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# ECONOMICS

# CHINA'S GENDER IMBALANCE AND ITS ECONOMIC PERFORMANCE

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**DISCUSSION PAPER 12.10**

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## Abstract

Chinese GDP growth faces rising handicaps that include the slowdown and eventual contraction of its labour force, a complication of which is its rising sex ratio at birth. The undesirable consequences of the resulting gender imbalance include excessive saving as families with boys compete to match their sons with scarce girls, trafficking in women and rising disaffection and crime amongst the low-skill male population. These are reviewed and analysed using a dynamic model of both economic and demographic behaviour. The results show that the proportion of unmatched low-skill males of reproductive age could be as high as one in four by 2030, with numbers too large for female immigration to be a solution. Policies to rebalance the sex ratio at birth will take decades to reduce the sex ratio at reproductive age and any associated allowance of higher fertility would slow growth in real per capita income. Yet the results suggest that the beneficial effects of reduced male disaffection and crime could outweigh the losses from reduced saving and higher population.

## 1. Introduction

According to the United Nation's (UN) Population Prospects 2010 revision, China's sex ratio at birth (SRB) reached 120 (male births per 100 female births) in 2005-10, compared with a world average of 107, and a "normal range" of between 104 and 107. This earned China first place on the global ranking of imbalanced sex ratios at birth, a rank it has held since the mid-1980s when China first departed from this normal range (Figure 1). While it is sometimes asserted that the missing female births represent a lack of recording, the weight of evidence supports a rise in the SRB since the 1980s that is at least as large as these UN numbers suggest (Cai and Lavely 2007). Li (2007) draw on China population censuses and 1% population sample surveys to show that the national-level SRB rose from just 107 in 1982 (around which it had hovered for 30 years), to 111 in 1990, 120 in 2000 and up to 121 in 2005 (see Figure 1). If these national figures are alarming, some of the sub-national figures are even more so. Using the 1% inter-census survey from 2005, Zhu et al. (2009) find that China's sex ratios are high in all age groups and residency types, but highest in the 1-4 age-group, peaking at 126 in rural areas, with six provinces recording ratios over 130. The SRB also rises steeply for second order births, exceeding 160 in nine provinces.

Compounding China's gender imbalances are its rates of excess female child mortality (EFCM), which are measured by comparing the normal ratio of male to female child mortality (of between 120 and 130 for infants between birth and age one) with the observed ratios. In 2005 these were "severely abnormal" at 80 for children in the first year of life and 84 for children in their second year (Li, 2007). While women in China have higher life expectancies than men, as elsewhere, the combination of high SRBs and high EFCM has left China with the world's highest sex ratio in the total population, at 108 and rising in 2005-10 compared with the global average of 101 (United Nations, 2010).

These gender imbalances have resulted in substantial numbers of "missing women", a term coined by Amartya Sen in the late 1980s, based on his own research indicating that more than 100 million women were missing worldwide[1]. Klasen and Wink (2003) review the range of estimation techniques used since Sen, and show that the number of women missing in absolute terms has continued to increase worldwide, while the percentage in terms of women alive has fallen. However, in China there has been further deterioration in both absolute and percentage terms, with an estimated 41 million missing women in 2000 or 6.7 per cent of the female population (very similar to those of Li, 2007 and Bulte et al., 2011).

[1] Downloaded at http://www.nybooks.com/articles/archives/1990/dec/20/more-than-100-million-women-are-missing/?pagination=false on 10 May 2012.

According to demographer Zeng Yi (2007), if China's SRB remains constant and current fertility policy is unchanged, the proportion of excess men aged 20-49 compared to women of the same age will increase from 6% in 2010 to 11% in 2030, peaking at over 14% in 2050. Similarly, Li and Jiang (2005) project that if SRBs remain at 2000 levels, by 2030 the population size will be 84.2 per cent of what it would be under normal SRB patterns (in the range of 104-107). That is, 15.8% of the population would disappear because of the number of women missing, and the proportion of excess males would reach 20.7 per cent! As with most phenomena relating to China, the issue of gender imbalances is taking place on an unprecedented scale, with consequences that extend into all realms of economic, social, anthropological and political life.

China's rising gender imbalances are occurring in tandem with the slowdown of China's labour force growth, an issue that has received much attention from economists in recent years (Golley and Tyers 2012a,b, Cai and Wang 2011, Cai, 2012). By itself, this slowdown brings forward the Lewis "turning point" beyond which the rural to urban transformation proceeds more slowly, constraining future growth.[2] Rising gender imbalances compound this slowdown since, for given fertility levels, the declining share of women then further reduces the population and labour force growth rates. This is just one of a number of undesirable consequences of gender mismatch, others of which centre on the rising proportion of unmatched males, including excessive saving as families with boys compete to match their sons with scarce girls (Wei and Zhang 2009, 2010), trafficking in women and increased rates of crime (Edlund et al. 2007, Hvistendahl 2011). If it is then recognised that males from middle and upper socioeconomic strata will "marry down" when this is the only way for them to make matches, it is clear that the mismatch will be extreme for low-income males, heightening the likely levels of disaffection and crime.

In this paper we review prior work on the causes and consequences of China's high SRB and offer a prospective quantification of its effects via simulations using a dynamic model of both economic and demographic behaviour. The results show that the number of unmatched males could achieve extreme proportions, by 2030, such that immigration by women from other Asian countries could never be sufficient to achieve gender balance in China's reproductive age groups. The results suggest that an associated crime-induced productivity slowdown would outweigh the increased savings of families with boys and so further retard growth, contributing to the yet-avoidable possibility that China could fall into a "middle income trap" (Easterly 2000, World Bank 2010, Eichengreen et al. 2011).

[2] The timing of China's Lewis turning point is a subject of controversy, as suggested by the contrasts between the views expressed by: Cai (2010), Garnaut (2010) and Golley and Meng (2011), which offer just a sampling of a substantial literature. There is, however, little doubt that the turning point is on its way, even if there is little agreement as to whether recent real wage rises suggest its presence.

