ECONOMICS

FERTILITY AND SAVINGS CONTRACTIONS IN CHINA: LONG-RUN GLOBAL IMPLICATIONS

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DISCUSSION PAPER 16.24

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Abstract

Following three decades of rapid but unbalanced economic growth, China's reform agendas are set to rebalance the economy toward consumption while maintaining strong GDP growth. Headwinds include a demographic contraction that will bring negative labour force growth and rapid ageing. Rising aged dependency, combined with lower saving rates will rebalance the economy but they will reduce both GDP growth and real per capita income. While an effective two-child policy could sustain growth and eventually mitigate the aged dependency problem, it would set real per capita income on a still lower path. These conundrums are examined using a global economic and demographic model, the results from which show that continuing demographic and saving contractions in China would alter the trajectories of both the Chinese and global economies.

Key words:

China, demography, saving imbalances, spill-overs, global effects

JEL Codes:

F42, F43, F47

* 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 April 2016.

1. Introduction

Between 1978 and 2008, domestic economic reforms coupled with opening up to the international economy delivered unprecedented rates of economic growth in China, transforming not only the Chinese economy, but the global economy as well.¹ These three decades also heralded dramatic demographic change in China, with ongoing fertility declines following from the introduction of the one-child policy in 1980, along with socio-economic developments thereafter. Lower fertility reduced youth dependency, raising the growth of the labour force relative to that of the total population and yielding the much-celebrated ‘demographic dividend’.²

While the first decade and a half delivered ‘reform without losers’, from the mid- 1990s the commonality of interests served by the continued growth and reform began to break down (Lau, Roland and Qian 2000). By the mid-2000s, then premier Wen Jiabao called for urgent reforms to an economy that he described as “unbalanced” and “unsustainable” (Wen 2007, 2011). Most striking was the fact that China’s consumption grew comparatively slowly, while savings were at an unusually high rate, beyond its domestic investment needs. This left China producing more than it consumed and so running a substantial current account surplus and accumulating considerable foreign assets, contributing not only to growing social unrest at home, but also to tensions abroad. Protectionist pressures rose, particularly in the US, where there were prominent accusations of ‘currency manipulation’ and that China’s contribution to the “Asian savings glut” had been a major contributor to the global financial crisis (GFC) in 2008–09 (Bernanke 2005, 2011).

In response to these tensions, economic policy efforts after 2004 emphasised the need for a more balanced growth strategy to boost domestic demand and reduce the country’s reliance on external demand (Lardy 2006; Hu 2007; Wang and Cai 2015). Although only limited ‘rebalancing’ has occurred in the decade since, President Xi Jinping remains committed to a reform agenda that should, if effective, lead the economy towards consumer-led growth in the decades ahead. Yet however effective, this has been associated with a transition to slower, ‘new normal’, rates of growth. This has added a new source of anxiety as to what the domestic and global economies will look like in China’s ‘post-boom’ period.

¹ This extraordinary performance is much written about. Works focussing on international implications include Eichengreen (2004), Bergsten (2008), Bernanke (2011), Chinn et al. (2012), Lardy (2012), Autor et al. (2013), Harris and Robertson (2013), Arora et al. (2015), Tyers (2015, 2016a, 2016b) and Golley et al. (2012).

² The demographic dividend has been variously estimated as being responsible for between one sixth and one quarter of per capita GDP growth in this period. See Cai and Wang (2005), Bloom *et al* (2010), Wei and Hao (2010) and Golley and Tyers (2012a, b).

New attention now focuses on the longer-term consequences of fertility decline, including the relatively rapid ageing of the population, the reversal of the ‘demographic dividend’ and the uniquely Chinese phenomenon of ‘growing old before growing rich’ (Cai 2010, 2012). In late 2015, the Chinese government announced that the one-child policy would be abolished and replaced with a nationwide two-child policy, effective as of 1 January 2016. Higher fertility, according to the National Health and Family Planning Commission, is expected to add 30 million people to the labour force and increase the rate of GDP growth by 0.5 percentage points by 2050.³ These expectations, however, hinge on the assumption that a significant proportion of parents choose to have a second child. An alternative possibility, and a more likely one, is that China is headed for a ‘low-fertility trap’, consistent with other countries in the region, including Japan and South Korea.⁴

The economic and demographic strategies being pursued by the Chinese Government are indicative of at least two interrelated conundrums. First, consumption-driven growth will require reducing the saving rates that have financed investment-led growth of the past. Doubt remains as to whether growth in consumption can sustainably replace that in export demand at the intended pace (Ma and Yi 2010; Yang *et al* 2011). Second, while higher fertility rates would indeed contribute to higher rates of GDP growth and likely to higher consumption as well, they would come at a per capita income cost, with negative welfare implications (in economic terms at least) for the average Chinese citizen.

This paper offers quantitative analysis of these conundrums using a dynamic global economic model that incorporates full demographic behaviour. 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’. The results show that the implications of the demographic and the double contractions for both the domestic and global economies 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

³ See, for example, http://www.chinadaily.com.cn/china/2015-12/21/content_22759611.htm

⁴ This position is suggested by, among others, Chen *et al.* (2009), Basten and Jiang (2015) and Zhao (2015).

China's context. Section 3 summarises our approach to modelling demographic change and economic performance. 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

Here we review developments in China's demographic structure as well as in its saving and investment behaviour. These three elements of the Chinese economy are extraordinary by international standards with the population and labour force in decline and very high levels of saving and investment (Figure 1). During the growth surge of the 2000s about half of all China's income was saved and almost half was committed to investment. The consumption share of total income declined by 10 percentage points in this period and the corporate share of total saving was running at a fifth of GDP.

2.1 Demography

China's demographic transition commenced well before the one-child policy was introduced in 1980, with fertility rates declining from the 1950s onwards, and with particularly sharp drops in the 1970s (Wang and Cai 2010). The one-child policy solidified this decline and, according to official claims, averted 400 million births during its first three decades, while more careful analysis by demographers puts the figure closer to 250 million (Wang, Yong and Gu 2009). Doubtless, China's population growth slowed substantially after 1980 and the one-child policy was a major contributor.

