For Australia, value-added exports to China were about 80 per cent of the value of gross exports, implying that roughly four-fifths of value added in Australian exports are attributable to Chinese final demand, while about one-fifth is attributable to demand for Chinese exports (using Australian inputs) from other countries.

Figure 32: Exports to China
2011

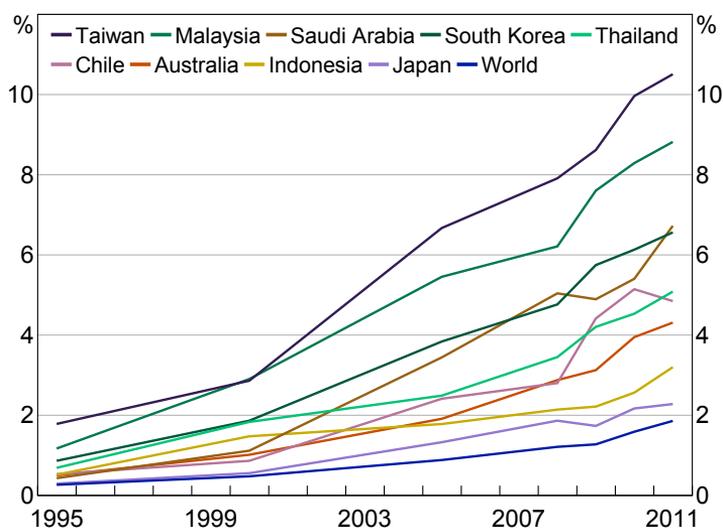


Sources: Authors' calculations; OECD

If we consider the time dimension, the data indicate that trading partner exposure to the Chinese economy has risen markedly since 1995 (Figure 33). In all cases, the share of exporting economies' gross value added that is attributable to Chinese domestic final demand has increased over time. The most highly exposed economies are China's east Asian neighbours, along with resource exporters such as Saudi Arabia, Chile, Australia and South Africa.⁴⁹ In 2011, Chinese domestic final demand (that is, final demand excluding net exports) accounted for about 4.3 per cent of Australian value added, a much higher level of exposure to the Chinese economy than that faced by other developed economies (Table 9).

⁴⁹ We exclude Hong Kong SAR, which derived 11.2 per cent of gross value added from (mainland) China in 2011, and the small resource exporter Brunei Darussalam, which derived 6.2 per cent of gross value added from China in 2011.

Figure 33: Value-added Exports to China
Share of exporter's gross value added



Sources: Authors' calculations; OECD

Table 9: Exposure to China
Exports to China as a share of domestic value added in 2011, per cent

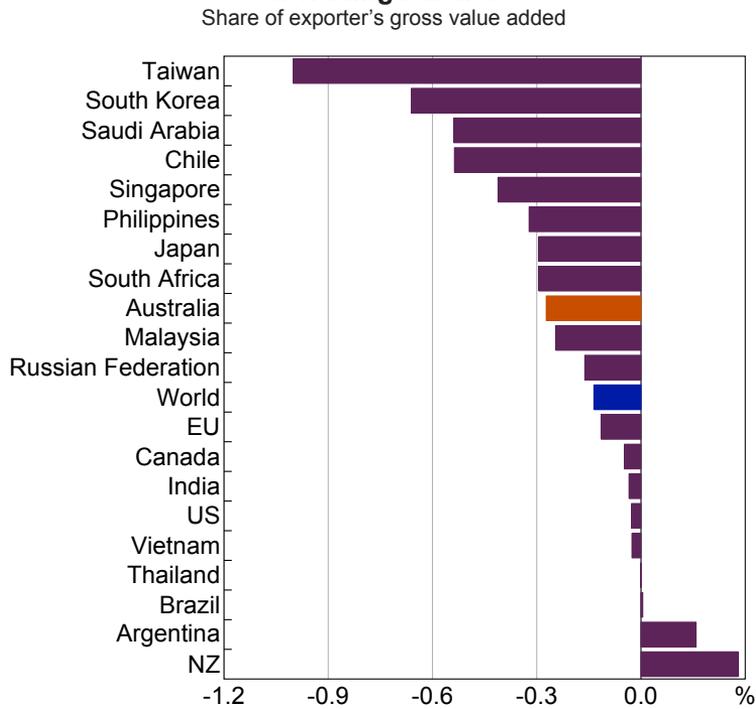
	Exporter							World
	Australia	Japan	Brazil	EU	Canada	United States		
Gross export share	5.4	2.6	2.0	1.2	1.2	0.8	2.3	
Value-added export share	4.3	2.3	1.7	1.1	1.1	0.7	1.9	

Sources: Authors' calculations; OECD

Just as China's internal rebalancing is likely to affect China's domestic industries to different extents on the production side, it may also have differential effects on China's trading partners depending on how exposed they are to Chinese consumption and investment demand. To illustrate this, Figure 34 compares how a rotation of 15 percentage points in Chinese domestic expenditure from gross fixed capital formation to total consumption (without changing the relative shares of household and public consumption) would have affected the value-added exports of China's trading partners in 2011. As Chinese investment is generally more import intensive than consumption, the impact on most trading partners is negative, although there are a few exceptions (notably New Zealand). Australia is more negatively affected than the world on average, but less negatively affected than two other resource exporters (Chile and Saudi Arabia) and several exporters of manufactured capital goods (Japan, South Korea and Germany).⁵⁰

⁵⁰ The major driver for the European Union's negative result is Germany, a capital goods exporter with a larger relative exposure to Chinese investment than Japan.

**Figure 34: Relative Impact of Chinese Rebalancing
on Trading Partners**



Note: Estimated for a 15 percentage point shift in Chinese domestic absorption from investment to consumption in 2011

Sources: Authors' calculations; OECD

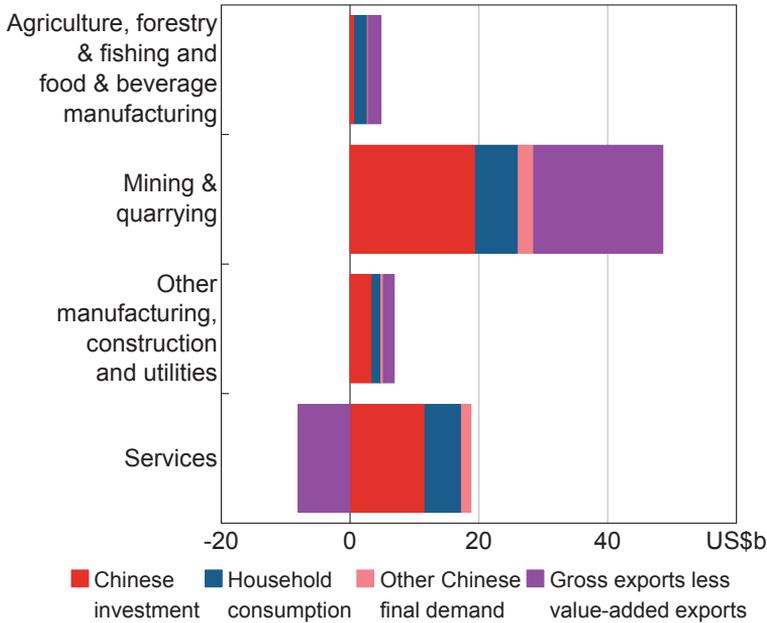
For Australia, the negative effect of Chinese rebalancing is principally due to the role of Chinese investment in driving demand for mining exports (Figure 35).⁵¹ These exports, particularly iron ore and coking coal, provide key inputs for the Chinese metals manufacturing industry, which in turn derives much of its demand from the strongly investment-driven construction and machinery & equipment manufacturing industries. As such, the negative impact of rebalancing on Australia will largely be borne by the country's mining sector.⁵² In contrast, Australia's agriculture, forestry & fishing, food & beverage manufacturing, and education and tourism services industries would benefit from rebalancing, although the size of the offset would be relatively small.⁵³

51 In Figure 35, the value-added exports of the services sector exceed the sector's gross exports. This is due to the fact that service sector value added is incorporated in the gross exports of other goods that are produced using services as an intermediate input. For more details, see Kelly and La Cava (2014).

52 The negative impact on Australia's mining & quarrying sector accounted for about 70 per cent of the total impact for Australia of Chinese rebalancing as estimated using the 2011 OECD ICIO tables. This does not include the impact on industries (such as those in the services sector) that provide inputs into the mining sector.

53 The impact of Chinese rebalancing on Australian industries that would be positively affected is about 10 per cent of that on Australian industries that would be negatively affected, as estimated using the 2011 OECD ICIO tables.

Figure 35: Sources of Chinese Demand by Australian Industry
2011

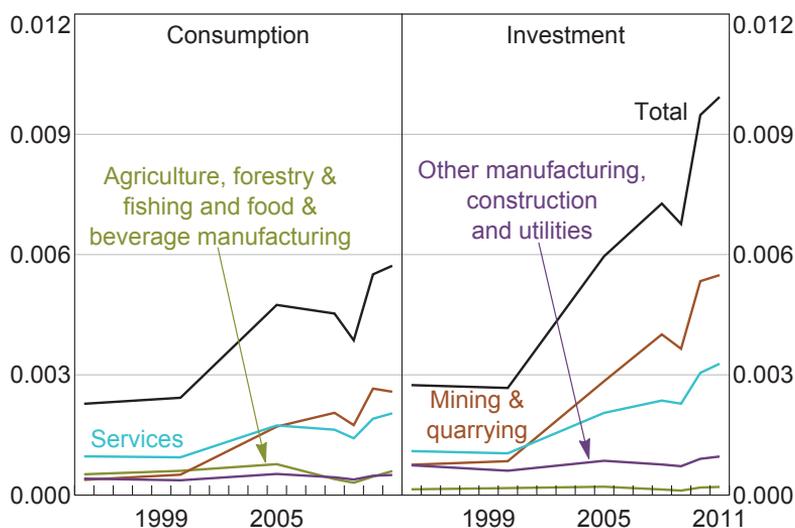


Sources: Authors' calculations; OECD

The differences between patterns of trade exhibited by economies more and less likely to benefit from Chinese rebalancing are pronounced. For instance, New Zealand's exports to China are dominated by agricultural products, food items such as dairy products and services, while a relatively small share are inputs to Chinese investment (see Figure A1). But such a pattern of trade with China is atypical. For most economies, the bulk of value-added exports to China meets investment rather than consumption demand (see Figure A2). In this respect, the Australian example is not unusual.

The difference between the relative demand intensities of Chinese consumption and investment for Australian imports will no doubt continue to evolve in the future (Figure 36). However, the demand for Australian value added per unit of Chinese consumption would need to rise sharply in order to offset the effect of a diminishing investment share. Moreover, as Chinese rebalancing is more likely to be driven by decelerating investment than accelerating consumption, a substantial reorientation of Australia's trade with China will be needed for it to benefit from the rebalancing process.

Figure 36: Australian Value Added per Unit of Chinese Consumption or Investment



Sources: Authors' calculations; OECD

5. Conclusion

This paper makes a number of observations about rebalancing in China – that is, a shift from a pattern of growth driven by investment to one driven by consumption – and its international consequences. First, we offer a reappraisal of the causes of China's unbalanced pattern of growth in recent decades with reference to an updated analysis of the flow-of-funds accounts. We find that conventional analysis understates the role of the household sector in contributing to the high investment share of the economy. Our explanation for the imbalances emphasises the role played by housing market deregulation as one of multiple prolonged positive productivity and demand shocks to the Chinese economy that simultaneously sustained returns to capital, lifted investment and boosted both private and public saving. While recent discussions stress the need to reform financial markets to foster rebalancing, we argue that rebalancing will probably happen anyway as a natural outcome of dwindling income windfalls from fading positive productivity shocks, the unwinding of demographic shifts and maturing housing markets, all of which helped drive the imbalances in the first place.

Second, we present estimates suggesting that the return to capital in China has been falling while the domestic cost of funding has been rising. These trends suggest that China's pattern of rebalancing will most likely be one characterised by falling investment growth in the years ahead.

A third leg to the argument is that Chinese consumption growth in recent years has been extraordinary by the standards of Chinese history and in comparison to other countries. Our rebalancing and growth scenarios indicate that meaningful rebalancing would require continued rapid consumption growth (more than 8 per cent per year) and prolonged weakness in investment. For such an outcome to be achieved, the effect of much lower investment

growth on household incomes and consumption would have to be very small. But historical and international comparisons suggest that it has been rare for economies experiencing rapid consumption growth prior to a rebalancing episode to sustain or to increase consumption growth in subsequent years. Such comparisons highlight the critical but uncertain role played by the resilience of consumption expenditure in China's rebalancing process.

In addition to illustrating how unprecedented and unusual a fast rebalancing in China would be, our scenarios underscore and clarify the 'knife-edged' nature of rebalancing and the considerable stakes involved. If rebalancing is too slow, the capital-to-output ratio rises to potentially unsustainable levels, and real household consumption per capita struggles to rise above that of a contemporary upper middle-income economy, even by 2030. If it is too fast, the implied disparity between the growth of consumption and investment, and the required increase in the efficiency of investment, suggest a pattern of growth that may be implausible in practice.

Fourth, our input-output analysis demonstrates that, for China, there is a close relationship between rebalancing on the expenditure side from investment towards consumption and a parallel rebalancing on the production side from manufacturing industry towards services. As services are more intensive in labour input than manufacturing, rebalancing from investment towards consumption could support a higher rate of employment growth for a given rate of GDP growth, possibly cushioning the effect of the slowing economy on the Chinese labour market and on household incomes. This in turn may lend some support for a rotation from investment to consumption.

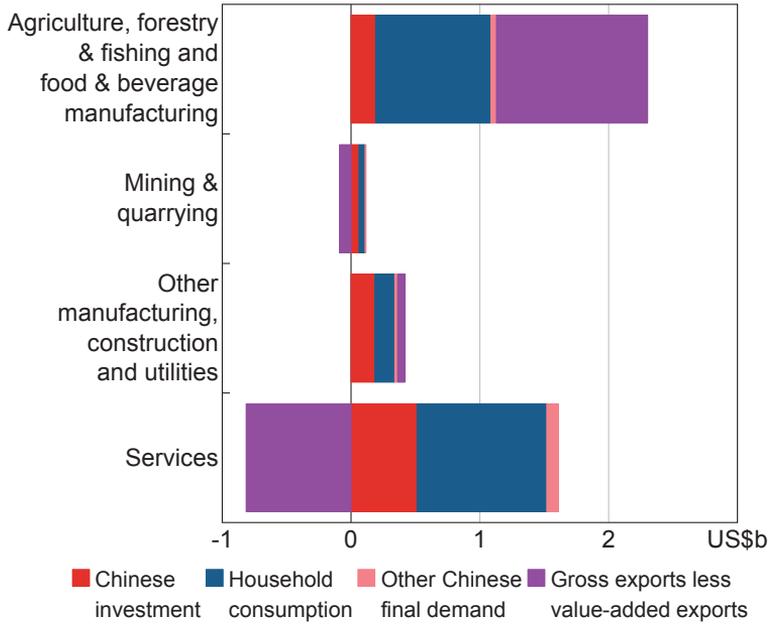
However, the close relationship between the structure of Chinese expenditure and production has another more global implication. The higher import intensity of Chinese investment relative to consumption means that internal rebalancing would be expected to place downward pressure on the import share of GDP. Accordingly, while a simultaneous resolution of domestic and external rebalances is possible, our investigation of global input-output tables from 2011 shows that the more likely outcome is that internal rebalancing supports a modest worsening of external imbalances.

Finally, we consider the consequences of Chinese internal rebalancing for key trading partners. Our results must be treated with caution, due to the comparative static nature of the analysis, which assumes that the structure of global trade and relative prices remain unchanged. With this caveat in mind, similar to Ahuja and Nabar (2013) we find evidence that domestic rebalancing in China is likely to be negative for countries that export resource commodities, including Australia. The negative effect of Chinese rebalancing in our analysis reflects the role of Chinese investment in driving demand for mining exports. While it is a commonplace assumption that commodity exporters will be more disadvantaged than other countries by rebalancing in China, in fact we find that most countries 'lose' from rebalancing, and that Australia is neither alone nor even unusual in this respect. With few exceptions (such as New Zealand), China's trading partners generally export manufactured goods that are used more intensively in investment than in consumption. If such a pattern of trade persists, our analysis suggests that few of China's current trading partners will benefit in net terms from Chinese rebalancing and many will experience a slowing in exports to China in coming years.

It is worth noting that continued growth in household incomes and consumption over time could see increased Chinese demand for imported services and rural, food & beverage manufacturing goods. There is therefore scope for related export industries in countries such as Australia to benefit from rebalancing. Our calculations suggest that the size of these industries and the degree of penetration into the Chinese market would have to increase sharply to offset the effect of a rebalancing China on Australian exports. Nonetheless, if domestic industries can adapt themselves to the changing composition of Chinese import demand, there will be opportunities for a range of Australian exporters to compete with other economies to supply these needs in the future.

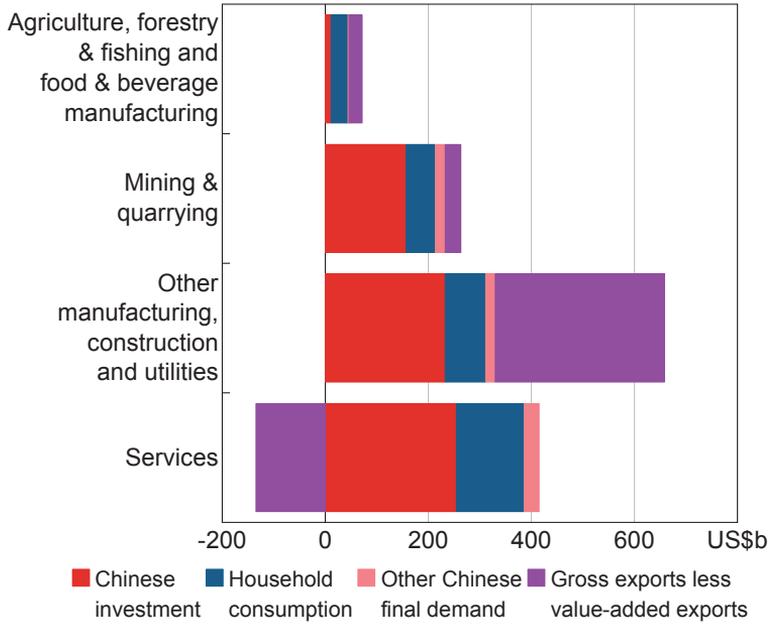
Appendix A: Sources of Chinese Demand by Industry

Figure A1: Sources of Chinese Demand by New Zealand Industry
2011



Sources: Authors' calculations; National Bureau of Statistics of China

Figure A2: Sources of Chinese Demand by Global (Non-Chinese) Industry
2011



Sources: Authors' calculations; OECD

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Discussion

1. Xingdong Chen

First of all, thank you to the RBA for their kind invitation. It is my great honour to comment on Guonan Ma, Ivan Roberts and Gerard Kelly's paper, 'A Rebalancing Chinese Economy: Challenges and International Implications'. It is a fascinating paper; a thorough examination and empirical study of China's economic growth and evolution over the past three decades. The findings of the paper, though the authors remind us that these are to be treated with caution, are, I believe, very valuable for both policymakers and businesspeople.

