

OECD Economics Department Working Papers No. 1093

China's March to Prosperity: Reforms to Avoid the Middle-income Trap

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https://dx.doi.org/10.1787/5k3wd3c4219w-en

OECD

Unclassified **ECO/WKP(2013)85**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **12-Nov-2013**

English - Or. English

ECONOMICS DEPARTMENT

ECO/WKP(2013)85
Unclassified

CHINA'S MARCH TO PROSPERITY: REFORMS TO AVOID THE MIDDLE-INCOME TRAP

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By Vincent Koen, Richard Herd and Sam Hill

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ABSTRACT/RESUMÉ

China's march to prosperity: reforms to avoid the middle-income trap

China is well-placed to avoid the so-called "middle-income trap" and to continue to converge towards the more advanced economies, even though growth is likely to slow from near double-digit rates in the first decade of this millennium to around 7% at the 2020 horizon. However, in order to sustain vigorous growth and improve the well-being of most citizens, renewed reform momentum is required in a number of areas. The following ones are discussed in this paper: financial sector liberalisation; strengthening competition in markets for goods and services; education, research and innovation. Progress is also needed in other areas, notably in fostering more socially-inclusive forms of urbanisation and more environmentally-friendly growth.

This Working Paper relates to the 2013 *OECD Economic Survey of China* (www.oecd.org/eco/surveys/china).

JEL Classification: D61, E20, E22, E23, E24, E27, E42, E44, E52, F21, F23, F31, F32, F43, F63, F65, G23, G28, I25, J11, J21, J24, J61, N15, N25, N35, O11, O14, O15, O16, O19, O24, O31, O32, O34, O38, O47, O53, P21.

Keywords: Business climate, catch-up, China, cities, competition, convergence, credit, development, economic growth, education, financial sector, foreign exchange, innovation, intellectual property rights, internal migration, investment, living standards, patents, productivity, renminbi, research and development, shadow banking, urbanisation.

* * * * *

En marche pour la prospérité : réformer pour poursuivre le rattrapage en Chine

La Chine est bien placée pour ne pas rester un pays à revenu intermédiaire et continuer à converger vers les économies les plus avancées, même si la croissance est vraisemblablement amenée à ralentir, passant d'un rythme à deux chiffres pendant la première décennie de ce millénaire à environ 7% à l'horizon 2020. Toutefois, le maintien d'une croissance vigoureuse et améliorant le bien-être de la majorité des citoyens nécessite une accélération des réformes dans un certain nombre de domaines. Sont passés en revue dans ce document : la libéralisation du secteur financier ; renforcer la concurrence sur les marchés des biens et services ; l'éducation, la recherche et l'innovation. Des progrès sont également requis dans d'autres domaines, notamment pour promouvoir des formes d'urbanisation socialement plus inclusives et une croissance plus respectueuse de l'environnement.

Ce Document de travail se rapporte à l'*Étude économique de la Chine de l'OCDE*, 2013, (www.oecd.org/eco/etudes/chine).

Classification JEL: D61, E20, E22, E23, E24, E27, E42, E44, E52, F21, F23, F31, F32, F43, F63, F65, G23, G28, I25, J11, J21, J24, J61, N15, N25, N35, O11, O14, O15, O16, O19, O24, O31, O32, O34, O38, O47, O53, P21.

Mots-clés : climat des affaires, rattrapage, Chine, villes, concurrence, convergence, croissance économique, crédit, développement, éducation, secteur financier, réserves de change, innovation, droits de propriété intellectuelle, migration interne, investissement, niveau de vie, brevets, productivité, renminbi, recherche et développement, système bancaire parallèle, urbanisation.

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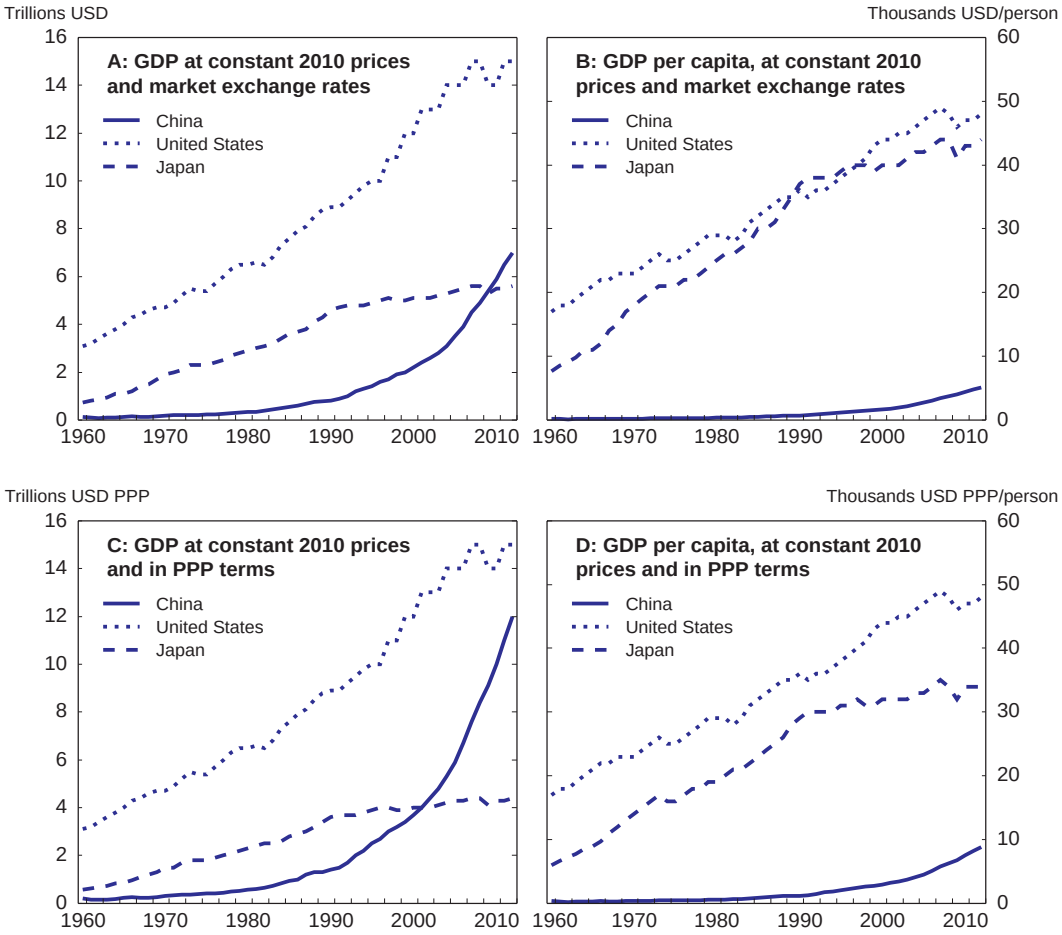
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CHINA'S MARCH TO PROSPERITY: REFORMS TO AVOID THE MIDDLE-INCOME TRAP

Vincent Koen, Richard Herd and Sam Hill [1]

China's growth performance since the sharp acceleration in the early 1980s has been exceptional and has propelled it to become the world's second-largest economy (Figure 1). While trend growth is bound to

Figure 1. China has become the world's second largest economy but income per capita remains low



Source: Penn World Table Version 7.1, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, November 2012; OECD Economic Outlook database.

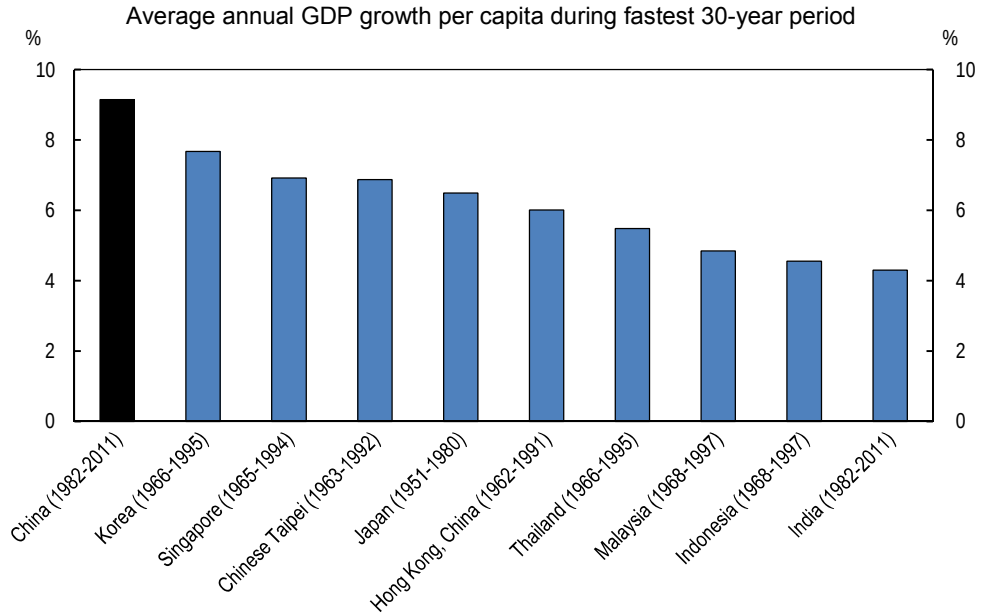
1. Vincent Koen is head of division, Richard Herd head of desk and Sam Hill was an economist in the OECD Economics Department when this working paper was prepared. It is based on the discussion of China's growth prospects in the OECD's *2013 Economic Survey of China*. The authors are grateful for valuable comments on earlier drafts from Chinese officials, members of the Economic Development and Review Committee, Andrew Dean, Bob Ford and Xiao Wang. Thanks go to Thomas Chalaux and Clara Garcia for statistical assistance and to Nadine Dufour, Pascal Halim and Mikel Iñarritu for editorial support. The views expressed in this paper do not necessarily reflect those of the OECD, of the Chinese authorities or of the OECD member countries.

slow gradually over time, China's rapid catch-up can continue during the coming decade provided reform efforts are kept up or regain momentum in a number of areas. Indeed, the Chinese economy is on course to become as large as that of the United States, in purchasing power parity (PPP) terms, around 2016. However, China's income per head will then still be only one-quarter of that in the United States. Looking further ahead, by 2020, China may have become a "moderately prosperous society" (to borrow the terminology used at the Chinese Communist Party's 18th National Congress in November 2012), and a high-income country on the World Bank definition (which sets the threshold at around $12 500 in 2011 prices). For growth to be sustained and to contribute as much as possible to citizens' well-being, however, it needs to become more inclusive and greener (OECD, 2013).

China's achievements have been underpinned by vigorous growth outside agriculture

The Chinese economy has expanded at an average annual rate of around 10% over the past three decades, and almost as fast in per capita terms. China has thus outpaced other high-performing, rapidly-industrialising Asian economies during their long growth spells (Figure 2). This has delivered major improvements in living standards. Based on the World Bank's classification, China recently graduated from lower to upper middle-income status. By 2012, GDP per capita, on a PPP basis, likely exceeded $9 000. A growing emphasis on improving access to health and education as well as high investment in infrastructure have helped spread the benefits of growth nationally including in rural areas, where incomes have enjoyed consistently strong gains.

Figure 2. High-growth spells compared



Source: Maddison (2003), *The World Economy: Historical Statistics*; CEIC; OECD Analytical database,

High GDP growth has been underpinned by a rapid and sustained expansion in industry and services, where high profits are largely reinvested. In contrast, excess labour remains in agriculture, which still employs 35% of the labour force, and where the marginal product of an extra worker is virtually nil. In the decade to 2011, non-agricultural growth averaged just under 11%. This performance was mainly driven by ever-more rapid capital accumulation (Table 1) – though there is considerable uncertainty about exact magnitudes in the absence of official capital stock data. The quality of investment appears quite good insofar as marginal returns to capital are quite high. There is also evidence that investment is allocated to areas where profits are highest, at least in industry, where the growth of the capital stock correlates well with the rate of return in previous years (Simons, 2013). The only exception is in electricity generation where the capital stock has continued to grow despite poor returns.

Employment growth picked up in the early 2000s with the large influx of labour from the countryside, though it subsequently slowed a bit. The contribution of total factor productivity gains to overall growth has steadily declined over the past three five-year periods. In the second half of the past decade, this may partly reflect the spurt in infrastructure spending in 2009-10. Such outlays generally only generate paybacks over the longer term or are in areas where not all of the benefits show up in GDP – as is the case for toll-free roads or loss-making high-speed trains.