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).⁵ A second economic effect of declining fertility, not accounted for in the older growth models, comes via the change in the age distribution of the population.⁶ At first,

⁵ See Golley and Tyers (2012a) for a more detailed discussion on this point, about which most, but not all, economists agree. See also the detailed analytical review of offered by Pitchford (1974: Ch.4).

⁶ Overlapping generations (OLG) models building on Diamond (1965), with sufficient disaggregation to capture dependency effects, have been applied to this issue, mainly with a focus on saving. See, for example, Choukhamane et al. (2014).

declining fertility reduces youth dependency and raises the proportion of workers in the population. Income per capita is therefore boosted, strengthening the basic Solow-Swan result and giving rise to the ‘demographic dividend’.⁷ In most related research the proportions of dependents and workers in the population is proxied by simple age classifications: ‘youth’, the population below the age of 15; ‘working age’ between 15 and 65; and ‘aged’ over 65. The UN (2015) defines a total dependency ratio as the quotient of youth and aged categories with the working aged. This ratio declined rapidly in China between 1980 and 2010, mainly due to declining youth dependency. From 2010 onwards, a sharp upturn in total dependency appears, driven by sharply rising aged dependency.⁸

Low fertility also 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 the comparatively skill-intensive, and mainly urban, services sector. In China, this skill composition is predominantly shaped by the proportions of the rural (low-skill) and urban (high-skill) populations. While traditionally higher fertility rates in rural areas supported the rapid expansion of unskilled labour-intensive manufacturing that dominated China’s export-led growth in the past, from the mid-2000s onwards, slowing rural labour force growth fed into labour shortages in the major export producing cities, albeit to an extent that has been highly debated.⁹ Future fertility trends, particularly as they differ between the skilled and unskilled populations, thus remain an important determinant of China’s competitiveness in all sectors of the economy. Our modelling exercise below allows for these fertility distinctions.

2.2 Saving behaviour

As Figure 1 shows, Chinese saving makes up about half its GDP, though two fifths of it is corporate saving, or retained earnings by companies for the purpose of financing new investment. Demographic change has direct implications for this form of saving but it also affects corporate saving, though less directly. We discuss the likely changes in these two components separately.

⁷ See Bloom and Williamson (1998) for a generic discussion of the demographic dividend in developing countries, Bloom *et al* (2000) for a detailed examination of the implications for Asia, and Cai and Wang (2005) for implications for China.

⁸ More accurate measures of dependency require knowledge of participation rates by age and gender, so as to evaluate the number of dependents per actual worker, rather than per individual in the population of working age. See the further discussion on this point in the following section, as well as Golley and Tyers (2012a, b).

⁹ Contributors to this debate include Cai (2010), Minami and Ma (2010), Golley and Meng (2011) and Golley and Wei (2013).

Household saving:

A further economic effect of fertility decline is via its impact on household saving rates. This effect is formalised in Modigliani's (1976) life-cycle hypothesis (LCH), which predicts an inverted U-shaped saving-age profile, in which a rising proportion of workers, particularly those of middle age, underpins rising saving rates, in contrast with rising shares of youth and young workers or the aged, who tend to be dis-savers. Evidence supporting the applicability of the LCH to China has been mixed. While Modigliani and Cao (2004) find empirical support for it 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.

By contrast, Chamon and Prasad (2008) find age-specific saving rates form an 'unusual U-shape', with high saving rates by younger workers and retirees. This is explored further by Rosenzweig and Zhang (2014), who follow Mason and Lee (2004) in assigning particular significance in China's case to co-habitation across generations. Sharing the parental home is a potential mechanism for lowering consumption by the young thus permitting higher household saving rates. If young adults desire to save, economies from share housing can boost their capacity to do so. Young people with higher incomes are more likely to leave their parents and form new households. Therefore, households with young heads are selectively richer, resulting in higher saving rates.

Chen (2016), among others, seeks to explain high saving rates at advanced ages, focussing on the impact of pension schemes in China. He finds that higher pensions lead to higher saving, rather than higher consumption. Motivations include the anticipation of future medical expenditures and bequest demands. Urban pensions appear comparatively generous in China and, given that the reforms of the 1990s saw a transition to comparatively high rates of home-ownership, the potential for saving in retirement is high compared with other economies with similar real per capita income levels. Rural pensions are less generous, however, and rapid ageing makes questionable the fiscal sustainability of the real values of current urban pension rates, at least without new taxes on housing wealth. Chen (2016) argues that the ratio of total pension payments from general government, including the pension pool, to general government expenditure roughly tripled in the 15 years to 2004. And from Figure 1 it can be seen that China's general government deficits are considerable and widening. On the one hand this supports the view that high pensions may not be sustainable and, on the other, that they do not

add greatly to total national saving, since their effect on household saving is offset by reduced government saving.

These explanations for the age distribution of saving rates do not shed light on the reasons for rising overall household saving rates, however. Song and Yang (2010) propose an explanation for rising saving rates, particularly among young households, that depends on China's growth surge. As an economy starts fast-paced growth, the earnings of young workers rise more rapidly than those of older workers, resulting in a flattening of the age-earnings profile during the transition period. This is because young workers with appropriate knowledge and skills are more productive in a high-growth environment. The structural change in earnings induces higher household saving rates through two mechanisms. At the older end, increased saving smooths income growth for retirement. At the young end, while young workers earn more relative to older cohorts at the entry level, they understand that the future entry of new workers with greater productivity will reduce their earnings growth due to diminishing returns in knowledge and skills. Faced with a flattened age-earnings profile, young workers therefore have the incentive to save more today to compensate for reduced earnings over their lifetimes.

Compounding these aggregate impacts, Choukhamane et al. (2014) identify further micro-channels through which the pattern of fertility decline to date affects individual household saving decisions. These are a reduction in total expenditure on children and higher parental savings in anticipation of reduced transfers from their progeny in the future. In all, Choukhamane et al. 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 saving would have been reduced by 6.5 percentage points. These results suggest that a successful two-child policy in the future will reduce household saving rates.

Du and Wei (2010, 2012) and Wei and Zhang (2011) identify yet another micro-channel that supports this point, attributing 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 as the number of unmatched men of reproductive age rises beyond 30 million.