The section to follow reviews the growing literature on China's rising SRB and the economic implications of gender imbalances more generally. Section 3 then summarises the simulation model we use while Section 4 examines the demographic consequences of the gender imbalance and its dependence on trends in the SRB. Section 5 associates the gender mismatch with the productivity effects of low-income male disaffection and crime. Conclusions are offered in Section 6.

## 2. China's rising gender imbalance: causes, consequences and prospects

### *The Causes*

Guilmoto (2009) examines the causes of sex imbalances at birth in a range of Asian countries (including China and extending to Azerbaijan, Armenia, Albania and Georgia).[3] Recognising that many cultures embody son-preference, he identifies three further motivations for deliberate sex selection: "fertility squeeze" (brought about by parents wanting or needing to limit the number of births), "ability" to limit those births (from traditional methods for dealing with unwanted girls through to high tech methods including ultrasound gender identification) and "readiness", which includes the social and legal circumstances that allow parents to take advantage of the birth limiting options available to them whether they be officially sanctioned or not. China clearly checks all the boxes, with a long-standing cultural preference for sons, the introduction of the one-child policy in the early 1980s precipitating the squeeze and with the widespread use of Ultrasound B technology to detect gender from the mid-1980s onwards (Ebenstein, Li and Meng, 2010).

Cai and Lavely (2007) and Li (2007) identify three proximate causes of China's high SRB: sex selective abortion, excess female child mortality and underreporting (or ultrasound, infanticide and hidden girls). There is mounting evidence to suggest that underreporting is not a major contributor, that the impact of EFCM is on the decline, and that sex selective abortion is primarily responsible for the rise in recent years (Cai and Lavely, Li, 2007, Ebenstein, 2008 and Zhu et al. 2009). Lin et al. (2010) establish a causal link between access to abortion and both the SRB and ECFM in Taiwan, demonstrating that the legalisation of abortion accounted for almost all of the observed increase in the SRB, but also decreased ECFM by around 20%, which could also explain the decline in ECFM in mainland China.

[3] See also Attané, Isabelle and Guilmoto, Christophe Z. (2005), *Watering the Neighbour's Garden: the growing female deficit in Asia, OECD.*

While the evidence from Taiwan (and many other countries) indicates that sex selection does not require strict family planning policies, it is difficult to ignore the impact that China's one-child policy and its variants have had on the country's fertility squeeze, and hence on its high SRB.[4] Based on the 2000 census, Gu et al. (2007) reveal that China has implemented one-child policies, 1.5 child policies, two-child policies and three-child policies in different parts of the country, giving rise to SRB levels of 112, 125, 109 and 198, respectively. This indicates that two-child policies bring SRBs down to almost normal levels, while the 1.5-child policy, which allows for a second child in rural areas if the first one is a girl, has been even more detrimental to China's SRB than the one-child policy itself.

Beyond the proximate causes, Li (2007) discusses the conditional causes of China's high SRB. These are primarily socioeconomic factors that help to sustain the traditional preference for sons, including the need for parents to have sons who will support them in retirement, and unequal rights and opportunities for women in terms of education and employment. For Li, the fundamental cause of China's gender imbalance is essentially cultural, tracing to the patrilineal system of the Han Chinese. By 2000, SRBs had reached abnormally high levels in provinces with "strong traditional cultures", including, Anhui, Henan, Hubei, Hunan, Shaanxi, Fujian and Guangdong, and were only normal in provinces with large ethnic populations, including Tibet, Xinjiang and Qinghai. Murphy et al. (2011) likewise show that patrilineal, patriarchal and patrilocal social networks and family systems have been a major determinant of the extent of son preference in China. This opens the door to a swathe of potential policy responses, of which further relaxation of the one-child policy is just one (discussed further below).

### *The Effects*

*Crime, conflict and productivity:*

In 2004 Zhang Weiqing, head of China's National Population and Family Planning Commission, declared that males of marriage age would outnumber females by 30 million by 2020, with Li Weixiong, vice-chairman of the Population, Resources and Environment committee of the National Committee of the Chinese People's Political Consultative Conference (CPPCC) concurrently stating that "Such serious gender disproportion poses a major threat to the healthy, harmonious and sustainable growth of the nation's population and would trigger such crimes and social problems as mercenary marriage, abduction of women and prostitution."[5] Rodrik's (1998) claim that social conflict has been a major determinant of growth collapses and stagnation in many countries since

[4] Interestingly, in his report prepared for the United Nations Population Fund, Li (2007) makes no mention of the one-child policy in his discussion on the proximal or other causes of China's high SRB. For a cynical interpretation of why this is the case, see Hvistendahl's (2011) fascinating book.
[5] http://www.china.org.cn/english/government/94926.htm

1975 is echoed in The World Bank's *World Development Report 201*1 on "Conflict, security and development," and attests to the potential costs this could inflict on the Chinese economy.

The link between rising gender imbalances and domestic social conflict is made by Hudson and den Boer (2004), in their book entitled "*Bare Branches: The Security Implications of Asia's Surplus Male Population*" ("bare branches" being the Chinese term used to describe unmarried men without children) and in their 2008 article, in which they argue that "a society with a masculinized young adult population, such as China's, is likely to respond to significant economic hardship with severe domestic instability and crime. Edlund et al. (2007, 2010) show that a 0.01 increase in the sex ratio caused a three per cent increase in property and violent crimes between 1988 and 2004, indicating that the rise in surplus males may account for up to one-sixth of the overall rise in crime during this period. While this does not validate all of Hudson and den Boer's claims (some of which are alarmist and speculative), it does indicate that the domestic costs of China's gender imbalances could be substantial.