Table 1. Growth accounting[1]

Average annual rate of change, in per cent

	1996-2001	2001-06	2006-11
Actual growth			
Capital	10.5	12.9	13.9
Labour	1.3	3.4	2.8
Output	8.9	10.9	10.7
Contribution to growth			
Capital	5.3	6.5	6.9
Labour	0.6	1.7	1.4
Productivity	3.0	2.8	2.3
Share of growth			
Capital	59.0	59.1	65.0
Labour	7.2	15.3	13.1
Productivity	33.8	25.5	21.8

1. For output outside agriculture and housing (as the output of the housing sector is poorly measured in Chinese national accounts). Figures are calculated from log differences multiplied by 100.

Source: OECD calculation.

The economy will gradually slow but high growth can be maintained for some time

As China reduces the gap in GDP per capita with the leading OECD economies, opportunities for technological catch-up and returns from capital deepening are set to diminish, damping longer-term growth (Eichengreen *et al*., 2012). The progression from middle to high income – based on the World Bank's typology – is not assured, as discussed in a burgeoning literature on the so-called "middle-income trap" (Felipe *et al*., 2012; Berg *et al*., 2012). However, one-quarter of the current OECD membership, including the Czech Republic, Korea and Poland, have made that transition, as have Chinese Taipei; Hong Kong, China; Singapore and Macao, China. Moreover, there is evidence that the number of economies able to close the gap with the income per capita of the United States has been increasing over time (Table 2).

Of the 35 economies with an income per head in 1990 above that of China in 2010, two-thirds grew faster than the United States in the following two decades. If the comparison is made in terms of countries whose income relative to that in the United States was higher than that of China in 2010, then 70% of these countries grew faster than the United States in the subsequent two decades. However, the average pace of catch-up for these countries was slow relative to the pace at which China has caught up.

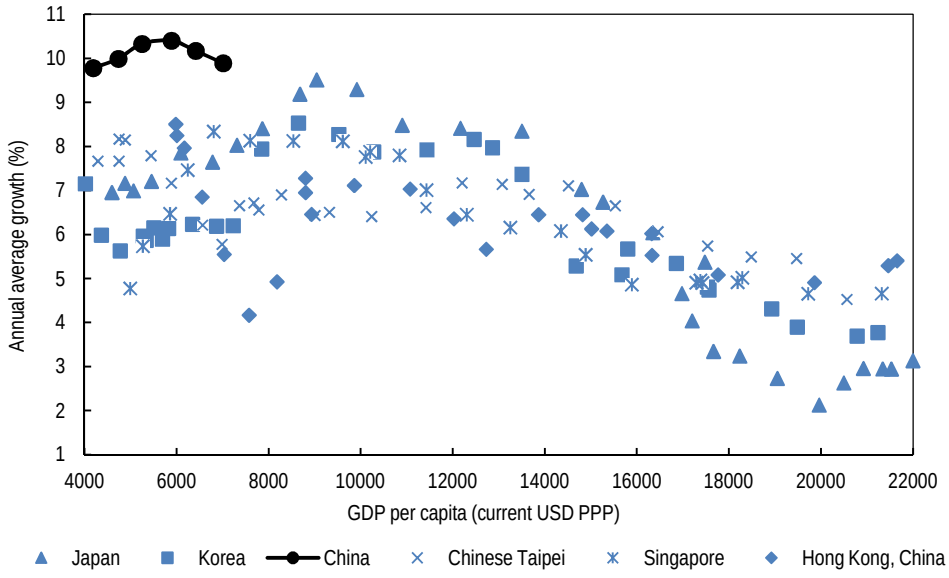
Table 2. More countries are catching up with the United States

	Countries catching up to the United States		
	by more than 1% per year		by more than 2.5% per year
	1960 to 1990	1990 to 2010	1990 to 2010
	Annual average growth (%)		
Average	2.6	2.6	4.2
Median	2.5	2.1	3.4
Number of countries	16	50	17
Initial income level of the catch-up countries relative to the United States			
	21.0%	18.0%	14.8%

Source: Author's calculations based on data in Bolt and van Zanden (2013).

In many ways China's economic progress has mirrored the earlier take-offs of Chinese Taipei, Korea and Japan, or the city-size economies of Hong Kong, China and Singapore. In each of these, rapid catch-up was driven by strong investment in physical and human capital, a dynamic and competitive export sector and a commitment to sound policy including prudent macroeconomic management. High growth was maintained for many years and only began to slow markedly at relatively high income levels (Figure 3). There is significant scope for further catch-up in China. China has a strong record with respect to several of the key factors for sustaining growth and is well positioned to emulate the record of earlier stellar Asian performers. Recent OECD simulations suggest that China could maintain high, though gradually easing, growth during the current decade, averaging 8% in per capita terms (OECD, 2012c).

Figure 3. Growth pathways in selected East Asian economies



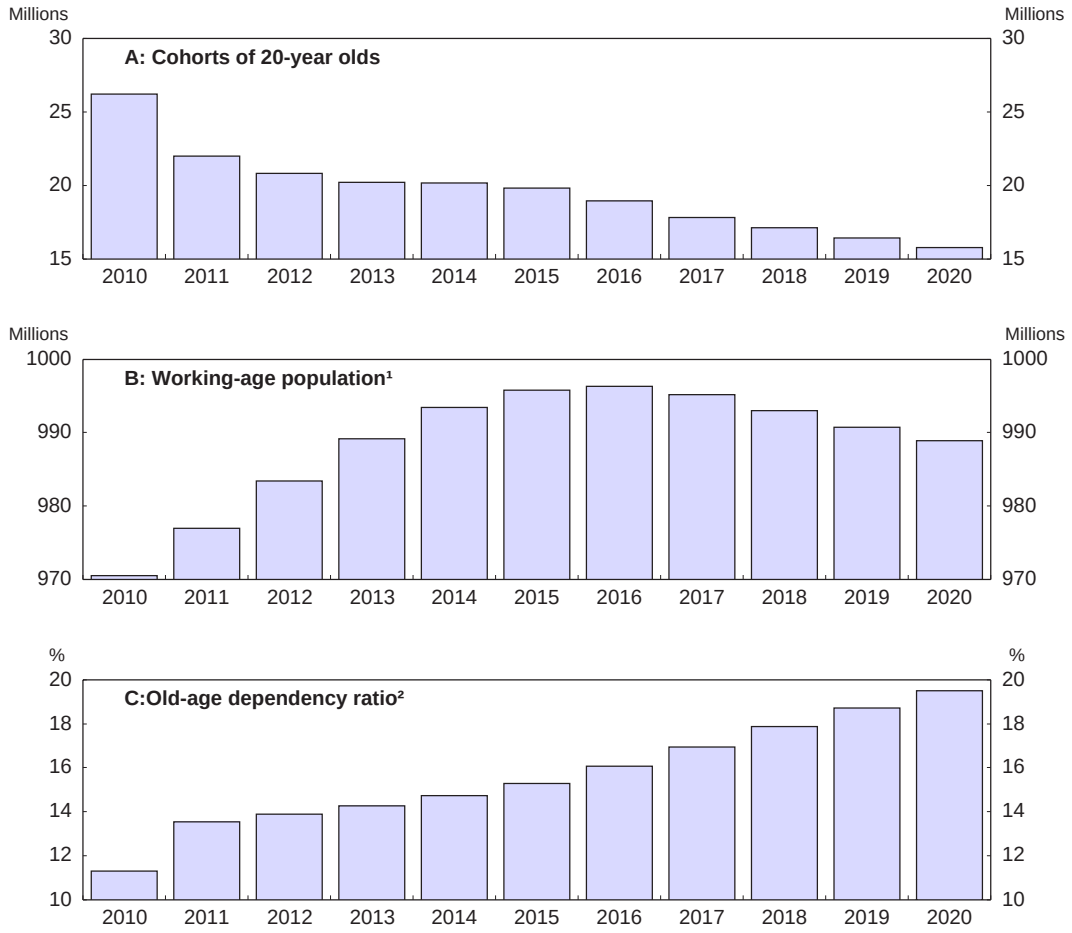
Note: Growth rates calculated as ten-year moving averages of annual observations. Each point for a country advances the ten-year moving average of the growth rate by one year. The starting point for the ten-year averages are as follows: Japan (1951), Korea (1970), China, (1999), Chinese Taipei (1967), Singapore (1961), Hong Kong, China (1961). The income level for each point is the income level at the mid-point of the moving average.

Source: Penn World Tables and OECD calculations.

Continued migration of labour from agriculture will support productivity growth

Over the medium term, demographics will switch from supporting growth to acting as a drag, as the size of younger cohorts shrinks, as the working age population starts to decline and as the population ages (Figure 4 and Herd *et al.*, 2010). Over the past three decades declining fertility and slower population growth supported high economic growth as the dependency ratio fell and the saving rate rose. The fertility rate, at around 1.5, is now well below the replacement rate, and is even lower in the most economically advanced parts of the country reflecting stricter enforcement of family planning policy in urban areas. Like in other industrialising countries, the fertility rate in the countryside is likely to fall due to rising incomes and labour force participation, higher education levels and increasing opportunity costs of child rearing. A marked fall in the proportion of women amongst younger cohorts in the next decade will also depress fertility and population growth. Over the longer term, the preference for male babies may fall as the education level of women increases and as the change in policy that allows a second child when the first one is a girl, starts to take effect. The share of the working-age in the total population is expected to peak soon, and the elderly dependency ratio will continue to rise, exerting downward pressure on saving rates (if the elderly in China behave as elsewhere in the world).

Figure 4. The demographic transition: an ageing population



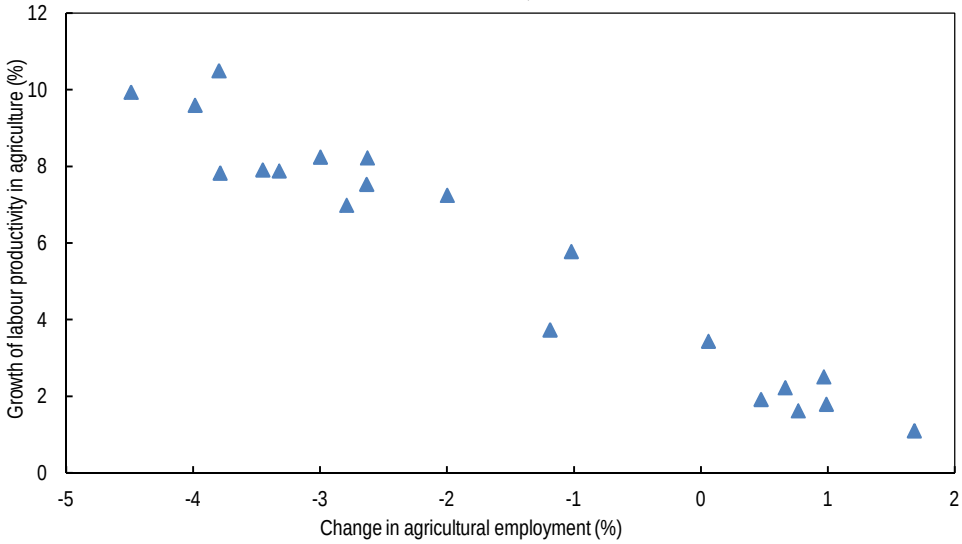
1. Population aged 15 to 64.

2. Ratio of population aged 65 and over per 100 population aged 15-64.

Source: US Bureau of the Census (2011) and United Nations, Department of Economic and Social Affairs, Population Division (2011), *World Population Prospects: The 2010 Revision*.

With slowing productivity, an already high investment rate and an ageing society, continued rapid growth in industry and services will require further transfer of labour from the agricultural sector. Agricultural employment has been falling for a decade at an average rate of 3.5% annually, with massive migration from the countryside to cities. This fall in employment has not been accompanied by any fall in agricultural output. On the contrary, faster outflows have been offset by larger productivity gains (Figure 5). Continuing migration of workers out of agriculture will help boost farming profitability, and encourage mechanisation. In addition, some consolidation of farms into bigger units may occur if the laws governing the ownership of rural land-use rights are changed to allow the sale of use-rights and favour the rental market for agricultural land.