China is undertaking rebalancing

Economic imbalance or unbalanced growth has been a chronic problem in China. Talk of rebalancing growth can be found in government policy documents year after year, but little progress has been made. This is particularly true since the global financial crisis in 2008–09. Retaining high growth has overwhelmed structural reform and economic rebalancing in practice. And, at least so far, the old growth model can still generate the required output through policy stimuli.

While the authors discuss the internal imbalance between investment and consumption and the external imbalance between exports and domestic demand, it is worth noting that there are yet more unbalanced economic phenomena affecting China. Examples include regional development disparity, income disparity among the people and between urban and rural areas, and urbanisation lagging behind industrialisation.

I agree with the authors' observation that some rebalancing has actually started since 2012 but, by my observation, this round of rebalancing has been particularly forced rather than being the result of more organic and enduring changes. Even using the official growth estimation, GDP growth missed the targets for two consecutive years in 2014 and 2015.¹ Additionally, this growth was only achieved with extremely hard policy actions and, even then, the official growth estimations are widely doubted and believed to be overstated. Growth statistics are more inconsistent than before. These facts suggest that the old growth model is no longer powerful. The government can no longer command growth to meet its target. In fact, growth is seriously constrained by the structural imbalances.

Nonetheless, the new Chinese leaders, who came to power in November 2012, have recently become more serious about implementing policies to rebalance the Chinese economy. After spending more than three years on political power consolidation and policy framework set-up, the new leaders formally launched their rebalancing commitment from 2016 by announcing policies to lower overcapacity, reduce housing inventory and facilitate financial deleveraging.

¹ The official GDP growth was 7.3 per cent in 2014 and 6.9 per cent in 2015, while the growth targets were set at 7.5 per cent and 7 per cent, respectively.

Rebalancing cannot be rapid

Despite these recent policy announcements, I totally agree with the authors that it is hard to foresee a rapid rebalancing. The existing economic imbalances have developed through a long and complicated history. The imbalances can be attributed to both tradition and the catch-up development strategies in the past three decades. China's high household saving ratio is a result of poor development of the social security system, poor consumer financial credit availability, policies that are less favourable to consumption, and the Chinese saving and thrift culture.

Economic rebalancing through restructuring is a hard task. To close a 'zombie firm', for instance, would raise tough questions as to how to resolve the huge debts and associated unemployment caused by such a closure. Because of these non-performing loan risks and job security, the Chinese Government has set its growth target at an average of 6.5 per cent over the next five years and a range of 6.5–7.0 per cent for 2016. I believe the bottom line growth target is meant to pave the way for smooth structural reform, though it will be difficult to achieve.

Notwithstanding this, I also agree with the authors that rebalancing cannot be too slow. Otherwise, rebalancing progress may be left behind and new imbalances may occur. For example, being aware of the tough challenges, China's National Development and Reform Commission (NDRC) set a modest target to reduce annual steel production capacity by 100–150 million tonnes over the next five years. I do not think this will be enough; I believe China needs to reduce capacity by at least 300 million tonnes. It is estimated that China has aggregate annual production capacity of no less than 1.2 billion tonnes of steel. The aggregate demand in the domestic market, on average, in the next five years would not be more than 700 million tonnes per year. Provided an 85 per cent capacity utilisation ratio is sufficient for economic return, China needs no more than 900 million tonnes of steel production capacity.

I see China walking a tightrope trying to balance reform and growth as the new normal. Nonetheless, I am cautiously optimistic that China will gear up its restructuring and rebalancing going forward, while gaining confidence in the process. Next, I will discuss some of the forces that give me this confidence.

Consumption and the services industry are booming

According to official statistics, if making an international comparison, consumption in China has grown rather rapidly, although growth of investment has been stronger still. Consumption of services is surging. Tertiary output grew 8.3 per cent in real terms in 2015 and substantially outpaced secondary industry, which grew by 6 per cent. In 2015, the services industry made up more than half of China's GDP for the first time and accounted for 66 per cent of real growth. The strength in the services sector was apparent across a range of sub-sectors: wholesale, retail, transportation, communication, postal services, logistics, tourism, hotels, catering, banking, wealth management, insurance, real estate services, housekeeping, health care, retirement life, nursing homes, sports, entertainment, education and legal services.

While this strength is a reason for confidence, I have long wondered if the consumption statistics have understated growth. Many kinds of consumption have been miscounted. For example, most consumption associated with corruption and a lot of the consumption of the owners and family of

private businesses are ascribed to intermediate spending on production and business operation. As a result of the government's anti-corruption campaign, the consumption associated with corruption has substantially reduced, if not vanished. Financial disciplines and tax enforcement would also help to reduce the consumption by owners and their families at the cost of their business operations. The correction of the distortion in the statistics would, of course, help to reduce the level of imbalance between consumption and investment. But most importantly, all the changes would help to boost real private or household consumption.

Furthermore, having recognised the obstacles holding back consumption in China, the government is now making massive efforts to reduce administrative hurdles, to promote consumption through changes in product mix, consumer financial credit, taxes and fees. What's more, the new generation is taking the lead in consumption spending. The saving and thrift culture is waning.

But investment remains the decisive factor in the short and medium term

While China is progressing its economic restructuring and rebalancing, the government appears to have retained growth as the policy priority. An average growth target of 6.5 per cent in the next five years has been chosen not only for realising its centennial objective to double GDP between 2010 and 2020, but to cushion the risks and challenges of rebalancing.

The modest failure to achieve the growth target in the past two years has not occurred because of consumption or exports, but because of investment. The NDRC set growth targets for fixed asset investment (FAI) of 17 per cent in 2014 and 15.3 per cent in 2015, but actual growth was only 15 per cent and 10 per cent, respectively. In Chen and Rong (2015) I estimate that, if China were to realise GDP growth of no less than 6.5 per cent this year, FAI growth should be no less than 8 per cent. But, from its leading indicator, the budgeted growth of the projects under construction is currently less than 5 per cent, far from being strong enough. Considering this, and in line with its growth targets, we should expect China to introduce more new investment projects in infrastructure, urbanisation, industrial renovation and technology over coming years.

Internal rebalancing to affect renminbi internationalisation

Turning from internal rebalancing towards external factors, one of the paper's findings is that, because of the higher import intensity of Chinese investment relative to consumption, rebalancing from investment to consumption could place pressure on the imported share of GDP. If China's exports as a share of GDP remain relatively stable, it would mean China's trade surplus would increase.

This would be an interesting development and I think it could have implications for the internationalisation of the renminbi (RMB). China is pushing the internationalisation of its currency and wants more RMB to be used internationally. Apart from increasing RMB loans, outward direct investment (ODI) or financial portfolio instruments, a trade deficit is an effective way of increasing the supply of overseas RMB. Thus, I wonder if the predicted increase in China's goods and trade surplus associated with internal rebalancing could slow RMB internationalisation?

International spillovers

Finally, I have a few comments on the international spillovers of Chinese rebalancing. Though it is rather depressing, the authors find that rebalancing in China would likely have more negative effects than positive on the countries that export resource commodities and capital goods.

Economic restructuring and growth rebalancing would likely have substantial negative effects on Australia, which has relied heavily on exporting resource commodities such as iron ore and coal, among others. Domestic coal prices have already plunged by 57 per cent from their peak in 2004 and coal imports decreased by 30 per cent in 2015. Growth of imported iron ore volumes was 2.2 per cent in 2015, compared with average growth of 16.8 per cent in 2003–15. It seems that the negative effects of China's rebalancing have just begun and could persist for the next 3–5 years.

However, China's internal restructuring and rebalancing would benefit the international market and Australia in other areas. As the paper sets out, China's potential demand for food, forestry & fishing products, tourism, education, health care, property and ODI are enormous. China's tourists travelling overseas amounted to 127.9 million individual trips in 2015, up from 57.4 million in 2010. This has occurred even though it is said that only 5–7 per cent of the Chinese population have passports. I am sure that numbers of Chinese overseas tourists will continue to surge. China's ODI reached US\$118 billion in 2015, up from US\$60.2 billion in 2010 and close to the amount of foreign direct investment in China (US\$126.3 billion in 2015). China is also opening up its domestic capital market. The Panda bond market is developing and foreign company equity initial public offerings in China could be possible in the future.

Reference

Chen X and J Rong (2015), '2016 Perspectives: 10 Top Questions', BNP Paribas Economics Report: China Economics, 16 December.

2. General Discussion

Much of the discussion centred on the importance of investment efficiency in the relationship between rebalancing and growth, with higher efficiency permitting faster overall growth for a given degree of rebalancing. It was noted that, despite the rapid increase in China's capital-to-output ratio over recent years, the capital-to-labour ratio remains low in comparison to that of developed countries. Some participants suggested that the size of the capital stock in China is still too small for recent declines in the return to capital to be interpreted as diminishing marginal returns to the capital stock; instead, these lower returns should be viewed as a symptom of allocative inefficiency and shortcomings of the financial system.

One participant noted that the return on assets in the private sector is significantly higher than that in government-owned sectors. Given the size of assets under government ownership, this suggests that reforms aimed at increasing the competitiveness of the government-owned sector would be beneficial. The increase in return on assets would also allow higher rates of economic growth to accompany a decline in the investment share of output. The authors noted that although the capital-to-labour ratio remains very low, the capital-to-output ratio has recently come to

approach that of developed countries and agreed that this suggests that there is significant room for improved investment efficiency. However, they expressed doubts that the return to capital would rise significantly given the likely reversal of the positive productivity and demand shocks that drove high returns to capital in recent decades.

One participant questioned the attribution of China's high investment and saving rates primarily to positive shocks rather than to factor market distortions caused by government policy. This argument appealed to standard neoclassical theory, under which a positive shock that raised permanent incomes would result in higher present consumption in the absence of credit constraints or risk aversion. The authors argued that the effect of various distortions on consumption, savings and investment are ambiguous and provide an inadequate explanation of how such rapid consumption growth in an emerging economy can be accompanied by even higher investment growth and a current account surplus. The authors posited that positive demand and productivity shocks were capable of boosting income even more than consumption.

On the topic of China's high overall saving rate, one participant emphasised the importance of corporate savings as well as household savings. Another participant questioned the sustainability of a high household saving rate in the future, given the declining working-age population in China. One participant remarked on the novel use of flow-of-funds data to attribute the large increase in China's saving rate principally to increasing gross capital formation undertaken by the household sector. The authors commented that a doubling in household gross capital formation as a share of GDP over a period of 20 years could be regarded as a decisive factor in China's unbalanced demand profile, considering the counterfactual in which this investment expenditure were instead allocated to consumption.

A participant argued that the imbalance between consumption and exports was more significant than the imbalance between consumption and investment, as it better signified the excesses of Chinese savings. It was argued that the current account surplus may be reversed in the future as the composition of Chinese production comes to more closely resemble the composition of Chinese demand, rather than being disproportionately geared towards the production of light manufactures requiring large export markets.

Several participants commented on the input-output based analysis of the consequences of Chinese rebalancing for China's trading partners. One expressed surprise at the difference between the effect of Chinese rebalancing on Australia and New Zealand, given the similarities between the two economies outside of mineral endowments. It was argued that the tourism and education industries would grow significantly in importance and that the overall effect of rebalancing on Chinese demand for imports may be positive.

Another participant questioned the results because the most recent global input-output tables are from 2011, when iron ore prices were at their historic peak. It was argued that with the recent declines in commodity prices, the import intensity of consumption may now be closer to that of investment than it was in 2011. It followed that the overall effect of future rebalancing on Australian exports might not be as negative as suggested by the paper. The authors acknowledged the limitations of global input-output data, given that they are released with a considerable lag and that coefficients relate to nominal values that do not distinguish prices from quantities. It was acknowledged that commodity price declines over recent years may have reduced the intensity

DISCUSSION

of Chinese investment demand for Australian value added, but that the composition of Chinese consumption demand would still likely have to change considerably in order for an average unit of Chinese consumption to match an average unit of Chinese investment in terms of demand for Australian value added.

Contractions in Chinese Fertility and Savings: Long-run Domestic and Global Implications

Jane Golley, Rod Tyers and Yixiao Zhou*

1. Introduction

Between 1978 and 2008, China's real GDP grew at an average annual rate of 10 per cent. During this period, domestic economic reforms, coupled with opening up to the international economy, helped to transform it from one of the world's poorest countries into a 'middle-income' country, the world's third largest economy (or second largest measured in PPP terms) and its third largest exporter (after Germany and the United States). The growth surge commenced with rural de-collectivisation and the consequent rise in agricultural productivity, which precipitated the world's largest ever rural–urban migration, enabling workers to be combined with capital and imported technology, yielding rapid productivity growth. The speed of growth, combined with lagging social institutions and industrial reform, also induced high and rising household and corporate saving rates, both of which financed extraordinarily high levels of investment. The policy framework that emerged fostered export- and investment-led growth and it not only transformed China's economy dramatically during this period, but the global economy as well.¹

These three decades also heralded dramatic demographic change in China. A substantial increase in population – from 987 million in 1980 to 1.34 billion in 2010 – occurred despite declining rates of population growth. There were ongoing declines in fertility, commencing in the mid 1960s and accelerated by the introduction of the one-child policy in 1980, along with socio-economic developments thereafter. Crucially, the 1980s saw the beginning of rapid drops in youth dependency, and a corresponding increase in the growth of the labour force relative to that of the total population. This provided China with the much-celebrated 'demographic dividend', which accounted for between one-sixth and one-quarter of per capita GDP growth in this period according to some estimates.²

However, this period was not without its problems. On the economic front, while the first decade and a half delivered 'reform without losers', from the mid 1990s onwards it became increasingly clear that this had shifted to 'reform with losers' (Lau, Qian and Roland 2000). By the

* Useful discussions on the topic with Ligang Song, Yanrui Wu and Warwick McKibbin are acknowledged, along with comments received on related research at seminars at the Australian National University and the Hong Kong Institute for Monetary Research. Particular thanks are due to Leon Berkelmans, discussant, and to other commentators at the annual conference of the Reserve Bank of Australia, 16–17 March 2016.

1 International consequences are surveyed by Tyers (2015, 2016).

2 The demographic dividend is well researched, including by Cai and Wang (2005), Bloom *et al* (2010), Wei and Hao (2010) and Golley and Tyers (2012a).

mid 2000s, growth had become highly unbalanced. China produced more than it consumed and so exported more than it imported and saved at an unusually high rate, beyond domestic investment needs, thereby accumulating considerable foreign assets. Along with a number of associated imbalances, this contributed not only to growing social unrest on the domestic front, but also created tensions abroad. Protectionist pressures rose and, in the extreme, there were accusations that China's savings 'glut' had been a major contributor to the global financial crisis in 2008–09 (Bernanke 2005, 2011).

Since that time, China's economic problems have reached new heights. At the National People's Congress in March 2015, Premier Li Keqiang's address was the most candidly pessimistic address in decades, acknowledging that '[w]ith downward pressure on China's economy building and deep-seated problems in development surfacing, the difficulties we are to encounter in the year ahead may be even more formidable than those of last year' (Li 2015). Around the same time, Premier Li lowered the country's target rate of growth of GDP to 'around 7 per cent' for 2015, which has been touted as the 'new normal' rate of growth. The official GDP growth estimate for 2015 came in on target, at 6.9 per cent, and is still a remarkable rate of growth by international standards. However, there is growing anxiety both inside and outside of China about whether this 'new normal' rate of growth is either accurate (Wu 2014) or sustainable, and what the domestic and global economies will look like in China's 'post-boom' period.

On the demographic front, while the one-child policy has always been controversial abroad, the economic benefits of the rapid decline in fertility received much attention in the past, not least by Chinese leaders themselves. In recent years, however, attention has shifted to the negative and longer-term consequences of that decline. The most obvious of these is the relatively rapid ageing of the Chinese population, with aged dependency projected to more than double between 2010 and 2030, and nearly double again by 2050 (United Nations 2015). This, according to most analysts, will bring China's demographic dividend to a rather sudden end, placing it in the unique position of being a transitional, developing economy facing what is primarily a developed country phenomenon, or 'growing old before growing rich' (Cai 2010, 2012). Rising gender imbalances, and their contribution to rising household savings, have also become a focus of economic research, with some scholars going as far as to suggest that '[w]hile the sex ratio imbalance is not the sole reason for global current account imbalances in recent years, it could be one of the significant, and yet thus far unrecognized, factors' (Du and Wei 2010, p 2).

The Chinese Government has not stood idly by as these complex and interconnected, economic and demographic pressures have escalated. In 2004, the Chinese Government under President Hu Jintao began to emphasise the need for a more balanced growth strategy that would simultaneously alleviate rising income inequality within China, reduce the pressure on energy demand and the environment, promote employment growth and reduce the country's reliance on external demand (Lardy 2006; Hu *et al* 2008; Wang and Cai 2015). Although only limited 'rebalancing' has occurred in the decade since, Xi Jinping remains committed to a reform agenda that should, if effective, lead the economy towards consumer-led growth in the decades ahead. A likely outcome of these reforms – and indeed a necessary one for rebalancing to succeed – is lower national saving rates in the future.

A more definitive decision came in late 2015 with the announcement that the one-child policy would be abolished and replaced with a nationwide two-child policy, effective as of 1 January 2016. The dominant reason for this change, as stressed in Chinese media reports, was that relaxing family planning policy would provide part of the solution to the ageing problem, with higher fertility expected to produce more than 30 million additional people in the labour force by 2050. The National Health and Family Planning Commission of the PRC also reported that a two-child policy could increase the rate of economic growth by 0.5 percentage points via its effect on aged dependency (e.g. Wang 2015). These calculations hinged on the assumption that a significant number of the fertile population will respond by actually having a second child – an assumption that is highly uncertain according to much demographic research on the topic. These studies suggest an alternative future in which China falls into a ‘low-fertility trap’, consistent with other countries in the region, including Japan and South Korea (Chen *et al* 2009; Basten and Jiang 2015; Zhao 2015).

As 2016 commences, the economic and demographic strategies being pursued by the Chinese Government are indicative of at least two interrelated conundrums that do not appear to have been given adequate attention by either the policymaking or academic communities. The first is that rebalancing the economy towards domestic consumption will require a reduction in the high saving rates that provided a key source of finance for the investment-led growth of the past. It is far from clear that this reduction will actually occur and hence whether consumption will sustainably replace export demand, allowing growth to continue at the intended pace (Ma and Wang 2010; Yang, Zhang and Zhou 2011). The second is that, while higher fertility rates would indeed contribute to higher rates of GDP growth and likely to higher consumption as well, higher fertility would come at a per capita income cost, with negative welfare implications (in economic terms at least) for the average Chinese citizen – just as lower fertility brought about a demographic dividend in per capita income in the past. On this point, the Chinese leadership appears to be largely silent.