Overall, considering the experience of the more advanced economies, continued demographic contraction and associated rapid ageing in China is most likely to lead to an eventual running-

down of household wealth and hence contribute to lower aggregate household saving rates in the future. The question then arises as to whether a successful two-child policy would offset this trend. In the coming decade or two at least, we expect the reverse: an acceleration of the rate of decline in household saving rates. This is for three reasons. First, a successful two-child policy will arrest the decline in youth dependency and therefore help raise consumption, while yielding little additional income for almost two decades. Second, it is also likely to reduce some of the dependency pressure to save that bears on older households, and third, it will also reduce the marriage market pressure to save that is carried by young households.

Corporate saving:

The levels of retained earnings in China's state and private sectors are many times higher than those in the advanced economies. They constitute savings because they draw funds from corporate income and commit them directly to investment, without the opportunity for owners (share-holders or, in the case of the government shares of SOEs, the public) to choose to direct these funds either to consumption or household saving. They arose during the growth surge of the 2000s, as indicated in Figure 1, from a rise in the profitability of SOEs and the lack of any requirement to pay dividends to the state, combined with advantageous corporate taxation arrangements (Kuijs 2006). Moreover, private enterprises had even greater incentives to save because of legal and financial market imperfections, whereby credit creation, mostly controlled by state banks, was directed mainly to the SOEs.

Private enterprises, which grew substantially in number and output share in this period, relied on comparatively expensive non-bank financing and retained earnings. Lower dividend requirements and this private investment financing motivation yielded an especially high savings rate for the corporate sector (Yang 2012). As Figure 1 shows, the share of corporate saving in GDP has declined since the global financial crisis (GFC), as the profitability of the remaining SOEs has also declined. The analysis offered by Tyers (2014) indicates that further privatisation, taxation and competition reforms would greatly reduce this source of national saving.

2.3 Investment

Investment surged following the contraction in demand during the GFC and the expansion in public infrastructure projects. As China's growth slows, this level of investment will no longer be needed and the associated construction industry will need to be downsized. This is planned under the government's 'rebalancing' strategy, which targets growth led by consumption rather

than investment. While the pace of rebalancing has been slow to date, there is undeniable progress in major areas of the economy, including recent reforms to agricultural land property rights, inter-governmental fiscal reforms and higher taxes on SOEs to be transmitted back to the state in order to support the pension and other social welfare systems (Naughton 2014, Bloomberg 2014). The collective effect of these and other reforms will see a continuation of the rise in the share of consumption in GDP that is evident in Figure 1 since 2010.¹⁰

Despite the economic imbalances caused by China's high saving and investment rates, it is important to recognise that the investment, both public and private, has underwritten the transformation of the Chinese economy and the elevation of hundreds of millions to middle class lifestyles. Moreover, the excess of Chinese savings over investment contributed a third of the rise in global saving 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. Indeed, 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.¹¹ The key question that remains is whether lower Chinese saving in the future will eliminate, or at least reduce, the perceived domestic and international problems associated with it, 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.

3. Modelling the Long-run Impacts of Chinese Demographic Change

The approach adopted is to employ forward simulations from a dynamic numerical model of the global economy that incorporates complete demographic behaviour.¹² The version used here has multiple regional households, disaggregated by age group, gender and skill level, each

¹⁰ There is evidence that the rise in the consumption share of GDP began earlier than the official statistics suggest. See Huang *et al* (2012) and Garner and Qiao (2013).

¹¹ See the survey in Tyers (2015). The savings glut hypothesis is reviewed by Arora *et al.* (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).

¹² 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 (Ianchovichina and McDougall 2000, Ianchovichina and Walmsley eds. 2012). Earlier applications of the standard model with preliminary demography include those by Tyers and Shi (2007, 2012) and by Golley and Tyers (2012a and b).

with endogenous saving rates. The unique elements of its structure are described in the following sub-sections.

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 ILO's occupational classification (Liu *et al* 1998).

Each age-gender-skill group is a homogeneous sub-population for which the group-specific parameters are: birth rates, sex ratios at birth, age and gender-specific death, 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. Complete matrices of migration flows between regions are also represented for each age, gender and skill group.¹³ 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 ‘gate keeping’ roles of immigration policies in destination countries.¹⁴ A further key parameter is the rate at which each region's education and social development structure transforms low-skill (production) worker families into high-skill (professional) worker families. Each year a group-specific proportion of the population in each low-skill worker age-gender group is transferred to professional (high-skill) status. These proportions depend positively on the regions' levels of development (proxied by real per capita income), the proportion of low-skill to high-skill labour and the skilled wage premium.

Labour force projections:

To evaluate the number of full-time equivalent workers, we first construct labour force participation rates, $P_{a,g,r}$ 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

¹³ The origins of the migration matrices are detailed by Tyers and Bain (2007).

¹⁴ As emphasised in World Bank (2015), while migration surges during periods of conflict, flows through time are overwhelmingly motivated by differences in real per capita income and real wages.

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 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, $F_{a,g,r}$. The labour force in region r is then:

$$(1) \quad \bar{L}_r^t = \sum_{a=1539}^{60+} \sum_{g=m}^f \sum_{s=sk}^{unsk} L_{a,g,s,r}^t \quad \text{where} \quad L_{a,g,s,r}^t = \mu_{a,r}^t P_{a,g,r}^t F_{a,g,r} N_{a,g,s,r}^t .$$

Here $\mu_{a,r}^t$ is a shift parameter reflecting the influence of policy on participation rates. The time superscript on $P_{a,g,r}^t$ refers to the extrapolation of observed trends in these parameters.¹⁵ $N_{a,g,s,r}^t$

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 age group a , gender group g , skill group s and region r , and $\bar{L}_r^t$ is the aggregate labour force in region r .