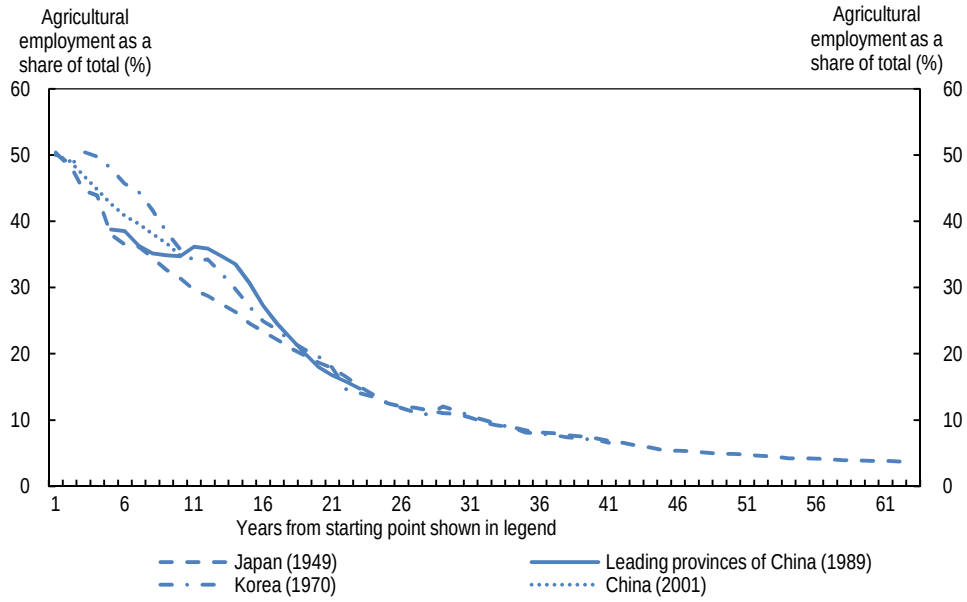
Figure 5. In agriculture, employment has declined and productivity has risen
Annual observations, 1991-2011



Note: The agricultural sector is defined here as including forestry and fishing.
Source: CEIC.

Further large economy-wide productivity gains are in store as urbanisation and the migration of labour from agriculture to higher value-added manufacturing and services proceed. One scenario would be for employment in agriculture to continue to fall at the same pace as during the five years to 2011. This would reduce the share of the labour force in agriculture to 12.5% by 2025, down from over half of total employment a decade ago. Such a massive reallocation of labour was in fact experienced in Korea during its period of rapid industrialisation from 1970 to 1990, and earlier on in Japan (Figure 6). It has also already been witnessed in China's five most advanced provinces over the past two decades. In this scenario, the non-agricultural labour force would continue to grow at close to 2% a year, a solid, if slower, pace than in the recent past.

Figure 6. Fall in agricultural employment in East Asian countries and regions



Note: The agricultural sector is defined here as including forestry and fishing.
Source: CEIC, Korean Statistical Yearbook, OECD projections.

Further capital accumulation, as well as more education and innovation, will also support growth

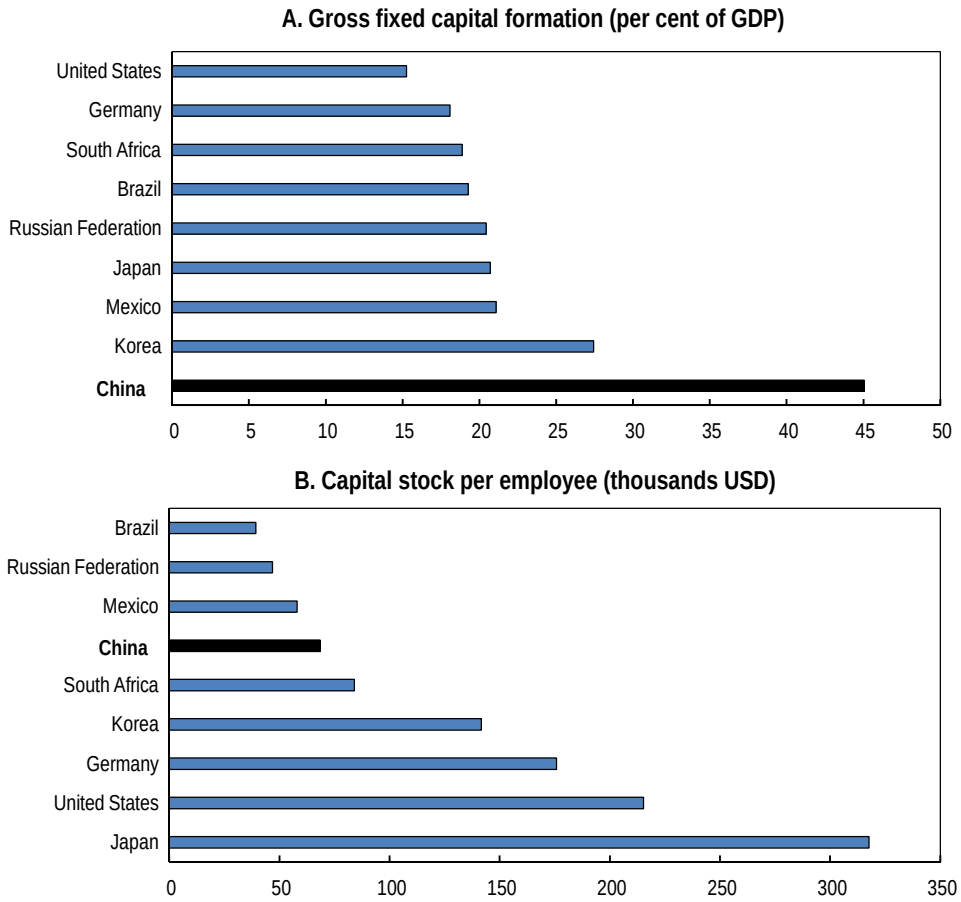
Growth will also continue to be underpinned by capital deepening. The investment share is already high (Figure 7, Panel A). Indeed, on some estimates it may far exceed warranted levels (Lee *et al.*, 2012). Given also that domestic saving rates will probably ease back as the population ages, the investment rate seems unlikely to rise further. However, capital per head in China remains well below levels in advanced economies, though above those in some other large emerging economies (Figure 7, Panel B). In key infrastructure segments capacity lags behind. By the late 2000s the total length of paved roads in China was around half that in the United States, despite a comparable land area and a population more than four times larger. The total length of the railway network in China is even further behind, at around one third of the United States. Accordingly, returns to infrastructure investment may still be high. Despite strong investment in the property sector, per capita residential living space is still just only 20 m² (and lower on an internationally comparable basis), while large sections of the rural and urban populations live in sub-standard buildings (Herd *et al.*, 2013). In sum, large unmet demand in a number of areas will require continued strong investment.

Notwithstanding a very high investment rate, profitability outside agriculture and housing has remained elevated by international standards: the estimated gross rate of return averaged 19% between 1992 and 2009 and the net rate of return 15%. This is probably a lower bound insofar as the capital stock includes assets in the government sector on which it makes no profit. The rate of return has been quite stable over time, though it has fallen in periods of slower growth. Other estimates confirm that the rate of return has been and remains high (Bai *et al.*, 2006; Sun *et al.*, 2011).

Housing and infrastructure investment seem likely to remain high for some time but the outlook for business investment depends on how profitability evolves. As noted, the labour supplied to the business sector is set to slow over the next decade, reducing profitability. In addition, overall productivity growth may well slacken as GDP per capita grows, as has happened in other fast-growing economies. Against this backdrop, the nominal capital-output ratio may stabilise by around 2020 (OECD, 2012c). This would imply a fall in the investment share. With employment stabilising and the growth of both productivity and capital per worker slowing, per capita GDP growth could slacken to under 7% by 2020.

Figure 7. Investment is high but the capital stock per employee is still low in China

In 2011

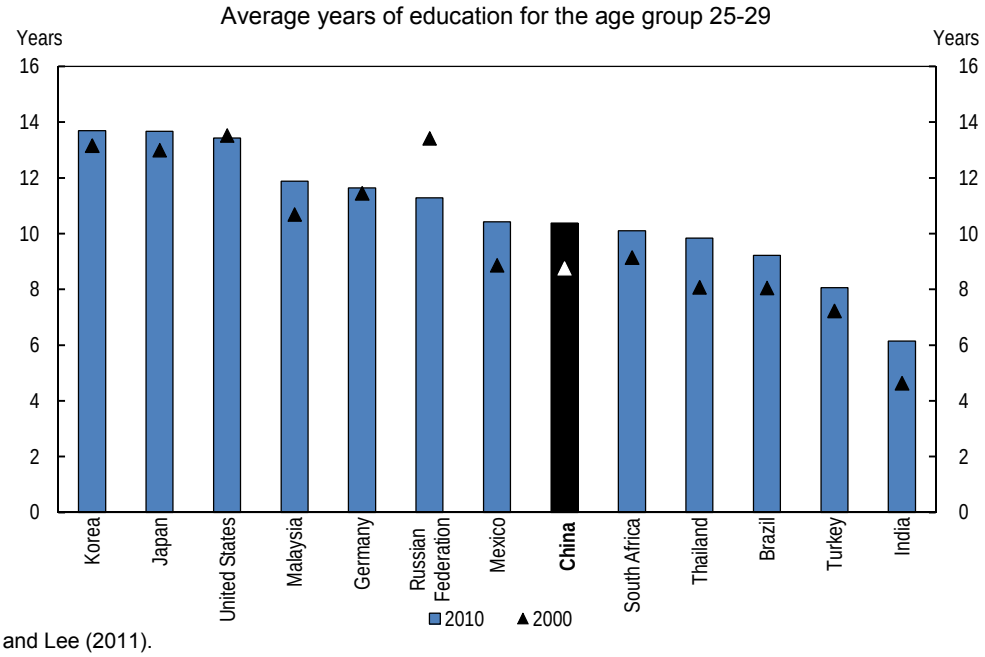


Note: The capital stock has been converted to constant 2005 international dollars using PPP for gross fixed capital formation.
Source: OECD.

However, other scenarios are possible. A much greater increase in the capital stock might be required to reduce the rate of return on capital to levels found in developed countries. This would be especially the case in the non-state sector of the economy, where rates of return are higher. Employment in the business sector might expand faster than suggested by overall demographic considerations. In such a scenario investment would be higher and growth stronger. Indeed, the superior performance of the Chinese economy compared with other East Asian economies when the latter were at a similar stage of development (Figure 3), suggests this could be the case.

Educational attainment continues to progress rapidly and average education levels across the population are now comparable to other upper-middle-income countries (Figure 8). Growth will be driven by further increases in educational attainment. Education up to the junior high school level, which involves nine years of schooling, is compulsory and now free of charge. This has helped ensure that the completion rate for this type of schooling is now reaching universal levels and is pushing up participation at higher levels of education. Upper secondary school completions rates are on the rise and the number of students enrolled in higher education institutions almost tripled through the 2000s. The government plans to ensure that all children receive 12 years of education by 2020. Over time, this rising participation in higher education of younger cohorts will ensure that average education levels amongst Chinese workers will increase and the gap with advanced economies narrow further. Moreover, on some measures, the quality of higher education is improving: 27 Chinese universities now rank in the top 500 worldwide when judged by faculty performance (Shanghai Jiao Tong University, 2013).

Figure 8. Human capital is catching up

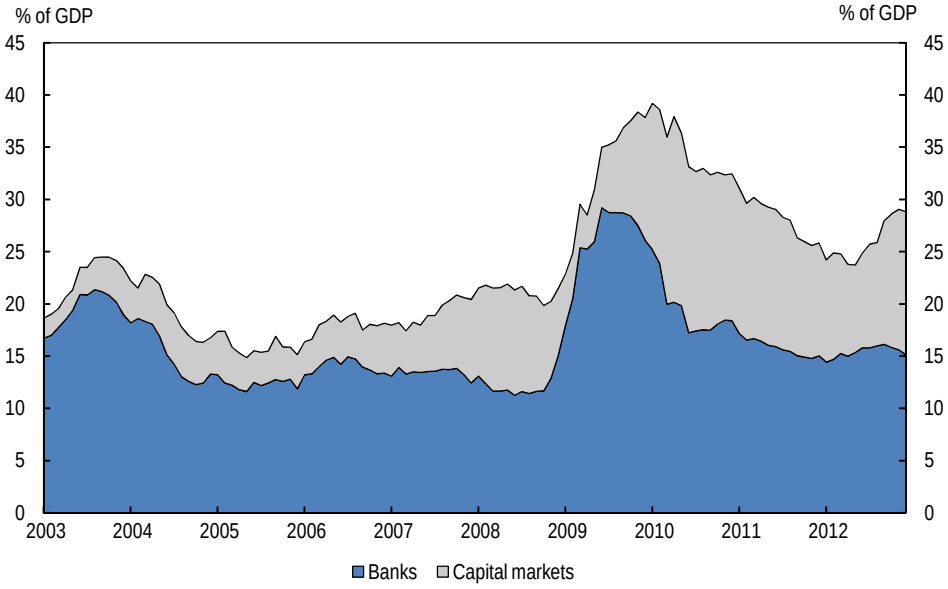


Source: Barro and Lee (2011).