This paper assesses the seriousness of these conundrums using a dynamic global economic model that incorporates full demographic behaviour. This enables us to clarify how alternative trajectories for China’s fertility and saving rates will affect China’s economic performance through to 2050 and, in turn, what these alternative trajectories will mean for economic performance in the rest of the world. We begin with a baseline scenario for the global economy through to 2050, in which continued high GDP growth is achieved through both the rising fertility that a two-child policy could potentially bring and an overall saving rate that declines only modestly. We then compare this with three alternative scenarios: a low-fertility scenario in which fertility is assumed to decline along its present path; a low-saving scenario in which Chinese savings are assumed to decline relatively rapidly toward levels common in the industrialised West; and a combination of these two – a ‘double contraction’. Our reason for this experimental structure is to emphasise the domestic and international implications of two potentially significant sources of a slowdown in Chinese growth in the decades ahead. The results offer numerical foundation to the anxieties relating to China’s ‘post-boom’ period and they show that the implications for the rest of the global economy could be considerable.

The paper proceeds as follows. Section 2 sets the scene with a discussion of some of the theoretical and practical links between demographic change, savings and economic growth in China's context. Section 3 summarises our approach to modelling demographic change and economic performance in a global context. Section 4 presents the baseline and counterfactual scenarios, and their projected outcomes for GDP growth in the Chinese and global economies through to 2050. We then delve deeper into the channels through which lower fertility and savings impact on economic performance in China (Section 5) and the rest of the world (Section 6). Conclusions are offered in Section 7.

2. The Context

2.1 Demographic change and economic growth

China's demographic transition commenced well before the one-child policy was introduced in 1980, with fertility rates declining from the 1950s onwards. There were particularly sharp drops in the 1970s, coinciding with the introduction of the 'later, longer, fewer' policy – in this decade alone, the total fertility rate was halved, from 5.8 in 1970 to 2.7 in 1979 (Feng and Cai 2010). The one-child policy solidified this decline and, according to official claims, averted 400 million births during its first three decades. More careful analysis by demographers indicates that this figure is a substantial overestimate, attributing many of the averted births instead to the socio-economic changes accompanying rapid economic growth during this time – including urbanisation and new employment opportunities for rural migrants, improvements in female education and the high parental cost of supporting children through an increasingly competitive education system (Feng, Cai and Gu 2012). Regardless, there is no question that China's population growth has slowed substantially since 1980 and that the one-child policy was a contributing factor to this slowdown.

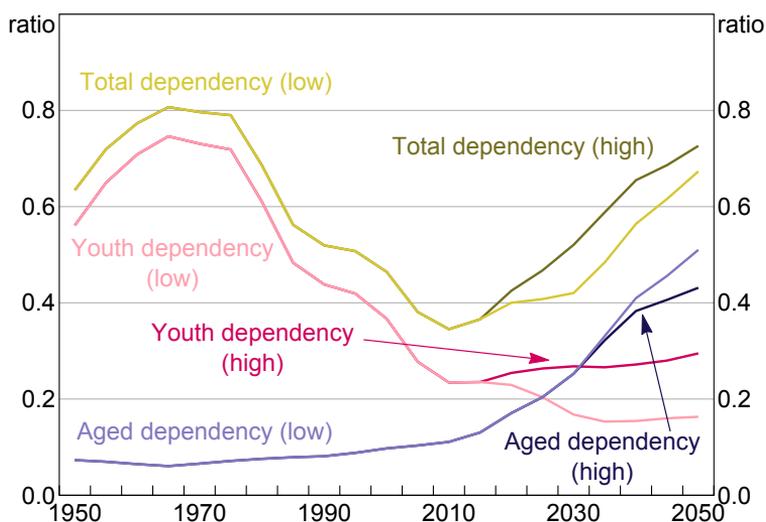
The most direct economic effect of declining fertility, and hence slower population growth, is slower GDP growth but higher per capita income. This result is common to all models with diminishing returns to capital and labour, including the elemental model of Solow (1956) and Swan (1956).³ Chinese policymakers in the past appeared to accept this premise, with demographic goals set in February 1980 including a targeted population of 1.2 billion in 2000 and a population growth rate of zero by that time, specifically intended to support Deng Xiaoping's overall goal of quadrupling China's per capita income between 1980 and 2000 (Feng *et al* 2012). While these demographic targets were not quite met, the per capita income goal was well and truly surpassed and China's present leaders readily credit the one-child policy as being an important contributing factor. On the per capita income costs of the recent reversion to a two-child policy (which we attempt to quantify below) they are, unsurprisingly, less vocal.

A second economic effect of declining fertility, not accounted for in the Solow-Swan model, comes via the change in the age distribution of the population, which alters average labour force participation rates and youth and aged dependency ratios. At first, declining fertility reduces youth dependency and raises the proportion of workers in the population. Income per

³ See Golley and Tyers (2012b) for a more detailed discussion on this point, about which most, but not all, economists agree. See also Solow (1956) and Swan (1956), and the detailed analytical review of offered by Pitchford (1974, ch 4).

capita is therefore boosted, strengthening the basic Solow-Swan result and giving rise to the demographic dividend.⁴ In most related research the proportions of dependents and workers in the population are proxied by simple age classifications: 'youth' below the age of 15; 'working age' between 15 and 65; and 'aged' over 65. Between 1980 and 2010 in China, there was a rapid decline in the total dependency ratio, underpinned by declining youth dependency (Figure 1).

Figure 1: Age Distribution-based Dependency Ratios



Notes: Youth and aged dependency defined, respectively, as the ratio of the population under 15 years of age and the population aged over 65 years to the population aged between 15 and 65 years; high and low refer to the United Nations high- and low-fertility scenarios, on which projections from 2015 onwards are based; the labour force participation rates of each age group are not considered in the construction of these dependency ratios

Source: United Nations (2015)

From 2010 onwards, there is a sharp upturn in total dependency driven by sharply rising aged dependency. Projections based on the United Nations high- and low-fertility scenarios further illustrate that the higher fertility that might be derived from the two-child policy has only a minimal effect on reducing aged dependency by 2050. Indeed, this is more than offset by higher youth dependency, ensuring that total dependency is higher, not lower, under the high-fertility scenario.

This paper builds on the work of Golley and Tyers (2012a, 2012b), who argue that the use of age-based proxies for understanding the links between demographic change and economic growth in China (and indeed elsewhere) is misleading, because they fail to take into account the number of actual workers in the population – as opposed to those of working age. Their more-carefully calculated dependency ratios – described and used in the modelling exercise below – provide at least one piece of good news for China: in contrast with the alarming trend

⁴ See Bloom and Williamson (1998) for a generic discussion of the demographic dividend in developing countries, Bloom *et al* (2010) for a detailed examination of the implications for Asia, and Cai and Wang (2005) for implications for China.

shown in Figure 1, more accurately measured total dependency may fall well into the future, under both high and low fertility assumptions.

Beyond age structure, a slowdown in population growth has implications for the skill composition of the labour force. This, in turn, affects the marginal product of capital and hence the level of investment, as well as relative prices and competitiveness in different sectors of the economy. In China, this skill composition is predominantly shaped by the proportions of the rural (low-skill) and urban (high-skill) populations. In the first three decades of reform, despite the relaxation of the one-child policy in most rural areas to allow a second child if the first was female, the rural population experienced more rapid fertility decline from higher initial levels. This ensured that the bulk of China's demographic dividend stemmed from a surge in the *rural* working to non-working population ratio (Golley and Wei 2013). This, combined with agricultural reforms and the opening of the economy, gave rise to mass rural-to-urban migration, fuelling the rapid expansion of unskilled labour-intensive manufacturing that dominated China's export-led growth. From the mid 2000s onwards, however, slowing rural labour force growth fed into labour shortages in the major export-producing cities of the past, prompting much debate on the timing and consequences of China reaching the Lewisian turning point (Lewis 1954; Cai 2010; Minami and Ma 2010; Golley and Meng 2011). Future fertility trends, particularly as they differ between the skilled and unskilled populations, will continue to shape this debate, with implications for China's competitiveness in all sectors. Our modelling exercise below allows for these fertility distinctions.

Although the dominant economic effects of fertility declines are the slowdown in labour force growth and the change in overall dependency associated with ageing, ageing also tends to reduce national average saving rates. This effect is formalised in Modigliani's (1966) life-cycle hypothesis (LCH), which predicts an inverted U-shaped saving-age profile, in which a rising proportion of workers, particularly middle-aged, in the population will underpin rising saving rates, in contrast with rising shares of youth and young workers or the aged, all of whom tend to be dis-savers. While evidence supporting the applicability of the LCH to China has been mixed in the past, the expectation among most observers is that rapid ageing will contribute to lower aggregate household savings in the future.⁵

Recent work by Choukhamane, Coeurdacier and Jin (2014) complicates the picture further, by introducing various micro-channels through which fertility decline affects individual household saving decisions. They show that an exogenous fertility decline reduces total expenditure on children and hence raises household savings, despite the rise in educational investments for the only child. Compounding this, the 'expenditure channel' is a 'transfer channel' through which parents save more in anticipation of reduced transfers from their child in the future, despite the higher wages that child earns resulting from human capital accumulation. In all, they attribute 60 per cent of the 20 percentage point rise in China's aggregate household saving rate between 1982 and 2009 to the one-child policy, while their two-child policy experiment indicates that the rise in China's aggregate household savings would have been reduced by 6.5 percentage points.

5 For example, Modigliani and Cao (2004) (not surprisingly) find empirical support for it; Chamon and Prasad (2008) find an 'unusual U-shape', with high saving rates in the younger workers and older cohorts; and Horioka and Wan (2007) find that demographic variables have little impact on Chinese saving rates, arguing that high saving rates are likely to persist in China for some time, despite rapid ageing.

Given these factors and compounding the LCH impact of ageing, the results from Choukhamane *et al* (2014) suggest that higher fertility rates – or in other words, two-child policy ‘success’ – will lead to a reduction in the household saving rate. Although operating through a different channel, this is consistent with Du and Wei (2010, 2012), who attribute close to 60 per cent of the rise in household savings in recent decades to rising gender imbalances, themselves a consequence of the one-child policy, among other factors (Golley and Tyers 2014). Their argument rests on the assumption of a ‘competitive marriage market’, in which single men (and their parents) save more in order to compete via wealth accumulation in the face of some 30 million ‘excess men’ of marrying age. The two-child policy is likely to reduce some of this pressure, albeit with a considerable lag, and this channel therefore offers a further possible reason for lower household savings in the future.

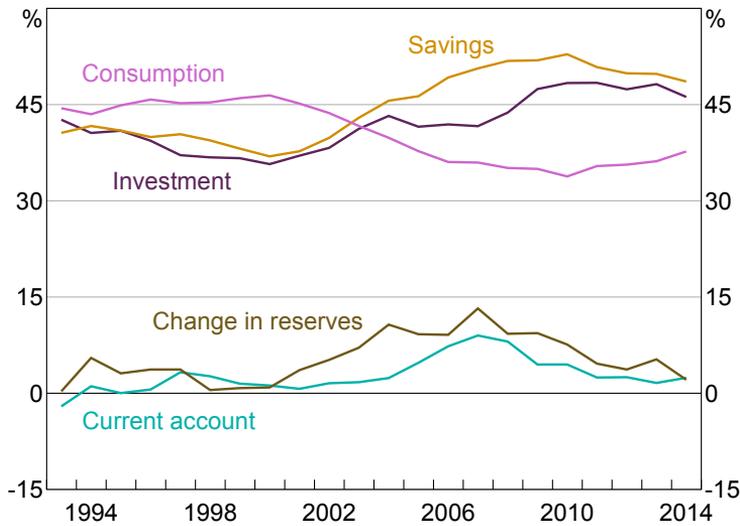
2.2 Savings, rebalancing and growth

Another reason why China’s saving rates are expected to decline in the future is the government’s ‘rebalancing’ strategy, focused in particular on reducing China’s reliance on exports and investment and instead targeting consumption-led growth. While this strategy met with little success under Hu Jintao, Xi Jinping has already demonstrated greater commitment to reforming an economy that had, in the words of Hu’s Premier Wen Jiabao, become ‘unbalanced, uncoordinated and unsustainable’ (Xinhua News Agency 2007). Xi formally announced his reform agenda at the Third Plenum of the 18th Central Committee of the Communist Party of China in November 2013 and, despite still further criticism for its slow pace, there is undeniable progress in major areas of the economy that are likely to underpin rebalancing in the decades ahead. Prominent among these are reforms to agricultural land property rights, inter-governmental fiscal reforms and steps toward addressing high corporate savings in the form of an increase in the share of state-owned enterprise dividends to be transmitted back to the state in order to support the pension and other social welfare systems (Naughton 2014; Orlik *et al* 2014).

The collective effect of these and other reforms will vary across the different sources of savings – households, governments and the corporate sector – and across different age cohorts, creating much uncertainty regarding future trends in China’s national saving rate. Yet it is highly likely that the declining trend in saving rates since 2010 will continue, with the further expectation that this will be matched by the rising share of consumption as a share of GDP (Figure 2).⁶ In recognition of this uncertainty, rather than making concrete predictions about these future trends, we investigate alternative scenarios for changes in age-specific household saving rates.

⁶ There is evidence that the rise in the consumption share of GDP began earlier than the official statistics suggest. See Garner and Qiao (2013) and Huang, Chang and Yang (2013).

Figure 2: Saving Surplus
Share of GDP



Sources: IMF, International Financial Statistics; National Bureau of Statistics of China

While high saving rates have underwritten the key economic imbalance, they have also provided a key source of finance for the high and sustained rates of domestic investment that, along with rapid export growth, has been the dominant driver of Chinese growth in the last three decades. Furthermore, the excess of Chinese savings over investment contributed a third of the rise in global savings since 1990 (World Bank 2013). While much attention has been given to the associated problems that this created across the globe – and particularly in the United States – in most cases, such assessments have been shown to be inaccurate or, at least, oversimplifications.⁷ Indeed, as discussed in detail in Tyers (2015), the bulk of the literature addressing this issue quantitatively finds improvements in terms of both product and financial terms of trade (cheaper light manufactures and cheaper debt) that were large enough to yield net improvements in the real per capita incomes of the advanced regions. The key question that remains is whether lower Chinese savings in the future will eliminate, or at least reduce, the perceived domestic and international problems associated with higher saving, and at what cost? To answer this question, we rely on the global economic model introduced below, which is designed to address the interactions between demographic change, saving decline and economic growth touched upon here.

⁷ See, for example, the literature asserting and depending on the ‘savings glut’ hypothesis, cited in the introduction and Arora, Tyers and Zhang (2015). The American literature critical of China’s macroeconomic policies is also extensive. Bernanke (2005, 2011) offers the outline and Krugman (2010) declares that ‘China is making all of us poorer’. The US macroeconomic position is put in more detail by, amongst others, Lardy (2006, 2012) and Bergsten *et al* (2008). Similar advocacy of policy-induced ‘imbalance’ in China’s growth can be found, still more formally, in Blanchard and Giavazzi (2006).

3. Modelling the Long-run Impacts of Chinese Demographic Change

The approach adopted follows Golley and Tyers (2012a, 2012b), in that it applies a complete demographic sub-model that is integrated within a dynamic numerical model of the global economy. The economic model is a development of GTAP-Dynamic, the standard version of which has single households in each region and therefore no demographic structure.⁸ The version used here has multiple regional households, disaggregated by age group, gender and skill level, each with endogenous saving rates. Complete written details of the model's formulation and calibration are available from the authors on request.

3.1 Demography

Populations are tracked in four age groups, two genders and two skill groups: a total of 16 population groups in each of 18 regions. The four age groups are the dependent young, adults of fertile and working age, older working adults and the mostly retired over-60s. The skill division of the population separates households according to their provision of production (low-skill) labour and professional (high-skill) labour, based on the International Labour Organization's (ILO) occupational classification (Liu *et al* 1998).

Each age-gender-skill group is a homogeneous sub-population with group-specific characteristics: birth rates; sex ratios at birth; age and gender-specific death rates; immigration and emigration rates; and life expectancies at 60. Differences in birth rates by skill level in China and other developing countries are intended to reflect the more readily measured rural–urban dichotomy. The sex ratio at birth is of more importance in the case of China. This is not experimented with here but is assumed to remain high, at 1.17 males per female throughout all scenarios, consistent with the starting point for the baseline scenario of Golley and Tyers (2014). Complete matrices of migration flows between regions are also represented for each age, gender and skill group, the origins of which are described by Tyers and Bain (2015). Immigration rates have base levels that depend on changes in group populations in destination countries but they are also responsive to inter-regional real wage comparisons, constrained by an elasticity parameter designed to represent the 'gatekeeping' roles of immigration policies in destination countries.⁹ A further key parameter is the rate at which each region's education and social development structure transforms low-skill worker families into high-skill worker families. Each year a group-specific proportion of the population in each low-skill worker age-gender group is transferred to high-skill status. These proportions depend positively on the regions' levels of development (proxied by per capita income), the proportion of low-skilled to high-skilled labour and the skilled wage premium.

8 The GTAP-Dynamic model is a development of its comparative static progenitor, GTAP (Hertel 1997). Its dynamics were initially developed by Ianchovichina and McDougall (2000) and presented comprehensively by Ianchovichina and Walmsley (2012). Applications of the standard model with preliminary demography include those by Tyers and Shi (2007, 2012).

9 As emphasised in World Bank Group (2016), while migration surges during periods of conflict, flows through time are overwhelmingly motivated by differences in real per capita income and real wages.

3.1.1 Labour force projections

To evaluate the number of ‘full-time equivalent’ workers we first construct labour force participation rates, by gender and age group for each region from ILO statistics on the ‘economically-active population’. For each age group, a , gender group, g , and region, r , a target country is identified whose participation rate is approached asymptotically. The rate of this approach is determined by the initial rate of change. Target rates are chosen from countries considered ‘advanced’ in terms of trends in participation rates. We then investigate the proportion of participating workers that are part-time and the hours they work relative to each regional standard for full-time work. The result is the number of full-time equivalents per worker and the full-time equivalent labour force, disaggregated by age, gender and skill level.

3.1.2 Dependency ratios

We define and calculate four dependency ratios: 1) a youth dependency ratio is the number of children per full-time equivalent worker; 2) an aged dependency ratio is the number of persons over 60 per full-time equivalent worker; 3) a non-working aged dependency ratio is the number of non-working persons over 60 per full-time equivalent worker; and 4) a more general dependency ratio is defined as the number of non-working persons (including children) per full-time equivalent worker. As an indicator of how these are formulated, the following is the non-working aged dependency ratio, which is of wide policy interest:

$$R_{r,t}^{ANW} = \frac{\sum_{g=m}^f \sum_{s=sk}^{unsk} (N_{60+,g,s,r}^t - L_{60+,g,s,r}^t)}{\bar{L}_r^t} \tag{1}$$

where $N_{a,g,s,r}^t$ is the population in age group a , gender group g , skill group s and region r , $L_{a,g,s,r}^t$ is the labour force in a, g, s and r , and \bar{L}_r^t is the aggregate labour force in r .