Dependency ratios:

We define four dependency ratios. First, we calculate a youth dependency ratio as the number of children per full time equivalent worker:

$$(2) \quad R_{r,t}^Y = \frac{\sum_{g=m}^f \sum_{s=unsk}^{sk} N_{015,g,s,r}^t}{\bar{L}_r^t} .$$

Then, for aged dependency, the numerator comprises only the *non-working* population over 60.

$$(3) \quad R_{r,t}^{ANW} = \frac{\sum_{g=m}^f \sum_{s=unsk}^{sk} (N_{60+,g,s,r}^t - L_{60+,g,s,r}^t)}{\bar{L}_r^t} .$$

Finally, a more general dependency ratio is defined that takes as its numerator the total non-working population:

$$(4) \quad R_{r,t}^T = \frac{\sum_{g=m}^f \sum_{s=unsk}^{sk} N_{015,g,s,r}^t + \sum_{a=1539}^{60+} \sum_{g=m}^f \sum_{s=unsk}^{sk} (N_{a,g,s,r}^t - L_{a,g,s,r}^t)}{\bar{L}_r^t} .$$

¹⁵ Although part time hours may well also be trending through time, we hold F constant in the current version of the model.

This last ratio indicates the number of non-working people of *all* ages and genders per full time equivalent worker.¹⁶

3.2 The global economic model

We use a multi-region, multi-product dynamic simulation model of the world economy.¹⁷ In it the world is subdivided into 18 regions, including, as separate regions, mainland China, Taiwan and Hong Kong. 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.

Sources of growth

As in most other dynamic models of the global economy the main endogenous components of simulated economic growth are labour force growth and physical capital accumulation. Human capital creation occurs as well, via a skill transformation process built into the demography that is sensitive to skilled wage premia, although it tends to have comparatively small growth effects in this model.¹⁸ 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 per capita real income growth rate.¹⁹

¹⁶ Note that the total dependency ratio is not the sum of youth and aged dependency, since the participation rate of working aged adults is significantly less than unity.

¹⁷ The model follows the structures introduced by Ianchovichina and McDougall (2000), Dixon and Rimmer (2002) and Ianchovichina and Walmsley (2012).

¹⁸ For a model in which human capital accumulation plays a larger role, see Harris and Robertson (2013).

¹⁹ The factor productivity growth rates assumed here are based on a survey of the literature through the 1990s. Key elements are that 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).

Investment

As represented in the model 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 saving contributes. In models of this type there is the tendency for the allocation of new investment to regions that have rising 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, most likely, in the future.

To avoid this we 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. An interest premium variable is made endogenous in this pre-baseline simulation to capture the associated premia. It creates wedges between the international and regional borrowing rates that trend through time, showing comparatively high premia in 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.

Consumption and saving

The sixteen groups (based on age, gender and skill) differ in their consumption preferences, saving rates and their labour supply behaviour. Regional national income is first divided between government consumption and total private disposable income. The implicit assumption, stemming from the design of the original model to serve long-run analysis, is that governments balance their budgets while private groups are either net savers or borrowers.

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 inter-temporal

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 per capita disposable income. A mechanism is then added to allow these group-specific saving rates to trend toward long-run targets.

As discussed in Section 2.2, in the case of China saving behaviour goes beyond age-specific saving rates at the household level. Corporate saving is high but declining, and likely to decline further, general government saving is currently negative and becoming more so. Since there is no direct facility to represent these in the model, their effects are captured through changes over time in shifters influencing consumption behaviour by population groups. In the simulations saving rates are endogenous in the short run but follow long-run trends that are influenced by anticipated changes in government and corporate saving. Thus, downward trends in saving rates occur not only because of the direct and endogenous effects of demographic (life cycle) changes but also to reflect these anticipated shifts in other forms of saving.

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. Instead, 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, the exogenous components of our baseline consumption behaviour are chosen so that saving rates remain relatively high, declining over time but modestly, reflecting little anticipated change toward government deficits and lower rates of corporate saving. Our motivation for this is to emphasise the implications of both demographic and saving contractions as departures from this baseline.

4.1 The demographic scenarios

Baseline fertility in China is set to return its average fertility rate to a stabilising level (2.1 children per woman) by 2050, underpinned by fertility increases for both skilled and unskilled 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 demographic contraction scenario, China's fertility rates are assumed to fall asymptotically toward one child per woman, paralleling 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. The average falls to a level just above one child per woman, which is in the vicinity of the United Nation's 'low' demographic projection for 2045–50.

China's population and labour force differ substantially under the baseline and contraction scenarios, with the baseline ensuring that both continue to rise through to 2050, while under the contraction scenario these both decline in the coming decade, as shown in Figure 2. Note that fertility is modelled as declining in all other regions as well, consistent with the World Bank (2015). Population growth remains comparatively 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 labour force participation and total fertility rates. 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 therefore constrains China's labour supply and hence retards its overall economic expansion.

Dependency ratios, measured according to equations (2) – (4), are illustrated in Figure 3. In both scenarios youth dependency continues to fall through to 2050, most strikingly in the low-fertility scenario. The ageing built into the initial age distribution continues to push up aged 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 our projections show a widening gap between the baseline and demographic contraction scenarios, even with continued low fertility under the contraction scenario the total dependency rate does not expand substantially through time, at least to 2050. In other words, under our definitions of dependency, ageing in China need 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.²⁰

4.2 The saving rate scenarios

Based on the earlier discussion, we offer the two Chinese saving rate scenarios. The trajectories of the saving rate of the 40-59 year age group are illustrated in Figure 4. As with the other

²⁰ Assumed international convergence in labour force participation rates by the working aged and those over 60 plays an important role in this result. This point is discussed at length in Golley and Tyers (2012a, b).

group rates, this is adjusted to reflect the effects of changing government and corporate saving, which do not otherwise enter the model. The ‘high saving’ scenario is the baseline, in which the rate of decline in all age-specific saving rates is slow enough that China’s national saving rate does not fall to advanced country levels until it achieves real per capita income parity, well beyond 2050.

We compare this with 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 is, by 2050, dis-saving at rates similar to those observed in advanced regions. In both cases these trajectories embody endogenous behaviour at the group level in response to changes in group real per capita incomes and interest rates. Demographic change alters the age, gender and skill distributions of the population and therefore the path of the national saving rate, but the differences in group-specific behaviour are primarily driven by exogenous shifts in consumption that reflect anticipated reductions in government and corporate saving.

4.3 Projected baseline performance

Besides the baseline scenario, three projections are made to 2050, as indicated in Table 1: a demographic contraction scenario that projects continued fertility decline, a saving contraction scenario and a “double contraction” scenario. In the following section we discuss the implications of these deviations from the baseline for China. Note that the saving contraction 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.