Further financial sector reforms are underway

With high investment underpinning rapid growth and a large share of investment undertaken by SOEs, a financial system that allocates capital efficiently is essential. The role of capital markets in the financing of the business sector has increased over the past decade. After a pause during the initial phases of the global financial crisis, the share of capital markets in total financing flows rose anew and by late 2012 it exceeded 40%, double the share in the five years before the start of reform in 2007 (Figure 9).

Figure 9. Composition of financing flows



Note: The total financing flows from capital markets is the sum of the change in entrusted loans, trust loans, bankers' acceptances, notes, bonds and equities. The flow from banks is the sum of the changes in domestic and foreign currency lending. The sum of flows from banks and capital markets is called "total social financing".

Source: CEIC.

Banks remain the key element in the Chinese financial system and have to conform to the new Basel III capital requirements by end-2018. The ratios are one percentage point higher for the systemically important banks, whose identity, however, has not been revealed so far. The major banks' capital ratios were already above the 2018 targets in September 2012. Moreover, as from 2013, the regulator will allow them to calculate risk weights internally, which may lift their capital ratios by one percentage point. However, stress-testing of the major banks points to vulnerabilities, with a medium-scale shock leaving half of them with a capital adequacy ratio below 12% (People's Bank of China, 2012).

Many new instruments have been developed. The short-term commercial paper market and the market for notes (bonds) with maturities of less than five years have taken off. The market for shorter-term securities is regulated and supervised by the central bank (People's Bank of China – PBoC), in contrast to the longer-term enterprise bond market supervised by the National Development and Reform Commission. In both markets, access is restricted to state-controlled firms with A or above credit ratings. The securities regulator (CSRC) has now opened a third channel for the development of bond markets by allowing the Shenzhen and Shanghai stock markets to list bonds from small or lower-rated companies. While the stock of bonds is still dominated by issuers linked to the central government, the stock of bonds issued by local government companies has grown rapidly, as has the stock of medium-term notes. The bond market is now the world's third largest but, in relation to GDP, it is much smaller than markets in most OECD countries.

Banks themselves have developed new products that offer savers higher rates of return by giving them access to capital markets. Notably, bank loans have been effectively securitised through a system known as "loan designation": investors specify the type of industry exposure they wish and set a desired rate of interest and the banks then create a matching portfolio of loans. Other channels have included the use of trust banks in which the trust purchases securities for the investor. Investors can thereby obtain a return higher than the regulated deposit rate and firms borrow below the regulated rate. These instruments were particularly popular in 2010-11 when tighter monetary policy drove market interest rates well above benchmark rates. The popularity of these products led to some attempts to discourage their use, as the regulatory authorities feared that the stability of banks would be undermined by off-balance-sheet lending. This issue remains a concern as many of these instruments (known collectively as wealth management products) display a mismatch between the maturity of their liabilities and assets. In addition, in some cases the assets consist of loans to just a few companies. Rules on maturity mismatch and risk diversification need to be strengthened for these products. The process of interest rate liberalisation continued in 2012, with the PBoC granting banks greater leeway to set their loan and deposit rates, allowing them to differ more substantially from the regulated rates. This was in part to avoid clients with the best risk-profile raising money from the market rather than banks, at the expense of the quality of banks' portfolios.

The government has launched pilots in the city of Wenzhou and the province of Guangdong to ease the provision of finance for small and medium-sized enterprises and formalise local non-bank credit channels. Existing informal lenders can acquire formal status if they do not lend more than three times their own equity, do not charge more than four times the PBoC benchmark rate and do not take deposits from the public. So far, the lending is short-term and tends to be secured with a mortgage on residential property belonging to the borrower. These non-bank lenders could eventually become village-level banks.

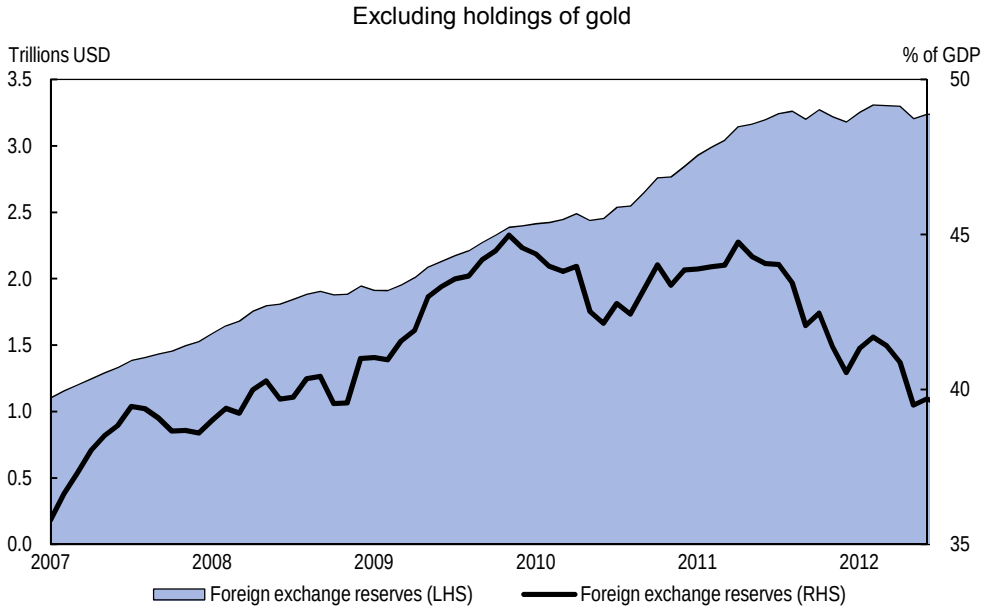
On the external side, controls on capital movements are being eased. Restrictions on the use of the renminbi by foreigners and by Chinese companies abroad have been relaxed. In 2009, companies in selected geographic areas in China were allowed to use the renminbi in trade-related transactions in Hong Kong, China. This led to the development of an offshore market for renminbi bank deposits in Hong Kong. The range of companies allowed to operate in this market was gradually widened. In early 2012, all restrictions on domestic companies using the market were removed and later in the year all restrictions on the opening of renminbi deposit accounts that applied to non-residents were abolished. As a result, the proportion of Chinese current account transactions settled in renminbi rose sharply, to 9.5% in the first

three quarters of 2012. Nonetheless, the renminbi is still only the 17th currency in terms of the total value of cross-border transactions, representing only 0.5% of the value of all transactions through SWIFT.

Restrictions on capital account transactions have begun to be loosened, and there is in fact a considerable amount of *de facto* capital account convertibility, even if the amount of capital inflow allowed is still small relative to the size of domestic markets (OECD, 2013). The quota for investment in the Chinese stock and interbank bond markets has been raised to $80 billion. In addition, the Hong Kong subsidiaries of qualified Chinese asset managers can apply for permission to use a quota of offshore renminbi for investment in mainland equity and bond markets, up to CNY 200 billion (around $30 billion). In combination, these two schemes represent 4.5% of the current value of negotiable shares on the Shanghai and Shenzhen stock markets. The major channel for foreign investment in the Chinese market is the Hong Kong stock market, where the value of mainland shares is equivalent to almost one-third of the market capitalisation of the Shanghai and Shenzhen stock markets. It is now possible to finance direct investment in China with an offshore renminbi loan. Foreign investors can also invest in the very small issuances that have been made offshore. Greater opening of the longer-term bond and equity markets could help achieve the government objective of liberalising capital transactions, with limited risk of outflows. In addition, the authorities have greatly reduced the controls over domestic companies wishing to invest abroad and outflows of direct investment have surged.

With the decline in the current account surplus and the growth of direct investment outflows, conditions in the foreign exchange market have changed markedly. In April 2012, the PBoC announced that the intra-day range for the movement of the exchange rate against the dollar had been widened to ±1% around the initial fixing price announced by the PBoC at the opening of the trading session. This signalled a move towards a more market-determined exchange rate regime. In the process, the accumulation of foreign exchange reserves essentially came to a halt in 2012, with the value of reserves ceasing to grow somewhat earlier due to valuation changes (Figure 10).

Figure 10. Official foreign exchange reserves



Source: CEIC.

Overall, China has continued to move towards a more market-based system despite a turbulent international financial environment. The official objective is to further enhance the role of the market in channelling financial resources to the economy. The government expects that bond and equity financing will represent 15% of total financing flows ("total social financing") by 2015, against 11% in 2011. Banks are to receive further degrees of freedom in interest rate setting. In a change of policy the government will actively encourage financial institutions covering more than one activity, subject to having clear strategies and effective risk control systems. Financial sector regulation is to be eased further, notably as regards capital account transactions. However, a careful sequencing of reforms is necessary. Domestic reform of the banking system should come first with deregulation of bank deposits and lending rates. Only when this has been achieved should the capital account be fully liberalised in order to avoid the creation of arbitrage opportunities. Greater exchange rate flexibility is envisaged, though without any specific targets. The presumption that it would result in a marked appreciation of the currency has withered. Greater flexibility would enhance the effectiveness of monetary policy. Other key goals include establishing a deposit insurance system and creating a mechanism for resolving failed financial institutions. Last but not least, co-ordination between the financial regulators is to be improved.

Strengthening competition and innovation

Market competition and innovation capacity are essential for lifting productivity and therefore for long-run economic performance and well-being. Competition helps promote efficient resource allocation and spurs firms to engage in costly R&D. Innovation can boost productivity through the accumulation of intangible assets: knowledge-based capital accounts for a rising share of business investment in China, as it does in a number of OECD countries (Hulten and Hao, 2012; OECD, 2012a). As the economy matures and opportunities for technological catch-up diminish the importance of innovation capacity will rise.

Competition and innovation, including greener modes of production and consumption, may also aid economic rebalancing (OECD, 2011a). Green innovations have already supported environmental improvements in China, notably through the rapid expansion of renewable energy. There remains tremendous scope for further gains. While multinational corporations continue to play a key role in the development of leading export sectors and facilitating the diffusion of advanced technology from abroad, Chinese policy is increasingly focussed on promoting indigenous innovation capability and lessening the reliance on foreign technology.

Liberalisation has intensified competition

A long-standing commitment to liberalisation has allowed market forces to play a primary role in allocating resources in the Chinese economy for some time (OECD, 2010a). Prices for most goods are market determined, with direct price regulation and price guidance now limited to some forms of energy, water and a very small proportion of retail goods. A modern competition policy framework has been established, underpinned by the 2008 Anti-Monopoly Law (AML) and more recent complementary regulations. This provides enforcement authorities with a comprehensive legal basis for addressing anticompetitive agreements, abuse of market dominance, anticompetitive mergers and administrative monopolies. Trade barriers are generally low and the dispersion of tariffs moderate. Empirical studies show that trade liberalisation and other reforms aimed at enhancing competition, including product market liberalisation, have boosted productivity in China (Bas and Causa, 2012; Zheng and Ward, 2011).

However, economic liberalisation has lost momentum in the past four years. The reduction in the size of the state-owned sector came to an end in 2008. Since then, employment in state-controlled enterprises has risen, while the number of enterprises has stabilised (Figure 11, Panel A). Even so, the value-added of private sector enterprises has continued to grow more rapidly than that of state-controlled firms. By mid-2012, the stock of their assets was on a par with that of the state sector, while they accounted for 80% of industrial employment. SOEs still account for a larger share of value-added than of employment, reflecting much higher capital per employee.

Back in 2000, total factor productivity was six times lower in SOEs than in the private sector (OECD, 2010a). SOE restructuring a decade ago helped boost efficiency, as did privatisation. Private sector productivity accelerated around 2003 as foreign firms entered the market and as the pace of restructuring in state-controlled firms slackened (Figure 11, Panel B). The slowdown in total factor productivity outside agriculture in the five years to 2011 can be ascribed, in part, to the interruption of SOE restructuring.

Progress with liberalisation has generally been sluggish in other areas, including banking where the four very large state-owned commercial banks accounted for around half of all banking assets in 2011 (CBRC, 2012). The state also retains control over the second-tier banks and other lending institutions and foreign ownership is restricted.

The 12th Five-Year Plan (FYP) foresees a growing role for the private sector, including via the promotion of private investment in sectors hitherto dominated by SOEs. Sector-specific guidelines calling for an opening to private capital were issued in 2010 and 2012 covering energy, finance, telecommunications, transport and others areas. While lifting restrictions, the guidelines lack detail on what forms of investment will be permitted and whether any other limitations might apply. These new arrangements need clarification and more generally further steps are called for to improve the business environment. In the World Bank's latest survey of 185 economies, China ranked 91st for ease of doing business, ahead of some other large emerging economies but far behind most OECD economies (World Bank, 2012). Reducing the time to register a new business is one area needing attention.