3.2 The global economic model

We use a multi-region, multi-product dynamic simulation model of the world economy following the tradition of Dixon and Rimmer (2002). In it the world is subdivided into 18 regions, including, as separate regions, mainland China, Hong Kong and Taiwan. Industries are aggregated into seven sectors: agriculture, light manufacturing, heavy manufacturing, metals, energy, minerals and services. To reflect composition differences between regions, these products are differentiated by region of origin, meaning that the products supplied in one region are not the same as those in the corresponding category produced in others. Consumers substitute imperfectly between versions of such products supplied from different regions. This structure has numerous benefits, including that it allows the representation of intra-industry trade.

3.2.1 Sources of growth

As in most other dynamic models of the global economy, the main endogenous component of simulated economic growth is physical capital accumulation. Human capital accumulation occurs as well, via the skill transformation process built into the demography, but it tends to

have smaller growth effects in this model.¹⁰ Exogenous sources of growth enter the model as factor productivity growth shocks, applied separately for each of the model's five factors of production (land, physical capital, natural resources, unskilled and skilled labour) in each of the seven sectors. Simulated growth rates are very sensitive to productivity growth rates because the larger these are for a particular region, the larger is that region's marginal product of capital. The region therefore attracts higher shares of global investment and hence a double boost to its real per capita income growth rate. The factor productivity growth rates assumed here are based on an early survey.¹¹

A consequence of the dominance of physical capital accumulation in the growth process is that, at least for the world as a whole, an increase in the growth rate of the population raises the growth rate of real GDP but reduces the level of real per capita income – that is, the basic Solow-Swan effect.

3.2.2 Investment

What distinguishes the model from its simpler progenitor is its recursive multi-regional dynamics. Investors have adaptive expectations about the real net rates of return on installed capital in each region. Capital accounts are open so these drive the distribution of investment across regions. In each, the level of investment is determined by a comparison of net rates of return with borrowing rates yielded by a global trust to which a portion of each region's savings contributes. The standard global model takes no explicit account of financial market maturity or investment risk and so tends to allocate investment to regions that have high marginal products of physical capital, driven by rapid labour supply growth. These tend to be labour-abundant developing countries where we know that considerations of financial market segmentation, financial depth and risk limit the flow of foreign investment at present and that these are likely to remain important in the future. To account for this we have constructed a 'pre-baseline' simulation in which we maintain the relative growth rates of investment across regions. In this simulation, global investment rises and falls, but its allocation between regions is controlled. To do this an interest premium variable is initially made endogenous. This creates wedges between the international and regional borrowing rates. They show high interest premia for the populous developing regions of Indonesia, India, other south Asia, South America and Sub-Saharan Africa. Premia tend to fall over time in other regions where labour forces are falling or growing more slowly. Once calculated in this way, the time paths of all interest premia are set as exogenous and regional investment is freed up in all regions. Investment is then retained as endogenous in the model's closure in all subsequent simulations.

3.2.3 Consumption and saving

The 16 groups (based on age, gender and skill) differ in their consumption preferences, saving rates and their labour supply behaviour. National income is first divided between government consumption and total private disposable income for each region. The implicit assumption,

¹⁰ For a model in which human capital accumulation plays a larger role, see Harris and Robertson (2013).

¹¹ In particular, agricultural productivity grows more rapidly than that in the other sectors in China, along with Australia, Indonesia, other east Asia, India and other south Asia. This is due to continued increases in labour productivity in agriculture and the associated shedding of labour to other sectors. In the other industrialised regions, the process of labour relocation has slowed down and labour productivity growth is slower in agriculture. In the other developing regions, the relocation of workers from agriculture has tended not to be so rapid. For China, these shocks are informed by such surveys as that by Wu (2011).

stemming from the design of the original model to serve long-run analysis, is that governments balance their budgets while private groups save or borrow.

In splitting each region's private disposable income between the eight age-gender groups, the approach is to construct a weighted subdivision that draws on empirical studies of the distribution of disposable income between age-gender groups for 'typical' advanced and developing countries. Individuals in each age-gender group then split their disposable incomes between consumption and saving. A reduced form approach is taken to the intertemporal optimisation problem faced by each. It employs an exponential consumption equation that links group real per capita consumption expenditure to real per capita disposable income and the real rate of return on the assets of the collective regional household. This equation is calibrated for each group and region based on a set of initial age-specific saving rates from real per capita disposable income. A mechanism is then added to allow these group-specific saving rates to trend toward long-run targets.

4. Constructing Scenarios

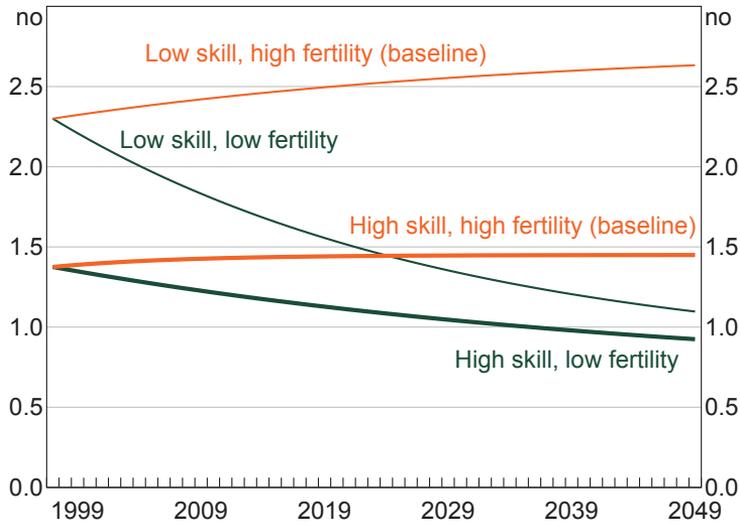
When numerical models are used to analyse shocks, a baseline projection is required as a starting point. This projection is not a *forecast*, since there are many possible shocks that determine the paths of economies through time, most of which prove to be unanticipated. In modelling exercises such as this, baselines are normally chosen to reflect the outcomes perceived as most likely by the modellers. We deviate from standard practice here by instead choosing a baseline in which fertility rates are projected to remain relatively high, and indeed rise through time, sufficiently to stabilise China's population in the long run. Similarly, our baseline savings are chosen to remain relatively high, declining over time but at a slower rate than in an alternative lower saving scenario. As noted in the introduction, our motivation for this is to emphasise the implications of a growth *slowdown* in China, underpinned by a demographic contraction and saving rate declines that stem from welfare and industrial policy reforms and ageing.¹²

4.1 The demographic scenarios

Baseline fertility is designed to return China's average fertility rate to a stabilising level (2.1 children per woman) by 2050, underpinned by fertility increases for both high-skill and low-skill women. This is consistent with the high-fertility scenario of the United Nations (2015), which sets China's total fertility rate at 2.13 for 2045–50. In an alternative (and, we believe, more likely) scenario, China's fertility rates are assumed to fall asymptotically toward one child per woman, similar to the rates observed in Japan and other neighbouring countries and consistent with the low-fertility trap. The fertility rate for low-skill Chinese women is projected to fall more substantially than for high-skill women, following the observed pattern in neighbouring regions (Figure 3). The average falls to a level just above one child per woman, which is in the vicinity of the UN 'low' demographic projection for 2045–50.

¹² Our long-run analysis does not address short-run policy reform priorities that include financial reform and internationalisation of the currency (He *et al* 2012).

Figure 3: Fertility Scenarios
Births per woman



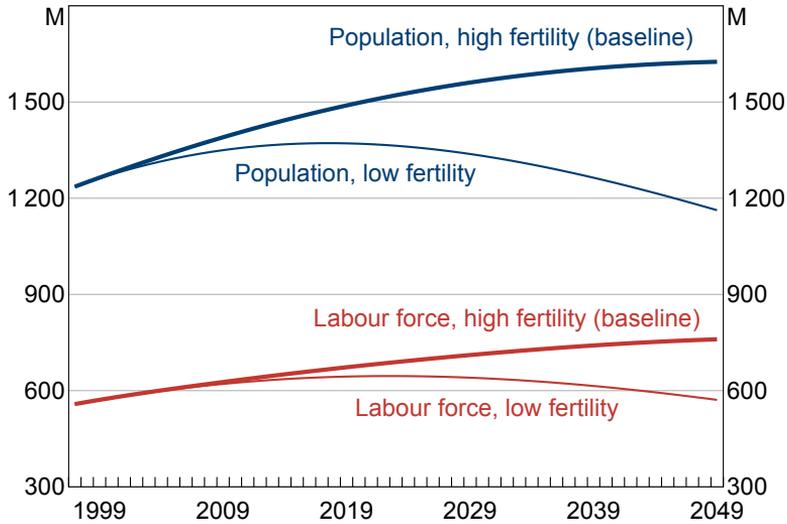
Note: Scenarios constructed as described in the text

China's population and labour force differ substantially under the two scenarios, with the high-fertility scenario ensuring that both continue to rise through to 2050, while under the low-fertility scenario these both decline in the coming decade (Figure 4). Note that fertility is modelled as declining in all other regions as well, consistent with the World Bank Group (2016). Population growth remains vigorous in south Asia, Africa and the Middle East because their most populous age groups are very young and, as these groups age, they raise the labour force participation rate and the total fertility rate. Thus, in a period during which China's labour force shows little net growth, that of India, for example, rises by half. Compared with the rest of the developing world, the low-fertility scenario for China must be expected to constrain its labour supply and hence retard its overall economic expansion.

The effect of these two fertility scenarios on the age structure of the population is illustrated in Figure 5. The baseline restoration of higher fertility stabilises the populations of children and young adults, while the initial age structure of the overall population ensures that the numbers of older working-aged and retirees continue to rise. By comparison, the low-fertility scenario sees an accelerating decline in the numbers of children and young adults. Interestingly, the numbers of older workers and retirees do not rise to the heights achieved in the baseline because smaller populations in the younger age groups cause lower survival rates into these older age groups, which become influential after 2020.

Figure 4: Population and Labour Force

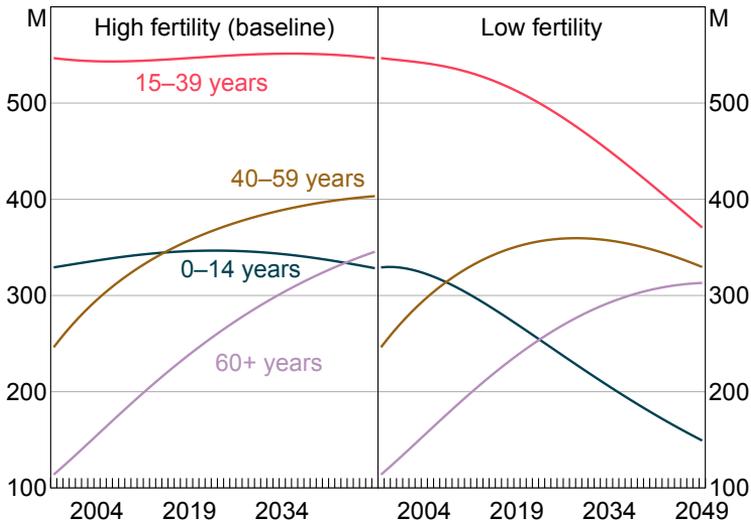
Million persons



Note: Scenarios constructed as described in the text

Figure 5: Changes in Age Distribution

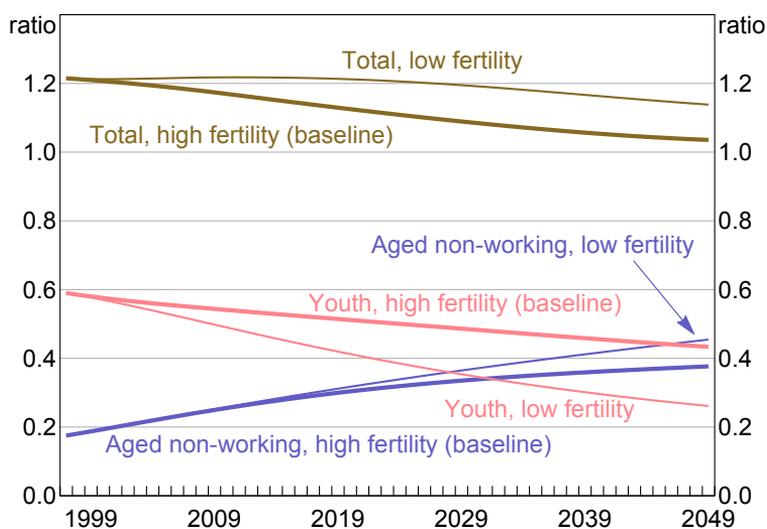
Million persons



Note: Scenarios constructed as described in the text

Associated with these changes in the age structure are dependency ratios. Recall that these are *non-working* dependency ratios and so they account for the different labour force participation rates across groups and, hence, dependents include not only children and retirees but also non-working adults of working age (Figure 6). In both scenarios youth dependency continues to fall through to 2050, most strikingly in the low-fertility scenario. The ageing built in to the initial age distribution continues to push up aged non-working dependency, in both the high- and low-fertility scenarios. While these youth and aged dependency trends are in the same direction as the United Nations' projections, our more precise definitions of dependency have crucial implications. In particular, while the United Nations' total dependency ratio starts to rise in 2010 (as seen in Figure 1), our projections result in declining total dependency all the way through to 2050. According to these projections, ageing may not be as catastrophic as many claim it to be, and the end of China's demographic dividend era may still be a long way off.¹³

Figure 6: Dependency Ratios



Note: Scenarios constructed as described in the text

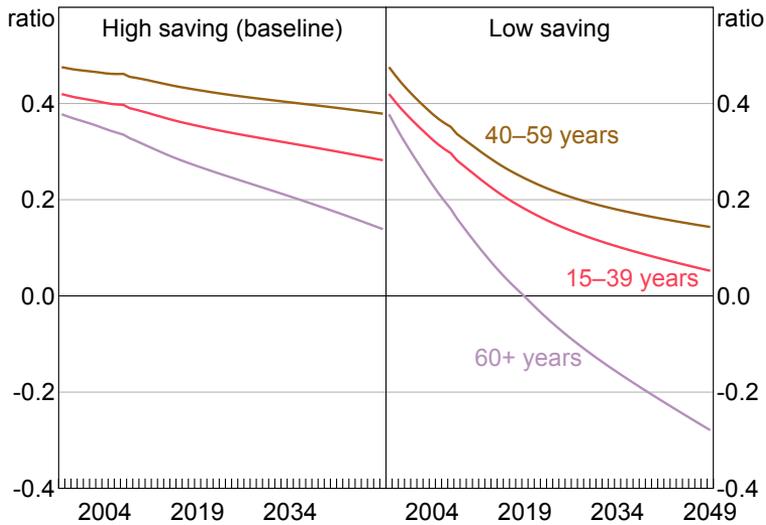
4.2 The saving rate scenarios

Based on the earlier discussion, we offer two Chinese saving rate scenarios (Figure 7). The baseline assumes high saving, in which the rate of decline in group level saving rates is slow enough that China's overall rate does not fall to advanced country levels until it achieves real per capita income parity, well beyond 2050. Note that, because age-specific saving rates differ, the average national rate from GNP applies only to the baseline assumption of high fertility. The average level actually depends on changes in the age distribution indicated. Against these high saving cases we compare a low-saving scenario in which age-specific rates of saving decline quite rapidly, particularly for retirees (60+), so that the rising population of the aged by 2050 is

¹³ This point is discussed at length in Golley and Tyers (2012a, 2012b).

dis-saving at rates similar to those observed in advanced regions. In both cases, these changes in age-specific rates are constructed by specifying long-run exponential declines toward specified targets, while allowing for short-run intertemporal change in response to real per capita income and real interest rate shocks.

Figure 7: Saving Rate Scenarios by Age Group
Savings to disposable private income



Note: Scenarios constructed as described in the text

4.3 Projected overall performance

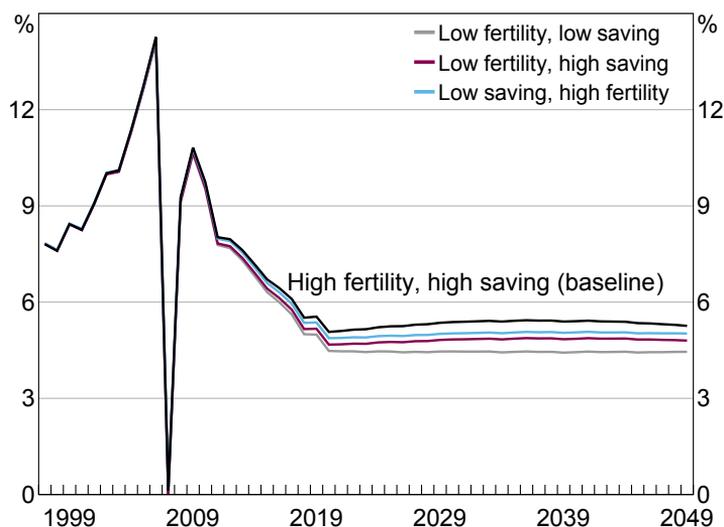
Besides the high-fertility baseline scenario, three projections are made to 2050 (Table 1). In the following section we discuss the implications of these deviations from the baseline for China. We note that the low-saving scenario is consistent with ‘dual policy success’: fertility is assumed to remain high in response to the two-child policy, while rebalancing policies bring the average saving rate down. In the discussion on the international implications (in Section 6) we concentrate on the low-fertility and double contraction scenarios, to emphasise what is of most concern worldwide: a slowdown of China’s GDP growth in the future, brought about by one or both of these contractionary forces.

Table 1: Fertility and Savings Scenarios

		Fertility	
		Low	High
Savings	Low	Double contraction	Low savings
	High	Low fertility	Baseline

The future growth of all the modelled economies depends on three endogenous behaviours – labour force growth, capital accumulation and skill transformation – and on two sets of exogenous projections – productivity growth and investor security (interest premia). Capital accumulation depends on saving rates and each region’s comparative performance in attracting investment from abroad. To a lesser extent, demographic change also depends on comparative performance, through its effects on migration incentives. The underlying productivity projections remain crucial, however, in driving regional growth and accumulation relative to other regions. A consequence of this is that the fertility and saving contractions have comparatively small (but always negative) effects on the *growth rate* of China’s real GDP. This can be seen from the simulated paths of this growth rate (Figure 8). Importantly, the baseline shows stable growth from the present through 2050, which helps maintain the focus of the analysis on demographic and saving rate shocks.