There may also be numerous indirect costs associated with having a growing number of unmarried men in Chinese society. Anthropological studies have shown that men in societies with large numbers of surplus men will engage in non-productive and risky "wife-seeking" behaviour, sacrificing their own productivity and paternal investments that would have raised their children's productivity as well (Henrich et al., 2012). In addition to these productivity losses, unmarried men also suffer from poorer physical and psychological health, with one recent study showing that unmarried Chinese men are 11% less likely to describe themselves as being in good health than married men (Ebenstein and Sharygin, 2009, Zhou et al. 2011).

Korenman and Neumark (1991) point out that if marriage really does make men more productive, as their analysis of US data suggests, then "changes in marital status composition potentially can affect the productivity of the labor force" (p. 283).[6] However, it is not obvious how these changes will play out in aggregate in the Chinese context. Edlund et al's (2010) evidence that higher sex ratios in China are associated with higher educational attainment and wages for men on average, and lower educational attainment for women on average, supports the notion that men may invest more heavily in characteristics to make them competitive in the marriage market, while women may choose to invest less. They also show, however, that higher sex ratios increase the variance of men's labour market outcomes, which they put down to a "hetereogenous incentive effect where men with low initial endowments choose to engage in crime" (p.17). It is clear is that the impact of rising sex ratios varies significantly across different members of society, both within and between

[6] On the debate concerning whether married men earn more because they are more productive, see Becker (1981, 1985), Angrist (2002) and Antonovics and Town (2004).

the sexes. It is unclear what the aggregate impact will be in terms of productivity, wages, educational attainment, and other key factors that impact on long-term growth performance, of which savings is one.

*Male participation, entrepreneurship and saving:*

A recent string of papers links China's rising sex ratio to its rising saving rates, with rather dramatic global macroeconomic consequences. Du and Wei's (2010) theory of "male excess savings" arises in the context of a steady increase in the ratio of men to women as men seek to be competitive in the marriage market. Wei and Zhang (2009) show that variations in savings patterns across Chinese households and regions are consistent with this theory, with the rise in China's sex ratio explaining half of the increase in Chinese household savings as a share of disposable income (from 16 per cent in 1990 to 30 per cent in 2007). Wei and Zhang (2010) also show that the sex ratio imbalance stimulates entrepreneurial activities as men are driven to increase their wealth, providing evidence that men in regions with relatively high gender imbalances are more willing to accept dangerous and unpleasant jobs and supply more hours of work. This boosts private sector growth, suggesting that not only household, but also corporate savings are higher as a consequence. Du and Wei (2012) describe further how the increase in savings and the expansion of the supply of male workers both put downward pressure on the real exchange rate (assuming that non-tradables are more labour intensive in China and that tradable prices are determined in world markets).

Du and Wei (2010) develop an overlapping generation model in which higher competition for men in the marriage market in "generation 1" induces higher male savings rates, which raises aggregate savings in "generation 2". Their calibrations assume that a "synthetic" United States has a balanced sex ratio, while that of a synthetic China rises from balanced (1) to very unbalanced (1.5). These – obviously exaggerated – sex ratios give rise to current account balances that amount to more than half of the actual current account imbalances in the data, leading them to conclude that although "The sex ratio imbalance is not the sole reason for global imbalances, it could be one of the significant, and yet thus far unrecognised, factors" (page 2).

*Female labour supply:*

Finally, Seguino (2000), focusing on the "gendered characteristics of economic outcomes in Asia", shows that women, with their significantly lower wages than men, have formed a large and rising share of the workforce engaged in labour-intensive export-oriented industries, suggesting that gender relations at the micro-level have had positive macro-level effects on Asian rates of growth.

Viewed in this context, rising gender imbalances could translate into an increasing relative shortage of women and hence rising female wages, which could in fact be detrimental to growth, despite the obvious benefits for women themselves. The extent to which this happens will be country-specific, depending on labour market conditions in general, and women's labour rights and educational opportunities in particular.

***Future Prospects***

The preceding point feeds into the debate over whether gender imbalances will be self-correcting, through evolutionary, economic, social or other means. Becker and Posner (2007) adhere to laws of supply and demand, arguing that "As children become adults in cohorts with a high ratio of boys, the advantage of girls and women increases since they are scarcer" so it is men and not women at a disadvantage as the value of women rises and value of men falls. Qian (2008) finds some evidence of this in her clever analysis that shows that a rising sex ratio leads to higher female income and higher survival rates among girls. She estimates that if annual rural household income could be augmented by 10% and given entirely to the household's women, the fraction of girls would rise by 1.3 percentage points. Becker and Posner go on to defend sex selection of births because the market will correct for it in the long run. Qian's policy conclusion that "One way to reduce excess female mortality and to increase over- all education investment in children is to increase the relative earnings of adult women" (p.1281) is far less contentious, as she doesn't assume that the market will achieve this increase, nor does she go on to say that therefore sex selective abortion is OK.

Guilmoto (2009) argues that sex ratios have a tendency to level out over time, gender discrimination and male-based traditions and customs weaken. The rebalancing of South Korea's sex ratio since the early 2000s is often cited as a case in point, with das Gupta et al. (2009) arguing that urbanisation and industrialisation have eroded the social structures that lay beneath son preference there in the past.[7] They suggest that similar processes are likely underway in China (and India), but recognise that more needs to be done. Murphy et al. (2011) confirm that certain aspects of socioeconomic change, including higher education, agricultural mechanization and increased labour force opportunities for women, all help to reduce the preference for sons, although their research indicates that this is having limited impact in rural China because of female disadvantages in land rights, wages and education. Ebenstein and Leung (2010) note that son-less parents are more likely to participate in old-age pensions, and find evidence that the availability of rural old-

[7] Hvistendahl (2011) disagrees with this interpretation of the Korean case, providing evidence to the contrary, that son preference still exists and that women still have a "gender empowerment" measurement that remains one of the lowest of any developed country (p. 235).

age pensions is associated with lower sex ratios, an important piece of evidence indicating that policies can make a difference.