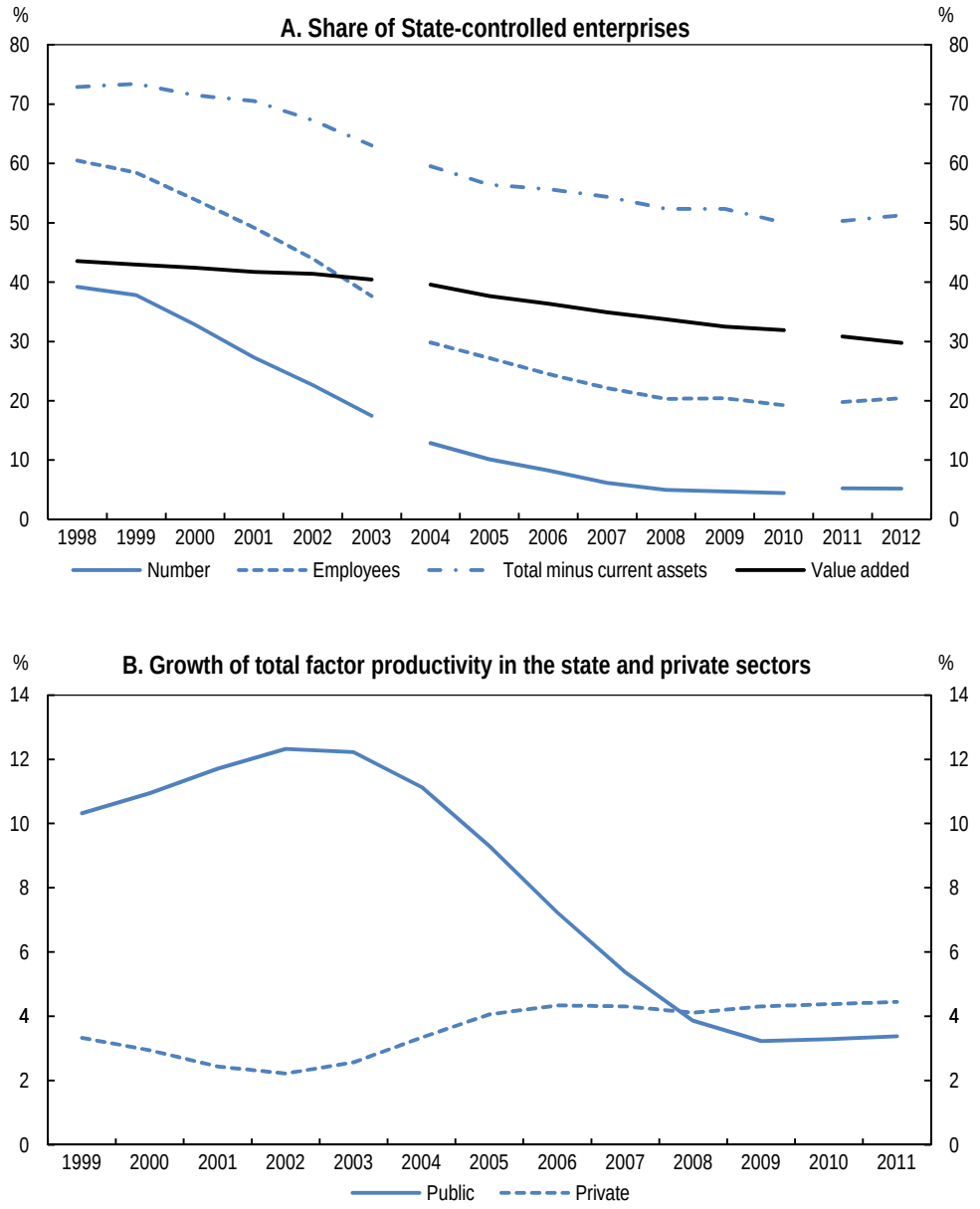
In order to stimulate private investment the authorities will need to proactively address any anticompetitive behaviour and strengthen institutional capacity to ensure effective enforcement. The effectiveness of the AML in promoting competition in China depends on how it is applied in practice. The authorities have begun to scrutinise mergers under the new framework and action has been taken against price collusion and other anti-competitive behaviour at the local level (Fels, 2012).

The 12th FYP also identifies a number of strategic emerging industries which the government is actively promoting with a view to increasing their share in the economy to 8% by 2015. In the process, the government needs to avoid promoting "national champions" and instead focus on removing impediments to investment. Undue industrial policy activism would stifle competition and work against other government objectives, including promoting the role of private enterprise.

Furthermore, renewed action is needed in the state-controlled sector. Local governments still own scores of loss-making industrial companies that need to be rationalised. In addition, more SOEs need to be run as corporations and listed on stock markets, which will boost their productivity (OECD, 2010a). This holds in particular for railways, postal services, water and sanitation enterprises. As well, a vast number of semi-commercial activities are still part of Ministries – especially in publishing, culture and sport. Over 20 000 SOEs are operating restaurants, hotels, wholesaling and retail stores, which could also be privatised.

As importantly, the corporate governance of the major central enterprises needs to be improved. A key challenge remains coordinating the multiple roles played by state entities – as shareholders, regulators and managers (OECD, 2011a). In particular, the opaque holding companies sitting between the listed SOEs and the government should become more transparent. Their listed assets should be split out from the holding company, which is generally the major shareholder of the listed company. Already in 2008, nearly 67% of the assets of centrally-owned SOEs were listed and they accounted for almost 90% of the after-tax profits of this sector. If the government became the direct shareholder of these listed companies (as is already the case with several major banks) then it would receive their dividends directly and transparency would be improved. The holding companies would then need to be restructured and their remaining assets

Figure 11. A comparison of the state and private industrial sector



Note: There are two discontinuities in the data series. The 2004 Economic Census brought to light a large number of hitherto unrecorded private sector companies. In 2011, the reporting threshold for industrial companies was raised from a turnover of CNY 0.5 million to CNY 2.0 million. These discontinuities have been controlled for in Panel B. The year-to-year growth in total factor productivity has been smoothed using a Hodrick-Prescott filter.

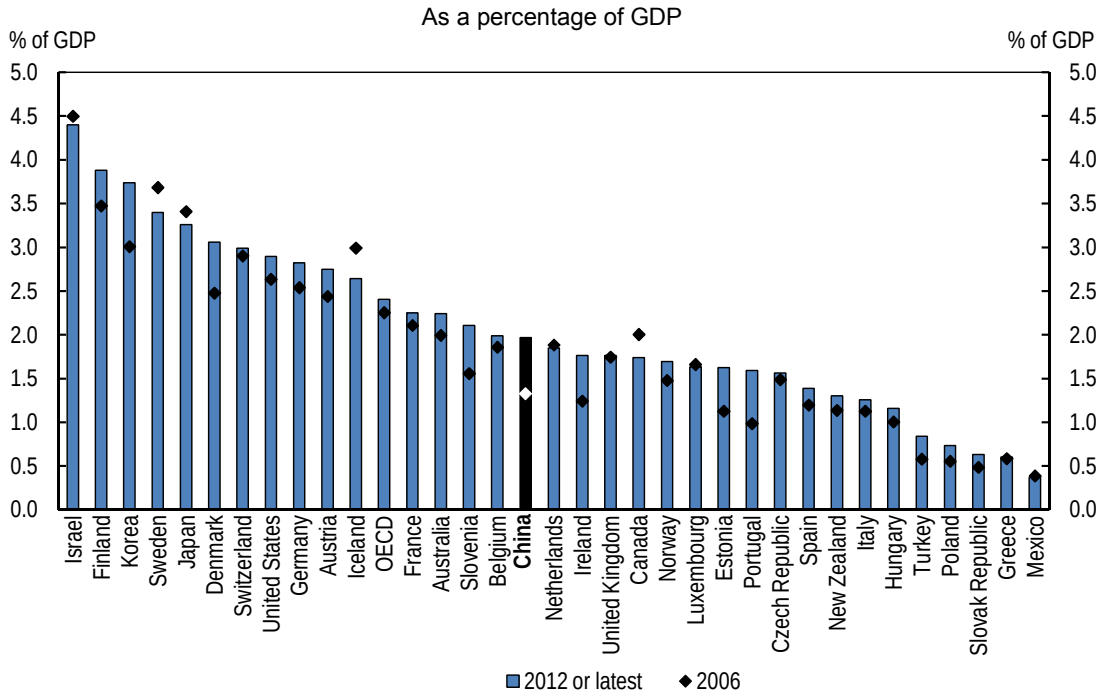
Source: OECD estimates based on data from CEIC on the main economic indicators of industrial enterprises.

eventually listed. While the overall corporate governance of the state-owned sector needs improvement, especially for the holding companies at the top the pyramid of SOEs, a few quoted SOEs have made considerable progress, with five of China's largest SOEs quoted in Hong Kong being rated as amongst ten companies with the best governance when judged by their compliance with the OECD *Code of Corporate Governance* (Hong Kong Institute of Directors and Baptist University of Hong Kong, 2012).

Research and development capacity continues to rise

Resources devoted to innovation in China are expanding rapidly, with research and development (R&D) spending approaching 2% of GDP by 2012 (Figure 12). Measured in absolute, PPP, terms Chinese expenditures are second only to the United States, having overtaken Japan in 2009, while China is home to one of the largest R&D workforces. As in many OECD countries, the business sector accounts for the largest share of R&D spending in China, which on the surface suggests strong industry-research linkages. However, this reflects the key function played by SOEs, rather than a leading role for private business, with only a little over a third of the spending by large and medium enterprises undertaken by private mainland firms or wholly owned non-mainland or joint venture companies.

Figure 12. Spending on research and development



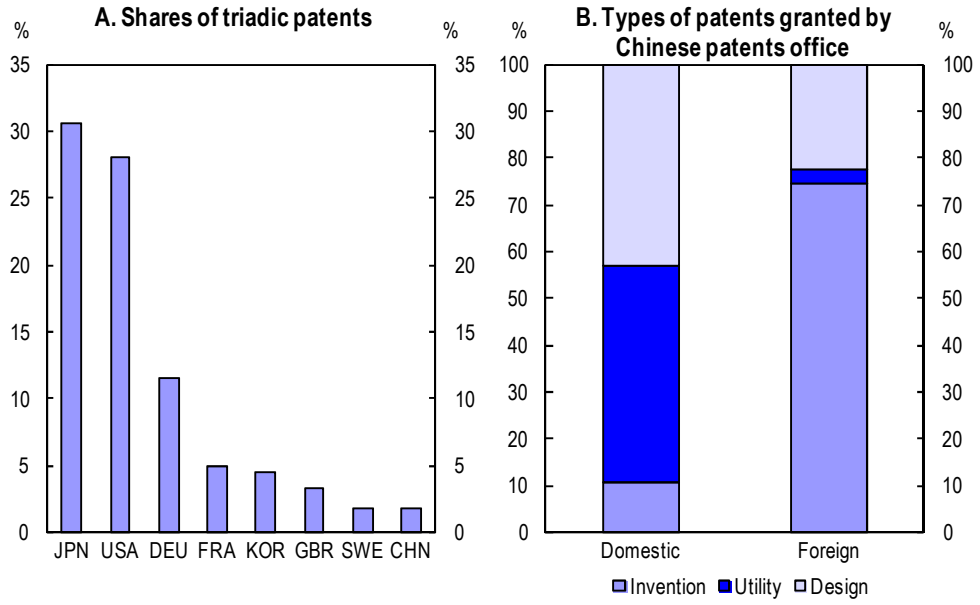
Source: OECD and NBS.

As part of its Medium and Long-Term National Plan for Science and Technology (MLP), the government is aiming to lift R&D spending to around 2.5% of GDP by 2020 while the 12th FYP includes an interim target of 2.2% of GDP by 2015. The MLP identifies several key priority sectors for innovation including: energy and environmental protection; information technology; biotechnology; large-scale machinery; new materials; and electric vehicles. As part of the innovation push, science and technology policy has broadened, with several ministries and other government agencies now contributing to its design and implementation while central and local governments increasingly draw upon a wide range of policy tools to pursue objectives, including tax breaks, subsidies and other forms of financial assistance (Liu *et al*., 2011). Local governments have also invested heavily in expanding innovation infrastructure, including technology parks, and provided incentives to boost the scientific workforce. These efforts have been complemented by supportive demand-side policies, including preferential government procurement arrangements for domestic innovators. As in other policy domains the central government sets the broad policy strategy for science and technology with sub-national governments required to establish a regional policy framework consistent with national objectives. Local governments also play an important role in funding innovation, accounting for an approximately equal share of public spending on science and technology as the central government in 2010.