Figure 8: Projected Real GDP Growth
Year-average

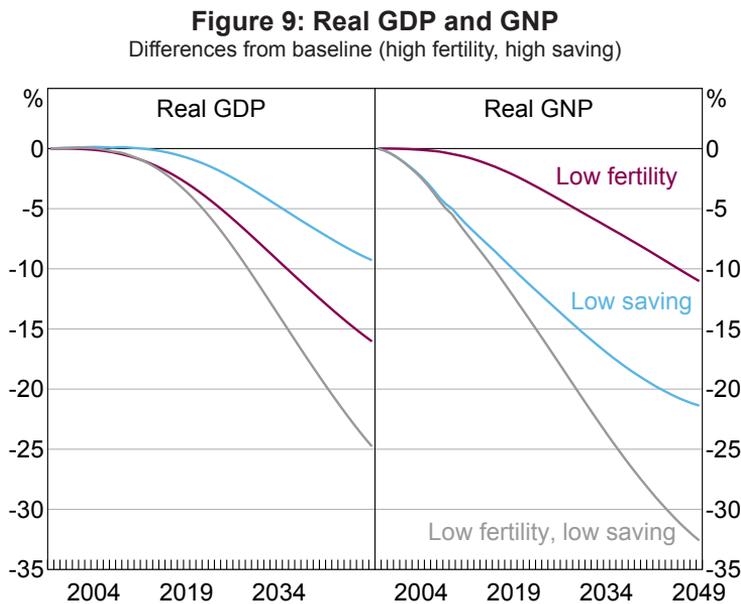


Note: Scenarios constructed as described in the text

5. The Domestic Effects of More Rapid Declines in Fertility and Saving

Here, we discuss the domestic effects of rapid declines in fertility and saving in terms of the labour force, real wages and real per capita income changes, the implications for rebalancing and the changes in sectoral composition. While the real GDP growth rate deviations appear modest, they yield large departures from the baseline in the *levels* of real GDP and real GNP by 2050 (Figure 9). The shortfall in real GNP is comparatively large in the low-saving case because this scenario has greater foreign investment and therefore greater repatriation of capital income. The contraction scenarios have significant implications for the global economy as well: relative to the baseline,

world GDP in 2050 is 3 per cent lower with a Chinese demographic contraction, 6 per cent lower with more rapid savings decline and 9 per cent lower for a double contraction.



Notes: Real GDP is deflated by the GDP price index, while real GNP is deflated by the CPI; scenarios constructed as described in the text

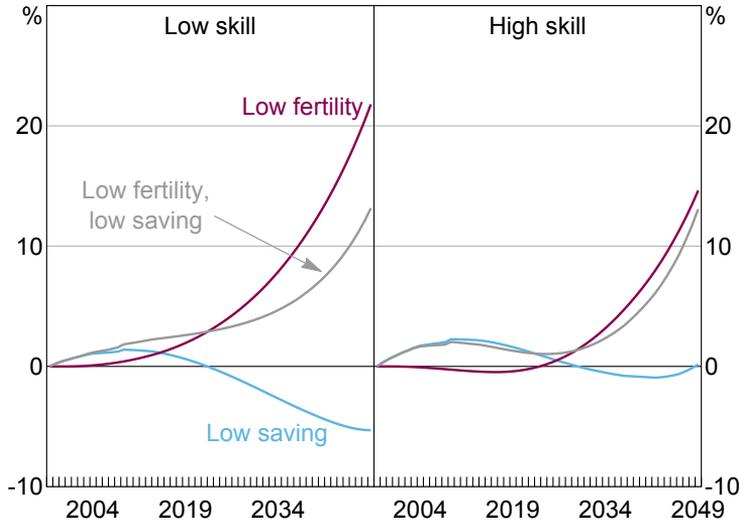
5.1 Labour force, real wage and real per capita income changes

Other things equal, it is obvious that lower fertility should increase real wage growth, due to a reduction in the relative abundance of labour. As simulated, this is particularly pronounced for low-skill labour, because the proportional fertility decline is larger for the low-skill population (Figure 10). This causes real per capita income to grow more rapidly, with the level 20 per cent higher than the baseline by 2050 (Figure 11). This confirms that the average Chinese derives economic *benefits* from lower fertility, in contrast to the projected GDP growth reduction that it brings.

Lower saving also negatively affects projected GDP growth rates, primarily through its effect on Chinese investment. Its effect on real wages is complicated in the short term by historical capital market dynamics, but for low-skill workers (by far the dominant proportion of the workforce) the overall effect is negative, with real per capita income 15 per cent lower compared with the baseline by 2050. In contrast, slower capital accumulation boosts the value-added share of services, which favours high-skill workers, whose real wage is slightly higher than the baseline through to around 2025.

Figure 10: Real Wages

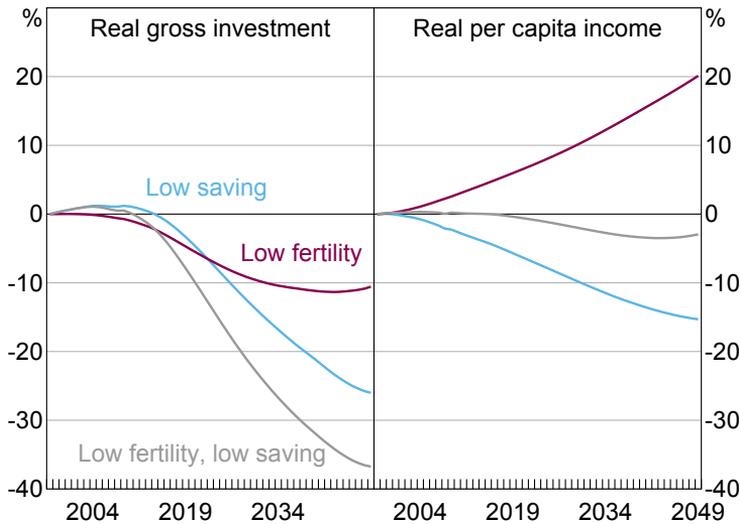
Differences from baseline (high fertility, high saving)



Note: Scenarios constructed as described in the text

Figure 11: Real Investment and per Capita Income

Differences from baseline (high fertility, high saving)



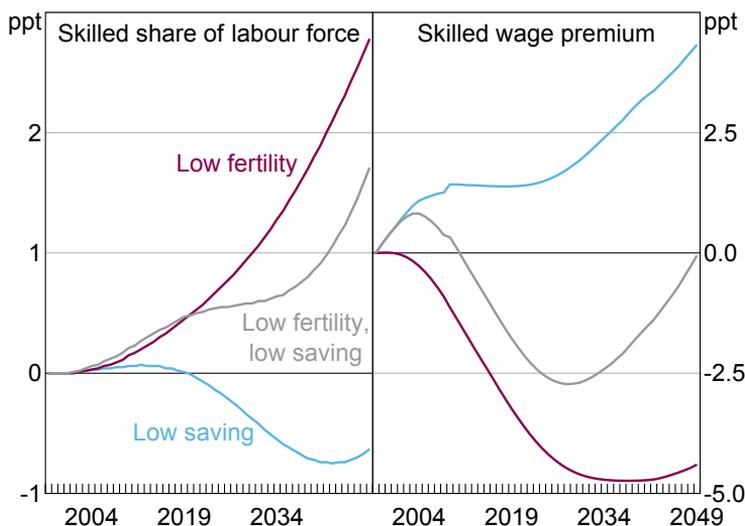
Note: Scenarios constructed as described in the text

A further implication of low fertility is a reduction in the skilled wage premium in the first two decades, stemming from the relatively rapid fertility decline for low-skill females and the relatively large contraction of the low-skill labour force as a consequence. While a lower skilled wage

premium slows the transformation rate from low-skill to high-skill labour, the effect is outweighed by the higher real per capita income that lower fertility brings (Figure 12, left-hand panel).

By contrast, the low-saving scenario sees a rise in the skill-wage premium relative to the baseline, particularly after 2030. The transformation of low-skill into high-skill workers is accelerated by this. But, again, the effect is more than offset by lower real per capita income, so the net effect is a decline in the skill share of the labour force. Thus, if we think of the high-fertility, low-saving scenario as the case of ‘dual policy success’, the results highlight a contradiction: success leads to lower real per capita income and a lower skilled labour force.

Figure 12: Skill Share and Skilled Wage Premia
Differences from baseline (high fertility, high saving)

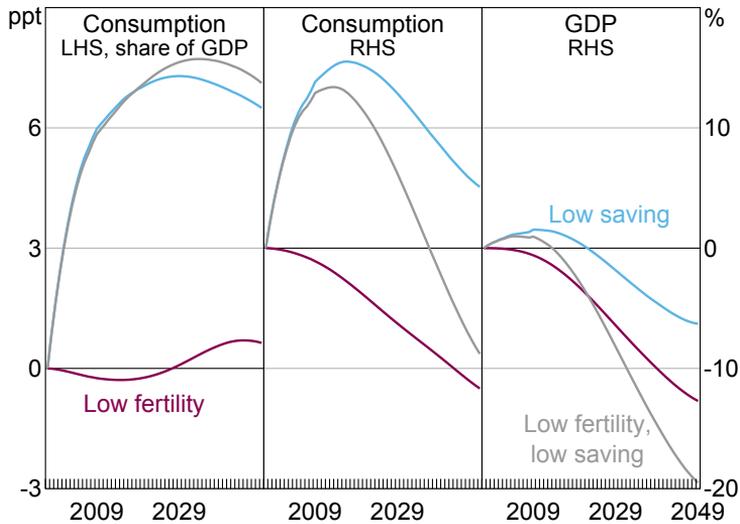


Note: Scenarios constructed as described in the text

5.2 Saving and economic rebalancing

The extent of rebalancing in the economy is more affected by changes in the savings scenarios than changes in fertility (Figures 13 and 14). The low-saving scenarios show more dramatic declines in saving by construction and are therefore expected to yield more substantial short-run rises in consumption and in the consumption share of GDP. In turn, these lead to shifts in the current account toward deficit. The simulated patterns prove a little more complex than this, however, because consumption behaviour depends on real per capita income. In particular, the low-saving scenario results in a very substantial short-run rise in consumption and in the consumption share of GDP, as consumption spending rises relative to the baseline in the early years but falls subsequently as GDP grows more slowly (Figure 13) and incomes (linked to GNP) grow more slowly still (Figure 9). This result stems from two opposing forces. A falling saving rate advances consumption but the resulting decline in real per capita income retards it, with the latter force coming to dominate around 2040.

Figure 13: Consumption and GDP
Differences from baseline (high fertility, high saving)



Notes: Expenditures on consumption and overall GDP are here measured in per cent departures from the baseline where the level measures are relative to the global numeraire; scenarios constructed as described in the text

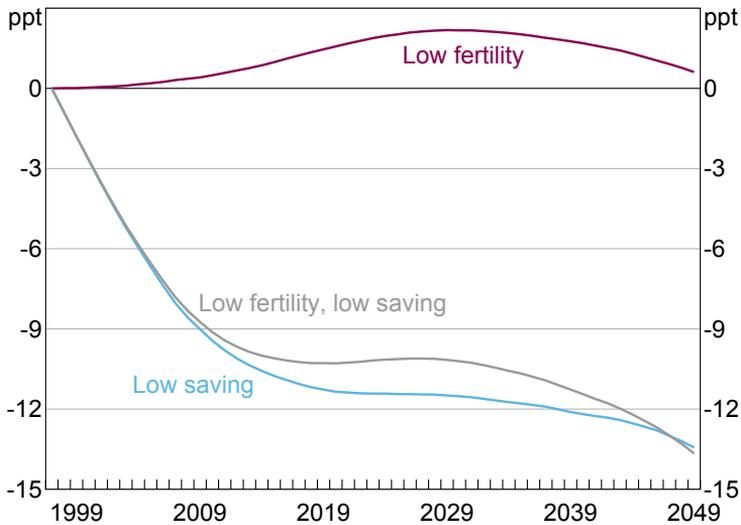
Now consider the low-fertility scenario. The overall saving rates are initially higher in the low-fertility scenario than in the baseline, since expenditure shifts away from children, who do not save, toward retirees, who save less than other adults but more than children.¹⁴ However, throughout the projection period, the influence of the low-saving aged rises and the overall saving rate begins to fall. The net effect in the early decades is a slight fall in the consumption share of GDP (relative to the baseline) that reverses in the later years.

In terms of external rebalancing, the low-saving scenario sees a substantial shift toward current account deficit, ultimately by 14 percentage points of GDP (Figure 14). These changes under the low-saving scenario effectively reverse the imbalance that has been the primary international concern since the 1990s. They have the effect of tightening global financial markets and contracting global investment, as suggested by the higher yields under these scenarios for China and abroad (Figure 15).

¹⁴ As described in Section 4.3, the assumed levels of saving for each age group are the same in the baseline and the low-fertility, high-saving scenario, but the aggregate saving rate is different because of the difference in the age structure of the population.

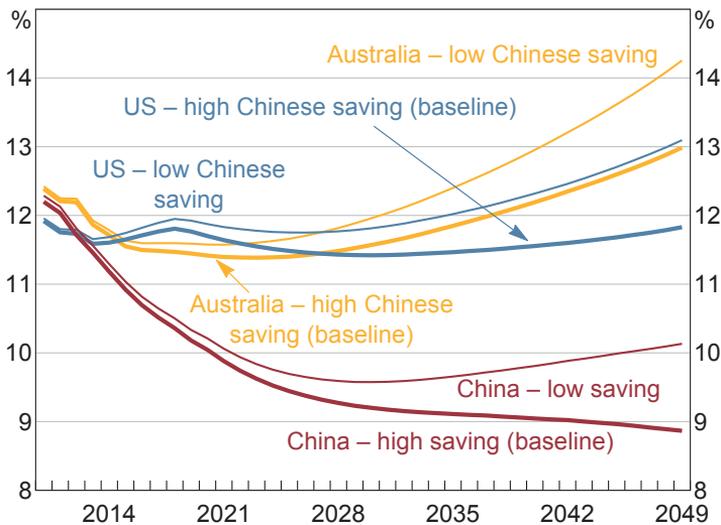
Figure 14: Current Account

Share of GDP, differences from baseline (high fertility, high saving)



Note: Scenarios constructed as described in the text

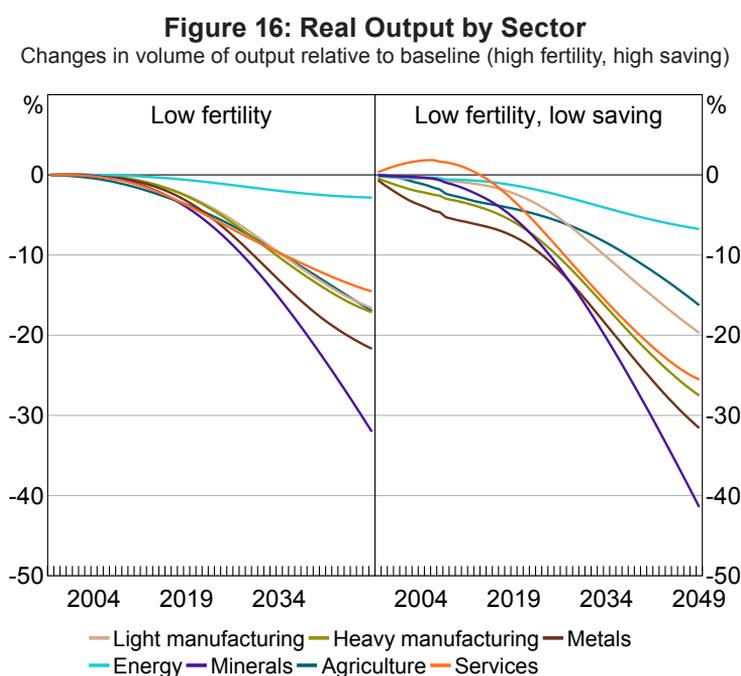
Figure 15: Gross Rates of Return in China, Australia and the US



Notes: This rate of return is calculated as the quotient of annual capital earnings and the value of the capital stock, it is therefore gross of depreciation, which averages at 4 per cent per year in each region; scenarios constructed as described in the text

5.3 Sectoral implications

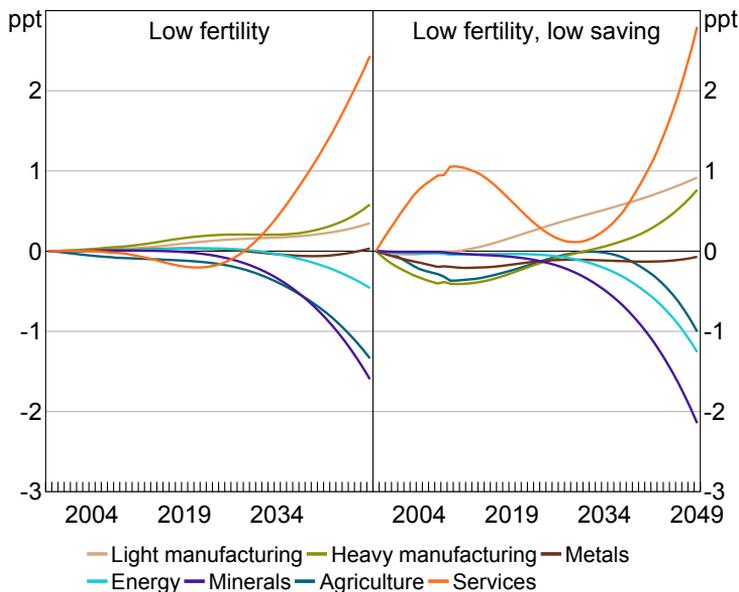
Relative to the baseline, the overall contractions in real GDP due to demographic decline and reduced saving are accompanied by contractions in the output generated in all seven of the industries considered. The primary drivers of these changes are reduced endowments of labour and skill for the demographic contraction and reductions in accumulated capital for the low-saving scenario. When these variable factors are reduced relative to the fixed factors, land and natural resources, the relatively advantaged sectors are agriculture and energy (Figure 16). On the other hand, the greatest contractions are in the sectors most intensive in labour and capital, namely metals, minerals and manufactures. As expected, the contractions are larger when fertility decline is coupled with low saving. This is because, while the rate of capital accumulation is reduced with demographic contraction alone, it is much more affected by savings decline.



Note: Scenarios constructed as described in the text

By comparison with the baseline, the contraction scenarios raise domestic labour and capital costs, tending to boost value added in some industries even while their output volumes contract. The pattern of change in value-added shares is therefore slightly different from those in final output volumes (Figure 17). The value-added shares of manufacturing and services expand, while those of minerals, metals and agriculture contract. Significantly, after 2030, when the demographic contraction is strongest, there is a substantial increase in the share of services. This is a price effect associated with the rising relative costs of labour, skill and capital, the factors on which services exclusively depend. The fact that services cannot easily be substituted with imports causes their product price to rise more than others. Moreover, their comparative intensity in high-skill labour tends to raise the skill premium.