Li (2007) addresses policy priorities in China directly, describing the government's efforts to improve women's rights and promote gender equality with a view to lowering the SRB and improving girl survival rates, including the "Care for Girls" campaign, first introduced with some success in the Chaohu Experimental Zone in 2000, and then in the entire country from the beginning of 2006, and new laws and regulations to promote gender equality and to restrict sex-selective abortion. The Chinese Government has recently identified reducing the SRB by 2016 as a national priority (Ebenstein and Leung, 2010), although it is not yet clear how they intend to achieve this goal.

One option being discussed, by academics at least, is to relax the current fertility policy. Zeng (2007) argues that the economic and social costs of maintaining China's current fertility policy (which he refers to as a 1.5-child policy) are too high, with the consequences of the sex ratio imbalance being prominent among those costs. He recommends a "two-children with late childbearing soft-landing" scenario, with a smooth transition period through to 2014, when all couples in China would be allowed to have a second child with appropriate spacing, reaching a soft-landing around 2035, at which point everyone would be able to choose their family size and timing freely. Compared with the worst-case scenario of a constant SRB and "current policy unchanged", his preferred policy would see the SRB normalise by 2030, with the number of excess men peaking in 2040 and returning to normal by 2050. While the official stance regarding current fertility policy indicates that such a policy relaxation is not yet supported,[8] these results are indicative of the potential impact that alternative fertility policies could have on China's gender problem.

On a different note, Song (2012) shows an abrupt decline in China's sex ratio at birth beginning a little over one year into Great Leap Forward famine in April 1960 and ending in October 1963, two years after it ended, followed by a compensatory rise between through to July 1965. He presents this as support for an "adaptive sex ratio adjustment hypothesis", in which healthy, well-nourished and high-status mothers are more likely to give birth to sons, whereas unhealthy, poorly nourished and low-status mothers are more likely to give birth to daughters. Evolutionary biologist Rob Brooks (2012) explains further how this can bring about a more balanced sex ratio in societies where hypergamy[9] is common, as high-status (rich) mothers give birth to more sons who match up

[8] Chinese Vice Premier Li Keqiang announced in 2010 that China will continue to "coordinate its national family planning policy, stabilizing an appropriately low birth rate and improving the quality of its population" (cited in the *The China Daily* 2010).

[9] Hypergamy exists when girls from lower socioeconomic groups marry boys from higher ones. Evolutionary psychologists indicate that females have evolved a preference for higher status males because they offer their

with the more daughters born to low-status (poor) mothers. However, the ready availability of ultrasound technology throughout China, combined with strong son preference, suggests that this kind of balance is unlikely to emerge naturally, short of another serious famine, which is hardly a solution worth counting on. Most critically, the concentration of unmatched males in lower socioeconomic groups may have serious social consequences, an idea we explore further below.

Finally, it is worth noting that large variations in the broader sex ratios of human populations are not uncommon in history, with low values occurring when disproportionate numbers of males have been lost in wars and other disasters. Extraordinarily high values have also occurred when humans have expanded into new territories, including in Australia and California during the gold rushes of the 19th Century.[10] In these cases the gender imbalances were righted by subsequent female immigration from regions with much larger populations.

## 3. Modelling

The approach adopted follows Tyers and Shi (2007), in that a complete demographic sub-model is integrated within a dynamic numerical model of the global economy.[11] The analysis to be described here uses this model to construct a "business as usual" projection of changes in population and labour force levels, gender imbalance, dependency ratios, real GDP and wage levels and the levels of real per capita income in the countries represented through to 2030. We refer to this projection as the "baseline". It commences in 1997 and therefore captures some of the recent rise in China's SRB. Thereafter, we construct contrasting simulations in which the path followed by China's SRB differs from the baseline.

### *Demography*

Each region represented in the model includes four age groups, two genders, and two skill categories, for a total of 16 population groups in each of 18 regions, two of which are Mainland China and India. 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 subdivision is between households

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prospective children both "better" genes and greater resources. Men, on the other hand, tend to invest less in their children and therefore have less reason to prefer mates with high social status. Moreover, some may choose to "marry-down" to ensure that their mates have a stronger incentive to remain faithful.

[10] See Hudson and den Boer (2004) for a fascinating discussion of gender imbalances in history.

[11] 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. The model dynamics are described by Ianchovichina and Walmsley (2012). This version expands GTAP-Dynamic by including multiple households disaggregated by age, gender and earnings type, along with complete demographic behaviour.

that provide unskilled (production) labour and those that provide skilled (professional) labour.[12] Each age-gender-skill group is a homogeneous subpopulation with group-specific birth and death rates and rates of both immigration and emigration. If the group spans *T* years, the survival rate to the next age group is the fraction *1/T* of its population, after group-specific deaths have been removed and its population has been adjusted for net migration.

The final age group (60+) has duration equal to measured life expectancy at 60, which varies across genders and regions. So the narrowly demographic parameters are birth rates, sex ratios at birth, age-gender specific death, immigration and emigration rates, and life expectancies at 60.[13] The birth rates, sex ratio at birth, life expectancy at 60, and age-specific death rates all trend through time, approaching exogenous targets asymptotically.

### *Economic behaviour*

The economic component of the model considers each region to contribute seven industries: agriculture, light manufacturing, heavy manufacturing, metals, energy, minerals and services. To reflect compositional differences between regions and failures of the "law of one price", these products are differentiated by region of origin, meaning that the "light manufactures" produced in one region are not the same as those produced in others. Consumers and firms purchasing intermediates substitute imperfectly between manufactures from different regions.[14] Regions have open capital accounts with empirically based investment biases and trade distortions.