As noted above, education attainment continues to rise strongly, including at the tertiary level, thereby enhancing innovation capacity. The proportion of the population holding post-graduate qualifications is also rising, albeit from a relatively low level, while China benefits from having a high proportion of recent doctorates being awarded in science-related disciplines (OECD, 2012b). As part of the broader effort to upgrade science and technology capacity, as well as boost higher education provision, the government has increased funding and implemented several reforms to increase university quality (Chen, 2012). As a result of these changes the higher education sector has become a key driver of innovation, particularly in basic and fundamental research, with the university and college share of high-quality domestic "invention" patents granted steadily rising from around 10% in 2000 to almost a quarter by 2010. Aside from increasing general funding to the sector, as in other emerging countries the government has adopted a strategy of building world-class research-oriented universities through special funding and other arrangements for a select group of leading universities. These changes have also ushered in reforms to working arrangements for academics which have converged towards the tenure-track system adopted in a number of OECD countries, placing more emphasis on publication records in determining promotions and funding. Efforts to lure leading Chinese scholars working abroad through special contracts, including more lucrative remuneration, have also been stepped up.

Strong growth in R&D resources has led to a tripling in the number of patents granted to domestic inventors in China between 2005 and 2010. Likewise, the number of scientific papers published by Chinese residents in domestic and international journals has soared in recent years. Despite these achievements China still lags well behind OECD countries in terms of innovation output per capita as well as high-end knowledge accumulation. One international benchmark of innovation capacity is the number of triadic patents held, which are those simultaneously registered in the leading markets of the United States, Europe and Japan. Though improving, on this metric China continues to score relatively poorly, accounting for less that 2% of the global total in 2010, well behind leading nations including Japan, the United States and Germany (Figure 13, Panel A).

Figure 13. China still lags well behind on patents



Source: OECD and NBS (2011).

Despite the progress to date, there are some indications that the quality of R&D is sometimes lacking and still focussed more on low-end innovations. In China the domestic patents authority, the State Intellectual Property Office, grants three types of patents which are available to both domestic and foreign inventors. Leading innovations are covered by "invention" patents which involve a more detailed examination by authorities and are granted for 20 years. In contrast "utility" and "design" patents are examined less carefully, offer protection for a shorter period and are used for incremental low-budget innovations. Whereas patents granted to foreign companies are dominated by "invention" patents, those awarded to Chinese firms continue to focus on the lesser "utility" and "design" types (Figure 13, Panel B). Quality issues are further highlighted by evidence that the implicit value of patents held by Chinese inventors is lower than their foreign counterparts' (Gupeng and Xiangdong, 2012). As patent renewal is costly, the decision by an inventor to renew a patent depends on its market value which will reflect, *inter alia*, its technology superiority over alternative inventions. Patents for inventions that are less valuable will be renewed less frequently while the opposite will hold for more valuable inventions. For patents registered with the Chinese patents authority, fewer patents are renewed by Chinese inventors, even after controlling for other factors that may impact on the frequency of renewal such as the field of innovation, implying a lower commercial value compared to the patents owned by foreign competitors.

Policies need to focus on enhancing innovation effectiveness as well as expansion

With innovation output continuing to lag the input of resources, further reforms are needed to improve the effectiveness of the innovation system. Ensuring that funding is allocated in an efficient and transparent manner is essential, particularly in light of government intentions to further ramp up R&D spending over the medium term. One of the main government agencies with responsibility for disbursing research grants is the National Natural Science Foundation. While this organisation allocates funding through a competitive, peer-reviewed process involving a range of external experts, it has a relatively modest staff, raising questions concerning its capacity to manage an increasing budget effectively. Indeed while allocated funding more than doubled between 2005 and 2010, to reach over CNY 10 billion the number of core staff with responsibility for managing and monitoring these funds declined. The cost of increasing the capacity of this institution to deal with rising research funding, including undertaking programme evaluation, is likely to be relatively low and would be a sound investment to help ensure large sums of public money are allocated efficiently.

A further concern, raised by Chinese scholars, is that public funding allocated through some mechanisms, including for national priority projects, has not always followed best practice and been skewed to favour particular initiatives or outcomes (Shi and Rao, 2010). This hampers objectives to improve research quality through competitive, merit-based funding. It also raises questions concerning the role of the government in guiding the direction of R&D. While priority setting can form part of an effective science and technology strategy, innovation, particularly ground-breaking research, is generally not amenable to excessive top-down guidance while attempts to "pick winners" can lead to waste. Avoiding policy myopia is a related challenge and the government recently scaled back its targets to expand the number of electric vehicles and increased the emphasis on hybrid vehicles. In addition, there is a need to strike a balance between ensuring adequate funding for fundamental research and supporting strategic initiatives. Compared with OECD countries public R&D funding in China is heavily oriented towards applied research suggesting that some rebalancing in funding priorities is needed in order to support cutting-edge research (OECD, 2012b).

Experience in OECD countries also highlights the importance of sound framework conditions for creating the right incentives and a supportive environment for innovation (OECD, 2010b). This includes a system of intellectual property rights (IPR) that balances the need to provide sufficient financial reward and protection for costly investments with the need to make new technology accessible to firms. China established an IPR framework consistent with international norms in tandem with WTO membership and

the signing of the international agreement on Trade-Related Aspects of Intellectual Property Rights in 2001. Since then several amendments, most recently in 2009, have brought the framework into closer alignment with those operating in many OECD countries. While efforts to strengthen enforcement have also been stepped up, concerns remain over infringement, including software piracy and the production of counterfeit goods (Kassner, 2012). In recent surveys, foreign investors in China continued to voice concerns over IPR enforcement (AmCham China, 2012; European Chamber, 2012).

Nevertheless, there are indications that when aggrieved firms seek legal recourse over possible IPR violations, matters are often dealt with adequately. Responses from one survey of foreign businesses showed almost two-thirds of those who had taken action against infringements were satisfied with the level of co-operation with local officials and courts (AmCham China, 2012). An analysis of trademark infringement cases dealt with by courts in the coastal province of Zhejiang showed that rulings overwhelmingly favoured foreign firms (Snyder, 2012). Both foreign and domestic firms are making increased use of legal avenues to address infringement concerns. Indeed, it would appear that as domestic innovation capacity expands, local inventors and owners of intellectual property, particularly in high-technology sectors such as software, are seeking stronger legal protection (Suttmeier and Yao, 2011). Going forward, IPR enforcement should be further strengthened by raising awareness of laws and ensuring adequate penalties for infringements. Such moves will help promote the diffusion of foreign technology, through the continued presence of multinational corporations, and achieve the policy objective of creating a world-class domestic innovation capability.

Strengthening other framework conditions including governance, competition and access to finance, will also support innovation goals. Access to finance is especially a problem for SMEs (OECD, 2010a). Firm-level analysis from emerging economies underscores the importance of framework issues such as access to finance and competition in determining the pace of innovation (Ayyagari *et al*., 2011). Indeed, in a survey of SME managers in China that examined the key institutional barriers to innovation, the top two responses related to problems in accessing finance and unfair competition (Zhu *et al*., 2012). This holds back the ability of small firms to innovate and commercialise their new technologies. Recently, though, access to finance has been improving, with a rapid increase in bank lending to small and micro enterprises.

Avoiding the "middle-income trap"

In sum, China is well-placed to avoid the so-called "middle-income trap" and to continue to catch up and converge towards the more advanced economies, even though growth is likely to slow from near double-digit rates in the first decade of this millennium to around 7% at the 2020 horizon – partly because of population ageing. However, in order to sustain vigorous growth and improve the well-being of most citizens, renewed reform momentum is required in a number of areas, which feature in the 12th FYP and are highlighted in this paper: financial sector liberalisation; open competition in markets for goods and services; education, research and innovation. Progress is also needed in other areas. In particular, more socially-inclusive forms of urbanisation need to be fostered, notably by addressing the problems stemming from a still rigid labour registration system, as discussed in a companion working paper (Herd *et al*., 2013). Greening growth, as discussed in another one (Hill, 2013), is also a major priority. In that sense, if there is a risk of a trap down the road, it would be that of a policy trap associated with insufficient reform more than some barrier that economies are bound to encounter as they climb up the income ladder.

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ANNEX 1: HOW MUCH HAS CHINA'S POTENTIAL GROWTH RATE SLOWED?

The recent performance of the Chinese economy suggests that its achievable trend growth rate has declined markedly. Average annual growth fell from 11.6% in 2002-07 to 9.2% in the subsequent five years. There are many reasons for this slowdown: notably the ending of the one-off gains that came from reforming state-owned enterprises and entering the world market after joining the WTO and the impact of the global Great Recession. Standard production functions can be used to determine the factors behind this slowdown but any estimate of China's trend growth has to take into account the specificities of a large, rapidly growing economy which still has a GDP per capita half that of the upper middle-income countries in the OECD area when measured at PPP exchange rates.

Separating trends and cycle in Chinese GDP

Most methods for estimating potential growth rest on using a statistical procedure to separate the trend from the cycle. Over the years many different methodologies have been used: the Hodrick-Prescott (HP) filter; band-pass filters; Kalman filters; exponentially weighted moving average filters and trend-cycle filters. Two types of filter are tested here in order to see which produces results that correspond best to *a priori* views on the development of the Chinese economy. The HP filter is the first to be evaluated, followed by a more general filter proposed by Mohr (2005), which allows an independent specification of parameters that govern the cyclical process and the length of the business cycle.

The HP filter

Filters allow separating components of a time series that have different frequencies. Lower frequencies are attributed to the trend, higher ones to the cycle and very high ones to seasonal movements. For the HP filter, there is a relationship between the only input variable λ (the smoothing parameter) and the cut-off frequency which is used to determine the trend. When the value of λ is set to 1600, as it often is for quarterly data, then the cut-off period corresponds to a cycle of close to 40 quarters (Mills, 2009). As a result, frequency components below 40 quarters will be attributed to the cycle though this may not reflect an economic reality if the business cycle lasts for less than 10 years.

With annual data, a value of 100 is commonly used for the smoothing parameter λ (for an example see Backus and Dehoe, 1992). In this case, the cut-off frequency becomes 20 years. As a result, such a filter will tend to produce large cyclical fluctuations and a very smooth trend. Different smoothing factors can be used with the HP filter but, since there is no cyclical model in the filter, changing the smoothing factor only changes the volatility of the trend element at the expense of the volatility of the cycle. Moreover, with the annual and quarterly smoothing factors set at 100 and 1600, there is no necessary congruence between the annual growth rates of the trend estimated from annual data and from quarterly data.

Ravn and Uhlig (2002) argue, on an empirical basis, that in order to obtain congruence between the trends estimated with an annual and a quarterly HP filter, it is necessary to set λ equal to 6.25 when the standard value of λ (1600) is used for quarterly data. Maravall and del Río (2007) give this claim a better theoretical basis by showing, algebraically, that λ should equal 6.65 with annual data if the cut-off point for attributing fluctuation to the trend is to remain at 40 quarters.

A Trend Cycle model

The second type of filter is one developed by Mohr (2005). The Trend Cycle (TC) filter is more flexible in that it has three input variables covering the orders of the autoregressive and moving average components of the cycle and the cycle length. This gives the methodology greater flexibility in separating the trend and cycle than the HP filter, overcoming the volatility trade-off of the HP filter. Moreover, by choosing the input parameters appropriately, the TC filter can replicate an HP filter.