Figure 17: Value-added Shares by Sector
 Change relative to the baseline (high fertility, high saving)



Note: Scenarios constructed as described in the text

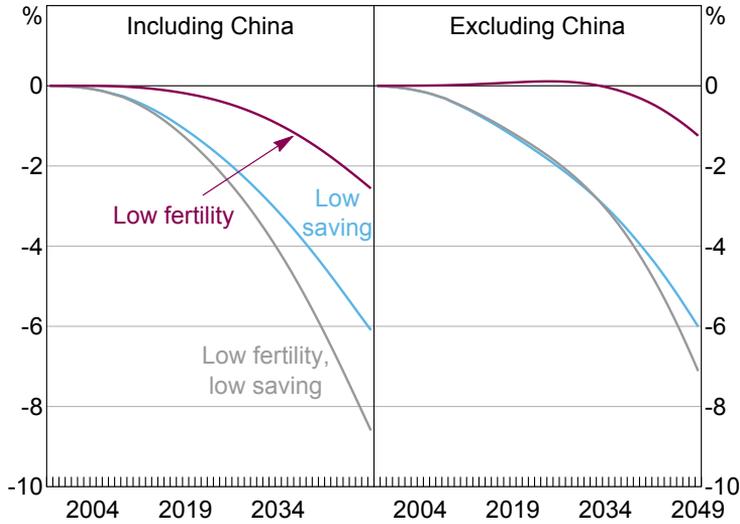
6. The View from Abroad

The effects of lower Chinese fertility and saving on foreign regions are transmitted through finance and trade. While demographic change alone has modest effects on global financial markets, reduced Chinese saving tightens them substantially. By 2050, the extent of financial tightening varies across regions but is approximately 130 basis points per annum in China, the United States and Australia. This reflects the loss of Chinese saving that finances new investment globally in the baseline scenario. Tighter financial markets and a smaller Chinese labour force turn out to have considerable effects on global growth: in the worst-case scenario of a double contraction, world GDP in 2050 is 9 per cent lower than the baseline, or 7 per cent lower if China is excluded (Figure 18).

Clearly, by 2050, China’s economic performance will be very significant for global welfare. The distribution of effects on other regions depends on the level of China’s financial integration and on the direction and composition of its trade flows. The model assumes a high level of financial integration and little financial discrimination across regions.¹⁵ It retains considerable momentum in the direction of trade flows, however, and so Chinese shocks might be expected to significantly affect regional welfare via idiosyncratic changes in real exchange rates and the terms of trade. The product-specific effects are discussed in the next sub-section. Before doing so, however, it is useful to consider changes in real exchange rates.

¹⁵ This is a consequence of the characterisation of international capital flows as via an intermediary ‘global trust’, which receives investment, rewards it at a globally common rate and distributes it across destination regions according to rates of return. A full bilateral representation of financial flows is being developed.

Figure 18: Global GDP with and without China
Relative to baseline (high fertility, high saving)



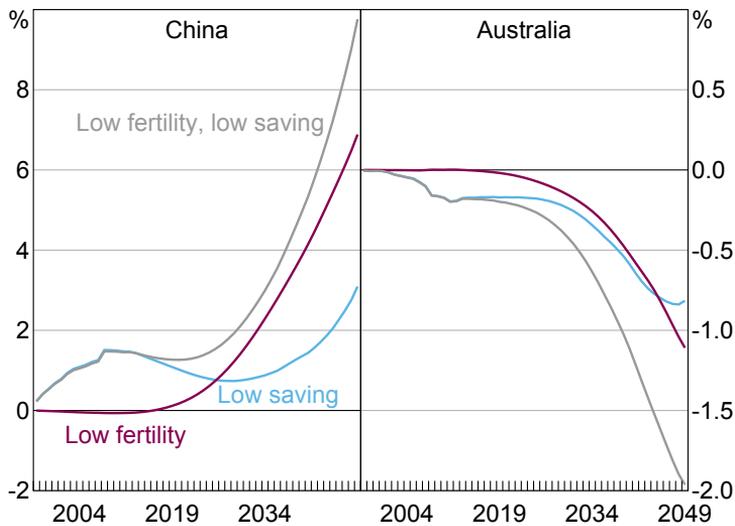
Note: Scenarios constructed as described in the text

Real exchange rates are modelled bilaterally against the US dollar, calculated as the ratio of the regional GDP price with that of the United States. These bilateral rates are then combined with trade shares to calculate trade-weighted indices, or real effective exchange rates for each region. For China, regional shocks contracting essential factors of production, like labour and physical capital, tend to raise comparative costs and therefore appreciate the region's real effective exchange rate (Figure 19).¹⁶ In smaller regions that depend on exports to China, such as Australia, the Chinese contractions reduce global demand for their products and so lower their prices relative to the products of other regions. Thus, they cause real depreciations.¹⁷

¹⁶ For comprehensive surveys of the determinants of China's real and nominal exchange rates, see Tyers and Zhang (2011, 2014).

¹⁷ The historical effects of China's pre-global financial crisis growth surge on Australia's real effective exchange rate were larger than indicated in Figure 19. The model used here is long run in orientation (physical capital is mobile between industries) and so it under-represents the very sharp spikes in commodity prices in this period.

Figure 19: Real Effective Exchange Rates
Relative to baseline (high fertility, high saving)



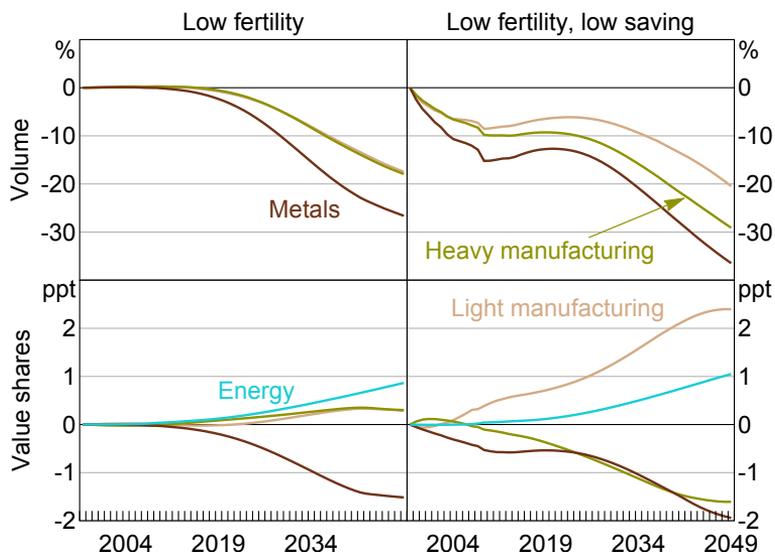
Notes: Real effective exchange rates are trade-weighted indices of GDP price ratios; scenarios constructed as described in the text

6.1 Effects on the volume and composition of China’s exports and imports

China’s total trade, unsurprisingly, takes a lower growth path under the low-saving and low-fertility scenarios relative to the baseline. Its variable factors of production shrink and, at least in the short run, low-saving scenarios raise home consumption expenditure, which can be expected to reduce exports and boost imports. In the long run, slower population growth and more rapid savings decline reduce Chinese economic activity, and so trade flows also take a slower path (Figure 20). Of particular interest abroad, however, are the product compositions of China’s import and export values (Table 2).

Figure 20: Changes in Chinese Exports

Relative to baseline (high fertility, high saving)



Notes: Changes smaller than 1 per cent are not shown; scenarios constructed as described in the text

Table 2: Share of Chinese Export Values

Per cent

	Baseline		Alternative scenarios – 2050	
	2015	2050	Low fertility, high saving	Low fertility, low saving
Agriculture	0.1	0.1	0.1	0.1
Light manufacturing	29.9	26.6	26.9	29.0
Heavy manufacturing	54.7	56.0	56.3	54.4
Metals	11.2	15.0	13.5	13.0
Energy	1.6	1.3	2.1	2.3
Minerals	0.3	0.1	0.0	0.0
Services	2.2	1.0	1.1	1.1
Total	100.0	100.0	100.0	100.0

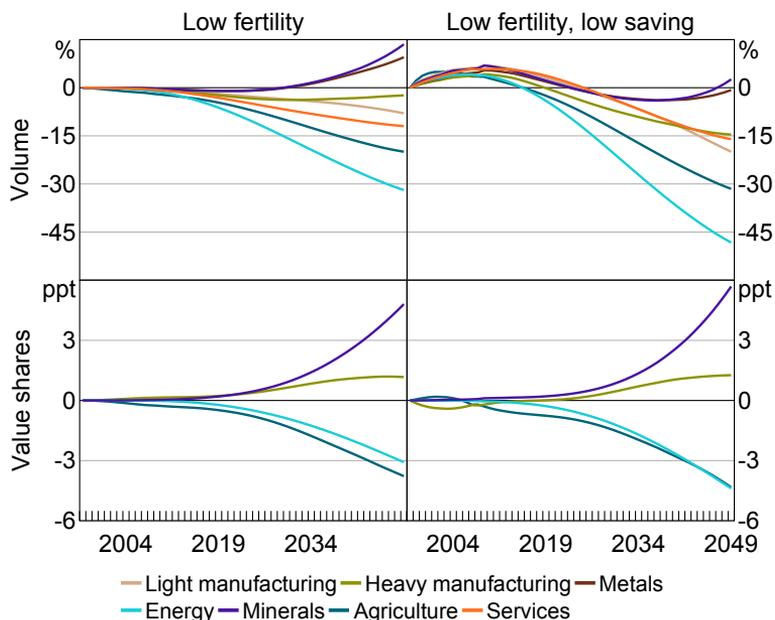
Notes: Data for 2015 are as simulated, with calibrated intermediate shocks, from a 1998 database; scenarios constructed as described in the text

It is understandable that, in the baseline case, the rise of the skilled labour force, combined with continued rapid capital accumulation, should see expanded exports of heavy manufactures. While these come to dominate China's trade, exports of metals assume a significant role. This is a figment of the exogenous productivity shocks embodied in the baseline, from which most of our analysis is independent. In this instance, however, the rise of metals exports does affect both the initial export shares and the changes that take place in them. This characterisation reflects the experience of both Japan and South Korea, which became exporters of processed metals as the growth in their domestic use subsided.

More broadly, the shares might be expected to respond to changes in China's pattern of comparative advantage, due to the new trajectories of its factor endowments and its real exchange rate. While the simulated pattern is consistent with these underlying forces, the actual departures from the baseline are surprisingly small. The low-fertility scenario has the shares of total exports devoted to energy and manufactures expanding relative to the baseline, while the metals export share contracts. When the savings contraction is added, the effects are larger, with the baseline trend toward heavy manufacturing exports reversed in favour of a return to dependence on light manufacturing exports. Again, the share of metal exports falls and that of energy exports expands.

On the import side there is considerable diversity in outcomes relative to the baseline (Figure 21). Most conspicuous is the short-run increase in imports that results from higher consumption expenditure in the low-saving scenario. Beyond 2020, however, the effect of slower capital accumulation and labour force growth on domestic income comes to dominate and imports contract relative to the baseline. The changes in import composition turn out to be more robust to the type of shock delivered. Relative to the baseline, whether the scenario is slower population or slower saving growth, the share of imported minerals rises while the shares of energy and agricultural products contract. Metal exports constitute 15 per cent of export revenue in the baseline, suggesting that China will follow Japan and South Korea in becoming an exporter of steel and other metal products. With contracting population and savings, metal production contracts relative to the baseline and metal exports contract in share. But the relative decline in overall imports sees the share of this eventually export-oriented industry's mineral inputs expand.

Figure 21: Changes in Chinese Imports
Relative to baseline (high fertility, high saving)



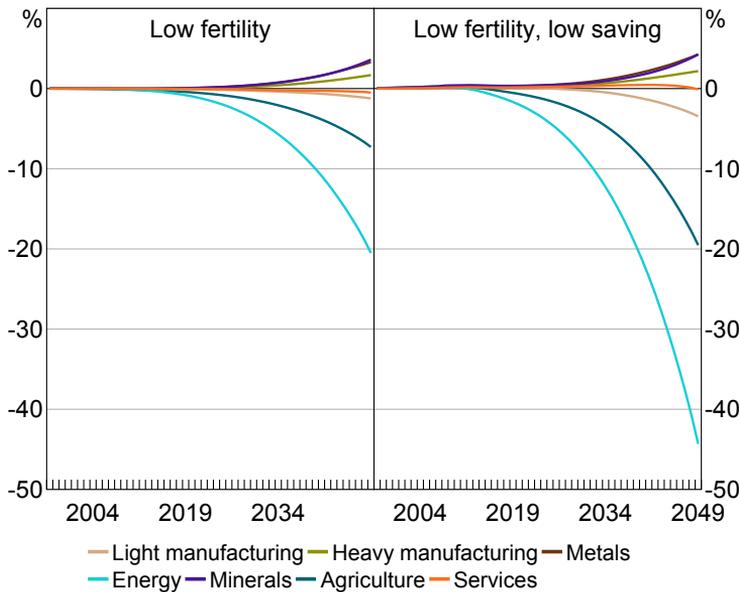
Notes: Changes smaller than 1 per cent are not shown; scenarios constructed as described in the text

6.2 Changes in international prices and real per capita income abroad

These changes in China’s trade lead to corresponding changes in international trading prices and hence in the terms of trade faced by other regions (Figure 22). For the products that dominate world trade, namely manufactures, the changes due to China’s low fertility and low saving are small. But the effects are very large for agriculture and energy products, most particularly in response to slower Chinese saving growth. The results suggest that a slowing Chinese economy will continue to have a significant negative effect on energy markets.

Figure 22: World Trading Prices

Changes in average world prices (relative to US GDP deflator) relative to baseline (high fertility, high saving)

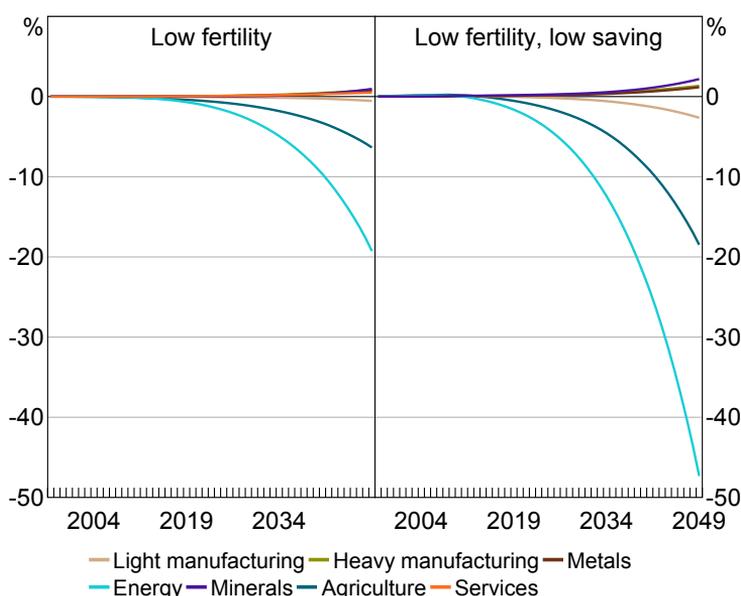


Notes: These are bilateral trade-weighted trading prices by product, recognising that the model treats regional products as differentiated and so prices can differ by trading route; scenarios constructed as described in the text

Because the model characterises products as being differentiated by region of origin, international prices differ by trading route. This recognises that the composition of product groups in exports differ across trading routes. In Australia's case, energy exports are projected to continue through 2050, but implicit in the behaviour embodied is that those energy exports are dominated by coal. A demographic contraction alone affects Australia's export prices less than the global average, but when a savings reduction is added Australia's energy exports are more affected than the others and so Australia's energy export price falls by more than the global average, relative to the baseline (Figure 23). Quite clearly, Australia is little affected by a Chinese demographic contraction alone but it is affected very substantially by a decline in China's savings and hence in the capital intensity of its future growth and its products.

Figure 23: Australian Export Prices of Tradeable Products

Changes in prices (relative to Australia's GDP deflator) relative to baseline (high fertility, high saving)



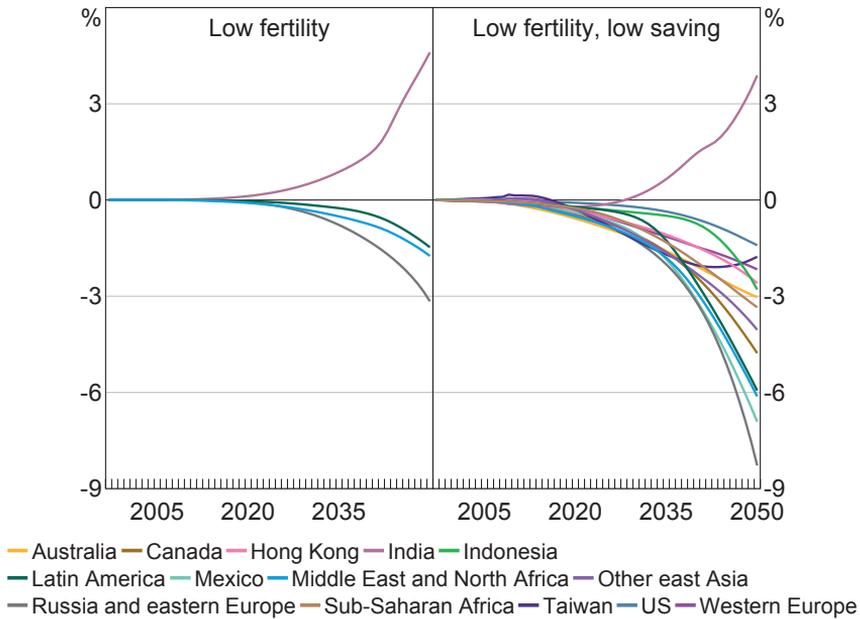
Note: Scenarios constructed as described in the text

Perhaps the best bottom line measure of the international welfare effects of low Chinese fertility and saving is the change in regional real per capita income (Figure 24).¹⁸ Two regions stand out as being most affected by the Chinese slowdown. The first is India, which benefits, especially from the demographic contraction. It is the alternative large and populous economy and, as modelled at least, its low real wages, comparatively rapid population growth and rising share of workers in the population leave it poised to take over the industrial path of China.¹⁹ The comparative slowness of its economic policy reforms and the bias against manufacturing that is embodied in its labour laws are not accounted for in this analysis. Thus, the simulations suggest that slower Chinese growth benefits India by making energy and food cheaper and by creating room for a growing Indian manufacturing industry. At the other end of the spectrum is the composite region, Russia and eastern Europe. As a large energy exporter this region suffers a substantial decline in its terms of trade, particularly when there is both a demographic and a savings contraction in China.

¹⁸ Real per capita income is defined conventionally as household income divided by the population and deflated by the consumer price index, all of which are carried by the model.

¹⁹ For details on India's pending demographic dividend, see the comparative analysis with China by Golley and Tyers (2012a, 2012b).