To capture the full effects of demographic change, the multiple age, gender, and skill groups are modelled as separate households. These 16 groups differ in their shares of regional disposable income, consumption preferences, saving rates, and their labour supply behaviour. While the consumption-savings choice therefore differs for each age-gender group, it is dependent for all on current group-specific real per capita disposable income and the real lending rate. [15]

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[12] The subdivision between production and professional labor accords with ILO's occupation-based classification and is consistent with the labor division adopted in the GTAP Database. Mothers in families providing production labor are assumed to produce children who will grow up to also provide production labor, while the children of mothers in professional families are correspondingly assumed to become professional workers

[13] Immigration and emigration are also age and gender specific. The model represents a full matrix of global migration flows for each age and gender group, which are sensitive to real wage differences and quantitative restrictions. See Tyers and Bain (2006) for further details.

[14] Consumption and production behavior correspond to the standard *GTAP Dynamic* structures.

[15] There is, however, no endogeneity of saving rates to life expectancy, as suggested by Bloom and Canning (2005b), nor to the sex ratio of the population, as suggested by Du and Wei (2012). Death rates, and hence life expectancies, follow largely exogenous paths, as does the SRB.

As in other dynamic models of the global economy, the main endogenous driver of simulated economic growth is physical capital accumulation.[16] Technical change is introduced in the form of exogenous productivity growth that is sector and factor specific. The overall rate of economic growth proves quite sensitive to these exogenous shocks since the larger these are for a particular region the larger is that region's marginal product of capital. The region therefore enjoys higher levels of investment and hence higher marginal products of labour and real wages. This causes a double boost to its per capita real income growth rate. For China the continuing productivity shocks are at levels that are high compared with the other regions.

The model has the Solow-Swan property, shared with all neoclassical dynamic models that embody diminishing returns to factor use, that an increase in the growth rate of the population raises the growth rate of real GDP but reduces the level of real per capita income. What distinguishes it from its simpler progenitors is its multiple households, the endogeneity of age specific saving rates, its multiregional structure and its open capital accounts, which allow collective regional households to hold claims on capital abroad. The demographic behaviour allows regional average saving rates to respond to changes in age distributions. As a young population ages, the proportion of its population in the saving age groups rises and so therefore does its average saving rate.

In old populations, further aging raises the proportion of non-working aged, and so its average saving rate tends to fall. The Chinese 60+ age group is unusual, however, in that it has had low labour force participation but high state-financed retirement incomes. The pensions, combined with low consumption expenditures due to extended family sharing, lead to high initial retiree saving rates. The result is flat age-specific saving behaviour underlying in model and hence not much decline in China's average saving rate as its projected population ages. In the analysis that follows, however, we impose exogenous shocks to China's saving behaviour that are in the range suggested by Du and Wei (2012).

## 4. The demographic significance of China's gender imbalance

There have been a number of valuable, though purely demographic, analyses of China's gender imbalance, which include those by Li and Jiang (2005) and Zeng (2007). In this section we cover some of the same ground but with two differences. First we are more pessimistic than the official view of China's fertility and its future population growth, assuming that its total fertility rate will decline to 1.2 by 2030 in the manner of most of its East Asian neighbours. Indeed, the TFR figures

[16] The transformation of workers from unskilled to skilled is another endogenous force in this model, with transformation rates differing by age and gender and depending on the real skilled wage premium. Its role is limited in the experiments conducted here, however, and so it is not given emphasis. See Tyers and Bain (2006) for further details.

for China used in our baseline are the "lower fertility" TFR figures in Golley and Tyers (2012a). As noted in that paper, we choose this as a baseline fertility projection because we are now convinced by the analysis of Zhao (2011) and Zhao and Chen (2011) that even the United Nation's (2010) medium fertility variant for China is too high.[17]

Second, we disaggregate the population between households dependent on skilled (professional) and unskilled (production) occupations. When male and female populations are divided socioeconomically, we can evaluate the effects of female hypergamy (the "marrying-up" preference) on the proportion of unmatched unskilled males. The first step is to construct a baseline and alternative scenarios for movement through time in the SRB through 2030. The demographic consequences of the high SRB are then examined for their implications for the numbers of unmatched low-skill males.

### *SRB Scenarios*

Recent studies suggest that China's SRB has already begun to decline in some provinces, while the rate of increase has slowed in others (das Gupta et al. 2009). That the growth of the SRB is slowing is also supported by population census and 1% population sample survey data (Figure 2). We therefore choose a baseline scenario that has the SRB converging upon a level not far above that already reached. Our choice for a second scenario has policy actions (regarding fertility and gender discrimination in particular), combined with endogenous preference changes, bringing about a return of the SRB to 106 by 2030. These two paths for China's SRB are shown in Figure 3. Considering the long lead times required for demographic changes to affect overall populations, it is not surprising that these two scenarios, being identical in all other respects, are similar in both their demographic and economic implications. For further contrast, we also construct a hypothetical counterfactual scenario, in which China's SRB had been at 106 throughout the simulation period from the late 1990s onward. This scenario is designed to indicate how different China's demography and economy might have looked had this problem not arisen.

### *Baseline demographic results*

Our comparatively pessimistic baseline path for Chinese fertility, combined with the SRB path shown in Figure 3, yields the paths for population components shown in Figure 4. Note that the total population peaks in the current decade and then declines, as do both the total male and female

[17] See Golley (2012b) and Golley and Tyers (2012b) for further explanation.

populations. The skilled population rises continuously, while the unskilled population begins declining sooner and falls more sharply than the total population. Under this scenario then, the effects of population slow-down and decline are already in train.[18]

*Unmatched male shares:*

In general, we regard the unmatched male share as the difference between the male and female populations, expressed as a proportion of the male population. We calculate four such shares: 1) the share of unmatched boys 0-14, which is a signal to parents that there will be competition for partners for their sons, 2) the share of unmatched low-skill males of reproductive age, if marriages are restricted to partnerships between members of families with low-skill incomes, 3) the share of unmatched low-skill males if women from low-skill families choose to marry up (ensuring that there are no unmatched skilled men), and 4) the share of unmatched low-skill males if sufficient low-skill women choose to be *second* partners of high-skill men as to allow these men to have 1.5 partners on average. While the fourth share offers a socially uncomfortable prospect, there is ample anecdotal evidence for women from low-income households preferring second partnerships with rich men over exclusive marriages to poor men. The number is clearly larger than unity, though our choice of 1.5 is arbitrary and illustrative.