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 country’s comparative performance in attracting investment from abroad. To a much lesser extent in this analysis, 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. Importantly, the baseline shows stable growth from the present through 2050 at just over five per cent per year, which helps maintain the focus of the analysis on demographic and saving rate shocks.

5. The Domestic Effects of More Rapid Declines in Fertility and Saving

Here we address the domestic effects of rapid declines in fertility and saving on the labour force, real wages and real per capita income changes, the implications for rebalancing and the changes in sectoral composition. While real GDP deviations are modest in terms of the changes in growth *rates*, the departures from the baseline in the *levels* of real GDP and real GNP by 2050 are large, as indicated in Figure 5. 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 three per cent lower with a Chinese demographic contraction, six per cent lower with more rapid savings decline and nine per cent lower for a 'double contraction'.

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 *unskilled* labour, because the proportional fertility decline is proportionally larger for the low-skill population. This causes real per capita income to grow more rapidly, with the level 21 per cent higher than the baseline by 2050, as shown in Figure 6. 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 impairs the projected GDP growth rate, 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-skilled workers (by far the dominant proportion of the workforce) the overall effect is negative, with 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.

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 unskilled to skilled labour (see Section 3.1), the effect is outweighed by the higher per capita income that lower fertility brings. 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. Again, however, 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. These results highlight a contradiction of dual policy ‘success’ (high fertility, low saving) in that it leads to lower real per capita income and a less skilled labour force.

5.2 Saving and economic rebalancing

As expected, economic ‘rebalancing’ is more affected by changes in the saving scenarios than by changes in fertility. The low-saving scenarios show more dramatic declines in saving by construction and therefore yield more substantial short-run rises in consumption and the consumption share of GDP. 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 7) and incomes (linked to GNP) grow still more slowly (Figure 5). This result stems from two opposing forces. A falling saving rate advances consumption but the resulting decline in real per capita income retards it. As simulated, the latter force comes to dominate around 2040.

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 do. In the early decades there 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, as Figure 8 shows, the low-saving scenario sees a substantial shift toward current account deficit, ultimately by 14 percentage points of GDP, while lower fertility has only a minor impact, as expected. This effectively reverses the imbalance that has been the primary international concern since the 1990s.

5.3 Sectoral implications

Relative to the baseline, the overall contractions in real GDP due to fertility decline and reduced saving are accompanied by contractions in output 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. 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 the 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.

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 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.

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 US and Australia. This reflects the loss of the 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 nine per cent lower than the baseline, or seven per cent lower if China is excluded.

The distribution of effects across regions depends on their level of financial integration with China 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.²¹ 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.

Before discussing the product-specific effects, it is useful to consider changes in real exchange rates. These are modelled bilaterally against the US dollar, calculated as the ratio of the regional GDP price with that of the US. They are then combined with trade shares to calculate trade-weighted indices, or real effective exchange rates for each region. For China, region-specific shocks that contract essential factors of production, like labour and physical capital, tend to raise comparative costs and therefore appreciate the region's real effective exchange rate.²² 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.

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-savings and low-fertility scenarios relative to the baseline. Its variable factors of production shrink and, at least in the short run, low savings raise home consumption expenditure, which can be expected to reduce exports and boost imports. In the long run, slower population growth and more rapid decline in saving act to reduce Chinese economic activity and hence trade flows as well.

Of particular interest abroad are the sizes and product compositions of China's export and import values. In the long run, slower population growth and the more rapid decline in saving reduce Chinese economic activity and so trade flows also take a slower path. Figure 9 illustrates the projected declining trend in real import volumes, relative to the baseline, for the low-fertility scenario and, when the low-saving shock is included, the further short-run decline due to temporarily higher consumption expenditure shown earlier in Figure 7. Whether the scenario is slower population or slower saving growth, the value shares of imported minerals rise while the shares of energy and agricultural products contract.

²¹ 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.

²² For comprehensive surveys of the determinants of China's real and nominal exchange rates, see Tyers and Zhang (2011, 2014).

With a contracting population and the lower capital growth that comes with reduced savings, metal production contracts relative to the baseline and metal exports contract in share. However, the decline in overall imports sees the importance of this eventually export-oriented industry's mineral inputs expand. The rise of the skilled labour force, combined with continued rapid capital accumulation in the baseline sees expanded exports of heavy, at the expense of light, manufactures. Heavy manufactures come to dominate China's trade but exports of metals assume an increasingly significant role. Indeed, by 2050, baseline Chinese metal exports constitute 15% of export revenue. This reflects the prior experience of both Japan and Korea, which became metal exporters as the growth in their domestic use subsided. Indeed, this effect appears to have arisen more rapidly in the case of China, which is now exporting metals and is already responsible for a global glut in steel production. The anticipated slowdown in export volumes with the contraction scenarios is significant in both but the relative capital scarcity of the low-saving case ensures that the slowdown is larger overall and especially larger for the relatively capital-intensive heavy manufacturing and processed metals.

The product shares of exports respond to changes in China's pattern of comparative advantage, due to the new trajectories of its factor endowments and its real exchange rate. 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. Relative capital scarcity reverses the trend toward heavy manufactured exports in favour of a return to dependence on light manufactured exports. Again, the share of metal exports falls but, this time, there is modest growth in the share of now-surplus energy products.

6.2 Changes in international prices and real per capita incomes abroad

The changes in China's trade lead to corresponding changes in international trading prices and hence in the terms of trade faced by other regions. These are indicated in Figure 10. Prices in the markets for the products that dominate world trade, namely manufactures, the changes due to China's contractions 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 particularly significant negative effect on energy markets.

Perhaps the best bottom line measure of the international welfare effects of the Chinese contractions is the change in regional real per capita income. The time paths of these effects, where they are large, are summarised in Figure 11 and the regional detail for 2050 is offered in

Table 2. 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.²³ 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 Central 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. Most other regions are also net losers from the loss of Chinese economic activity, though mainly from the loss of Chinese saving and therefore the higher cost of capital each must bear.