Figure 24: Real per Capita Income
 Changes relative to baseline (high fertility, high saving)



Notes: Note that regions affected by less than 1 per cent are excluded; scenarios constructed as described in the text

Most other regions are also net losers from the loss of Chinese economic activity, though mainly from the loss of Chinese savings and therefore the higher cost of capital each must bear. (Table 3). In Australia’s case, the net effect of the deterioration in the financial terms of trade in the low-saving scenario combines with a marginally negative product terms of trade change. A stronger negative terms of trade effect is avoided by the significantly lower Chinese manufactured export prices and the comparative stability of Chinese mineral import volumes, at least as modelled.

Table 3: Effects of Low Fertility and Low Saving on Real per Capita Income in 2050

Relative to baseline (high fertility, high saving), per cent

	Low fertility, high saving	High fertility, low saving	Low fertility, low saving
Australia	-0.1	-2.9	-3.0
United States	-0.3	-1.1	-1.4
Canada	-1.5	-3.5	-4.8
Mexico	-0.8	-6.2	-6.9
Western Europe	-0.9	-1.4	-2.2
Russia and eastern Europe	-3.2	-5.2	-8.3
Japan	-1.0	0.8	-0.4
China	20.7	-15.4	-2.7
Taiwan	-0.7	-1.0	-1.8
Hong Kong	-1.3	-1.4	-2.6
Indonesia	-0.1	-2.9	-2.8
Other east Asia	-0.6	-3.6	-4.0
India	4.6	-0.3	3.9
Other south Asia	0.8	-1.6	-0.8
Latin America	-1.5	-4.7	-5.9
Middle East and north Africa	-1.7	-4.7	-6.1
Sub-Saharan Africa	-0.9	-2.7	-3.3
Rest of world	-1.6	-3.2	-4.7

Note: Scenarios constructed as described in the text

7. Conclusions

This paper sets out to assess the importance, both within China and abroad, of a number of conundrums facing Chinese leaders as they embark on a new phase of development in which slower GDP growth is being portrayed as the 'new normal'. Using a dynamic global economic model with full demographic behaviour to project through to 2050, a quantitative perspective is offered for many, if not all, of the complex linkages between China's demographic change, saving rates and economic performance. The results support the following points.

First, fertility levels rising toward population sustainability levels would indeed contribute to higher rates of GDP growth, an increase in the proportion of children and a reduction in the proportion of aged people in China in the decades ahead, as well as providing a modest source of higher domestic consumption. Our analysis confirms that these effects would be small – amounting to less than half a per cent per year of GDP growth and a reduction in aged dependency by 0.03 percentage points. Furthermore, higher fertility would come at a significant cost in terms of per capita GDP, reducing its level by 21 per cent in 2050 compared with the low-fertility scenario.

Second, we consider the case in which fertility rises toward population sustainability levels but there is more rapid savings decline, induced by a range of policy reforms. We think of this as the 'dual policy success' scenario. It would result in a rebalancing of the domestic economy towards consumption, while shifting China's external balance away from surplus and toward deficit. Yet, the associated decline in China's rate of capital accumulation and a relative increase in foreign ownership of home capital would see this coming at a significant cost to China's future income. Indeed, its real household income per capita would be 15 per cent lower than the baseline scenario by 2050. This reduction in per capita income would translate into *lower* consumption in the longer term, with the slowdown being substantial enough to bring about a fall in consumption as a percentage of GDP from around 2035. Moreover, the lower growth path of real per capita income resulting from both lower savings and higher fertility would cause the high-skill share of the labour force to decline relative to the other scenarios, impeding China's ongoing efforts to upgrade its industrial structure.

Third, the final scenario considered has declines in both fertility and saving rates, according most accurately with our expectations, notwithstanding considerable uncertainty about both. We refer to this as the 'double contraction' scenario and it is the one where the implications for the global economy prove to be most apparent. Not surprisingly, it yields slower population and labour force growth and a significantly lower growth path for all Chinese economic activity. While the boost to China's domestic consumption from lower savings is shown to boost imports in the short term, beyond 2020 this outcome is reversed in all but minerals, which, as modelled, feeds a domestic metals industry that becomes export oriented following the experience of South Korea.

Finally, our results do *not* imply that we do not support the Chinese Government's decision to abolish the one-child policy: the non-economic benefits of this shift are, quite simply, immeasurable. Rather, they call for recognition that a two-child policy – were the people to respond to it – is not a first-best policy option for tackling either China's growth slowdown or its ageing problem. The fact that the bulk of recent demographic research indicates that China's fertility rates will not, in fact, rise to the levels implied by our baseline adds further weight to this call. Likewise, our results *do not* imply that rebalancing the Chinese economy is necessarily a bad idea. Rather, this paper highlights the need for alternative sources of growth if China is to fend off the negative outcomes that its current 'dual policy objective' implies. Raising the productivity of all factors of production (labour, land, capital and natural resources) and speeding up the pace of skill transformation (or human capital acquisition) seem like the obvious places to look for replacing the physical capital accumulation that has been the dominant driver of growth in the past, and that will inevitably decline in the future. Increasing labour force participation rates – by simple measures such as raising the statutory retirement age (planned for 2017), and by more complex reforms to the welfare and *hukou* systems – would directly tackle China's ageing problem and provide an additional source of growth as well (Golley and Tyers, 2012a, 2012b). Exploring the positive effects that these could have on both the Chinese and global economies remains the task of another paper.

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Discussion

1. Leon Berkelmans

The purpose of this paper is straightforward. Jane Golley, Rod Tyers and Yixiao Zhou use a model of the world economy to assess the effects of changes to fertility and savings behaviour in China.

The model itself is a rich worldwide model, incorporating demographics, where the major endogenous influence on growth is capital accumulation.

The main message of the paper is that the Chinese authorities face some conundrums. First, while a fall in saving rates will help rebalance the economy, it will lead to less capital accumulation and a decline in GDP growth. Second, while increasing fertility results in faster economic growth and lower aged dependency, it leads to lower per capita incomes through familiar Solow-Swan-type dynamics.

While there are many interesting modelling issues to be teased out, for example how assumptions about international capital flows affect the results, I will focus my comments on some higher-level issues. I have three main comments: consumption per capita is a better measure of welfare than GDP; the aggregate effects of this are small; and the distributional effects might not be small.

Comment 1: Consumption per capita is a better measure of welfare than GDP

We write utility as a function of consumption rather than other components of GDP. If we focus on consumption per capita as an object of policy, then some of the conundrums the authors focus on fade somewhat.

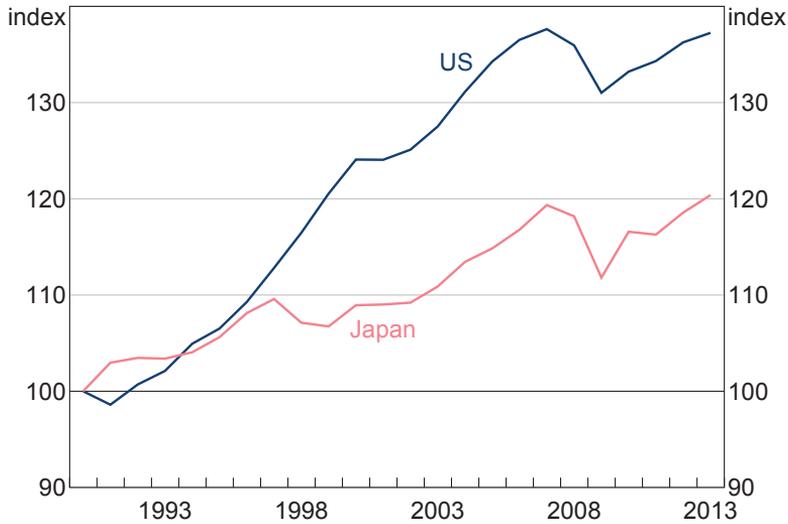
Take, for example, lower savings. Figure 13 of the paper shows that consumption is higher under a low-saving scenario in the long run. Because the low-saving scenario does not reflect any changes in demographics, this is also what happens to consumption per capita.

It appears, therefore, according to this model, that Chinese savings is above the 'Golden Rule' level of savings that drops out of the Solow model. In which case, the policy prescription is relatively clear: the saving rate at the moment is too high.

Determining what happens to consumption per capita in the low-fertility scenario is a little more complicated given that population numbers change, but it does appear that consumption per capita increases with lower fertility.

In any case, in an economy with rapidly changing demographics, GDP per capita can give an incomplete picture of welfare. Take, for example, Figure 1, which shows Japanese and US GDP per capita since 1990. Japanese per capita GDP has substantially lagged behind the evolution of US GDP per capita.

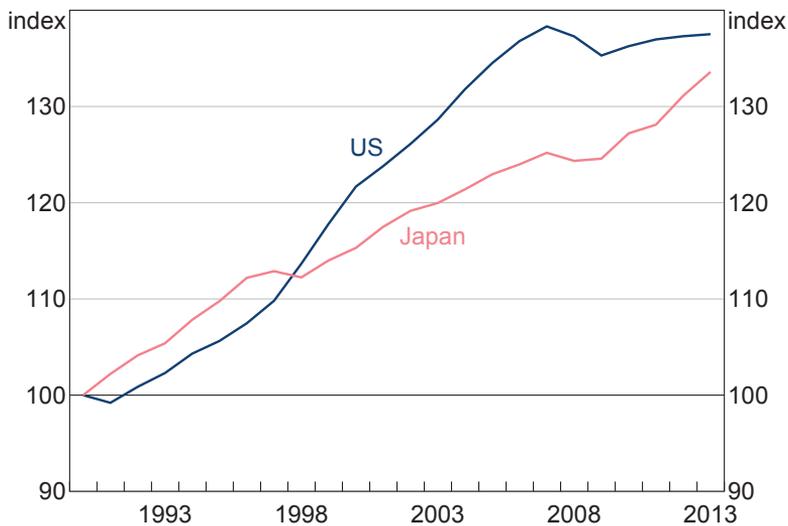
Figure 1: GDP per Capita
1990 = 100



Source: OECD

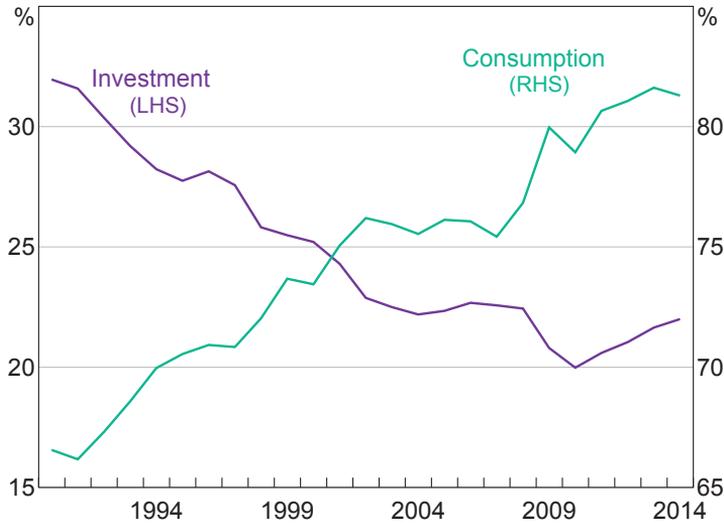
However, if we look at consumption per capita (in this case, private and government consumption), as in Figure 2, the Japanese economy's comparative performance is much better, because the share of Japanese GDP devoted to investment has fallen over the years (Figure 3). As the Japanese population has started to shrink, less capital has been needed to complement the available labour in the workforce and investment has fallen.

Figure 2: Consumption per Capita
1990 = 100



Source: OECD

Figure 3: Japan – Consumption and Investment
Per cent of GDP



Sources: Author's calculations; OECD

Therefore, in a rapidly aging society, consumption will grow faster than GDP. GDP may also miss other features. For example, fast-growing economies may see their terms of trade move against them, as the supply of their goods and services expands rapidly (Acemoglu and Ventura 2002).

While consumption per capita is a better welfare measure, it is by no means perfect. Lifting the restrictions associated with the one-child policy undoubtedly improves welfare and choice, but these improvements will not be picked up by the national accounts.

Another potential reason that consumption, as measured by the national accounts, is an imperfect measure of welfare is that in a rapidly aging economy many people are retiring from the workforce. It is well known that when people retire, measured consumption falls. However, Aguiar and Hurst (2013) pointed out this fall is concentrated in areas where home production is a good substitute, for example food preparation, or areas that are complementary to work, for example travel associated with commuting. In either case, the drop in measured consumption does not reflect a fall in welfare.

Comment 2: The aggregate effects are small

The uncertainties regarding China's economic evolution over the coming decades are large and there is widespread disagreement. Some observers suggest that China could sustain a growth rate of 8 per cent for decades (Lin 2012), while others think 3–4 per cent is an upper bound (Pettis 2013).

Figure 8 of the paper shows the range of GDP growth outcomes associated with the different assumptions about savings and fertility, which spans around 1 percentage point per year out to 2050. In the context of the overall uncertainty of Chinese GDP prospects, and even past variability, 1 percentage point looks rather small, even though, for most economies, it would be significant.

This is a valuable message. There is much angst about China's demographic prospects and what that implies for the economy. This paper provides an important counter to that message. According to the model, the Chinese economy will continue to grow, even in the shadow of a shrinking working-age population. Moreover, anything that you do to change the demographic characteristics will not buy you much compared to the overall uncertainty regarding China's medium- to long-term outlook.

Comment 3: The distributional effects might not be small

Pension expenditures are substantial in many countries. It may be the case that the Chinese Government will also incur a large expense. If that is the case the transfer from the working-age population to the older members of the economy could represent a considerable redistribution of income.

This model may be well suited to run these numbers as different age groups are tracked as part of the model. At the moment, it is assumed that the government's budget is balanced, but that could be relaxed. Assumptions could be made about tax revenues and government expenditures, so as to develop a path of government debt. This would be an exercise much like Australia's Intergenerational Report, and would help highlight some of the stresses that will be placed on the budget, and whether some generations may be asked to contribute more than others.

Other

This model is quite rich, and there is much from the paper I have not covered. In particular, the effects on the rest of the world are worthy of a paper on their own.

That richness is an asset. There are many directions this model could be taken. The extension toward distributional considerations that I have suggested is just one example.

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2. General Discussion

The discussion began with comments about factors other than fertility that could affect China's saving rate. One participant suggested that increased longevity could raise the saving rate as people save more to fund the expected extra years in retirement. Another participant questioned how the results would be affected if retirement ages in China were increased, as has occurred in many developed economies. A number of participants also suggested a more balanced gender

ratio in China, for example, as a result of relaxing the one-child policy, may lead to a decline in the saving rate.

One participant was interested in how technological progress is captured in the model, citing the increased use of robots in some production processes in China. Another participant also discussed the possibility of allowing technology to change over time in the model or including technology as an endogenous variable. Rod Tyers explained the aim of the current model was to show the difference between economic performance under the different fertility and saving scenarios, abstracting from technological changes. However, he agreed that there were likely to be interactions between the saving rates, the demand for technological change and expected future income and that the authors had considered using a long-run forward-looking closure to capture these interactions.

One participant questioned how changes in the quality of labour and accumulation of human capital are incorporated into the model. Jane Golley suggested the quality of labour is affected by changes in fertility policies. The one-child policy was more strictly implemented in urban areas where workers are higher-skilled on average, and has reportedly reduced the quality of labour in aggregate. She explained that while the model does not fully account for the rural–urban divide, it does distinguish between high-skill and low-skill labour. In the high-fertility scenario, there was a larger increase in the rural population, which slows wage growth for rural Chinese and drives up the wage premium for skilled labour. However, the transformation from low-skill to high-skill labour is slowed by lower per capita income as a result of a larger population.

The authors also responded to the discussant's comment that consumption is a better measure of welfare than GDP. Dr Tyers agreed that consumption as a share of GDP is important and noted that, in order for the share to stay elevated until 2050, the saving ratio would have to drop substantially. He also argued that real GNP is a good measure of real personal income as it captures the choice between consumption and saving. Dr Golley also acknowledged that there were non-economic welfare benefits from more relaxed fertility policies that are important and not captured in the model, such as freedom of choice. Also in response to the discussant and a participant's question, Dr Tyers noted that while the four scenarios only resulted in slightly different projections for GDP growth, the difference between the level of GDP in the baseline scenario and the low-fertility, low-saving scenario was about 30 per cent by 2050.

The implications of the scenarios for global interest rates were also raised by one participant. Dr Tyers stated that in the low-saving scenario interest rates would be 150 basis points higher in China and 100 basis points higher in the rest of the world by 2050, compared with the high-saving baseline scenario. He also elaborated on the effect of China's rebalancing on the global economy. He discussed that the effect of the changes in savings and demographics on international prices were substantial. Under the low-fertility, low-saving scenario, international energy and agricultural prices would fall substantially relative to manufacturing prices. Australia's terms of trade would also be lower under the low-fertility, low-saving scenario compared with the baseline scenario. Large declines in Australia's energy export prices would be partly offset by relatively stable mineral export prices (as China continues to export metals) and lower manufactured import prices (as India and south Asia take over as major low-cost manufacturers). Dr Golley highlighted that the extent to which India would benefit from China's rebalancing would rely on how well it is able to leverage its own demographic dividend, with the dependency ratio in India projected to fall until around 2040.

Panel Discussion: Assessing Structural Change in China and Its Consequences

The final part of the Conference was a panel discussion focused on assessing structural change in China and its consequences. The discussion was moderated by Stephen Green, an economist at Capital Group responsible for covering Asia, and included the following panellists:

- Andrew Batson, China Research Director at Gavekal Dragonomics
- Jian Chang, chief Chinese economist at Barclays Capital
- Lillian Cheung, Executive Director (Research) at the Hong Kong Monetary Authority
- David Gruen, Deputy Secretary, Economic at the Department of Prime Minister and Cabinet

As the Conference and panel were conducted under the Chatham House rule, no individual's comments are attributed.

1. Introduction

The session began with one panellist's overview of economic progress in China during the reform era and the future challenges China faces. The panellist emphasised the rapid GDP growth in China that has been achieved since 1978, supported by a relatively stable political environment. During this period, many people have been brought out of poverty and there has been enormous structural change, including the largest rural–urban migration the world has ever seen.

Five main challenges were identified: demographics; deregulation of the financial sector; rebalancing from investment to consumption; environmental degradation; and market reforms. The panellist questioned whether these challenges are qualitatively more difficult than those China has faced in the past; current problems always seem more serious because we are yet to see how they will be resolved, whereas past problems have been dealt with.

2. Household Consumption

Recent developments in household consumption were discussed by another panellist. They suggested that rebalancing has occurred slowly, with the household consumption share of GDP increasing from 36 per cent in 2010 to just 38 per cent in 2014. Furthermore, this has occurred via a decline in investment growth, rather than a pick-up in consumption growth. In fact, household consumption growth has slowed quite sharply in real terms, from 12.5 per cent in 2010 to 7.4 per cent in 2014. The slowdown has occurred because lower investment growth has affected corporate profitability, which has a flow-on effect to household income growth. In response, one participant agreed that the pick-up in the consumption share of GDP and the decline in the saving rate have been slow, but noted this progress should be compared with trends from the previous decade when these indicators were moving in the opposite direction.