Our first application of these shares is to the Du and Wei (2010) hypothesis that China's household saving rate has risen at least partially because of competition amongst families of unmatched males. Since this competition is likely to take place between families of male children, we show the baseline shares of unmatched males aged 0-14 in comparison with the recent paths of household and corporate saving as shares of GDP in Figure 5. From these results it is clear, first, that the saving shares of GDP and the unmatched shares of male children have similar upward trends, thus offering some support to the Du and Wei hypothesis. Second, the levels of the unmatched shares are high; suggesting that, in 2010, between a sixth and a fifth of low-skill male children can expect to remain unmatched. By 2030, these shares will have risen to between a fifth and a quarter, amounting to between 19 and 27 million boys.

It is also notable from Figure 5 that the path of the unmatched share of boys is flattest when girls are expected to marry up and skilled men are expected to take 1.5 women each on average. This is because, under this assumption, there is a large number of unmatched low-skill males in all years (including the present), even if the sex ratio at birth were balanced, and its number would grow only

[18] A more detailed analysis of the implications of the baseline projection, for dependency and demographic dividends in particular, is offered by Golley and Tyers (2012a and b).

slowly with the skilling of the male population (Figure 4). The high sex ratio at birth adds more unmatched males in the later years but in numbers that are initially smaller. To the extent that schooling is common between skilled and unskilled families in China, however, what parents would observe would be the unmatched share of *all* boys (the lowest of the paths). This has the steepest slope and the most obvious common trend with the saving rates.

If we imagine that families look at the unmatched rates of the cohort beyond that of their male children in choosing how to compete for female partners, the relevant unmatched share is that of low-skill males of reproductive age (15-39). We show this against the saving proportions in Figure 6. The case for common trends with saving rates appears weaker here but the shares of men of reproductive age that are unmatched are no less alarming. These results suggest that, in 2010, between a tenth and a sixth of low-skill male men of reproductive age were unmatched. As Table 1 indicates, by 2030, these shares will have risen to between a seventh and a quarter, amounting to between 28 and 48 million men of reproductive age.

*The Du and Wei hypothesis:*

While the rate of unmatched boys and reproductive males is clearly a worrying social problem, and notwithstanding the similar trends in Figure 5, there is reason to think that China's gender problem is only a modest cause of high savings and hence large current account surplus and low real exchange rate. First, Mainland China's household saving rate is high by global standards but not extraordinary in the experience of other countries in the East Asian region, where saving rates have peaked and are now declining (Horioka and Terada-Hagiwara 2011). All the usual reasons for high household saving apply to China at present, so the gender imbalance can only explain part of the observed growth in saving. Second, China's new income is highly concentrated (Wang and Woo 2011). It is wealthy households that are doing most of the saving, but these households' sons have the option of "marrying down" and so are less pressured by the gender imbalance to further increase their saving. And third, as indicated in Figures 5 and 6, the truly extraordinary thing about China's saving is the proportion due to corporations. This is best explained as an industrial reform problem, since China's corporate saving consists primarily of retained earnings by oligopolistic state owned corporations that are both lightly taxed and lightly burdened by dividend payments to the public and so move profits directly to investment at an extraordinary rate (Kuijs 2006, Tyers and Lu 2008). These concerns notwithstanding, we use the empirical results from Du and Wei (2010) in an analysis of the saving impacts to be presented in the next section.

*Unmatched Chinese males in a broader Asian context:*

The large proportion of low-skill Chinese men of reproductive age that is projected to be unmatched in Figure 6 is placed in an East Asian context in Figure 7. This figure shows our baseline projection of the *number* of such unmatched Chinese men, which grows to between near 30 and near 50 million by 2030, and compares it with the total number of women of reproductive age from low-skill households in East and Southeast Asia, including the Koreas, Indochina and Southeast Asia but excluding Japan. This comparison motivates the scale of the mismatch problem. By 2030 there will be less than 100 million women to make potential matches with the 30-50 million low-skill Chinese men, but these women are in no sense in surplus. They are all fully matched in their own regions, if not in short supply themselves, and they would have no incentive to relinquish marriage in their own countries for marriage to low-skill Chinese men. The clear conclusion is that, while trafficking of Asian women into China is likely to occur at the margin, female immigration cannot address the scale of the mismatch.

***The Demographic Effects of a Lower Chinese SRB***

*Simulating a declining SRB:*

Our "plain vanilla" baseline follows the time path of the SRB shown in Figure 3 and no other behaviours (fertility, labour force participation, saving or productivity) are assumed to be affected by the SRB. When we compare this baseline with the first contrasting projection of the SRB, in which it declines to 106 by 2030 (also shown in Figure 3) we arrive at the results summarised in Table 1. There is considerable reduction in the gender imbalance by 2030, at least for children. Effects on the imbalance at reproductive age are smaller but not insignificant. Overall, the economic effects are very small since the decline in the SRB alone, at least by 2030, supplies very little change in levels and skill shares of the labour force. For more economic implications it is necessary to take account of the effects of gender imbalance on saving rates and on productivity as it is affected by the disaffection of low-skill males and related crime. Since the feedback in our model between economic performance and demographic behaviour, which is restricted to skill-acquisition and migration rates, is modest in this case, the underlying demographics are essentially the same when these economic shocks are added. We therefore defer our discussion of the effects of complementary economic shocks to Section 5.