7. Conclusion

We 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, if we think of the high fertility baseline as a departure from the present trend toward lower fertility, a transition toward population sustainability 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, 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. Yet higher fertility would come at a significant cost in 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 saving rates decline as policy reforms moderate household saving, expenditure growth associated with ageing further increases government dissaving and industrial reforms moderate

²³ For details on India’s pending ‘demographic dividend’, see the comparative analysis with China by Golley and Tyers (2012a, b). Note that the comparative slowness of India’s economic policy reforms and the bias against manufacturing that is embodied in its labour laws are not accounted for in this analysis.

corporate saving. This might be referred to as the ‘dual policy success’ scenario. As expected, 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, with its real household income per capita being 15 per cent lower than the baseline scenario by 2050. This reduction in real 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 per capita income resulting from both lower savings and higher fertility would cause the skilled 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 the scales of both changes. We refer to this as the ‘double contraction’ scenario and it is the one where the implications for the global economy are 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 raises 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.

These results do *not* imply a lack of support for the Chinese Government’s decision to abolish the one-child policy: we concede that the non-economic benefits of this shift are, quite simply, immeasurable. Rather, the results highlight 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, the results *do not* imply that rebalancing the Chinese economy is necessarily a bad idea. Rather, our results suggest 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 while providing an additional source of continued growth.

References

- Arora V, R Tyers and Y Zhang (2015), “Reconstructing the Savings Glut: The Global Implications of Asian Excess Saving”, *International Journal of Economics and Finance*, 7(7): 19–42, July.
- Autor, D.H., D. Dorn and G.H.Hanson (2013), “The China syndrome: local labor market effects of competition in the United States”, *American Economic Review*, 103(6): 2121–2168.
- Basten S and Jiang Q (2015), ‘Fertility in China: An Uncertain Future’, *Population Studies*, 69(S1): S97–S105.
- Bergsten, C.F. (2008). *China's rise: challenges and opportunities*, Washington, D.C.: London : Peterson Institute for International Economics and Center for Strategic and International Studies (Washington, D.C.).
- Bernanke BS (2005), ‘Remarks by the Governor’, Sandridge Lecture, Virginia Association of Economists, Richmond Virginia, March, Federal Reserve Board.
- Bernanke BS (2011), ‘Global Imbalances: Links to Economic and Financial Stability’, speech given at the Banque de France Financial Stability Review Launch Event, Paris, France February 18.
- Bloom DE and JG Williamson (1998), ‘Demographic Transitions and Economic Miracles in Emerging Asia’, *World Bank Economic Review*, 12(3): 419–455.
- Bloom DE, D Canning, L Hu, Y Liu, A Mahal and W Yip (2010), “The Contribution of Population Health and Demographic Change to Economic Growth in China and India”, *Journal of Comparative Economics*, 38: 17–33.
- Bloomberg (2014), “China’s Transition: The Third Plenum, One Year On”, *Bloomberg Briefs*, October, accessed online on 30 November 2014 at <http://www.bloombergbriefs.com/content/uploads/sites/2/2014/10/China-Plenum-opt.pdf>
- Cai F (2010), “Demographic Transition, Demographic Dividend and Lewis Turning Point in China”, *China Economic Journal*, 3(2), pp 107–19.
- Cai F (2012), “The Coming Demographic Impact on China’s Growth: The Age Factor in the Middle-income Trap”, *Asian Economic Papers*, 11(1): 95–111.
- Cai, F. and D. Wang (2005), ‘Demographic Transition: Implications for Growth’ in Garnaut and Song, eds, *The China Boom and its Discontents*, Asia-Pacific Press, Canberra.
- Chen, J., R. Retherford, M.K. Choe, X. Li and H. Ying (2009), ‘Province-level Variation in the Achievement of Below-replacement Fertility in China’, *Asian Population Studies*, 5(3): 309–328.
- Chen, Y. (2016), ‘Never too old to save – explaining the high saving rates of the Chinese elderly,’ presented at the Annual Workshop on Population Ageing and the Chinese Economy, UNSW, 21-22 July. Online available at http://chenyiecon.weebly.com/uploads/6/0/4/5/60455201/pension_saving_1.pdf
- Cheng, K. (2003), ‘Economic Implications of China’s Demographics in the 21st century’, *IMF Working Paper* WP/03/29.

- Chinn, M.D., B. Eichengreen and H. Ito (2012), 'Rebalancing Global Growth', in O Canuto and D Leipziger (eds), *Ascent after Descent: Regrowing Economic Growth after the Great Recession*, Washington DC: World Bank: 35–86.
- Chinn M.D. and H. Ito (2007), "Current Account Balances, Financial Development and Institutions: Assaying the World 'saving glut'", *Journal of International Money and Finance*, 26: 546–569.
- Choukhamane T, N Coeurdacier and K Jin (2014), 'The One-child Policy and Household Savings'. Available online at https://personal.lse.ac.uk/jink/onechildpolicy_ccj.pdf.
- Diamond, P. (1965), "National debt in a neoclassical growth model", *American Economic Review*, 55(5): 1126–1150.
- Dixon PB and M Rimmer (2002), *Dynamic General Equilibrium Modelling for Forecasting and Economic Policy*, No. 256 in the Contributions for Economic Analysis series, Elsevier North Holland.
- Du Q and S Wei (2010), 'Sex Ratios, Savings Rates and Current Account Imbalances', unpublished version, Columbia Business School, December 6.
- Du Q and S Wei (2012), 'A Darwinian Perspective on "Exchange Rate Undervaluation"', http://www.nber.org/confer/2011/ease11/Du_Wei.pdf
- Eichengreen B (2004), 'Global Imbalances and the Lessons of Bretton Woods', NBER, Working Paper 10497, Cambridge Mass: National Bureau of Economic Research.
- Garner J and H Qiao (2013), 'China – Household Consumption Most Likely US1.6 Trillion Larger than Officially Stated', *Asian Insight*, Morgan Stanley Research, 28 February 2013.
- Golley J and R Tyers (2014), 'Gender rebalancing in China', *Asian Population Studies*, 10(2), pp 125–143.
- Golley J and R Tyers (2012a), 'Population Pessimism and Economic Optimism in China and India', *The World Economy*, 35(11), pp 1387–1416, November.
- Golley J and R Tyers (2012b), 'Demographic Dividends, Dependencies and Economic Growth in China and India', *Asian Economic Papers*, 11(3), pp 1–26, Fall.
- Golley, J., R. Tyers and Y. Zhou (2016), "Contractions in Chinese fertility and saving: long run domestic and global implications", in I. Day and J. Simon (eds), *Structural Change in China: Implications for Australia and the World*, Proceedings of the March Conference of the Reserve Bank of Australia, Sydney, November: 243-280.
- Golley J and X Meng (2011), 'Has China Run Out of Surplus Labour?' *China Economic Review*, 22(4): 555–572.
- Golley J and Z Wei (2013), "China's Rural-urban Age Structure, Sectoral Employment and Economic Growth", Crawford School Working Paper No. 13-12, Australian National University.
- Harris RG and PE Robertson (2013), 'Trade, Wages and Skill Accumulation in the Emerging Giants' *Journal of International Economics*, 89(2): 407–421, March.
- He D, L Cheung, W Zhang and T Wu (2012), "How Would Capital Account Liberalization Affect China's Capital Flows and renminbi Real Exchange Rates?" *China and the World Economy*, 20(6): 29–54, November.