An application to China

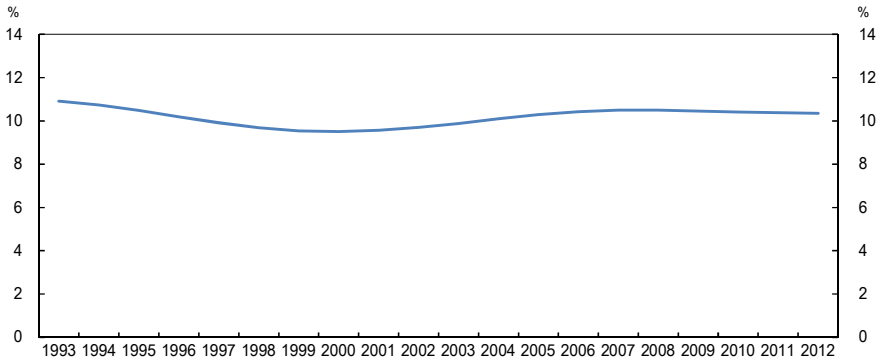
Several versions of the HP and TC filters were applied to the series measuring Chinese GDP. The objective was twofold. First, to have a filter that when used at the annual and quarterly frequency gave the same results for trend growth and the deviation from trend. Secondly, to determine which quarterly filter gave results that came closest to exogenous information on the state of the business cycle in China which was summarised by Yamasawa (2008) for the period until the Great Recession started and by relation to monetary policy after that date:

- Fiscal tightening in response to rising inflation (May 1993 to March 1994)
- Expansion following currency convertibility (mid-1995)
- The IT slump (August 2000 to February 2002)
- Expansionary policy (February 2002 to March 2004)
- Fiscal austerity to counter inflation (March 2004 to March 2005)
- Pre-Olympic investment boom (February 2005 to 2007)
- Monetary tightening to counter inflation (January 2008 to November 2008)
- Fiscal and monetary expansion to counter the Great Recession (November 2008 to mid-2011)
- Monetary tightening to counter inflation (mid-2011 to spring 2012)
- Monetary expansion (spring 2012 to date)

Correspondence between annual and quarterly estimates

When the HP filter with λ =100 is applied to annual data, the filter produces a very stable trend that fails to reflect the major reform shocks that have affected the Chinese economy, as this filter assumes a cyclical period of 20 years (Figure A1.1). Some have criticised this assumption on similar grounds in the case of European countries (Röger and Ongena, 1998).

Figure A1.1. Trend growth of GDP using an HP filter with λ = 100

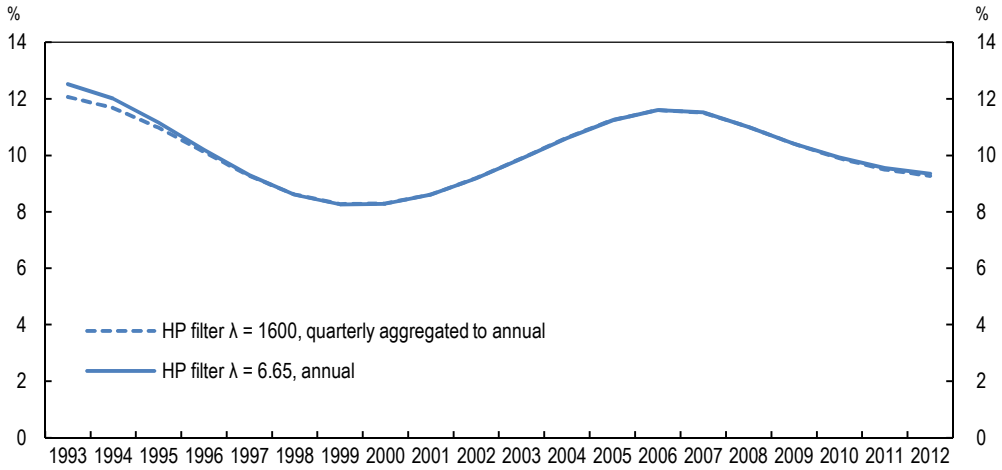


Note: the filter of the annual series was estimated from 1990 to 2012.

Source: Author calculations

Following Maravall and del Río (*op. cit.)*, the HP filter was tested with λ = 1600 for quarterly data and λ = 6.65 for annual data. The congruence of the annual and the aggregated quarterly data is almost perfect (Figure A1.2). Even in this case, however, the recent slowdown in trend growth is modest, as the filter still assumes a cycle of around 10 years.

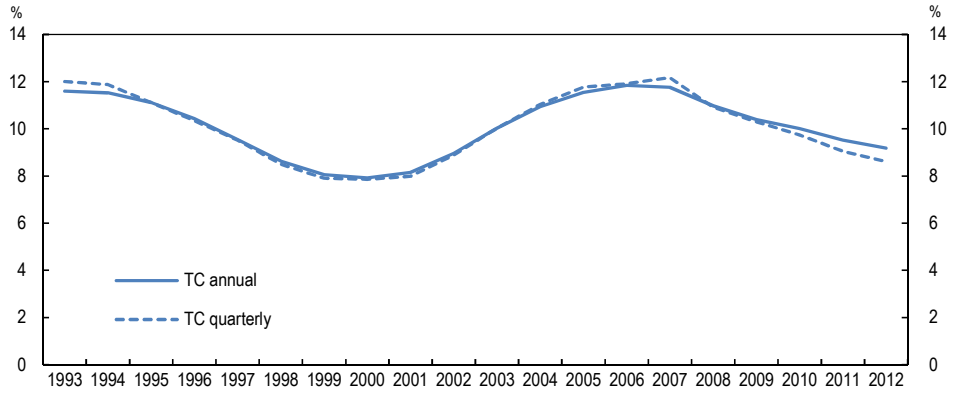
Figure A1.2. Annual and aggregated quarterly estimates of trend growth - HP filter with λ =6.65 and λ = 1600



Source: Author calculations.

Using the TC filter with parameters of two for the moving average and the autoregressive component and six years as the point at which components of the series are not allocated to the cycle, the annual and quarterly filters produce similar results for trend growth (Figure A1.3).

Figure A1.3. Annual and aggregated quarterly estimates of trend growth - TC filter using a 6-year cycle length



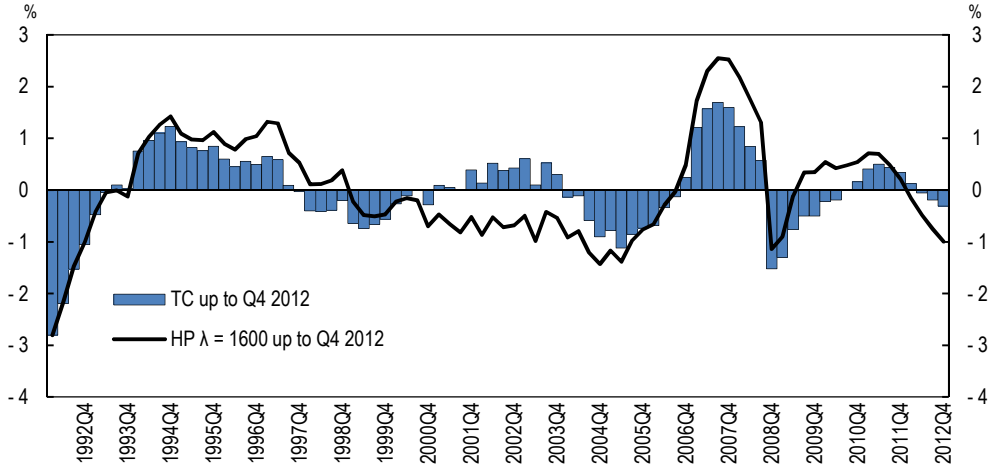
Note: Quarterly series estimated from 1992 to 2012, annual series from 1990 to 2012.

Source: Author calculations.

Given that the HP filter has a smoother trend than the TC filter, the former implies much bigger cyclical swings (Figure A1.4). As the TC estimates of trend GDP fluctuate more, they imply a more pronounced decline in trend growth at the end of the sample than does the HP filter.

Figure A1.4. Deviation of trend GDP from a trend estimated by a TC and an HP filter

Estimated from Q1 1992 to Q4 2012



Source: Author calculations.

Correspondence between quarterly deviations from trend and movements in the economy

The second factor governing the choice of filter, and the parameters for the filter, is whether the resulting deviations from trend GDP correspond to the reality of turning points in the Chinese economy. There are two problems areas for the identification of turning points with an HP filter (Figure A1.4):

1. The HP filter ($\lambda = 1600$) produces markedly worse results between 2000 and 2005, when it fails to identify the upswing and the following downturn.

2. At the end of the estimation period, in the fourth quarter of 2012, the HP filter shows the economy as being in as bad a recession as in the fourth quarter of 2008 period which does not correspond to most on-the-ground evidence.

3. The above problems are not shared by the quarterly TC filter which duly identifies the cycle in the first half of the 2010s and also gives a much smaller estimate of the deviation from trend in the final quarter of 2012 – a deviation which is, moreover much smaller than its estimate of the deviation from trend of GDP in the fourth quarter of 2008.

The end-point problems of the HP filter are well-known. Sometimes, in order to overcome this defect, the raw data is prolonged with a projection. The HP filter is then rerun over the entire length of the series including the projection. The resulting filtered series is then cut at the last historic point of the series. However, this methodology is problematic in that it contradicts the assumption used to create the filtered series. The best estimate of the next point of an HP filtered series is the trend provided by the filtered series. If another methodology is used to provide the extension of the series, then that methodology should be used to generate the trend. Extending the time series on the basis of a different model would contradict the model that has been used to estimate the filter in the first place, and therefore would not be a satisfactory solution (Mohr, 2006).

Overall, the results of these comparisons suggests that a TC filter with a cycle length set to six years provides a better measure of the trends in the economy and of cyclical developments than the HP filter

with standard input parameters. The quarterly version of the TC filter also gives more timely estimates of changes in trend growth than using annual data.

Chinese idiosyncrasies

At least three factors need to be taken into account when estimating China's trend economic growth rate and total factor productivity (TFP) from a structural model rather than using trends derived from GDP alone. These relate to rapid urbanisation, the shrinking weight of agriculture in the economy and the methodology used to measure government sector output.

Housing

The urban population has been growing at just under 3½ per cent per year for the past decade. Such growth has entailed a very large construction effort and an increase in the stock of housing relative to GDP. However, the latter makes no contribution to the growth of net domestic product as measured by the National Bureau of Statistics (NBS), as only estimated depreciation is included in GDP. No estimate is made of the profit (net operating surplus), either actual or imputed, stemming from the ownership of a property. Thus an increase in the proportion of the capital stock devoted to housing will tend to reduce the growth of any aggregate measure of TFP. The extent of the slowdown in TFP is thus best estimated by removing housing from both the capital stock and GDP, as is done in the OECD long-term projections. For most OECD countries, data for the housing capital stock are published by the national statistical office. For China, though, they have to be estimated based on published sources using equations in the NBS manual for the estimation of GDP (Herd *et al*. 2013). In addition, an estimate is also needed of the constant price valued added of the housing sector. This series is not published either and also has to be constructed following the NBS manual (*op. cit.)*.

Agriculture

As in other economies in transition from low to high income, a sizeable part of economic growth may come from the reallocation of resources between different sectors of the economy, notably out of agriculture. This transition still has at least another 25 years to run given the experience of other East Asian economies. Hence, it is useful to estimate trend growth separately for the agricultural sector and the remainder of the economy. Ideally, a production function would be estimated for agriculture. So far this has not been possible, though the primary sector the economy has become steadily more capital intensive.

Government sector

The Chinese national accountants measure the value-added of the general government sector by adding an estimate of the depreciation of the general government capital stock to the value-added created by government employees which is assumed to be equal to the compensation which is the sum of wages and salaries and in kind benefits of government employees plus, as in some OECD countries where the pension schemes of government employees are unfunded, pension payments to retired employees are added to the two other components of compensation of employees as a proxy for the long-run cost of the pension system. Gross real depreciation is computed by deflating nominal depreciation by a construction price index (Zhao, 2009). Real value added of employees is estimated by deflating total compensation by the consumer price index for selected services. Total real gross value-added is then the sum of these two components. Recently, some improvements have been made to the measure of real value-added from employees, by using various measures of real output. Nonetheless, this methodology effectively assumes that the productivity of government employees rises in line with their real wages. This may or may not be realistic but differs from the methodology used in many countries that follow the SNA where, until recently, productivity growth was assumed to be zero in the government sector.

The difference between these two methodologies generates a gap of almost one percentage point per year in the growth rate of China and countries that used the SNA to measure GDP in the period 1978 to 2006 according to Maddison (2007). This gap may have increased in recent years. If productivity in government services were held constant between 2005 and 2010, then the growth of the general government real value-added sector would be reduced from 9.7% per year to 2.9% per year. This would result in average GDP growth in the same period being reduced from 11.5% to 10.2%. The NBS has acknowledged that their procedure has probably overstated real growth of value added in non-market services (OECD, 2000).

Adjusting for the idiosyncrasies

While the first two idiosyncrasies can be addressed, it is not possible to deal satisfactorily with the third bias of the measure of TFP at the moment. There are estimates of nominal value-added for the government sector but there is no time series for nationwide employment in this sector, only estimates in census years. Urban employment in the government sector can be measured over time by using the urban work unit data as this data agrees with census estimate of urban employment. In rural areas, though, there is no time series based on work units. However, the 2010 census estimates that government employment in rural areas is only 15% of that in urban areas and so one possibility would be to assume that total employment in this sector grew in line with the urban work unit employment data. Such an adjustment has not been made here but the existence of differences in methodologies of measuring real GDP has to be acknowledged when comparing TFP growth in China and in other countries.