*A counterfactual simulation with low SRB throughout:*

Our third simulation is, as discussed above, a counterfactual one in which the SRB remains constant at 106 throughout. We construct two versions, one in which the trajectory of Chinese fertility is as for the baseline scenario and another in which and in which China's average fertility rate is slightly higher than in the baseline. In the second of these, we seek to explore the additional effect of using some relaxation of fertility restrictions as part of a policy arsenal to reduce the SRB. It remains unclear by how much China's fertility restrictions actually constrain birth choices so we make the arbitrary choice to allow in this second variant of the counterfactual simulation a return to the United Nations' medium forecast, which sees an average fertility rate of 1.8 in 2030 (up from our baseline level of 1.2).

Since the SRB is lower in this counterfactual simulation than the data for the base year show, base year age-specific sex ratios are well above balance, and indeed above the assumed SRB of 106. Consequently, in the simulations there are initial declines through time in age-specific sex ratios as the effect of the changed SRB flows through the age groups. It is clear from Table 2 that unmatched low-skill male numbers by 2030 are significantly lower in this counterfactual. The number of such unmatched males remains high, however, if skilled males take 1.5 women, since this creates unmatched low-skill males even if the SRB were always balanced. In the higher-fertility variant, births are boosted additionally (if only slightly) by the increased number of women to bear children. The result is higher population and labour force growth. As we will see from the analysis in the next section, this is a key source of economic impact.

## 5. Sex Ratios and Economic Growth

### *Saving effects*

The empirical work by Du and Wei (2010) suggests that changes in the sex ratio explain 30-60 per cent of the change in the household saving rate. From Figure 5, household saving as a share of GDP rose by nine percentage points between 1997 and 2010. A liberal interpretation of the Du-Wei results would suggest that 45 per cent of this, or four percentage points, was due to the changing sex ratio. Coincidentally, our simulated unmatched share of boys (0-14) also rose by four percentage points in this period. This does not suggest a unit-elasticity for all China's saving, however, since household saving is only 60 per cent of the total. With this adjustment we deduce an elasticity of 0.6, indicating that a one percentage point rise in the unmatched share of 0-14 males yields a 0.6 per cent rise in the share of GDP committed to saving.[19]

The first simulation to use this information is one that incorporates the decline in China's SRB from 120 to 106, as shown in Figure 3. The departure of the new simulation from the baseline causes the unmatched share of boys to fall and this fall induces a decline in saving. As Table 1 shows, while the sex ratio of children is significantly affected by 2030, significant effects on the sizes of the population and labour force come much later. The link between the sex ratio of children and saving is therefore likely to have the most impact on economic performance. Yet this decline can manifest in two ways. First, our dynamic model can exhibit a Keynesian tendency to reduce saving and thus to concentrate consumption expenditure at home rather than send it abroad. Other things equal, this tends to boost home GDP in the short run. But, in the medium to long run, the reduced saving lessens investment at home and assets abroad from which income accrues later to an extent that dominates the short-term effect.

Since the shocks to saving are proportional to the difference between the two SRB scenarios in Figure 3, they occur gradually, allowing the long-run investment effect to dominate from the outset. Yet these net effects are small, as indicated in Figure 8. The changes in real investment, real GDP and real per capita income due to the changes in the SRB and the associated changes in the saving rate are shown to amount to no more than a percentage point by 2030. While this is significant, it is small in relation to China's overall growth to that point. At the same time, the rate of change by 2030 is very considerable, suggesting that the saving effect could become much more important in the years beyond 2030.

[19] More precisely, since about half of China's GDP is saved, for each per cent rise in the unmatched share of boys, a negative shock of this magnitude is applied generically to the consumption equations in the model, so that saving increases with the unmatched share of boys.

Following Du and Wei, it is also possible to see from this simulation the effects of these shocks on China's real exchange rate. The net effect is small, however, since the saving and crime shocks are partially offsetting. Reduced saving tends to appreciate the real exchange rate, as Du and Wei indicate. The magnitude is only half a per cent by 2030.

***Crime-related productivity***

*Quantifying the effects of low-skill male disaffection and crime:*

Characterising the implications of disaffected low-skill men for aggregate economic performance is heroic at best given the non-complementary nature of social research on this issue for China to date. We embark on this with the objective of illustrating the potential scale of impacts rather than to offer a definitive forecast. Our reasoning is conservative throughout and it runs as follows.

Edlund et al. (2007, 2010) use Chinese statistics to draw a clear link between the sex ratio and crime, motivated by the disaffection of unmatched men and the "socialising" role of marriage for men's behaviour.[20] They control for other causes and deduce that a rise in the sex ratio by one per cent is sufficient to cause property and violent crime to increase by three per cent. The next link in the argument is an estimate of the scale of the productivity effects of crime in China, but this is unavailable to our knowledge. Instead, we note from studies of the economic implications of crime in the US that its cost has been measured at around five per cent of potential GDP (Harwood et al. 2009). We then speculate that violent and property crime in China could impact its economy in approximately the same proportion. This yields a link between the sex ratio and the productivity impact of associated crime.

Combining the Edlund et al. relationship with a GDP shortfall by five per cent due to property and violent crime, it follows that a rise in the sex ratio by one percentage point would reduce real GDP by 0.03*0.05=0.0015=0.15 per cent. This implies that a rise in the sex ratio by 10 percentage points would lower real GDP by only 1.5 per cent. Some amplification is obtained by drawing the link between the sex ratio of adults of reproductive age, from whence the behaviour stems, and the recognition that crime is primarily an urban phenomenon that impairs the services sector more than others. Add to this that the first urban destination of low-skill men is the construction sector, and that this constitutes the majority of investment expenditure, and the effects of crime are leveraged noticeably. Through these admittedly speculative steps we apply the following sequence: a rise of one per cent in the sex ratio of 15-39 year olds yields a three per cent rise in the crime burden.

[20] The latter is also argued by Becker (1985), Korenman and Neumark (1991), Antonvics and Town (2004) and Henrich et al. (2012).