The panellist noted that there has been a significant change in the composition of household spending. Growth of sales of many high-end consumer goods has accelerated rapidly, while the growth of mass market consumer goods has been relatively slow. This is partly because, as China has developed, the number of affluent and established households has increased remarkably, while the number of lower-income households has declined. The rapid growth of high-income consumption is potentially more important for Australia and other economies seeking to export goods and services. For example, Chinese tourist arrivals to Australia rose 20 per cent in 2015. Another panellist observed that something similar was recorded in South Korea and Taiwan in the decade after their per capita GDP exceeded US\$4 000 in the late 1980s. Both South Korea and Taiwan experienced a decline in their consumption share before a gradual pick-up.

The moderator asked one panellist if we should worry about the middle income trap, given the strong growth in some consumption categories. The panellist did not subscribe to the middle-income trap theory, but was not optimistic about aggregate growth of household consumption in the current macroeconomic environment. They felt that the labour market was deteriorating gradually, with wage and income growth likely to decline. This would then likely flow onto consumption, given that the saving rate has tended to change slowly.

3. Rebalancing and Reform

One panellist focused their comments on rebalancing and reform in China in recent years. The panellist believed there has been some rebalancing to date. In line with economic theory, after China passed the Lewis turning point (where there is no surplus rural labour), there has been rising wage inflation, which supports household consumption, reduces corporate profits, lowers the return on investment and leads to slowing growth of investment relative to GDP.

China is facing structural and cyclical downturns and significant imbalances in the economy. The panellist believed that the challenges facing China now are more difficult than those in the past. In order to continue the development process, there needs to be an increase in investment efficiency or total factor productivity. To achieve this, significant reforms to state-owned enterprises (SOEs), fiscal policy and land rights would need to be implemented. However, progress since the Third Plenum in 2013 has been limited, partly because reform goals are inconsistent with the high growth rate targets the government had preferred in the short run.

When asked about the likelihood of significant reform in the next five years, the panellist noted they had become less optimistic since mid 2014. Since then, strengthening the authority of the Party and increasing government controls to achieve short-term stability have been prioritised over reforms to allow markets to play a more decisive role, a goal stated in the Third Plenum. This has increased the chance of a policy mistake, given financial markets have also become more complex and the equilibrium level of certain prices is difficult to evaluate. For example, the target level that the government set for the stock index or the exchange rate could deviate significantly from the prevailing market equilibrium or the level that is consistent with economic fundamentals. The panellist believed that the authorities should be clear about the direction of economic development, policy priorities and incentives for key stakeholders. One participant agreed with the panellist's overall assessment of the likelihood of reform, but noted that leaders regard meeting growth targets as a prerequisite for structural reform.

Also on the topic of reform, one participant asked what policy advice panellists would provide to China's leaders if given the chance. One panellist noted that SOE reform should be a high priority, but has progressed slowly so far. They noted that SOE reform would not have an effect on short-term growth, but would be beneficial in the long run. Another panellist emphasised the need for market reform, and how entry and exit of firms generates significant productivity gains in advanced economies.

4. Recent Developments and Economic Risks

There was also a discussion of the risk of a hard landing in China, and the effect that might have on currencies, commodity prices, assets and credit markets. One panellist placed a 10–15 per cent chance of a hard landing occurring in the next 18–24 months, noting that challenges are growing quickly without a noticeable improvement in the role for markets to allocate resources efficiently. They sensed that market participants had become less concerned about near-term hard-landing risks of late, following the credit expansion and policy stimulus in the first quarter of 2016, but have become more worried about medium-term growth and the outlook for rebalancing because of unsustainable monetary and fiscal stimulus. In contrast to the view that strong growth facilitates structural reform, the panellist believed that cyclical adjustment and lower growth in the short run would be needed in order to undertake necessary structural reforms, such as capacity reduction and supply-side reform, which would be necessary for more sustainable growth over the medium term.

Another panellist suggested that residential housing investment is the driver of short-term cycles in China, similar to many developed countries. Indeed, the current cycle has been driven by housing investment, with a peak in fundamental demand for housing, high inventories and therefore declining housing investment. They noted that the industrial sector has already had a hard landing, with growth close to zero in nominal terms in 2015. The services sector has grown relatively rapidly, but if that were to reverse, China's economy as a whole could face a hard landing. This could occur via a disorderly outcome in the labour market flowing through to household consumption. The panellist noted financial markets are a more likely cause of a slowdown in the services sector. For example, if China was forced to float the exchange rate, asset prices would collapse (at least temporarily) and this would have a flow-on effect to the real economy. A third possible cause of a slowdown in the services sector put forward by the panellist was a banking crisis in the domestic financial system, which could have a big effect on confidence, asset prices and credit availability.

A third panellist noted that while economists are reasonably good at identifying what might cause a crisis, they should have some humility in their ability to assess the probability of these events occurring. Very few economists forecast the global financial crisis; the vast majority did not, and were unaware of the build-up of systemic risks that became clear only after the crisis occurred.

Financial deregulation was also noted as a risk, with one panellist stating that this process has rarely gone smoothly for other economies. A participant noted that official reserves had declined in defence of a currency which had been allowed to depreciate a little, and questioned whether the recent corruption drive had contributed to capital flight from China. One panellist commented that foreign reserve depletion and capital outflows largely reflect residents rebalancing assets and

liabilities, rather than cross-border outflows from non-residents. Another participant questioned whether the quality and the transparency of Chinese statistics had declined recently, and whether we are underestimating risks in China as a result.

5. Implications for Asia and Australia

The implications of developments in China for Asia and Australia were also discussed at length. One panellist emphasised how cyclical and structural change in China were likely to have different effects on economies in Asia. A cyclical downturn or hard landing in China would likely affect all economies in the region, with little difference in the effect across economies. On the other hand, structural change is likely to have different consequences for different economies. Trade is the main link between most economies in the region and China, but different economies are involved at different parts of the supply chain. Some economies depend on China as part of the supply chain for processing exports, while others export commodities or high-end capital goods.

The panellist noted two developments affecting the composition of China's imports. First, as China rebalances from investment to consumption, they are likely to import fewer commodities for construction purposes and more consumer goods and services. Second, preliminary analysis suggests China is exporting more high-end capital goods and importing more primary goods and fewer intermediate goods. This suggests China may be producing more intermediate goods and covering a larger part of the supply chain, which contrasts with the conventional wisdom that China is moving up the value chain.

The moderator asked one of the panellists about the financial linkages between Hong Kong and Mainland China. The panellist observed that the Hong Kong banking system's mainland-related bank lending has grown rapidly over recent years. While this may cause some concern to outside investors, there is little exposure to over-capacity sectors and property developers, with most of the mainland-related lending to multinational companies, large SOEs and top-tier private listed companies. The panellist believed the resilience of the Hong Kong banking sector is high, as shown by stress tests done by the banking regulators and the IMF. This is because of good risk management practices by the banks, tight supervision and the collateralisation of many loans.

The moderator questioned how Australia is placed to respond to developments in China in the next decade. A panellist responded that Australia has done remarkably well in recent years given the income shock and decline in mining investment. This is partly because of institutions and previous reforms in Australia, such as the floating exchange rate, an independent central bank and less centralised wage setting. The panellist noted that this experience should provide some confidence in Australia's ability to respond to developments in China.

One participant questioned whether Australia needs a new economic narrative following on from the Asian Century report (Australian Government 2012). If China is successful in rebalancing from investment to consumption, demand for Australia's iron ore and coal may have already peaked and there may be less demand for liquefied natural gas than previously forecast. One panellist agreed it was a good idea to update the analysis, but noted that the Asian Century report described the mining boom as the first stage of very rapid growth in Asia. The next stage outlined in the report is the rise of the middle class in Asia. Australia will need to compete with the rest of the world in this next stage, rather than rely on its natural endowments.

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Biographies of Contributors

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Elias Albagli is the Head of Modelling and Economic Analysis at the Central Bank of Chile. Previously he worked in the Central Bank's Economic Research Division, most recently as a Senior Economist (June 2013 to November 2014) and also as an Economic Analyst (2002 to 2005). He was an Assistant Professor of Economics and Finance at the University of Southern California from 2010 to 2013.

Dr Albagli has taught courses on financial markets and macroeconomics at different institutions, including the Economics Department at the Catholic University of Chile and the Economics and Business Management Department at the University of Chile. He has published numerous journal articles, book chapters and working papers on issues related to macroeconomics and financial markets.

He holds a Bachelor of Business and a Master's in Financial Economics from the Catholic University of Chile (2002), where he received the best graduating student award. He received his PhD in Economics from Harvard University in 2010.

Andrew Batson

Andrew Batson is the China Research Director at Gavekal Dragonomics in Beijing. He is also a senior non-resident fellow at the Paulson Institute, the Chicago-based think tank.

Andrew has lived and worked in China since 1998, and over the course of his career as an analyst and journalist has written hundreds of articles on Chinese business, government, economics and society. Before joining Gavekal in 2011, Andrew was an award-winning reporter for *The Wall Street Journal* and Dow Jones Newswires in Beijing and Hong Kong. He has also been a software engineer, a consultant and Treasurer of the Foreign Correspondents' Club of China.

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Leon Berkelmans is the Director of the International Economy Program and the G20 Studies Centre at the Lowy Institute. Before joining the Institute, Leon was a Senior Manager at the Reserve Bank of Australia, where he worked on the Chinese and Indian economies, investment, trade and financial markets. Prior to the Reserve Bank, Leon worked at the Board of Governors of the Federal Reserve System in Washington DC, where his responsibilities included macroeconomic modelling of the US economy.

Leon has also spent time working in Kenya, evaluating the efficacy of different methods of giving aid, and has also worked as an economic consultant at the Centre for International Economics. Leon has a PhD in Economics from Harvard University. He completed his undergraduate studies at the Australian National University, with a year on exchange to Oxford University.

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Natasha Cassidy is Head of Section in the Economic Analysis Department of the Reserve Bank of Australia. She is currently the head of a team that is responsible for the forecasting and analysis of prices, wages and the labour market. Before this, Ms Cassidy served in a number of roles in the Economic Analysis Department, covering areas such as business investment, trade, commodity prices, housing and financial conditions. She has also worked in the Reserve Bank's Domestic Markets and International Departments. She holds a Bachelor of Economics (Hons) from the University of Sydney.

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Jian Chang is a director and Chief Economist at Barclays. Prior to this, she worked at the Hong Kong Monetary Authority, where her most recent area of focus was the Chinese economy and financial markets. Jian worked for almost three years in the Research department covering the US, euro area and the UK economies, as well as conducting research projects on China and Hong Kong. Between 2001 and 2004, Jian worked at the World Bank as a consultant. Jian holds a PhD in Economics from Georgetown University in the United States.

Xingdong Chen

Chen Xingdong has been the Managing Director and Chief China Economist of BNP Paribas since 1998 and is based in Beijing. Previously, he has worked for Peregrine Group, Crosby, SocGen-Crosby Securities Limited, the World Bank and the State Commission for Economic Restructuring of China State Council.

Mr Chen is also a part-time Professor of the School of Economics of Peking University. He was the Director and Chairman of the Board of Trustees of the Cairncross Foundation, which has sponsored many research and training programs in Oxford. He graduated from Peking University with a Bachelor's and a Master's degree in Economics in 1983 and 1985, respectively. He went to Oxford for intensive study at Corpus Christi under the economic training program from October 1986 to February 1988.

Lillian Cheung

Lillian Cheung is the Executive Director (Research) at the Hong Kong Monetary Authority (HKMA) and is responsible for analysis and research on issues related to monetary and financial stability. She is also Director of the Hong Kong Institute for Monetary Research. She first joined the HKMA as Manager in 1998 and then spent four years as a Senior Economist at Swiss Reinsurance Company in Hong Kong. She re-joined the HKMA in 2005 and was promoted to Head of Economic Research Division in 2010, in charge of research relating to macroeconomic and financial stability issues. Dr Cheung holds a Bachelor of Commerce (Economics), a Master of Commerce (Economics) and a PhD in Economics from the University of Wollongong, Australia.

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Jane Golley is an economist focused on a range of Chinese transition and development issues. She is an Associate Director of the Australian Centre on China in the World, Australian National University (ANU) and head of the China Numbers research stream. She is presently working on China's demographic change and economic performance, rural–urban inequalities in education, and urban household consumption and carbon emissions.

After eight years of studying and teaching in Oxford (interspersed with stints at the World Bank in Washington DC, the United Nations University WIDER in Helsinki, and two semesters studying Chinese at Renmin University), she returned to the ANU's School of Economics and subsequently moved to the Crawford School of Economics and Government, where she developed a graduate course on 'China in the World'. In addition to her current research, she has published a book on Chinese regional development and journal articles and book chapters on Chinese industrial agglomeration and regional policy; China's real exchange rate; and cross-country comparisons of trade openness, institutions and growth. She is currently the President of the Chinese Economic Society Australia (CESA).

Jane completed her Bachelor of Economics at the ANU in 1993, with a major in Japanese. She began her career in the Asia Section of the Australian Commonwealth Treasury before undertaking her MPhil and DPhil in Economics at the University of Oxford, writing her thesis on 'The Dynamics of Chinese Regional Development'.

Stephen Green

Stephen Green is an Economist at Capital Group, responsible for covering Asia. He has 11 years of investment industry experience and joined Capital Group in 2014. Before joining Capital, he was Head of Research for Greater China at Standard Chartered Bank in Beijing, Shanghai and Hong Kong and the Asia Program at Chatham House. He is a member of the China Finance 40 Forum (CF40). Stephen is based in Hong Kong. He has also been a visiting researcher at Fudan University in Shanghai and at the Shenzhen Stock Exchange. He has published a number of books, including *China's Stockmarket: A Guide to Its Progress, Players and Prospects* (Profile Books 2003); *The Development of China's Stock Market, 1984–2002: Equity Politics and Market Institutions* (RoutledgeCurzon 2004); and *Exit the Dragon?: Privatization and State Control in China* (Wiley-Blackwell 2005, co-editor). He holds a PhD in Government from the London School of Economics, a First Class Honours degree in Social and Political Sciences from Cambridge University and a Master's degree from Warwick University.

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Prior to the DPC, David was the Executive Director of Macroeconomic Group at the Australian Treasury. David worked at the Reserve Bank of Australia for 13 years, and was Head of Economic Research Department from May 1998 to December 2002. Before joining the Reserve Bank, he worked as a Research Scientist in the Research School of Physical Sciences at the Australian National University.

With financial support from a Fulbright Postdoctoral Fellowship, he was visiting lecturer in the Economics Department and the Woodrow Wilson School at Princeton University from August 1991 to June 1993. He holds PhD degrees in Physiology from Cambridge University, England and in Economics from the Australian National University.

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Nicholas Lardy is the Anthony M Solomon Senior Fellow at the Peterson Institute for International Economics. He joined the Institute in March 2003 from the Brookings Institution, where he was a Senior Fellow from 1995 until 2003. Before Brookings, he served at the University of Washington, where he was the Director of the Henry M Jackson School of International Studies from 1991 to 1995. From 1997 through the spring of 2000, he was also the Frederick Frank Adjunct Professor of International Trade and Finance at the Yale University School of Management. He is an expert on the Chinese economy.

Nicholas' most recent books are *Markets over Mao: The Rise of Private Business in China* (2014), *Sustaining China's Economic Growth after the Global Financial Crisis* (2012), *The Future of China's Exchange Rate Policy* (2009, co-author), and *China's Rise: Challenges and Opportunities* (2008, co-author).

Nicholas is a member of the Council on Foreign Relations and of the Editorial Boards of *Asia Policy* and the *China Review*. He received his undergraduate degree from the University of Wisconsin in 1968 and his PhD from the University of Michigan in 1975, both in Economics.

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His research focuses exclusively on the Chinese economy and has been published in international, peer-reviewed journals including *China Economic Review* and *China Economic Journal*. Particular areas of interest include the study of China's business cycles and macroeconomic policy, productivity measurement at the provincial level and the Australia–China bilateral economic relationship.

He regularly writes on contemporary developments in the Chinese economy in outlets such as *The Australian Financial Review* and online at *The Conversation*.

He received his PhD in Economics from the University of Queensland in 2001.

Guonan Ma

Guonan Ma is a visiting Research Fellow at Bruegel, the Brussels-based economic think tank. From 2001, he was a senior economist at the Representative Office for Asia and the Pacific of the Bank for International Settlements for 13 years. He also worked as a chief north Asia economist for 10 years at various investment banks, including Merrill Lynch, Salomon Smith Barney and Bankers Trust.

Following the completion of his PhD in Economics at the University of Pittsburgh in 1990, he was a Lecturer in Economics and a Research Fellow at the Australian National University for four years. Dr Ma was born in China where he obtained his undergraduate degree at Beijing University (1982) and is responsible for many publications on the Asian and Chinese economies and financial markets.

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Huw McKay recently relocated to Singapore to take up the role of Chief Economist with BHP Billiton. From 2013 to 2015 he was a Visiting Scholar at the US Studies Centre at the University of Sydney.

He was Executive Director and Senior International Economist of Westpac's Economic Research Team from 2000 until very recently, where he was spokesperson on pan-Asian economic and market issues. Formerly a Principal Advisor in the Macroeconomic Group of the Australian Treasury, his views on the state of the global economy, and of Asia in particular, are widely sought by governments, corporations and investors around the world. He managed Westpac's medium- and long-term world growth and foreign exchange forecasting processes, alongside its stress testing and macro financial scenario analysis.

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Barry is the author of numerous articles on the Chinese economy and is editor or co-editor of three other books: *Reforming Asian Socialism: The Growth of Market Institutions*; *Urban Spaces in Contemporary China: The Potential for Autonomy and Community in Post-Mao China*; and *The China Circle: Economics and Electronics in the PRC, Taiwan, and Hong Kong*.

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Professor Song has published, lectured and spoken publicly on many aspects of China's economic and financial reforms. He has authored, co-authored and edited a large number of books and articles on the contemporary Chinese economy, including more than a dozen books co-edited with Professor Ross Garnaut, one of Australia's leading economists.

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His research applies economic modelling to issues in international economics, to which he has contributed 4 books, more than 70 refereed articles and 50 chapters in books. The majority of his research output has concerned the performance of Asian economies and their international implications and, during the past decade, he has focused on the economies of China and Japan.

Most recently, he has studied macroeconomic policy formation in China and the global implications of Chinese and Japanese demographic change, but he is currently working on the Australian economy and the implications of the recent boom for policy and performance. He has also worked on trade policy, commodity market volatility and the consequences of globalisation and technical change for labour market performance.

He has undergraduate and Master degrees from the University of Melbourne and a Doctorate from Harvard University.

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Wing Thye Woo was a consultant to China for the tax and exchange rate reforms implemented in 1994; a special advisor to the US Treasury in 1997–98; and was appointed an advisor to the Prime Minister of Malaysia in 2005. The University of California at Davis awarded him its Distinguished Scholarly Public Service Award in 2004.

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