Estimating trend growth using a more structural model

The disadvantage of creating a trend series directly from GDP is that there is no information on the proximate causes of changes in trend such as labour, capital and TFP. While this may not be a problem for very short-term projections, it is a disadvantage for longer-term projections. This can be remedied by using a Cobb-Doulas production function for three sectors (housing, agriculture and the remainder of the economy). Ideally, government services would have been separated as well but as mentioned employment and capital stock data for that sector are not yet available. A sectorial analysis of productivity requires data for capital and labour which are available only at an annual frequency. Given the analysis of different filters presented above, the estimation of potential output using a production function has focussed on the annual version of the Trend-Cycle procedure.

The data

For the housing sector, series for gross fixed capital formation and value-added have been taken from Herd *et al.* (2013). The capital stock estimate for the primary sector is derived with a perpetual inventory method based on fixed asset investment and a depreciation rate of 4%, using fixed investment data from 1980 from NBS publications and for 1950-57 from Kang (1974). It was assumed that in the primary sector fixed asset investment was equivalent to gross fixed capital formation. Gross fixed capital formation in the non-agricultural sector was then taken as the difference between the official estimate of total gross fixed capital formation and the estimates of gross capital formation in housing and the primary sector. A starting point value for the non-housing and non-agricultural capital stock was taken from Table 77 in Liu *et al.* (1963), as there are no recent estimates of the stock of capital. For employment, standard data series were used from 1990, when employment data based on a large sample survey replaced administrative returns (implying a marked change in the level of employment).

The production function used to calculate TFP has not been estimated econometrically. Rather it has been calculated using average shares of capital and labour income in GDP measured at basic prices (factor cost). The major problem with such a methodology is that this requires knowledge of the labour share in self-employment (mainly agriculture activities), which is notoriously difficult to measure in developing countries (Gollin *et al.*, 2012).

Between 1992 and 2007, the Chinese input-output tables show an average labour share of 0.89 in value-added in agriculture when measured at basic prices (factor cost). However, according to the OECD (2000), the Chinese national accounts make no attempt to separate income from land and capital from compensation of employees. Given this, a literature search was undertaken to determine the appropriate share of labour income in agriculture in China. For Japan, Taiwan, Korea, and the Philippines the agricultural labour shares in agricultural value-added ranged from 0.31 to 0.53 over the period from beginning of the twentieth century to the 1960s (Hayami *et al.*, 1979). Using a production function with land, labour and capital, Chow (1993) found the labour share to be 0.35. An updated version of Chow's regression by Cao and Birchenall (2013) puts the labour share at 0.38. Hertel and his colleagues (2012) use an average labour share of 0.417 for 13 emerging Asian countries (excluding the People's Republic of China). Here, the agricultural labour share has been taken as 0.4.

Net indirect taxes can be split between the agricultural and non-agricultural sector using input-output tables. Together with the estimates of gross value added from housing presented in Herd *et al.* (2013) and the overall share of compensation of employees in total GDP measured at basic prices, the labour share in the value-added of the non-agricultural non-housing sector of the economy can be estimated. This share averaged 65% over the period 1992 to 2009 for which data for compensation of employees is available in the flow of funds accounts. The share was not stable. There was a marked fall from over 70% in the first half of the 1990s to 60% in second half of the past decade, a pattern that has been observed in most emerging economies in the past 40 years (Guerriero, 2012).

Results

Two models have been estimated: a one-sector model explaining trend GDP growth with aggregate employment and the capital stock and a three-sector model distinguishing between housing, agriculture and the remainder of the economy. The three-sector model is not complete in that only the non-housing non-agricultural potential GDP has been estimated from a production function approach. The potential output of the other sectors, which accounted for 10% of real GDP in 2012, has been assumed to be equal to actual output.

The level of potential output has been estimated in the following fashion:

trend non-agricultural employment rate = TC filter (non-agricultural employment / population 16+)

trend non-agricultural employment = trend non-agricultural employment rate * actual population 16+

ln(trend non-agricultural non-housing TFP) = TC filter (ln(calculated non-agricultural non-housing TFP))

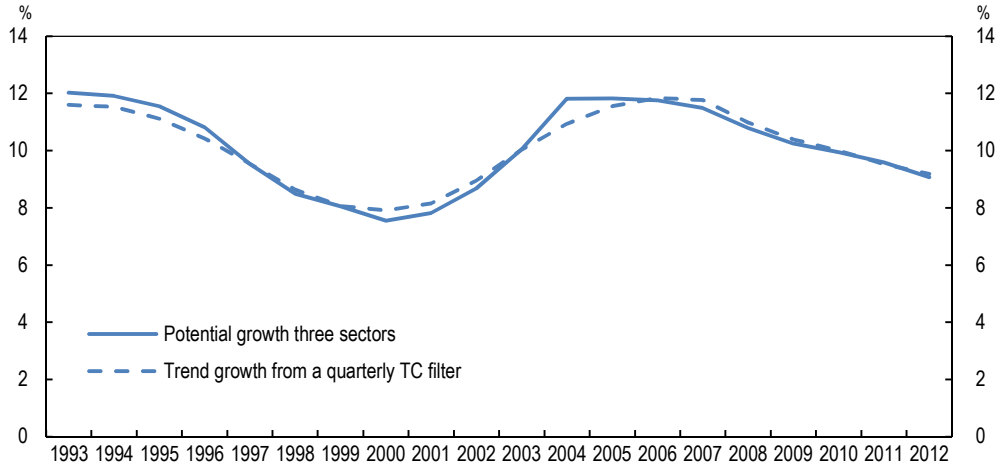
ln(trend non-agricultural non-housing GDP) =
ln(trend non-agricultural non housing TFP) + 0.65*ln(trend non-agricultural employment) +
0.35* ln(actual non-agricultural capital stock) + scaling constant

trend GDP = trend non-agricultural non-housing GDP + agricultural GDP + housing GDP

The estimation period for the filters was 1990 to 2012. For 2013, all logarithmic trend variables have been prolonged from their estimated 2012 values, by adding the first difference of the series in 2012 and the average of recent second differences of the series to the trend value in 2012, so allowing for any systematic movement in the trend. A similar procedure has been adopted for the trend series in absolute units. Actual GDP has been forecast to growth by 7.5% in 2013.

This three-sector model of potential growth shows a marked slowdown in the annual growth of potential output from a peak of 12% in 2005 to 8.9% in 2012 with a further decline to 8.2% projected for 2013 (Figure A1.5). This result is not affected by changing potential output in the housing and agricultural sectors to trended variables

Figure A1.5. Alternative estimates of potential growth



Source: Author calculations.

The contributing factors to the overall slowdown in potential output growth since 2007 are the following:

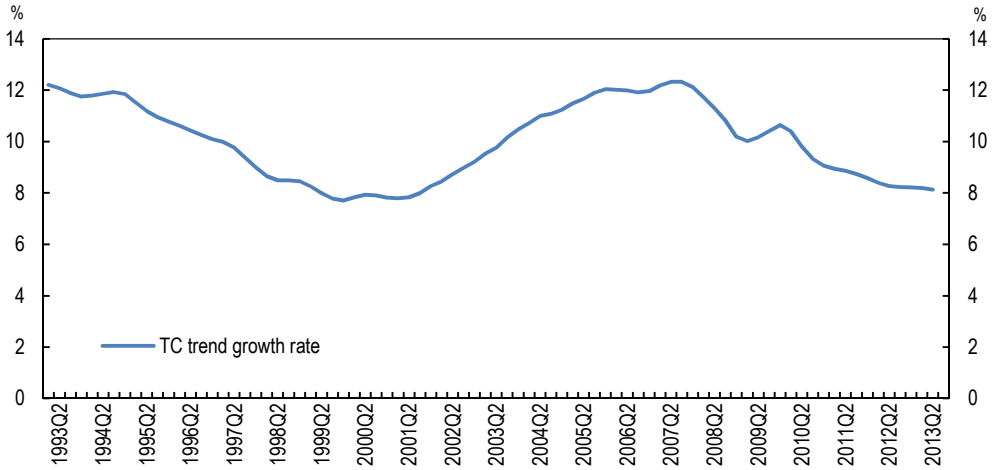
Table A1.1. Contribution of various factors to the cumulative slowdown in GDP growth between 2007 and 2013
Projected potential GDP in 2013 relative to what potential GDP in 2013 would be based on a projection at the 2007 trend growth rates of labour and TFP.

Sector	% difference		100*log difference[1]
Total GDP	-10.6	Non-agricultural non-housing GDP	-12.9
of which		*of which*	
Non-agricultural non-housing	-11.2	TFP	-5.1
Housing	0.1	Inputs	-7.8
Agriculture	0.5	Capital	-1.8
		Trend labour	-6.0

Note: Logarithmic differences have been used so that the components add to the total, given that the production function is logarithmic and not linear.
Source: Author calculations.

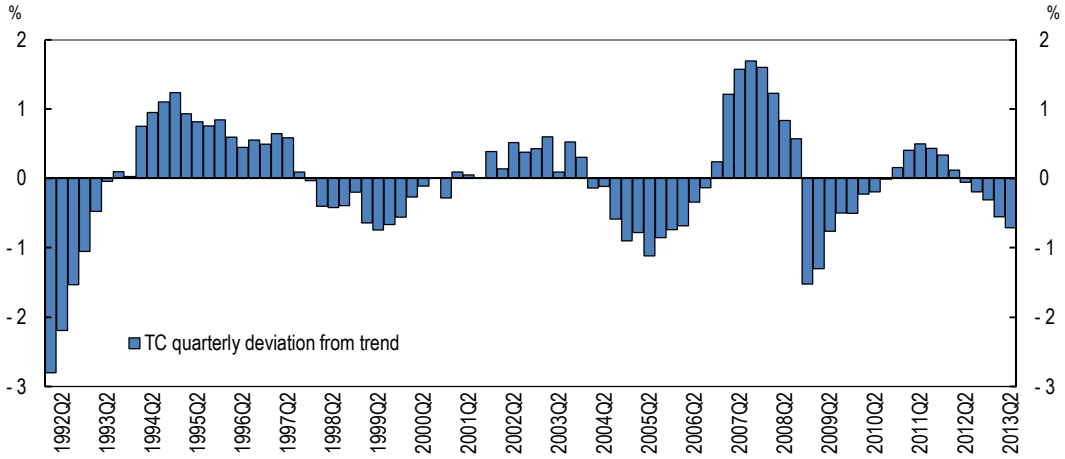
While the three-sector model is useful for understanding the factors behind an estimate of potential output, it adds little extra information to the direct estimation of trend growth from GDP data. There is a close correspondence between the growth of potential output from the three-sector annual model and the trend growth rate of GDP estimated from filtering the annual GDP data (Figure A1.5). Given the delays in obtaining annual data for labour and capital, this suggests that it is advisable to model the recent movements in potential by filtering a quarterly GDP series using the Trend Cycle method. When the estimation period is extended to the second quarter of 2013, the trend growth rate slips further, suggesting that the trend growth rate of the Chinese economy, measured over four quarters, had slipped to 8.1% (Figure A1.6). For the second quarter of 2013, the deviation from trend shown by this filter has increased relative to that at the end of 2012 and is in line with that of the 1999 and 2005 downturns (Figure A1.7).

Figure A1.6. Trend GDP growth estimated quarterly using a TC filter



Source: Author calculations.

Figure A1.7. Deviation from trend GDP estimated quarterly using a TC filter



Source: Author calculations.

Conclusion

In terms of methodology, a comparison of the HP filter and the TC filter on annual and quarterly GDP data suggests that the latter gives more plausible estimates of the Chinese business cycle. In the short term, a three-sector model of annual potential output that uses a TC filter for generating the labour and TFP trends used in an a production function does not give substantially more information about the growth of potential output than filtering annual or quarterly GDP with a TC filter that assumes a cycle length of 6 years. This suggests that the estimated growth of potential output in the very short-term can be guided by quarterly filters. For longer periods a more structural model is more useful.

The production function approach shows a slowdown in potential growth of 3.6 percentage points from the high point in the middle of the past decade. This slowdown can be attributed almost equally to a slowdown in the growth of labour supply to the non-agricultural sector and a slowdown in TFP growth, offset by very slight increases in the housing and agricultural sector.

Accordingly, both labour market reform to reduce the costs of migration and reforms to boost productivity are important to keep up growth in the future.

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