- Hu, A., J. Zheng, Y. Gao, N. Zhang and H. Xu (2008), “Provincial technology efficiency ranking with environment factors (1999-2005)”, *China Economic Quarterly*, 7(3): 933-960.
- Hertel TW (ed.), *Global Trade Analysis Using the GTAP Model*, New York: Cambridge University Press, 1997 (<http://www.agecon.purdue.edu/gtap>).
- Huang Y, J Chang and L Yang (2013), “Consumption Recovery and Economic Rebalancing in China”, *Asian Economic Papers*, 12(1): 47–67, Winter/Spring.
- Ianchovichina E and R McDougall (2000), ‘Theoretical Structure of Dynamic GTAP’, GTAP Technical Paper No.17, Purdue University, December.
- Ianchovichina E and T L Walmsley, eds (2012), *Dynamic Modelling and Applications for Global Economic Analysis*, Cambridge University Press, January.
- Ito H (2009), ‘US Current Account Debate with Japan Then, and China Now’, *Journal of Asian Economics*, 20, pp 294–313.
- Krugman P (2010) ‘Capital Export, Elasticity Pessimism and the *renminbi* (wonkish)’ *New York Times* (blog), 16 March (accessed 10 June 2013).
- Kuijs, L. (2006), “How will China's saving-investment balance evolve?” World Bank Policy Research Working Paper 3958. Beijing: World Bank, Beijing Regional Office.
- Lardy NR (2006), ‘Toward a Consumption-driven Growth Path’ *Policy Brief* 06-6, Washington DC: Peterson Institute for International Economics.
- Lardy NR (2012), *Sustaining China’s Growth after the Global Financial Crisis*, Washington DC: Peterson Institute for International Economics, January.
- Lau L, Y Qian and G Roland (2000), ‘Reform without Losers: An Interpretation of China’s Dual-track Approach to Transition’, *Journal of Political Economy*, 108 (1), pp 120–143.
- Lewis WA (1954), ‘Economic Development with Unlimited Supplies of Labour’, *The Manchester School*, 22(2): 139–191.
- Li K (2015) ‘Report on the Work of the Government’, 16 March http://news.xinhuanet.com/english/china/2015-03/16/c_134071473_2.htm (accessed 20 March 2015)
- Liu JN, TT Van Leeuwen, R Tyers and TW Hertel (1998), ‘Disaggregating Labor Payments by Skill Level in GTAP’, Technical Paper No.11, Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University, West Lafayette, September.
- Ma G and W Yi (2010), ‘China’s High Saving Rate: Myth and Reality’, *International Economics*, 122, pp 5–40.
- Mason, A. and S.-H. Lee (2004), “Population aging and the extended family in Taiwan”, *Demographic Research*, Max Planck Institute for Demographic Research, Rostock, Germany, 10(8): 197-230, May.
- Minami R and X Ma (2010), ‘The Turning Point of Chinese Economy: Compared with Japanese Experience’, *China Economic Journal*, 3(2): 163–180.
- Modigliani, F. (1966), “The life cycle hypothesis of saving, the demand for wealth and the supply of capital”, *Social Research*, 33(2): 160-217, summer.

- Naughton B (2014), “Is there a ‘Xi model’ of economic reform? Acceleration of reform since fall 2014”, *China Leadership Monitor*, 46.
- Pitchford JD (1974), *Population in Economic Growth*, Amsterdam: North Holland.
- Rosenzweig, M.R. and J. Zhang (2014), “Co-residence, life-cycle savings and inter-generational support in urban China”, NBER Working Paper 20057, Yale University Economic Growth Center Discussion Paper 1039, New Haven, April.
- Sharping T (2003) *Birth Control in China 1949–2000: Population Policy and Demographic Development*, RoutledgeCurzon, London.
- Song, Z., K. Storesletten, Y. Wang, and F. Zilibotti (2015), “Sharing high growth across generations: pensions and demographic transition in China”, *American Economic Journal: Macroeconomics*, 7(2): 1-39.
- Song Z. and D.T. Yang (2010), ‘Life Cycle Earnings and Saving in a Fast-Growing Economy,’ draft available online at <http://faculty.chicagobooth.edu/workshops/macro/past/pdf/101111.pdf>
- Tyers R (2014), ‘Looking Inward for Transformative Growth’, *China Economic Review*, 29, pp 166–184.
- _____ (2015), “International Effects of China’s Rise and Transition: Neoclassical and Keynesian Perspectives”, *Journal of Asian Economics*, 37: 1–19, April.
- _____ (2016a), “Slower growth and vulnerability to recession: updating China’s global impact”, *Scottish Journal of Political Economy*, 66(1): 66-88.
- _____ (2016b), “China and international macroeconomic interdependence”, forthcoming in *The World Economy*.
- Tyers R and I Bain (2015), “The Global Economic Implications of Freer Skilled Migration”, Discussion Papers in Economics No 15.12, Business School, University of Western Australia, April.
- Tyers, R. and Q. Shi (2007), “Global demographic change, policy responses and their economic implications”, *The World Economy*, 30: 537-66, April.
- _____ (2012), “Global demographic change, labour force growth and economic performance”, Chapter 13 in Ianchovichina E and T Walmsley, *Dynamic Modeling and Applications in Global Economic Analysis*, Cambridge University Press: 342–375.
- Tyers, R. and Y. Zhang (2011), “Appreciating the *renminbi*”, *The World Economy*, 34(2): 265–297, February.
- _____ (2014), ‘Real exchange rate determination and the China puzzle’, *Asian-Pacific Economic Literature*, 28(2): 1–32, November.
- United Nations (2015) *World Population Prospects: The 2015 Revision*, UN Population Division, <http://esa.un.org/unpp/>
- Wang, M. and F. Cai (2015), ‘Destination consumption’, Chapter 11 in L Song, R Garnaut, C Fang and L Johnston (eds), *China’s Domestic Transformation in a Global Context*, Canberra: ANU Press: 91–110.
- Wang, F. and Y. Cai (2010), ‘China’s one child policy at 30’, Brookings Research, September, accessed online on 5 May 2015 at <http://www.brookings.edu/research/opinions/2010/09/24-china-one-child-policy-wang>

- Wang, F., Y. Cai and B. Gu (2012), 'Population, Policy and Politics: How Will History Judge China's One-Child Policy', *Population and Development Review*, 38 (Supplement): 115–129.
- Wei, Z. and R. Hao (2010), 'Demographic structure and economic growth: evidence from China', *Journal of Comparative Economics*, 38: 472–491.
- Wei, S.J. and X. Zhang (2011), 'The competitive saving motive: evidence from rising sex ratios and savings rates in China,' *Journal of Political Economy*, 119(3): 511–564.
- Wen Jiabao (2007), *The Conditions for China to be able to Continue to Guarantee Stable and Rapid Economic Development*, www.npc.gov.cn, 16 March, accessed 28 October 2011.
- _____, (2011), *Report on Work of the Government*, www.npc.gov.cn, 5 March, accessed 24 March 2011.
- World Bank (2015), *Development Goals in an Era of Demographic Change*, Global Monitoring Report 2015/2016, Washington DC.
- Wu H and The Conference Board China Center (2014), 'China's Growth and Productivity Performance Date Revisited', available online at: https://www.conference-board.org/pdf_free/workingpapers/EPWP1401.pdf
- Wu Y (2011), 'Total Factor Productivity Growth in China: A Review', *Journal of Chinese Economic and Business Studies*, 9(2), pp 111–126.
- Yang, DT (2012), 'Aggregate Savings and External Imbalances in China', *Journal of Economic Perspectives*, 26(4): 125–146.
- Yang, DT, J Zhang and S Zhou (2011), 'Why Are Saving Rates So High in China?' IZA Discussion Paper No. 5465, Bonn: Institute for the Study of Labour.
- Zhao Z (2015), 'Closing a Sociodemographic Chapter of Chinese History', *Population and Development Review*, 41(4): 681–686.

Figure 1: China's Consumption, Saving and Growth
Share of GNP

Notes: I is investment, C consumption, Sd total domestic saving and Sc corporate saving. “ $Sg\ central$ ” is the central government’s fiscal surplus, “ $Sg\ general$ ” is central, provincial and local government total revenue less total expenditure.

Sources: IMF, International Financial Statistics; National Bureau of Statistics of China.

Figure 2: Population and Labour Force
Million persons

Note that the labour force accounts for participation rates by age-gender-skill group so it omits all non-working adults. See equation (1).

Source: Endogenous projections constructed as described in the text.

Figure 3: Dependency Ratios

Note that these dependency ratios incorporate labour force participation rates by age-gender-skill group so that total dependency incorporates all non-working adults. See equations (2)-(4).
Source: Endogenous projections constructed as described in the text.

Figure 4: Saving Rate Scenarios

Saving to disposable private income of the 40-59 year age group

Note: The gap between these scenarios is indicative of the corresponding gaps in endogenous saving rates for all age-gender-skill groups. They arise primarily because of differing assumptions about corporate and government saving.
Source: Endogenous projections constructed as described in the text.

Figure 5: Real GDP and GNP

Differences from Baseline (high fertility, high saving)

Note: Real GDP is deflated by the Chinese GDP price index while real GNP is deflated by China's CPI.
Source: Scenarios constructed as described in the text.

Figure 6: Real Investment and Real per Capita Income

Differences from Baseline (high fertility, high saving)

Note: Investment is a real volume index while real per capita income is real GNP deflated by China's CPI and divided by total population.

Source: Scenarios constructed as described in the text.

Figure 7: Chinese Consumption and GDP

% Differences from Baseline (high fertility, high saving)

Note: Expenditures on consumption and overall GDP are here measured in % departures from the baseline where the level measures are relative to the global numeraire.

Source: Endogenous projections from the model described in the text.

Figure 8: China's Current Account

Differences from baseline (high fertility, high saving) in % points of GDP

Note: The current account is China's trade surplus plus net factor income from abroad.

Source: Endogenous projections from the model described in the text.

Figure 9: Changes in Chinese Import Volume

% departures from the baseline

Low fertility

Low fertility and low saving

Note: Changes smaller than 1% are not shown.

Source: Endogenous projections from the model described in the text.

Figure 10: World Trading Prices

Changes in average world prices (relative to the US GDP deflator)

in % departures from the baseline

Low fertility

Low fertility and low saving

Note: 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.

Source: Endogenous projections from the model described in the text.

Figure 11: Real per Capita Income outside China

Changes in real per capita income in %, relative to the baseline (high fertility, high saving)

Note: Real per capita income is real GNP deflated by each region's CPI and divided by regional population.

Source: Scenarios constructed as described in the text.

Table 1: Fertility and Savings Scenarios

	Fertility		
		Low	High
	Savings	Low	Double contraction
		High	Low savings
			Baseline

Table 2. Effects of Low Fertility and Low Saving on Real per Capita Income in 2050

% departures from the baseline (high fertility, high saving)

	Low fertility, high saving	High fertility, low saving	Low fertility, low saving
Australia	-0.1	-2.9	-3.0
USA	-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
ME and Nth 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: Real per capita income is real GNP deflated by each region's CPI and divided by regional population.

Source: Scenarios constructed as described in the text.

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