Since the services sector supplies less than half of GDP in China, if crime reduces GDP by five per cent, but its effects are concentrated in services, it must reduce services GDP by roughly 10 per cent, and so the effect of crime originating with unmatched males deducts three per cent from about a tenth of services GDP. Thus, an increase of one per cent in the sex ratio of 15-39 year olds (total, not low-skill only) thereby reduces total factor productivity in both services and capital goods production by 0.3 per cent.[21]

While we have leveraged what little supporting information is available we believe the resulting elasticity of -0.3 to be conservative, considering the first argument of Rodrik (1998), that "social conflict" is typically responsible for the much larger growth collapses observed in the more poorly performing developing countries, and second, the observations of Easterly (2001) on the causes of growth stagnation at middle income. Indeed, the widening of China's income distribution (Wang and Woo) is just one factor that makes more fragile the political threads that hold its growth performance together (Tyers 2012), to which 30-50 million disaffected males of reproductive age would add.

*Simulating a declining SRB with saving and crime effects:*

In our second simulation, the demographic results from which are discussed above, we assume a decline in China's SRB from 2004 to 106 by 2030. At the same time, this decline is linked to consumption behaviour so as to reduce the average saving rate as described previously. Now we add the links between the sex ratio of the 15-39 age group and total factor productivity in the services and capital goods sector. These have the effect of boosting productivity as the sex ratio declines toward balance. The results are illustrated in Figure 9.

The story here is that the crime-related productivity shocks are shown to outweigh the slowing effects of lower saving and so they lead to stronger growth in the latter stages as the sex ratio of 15-35 year olds falls. Investment is affected most because low-skill men work in the construction industry, the largest single component of the capital goods sector. GDP and real wages rise by less than investment because the crime shocks are restricted to the services and the capital goods industries and so productivity in agriculture and manufacturing is unchanged. Real per capita income rises least because it depends not only on home output (real GDP) but, increasingly in the later stages, also on income from assets abroad, which are considerable but which are made smaller by the lower saving rate in this simulation.

[21] Given our earlier reasoning it would be more germane to link the sex ratio of low-skill adults of reproductive age, or the proportion of low-skill males that are unmatched to crime behaviour. We seek to be conservative here, however, being cognizant of the Edlund et al. (2007, 2010) results that use the overall sex ratio.

Finally, the effects on the real exchange rate are here mixed. The saving and crime shocks are partially offsetting. Reduced saving tends to appreciate the real exchange rate, as Du and Wei indicate, but improved services productivity from reduced crime affecting the largely non-traded sectors tends to depreciate it. The trajectory is flatter than in Figure 8 and it turns negative near the end as the productivity effects outweigh the saving effects. Overall, the effects on China's simulated economic performance across more than two decades are still smaller than a single year's growth.

***Low-SRB Counterfactuals***

Here we construct simulations with a constant Chinese SRB at 106 but commence from the same base period population distribution, in which age specific sex ratios are larger than this. The effect is for sex ratios to fall through time, converging on 106. The idea is to get a sense of how different China's experience would have been under these circumstances. As indicated in Section 4, there are two counterfactual simulations, the first with baseline fertility and the second with higher fertility to represent a more relaxed population policy as part of a package for keeping the SRB low. Both have lower saving and lower crime, related as before to the changes in the sex ratio of all boys on the one hand and the sex ratio of low skill males of reproductive age on the other. The lower saving is obtained by adjusting China's average saving rate according to the elasticity of consumption to the proportion of unmatched boys, as discussed in the previous section. Lower crime stems from applying the elasticity discussed above, linking the sex ratio of 15-39 year olds to productivity in services and capital goods supply. With all these applied, but in the absence of any increase in fertility, the cumulative per cent departures from our baseline simulation are as indicated in Figure 10.

Here again, a struggle is evident between the counterfactual's lower saving and its higher productivity. The higher productivity wins in terms of investment and real GDP, which is larger in 2030 by a twentieth. But the reduced saving retards the growth of real per capita income, the net effects on which are negligible. When we introduce higher fertility in the second counterfactual simulation the differences are due to the resulting higher population and labour force indicated in Table 2. From Figure 11 we see the expected (Solow-Swan) combination of reduced real wages and real per capita income higher real GDP. The increased workers and the reduced crime cause additional real GDP growth, sufficient to raise its level by one-tenth in 2030. The increased population, however, weighs on wages and real per capita income, resulting in comparatively small real wage increases and a net decline in real per capita income.

Reduced saving enters this mix by tending to reduce the growth in investment, most in the middle of the period, but this is more than offset by crime-related productivity improvements in the capital goods and services sectors, so investment growth is enhanced on net. The path of the additional investment tends to tail off at the end because the convergence of the sex ratio on 106 in the counterfactual and on 123 in the baseline sees growth in the productivity shocks die away at the end. As this happens, additional accumulated capital lowers home capital returns and hence tends to attract less further investment. Since services are skill-intensive compared with the other industries, stronger services growth in the counterfactual simulation raises the relative demand for skilled workers, which is why the gains in real skilled wages exceed those in real unskilled wages.

## 6. Conclusion

One of the constraints to continued rapid Chinese GDP growth is the slowdown and eventual contraction of China's labour force, which has been accelerated in China's case by its "one-child" policy. A complicating associated factor arises due to the Chinese traditional preference for at least one son, which, via selective abortion, has caused a rise in the SRB. This has eventually reduced the share of women of reproductive age and so further slowed population and labour force growth. Yet gender imbalance has other widely noted undesirable consequences, including excessive saving as families with boys compete to match their sons with scarce girls, trafficking in women and rising disaffection and crime amongst the low-skill male population.

Results from our dynamic modelling suggest that, depending on the tendency for low-skill women to "marry up" and to choose second partnership with wealthy men over marriage to poor ones, by 2030 the proportion of low-skill men of reproductive age that is unmatched will be between one in seven and one in four. Their number of such unmatched men of reproductive age will be between 30 and 50 million and still growing. Though this is sure to result in rising trafficking of women from other East Asian countries, the number is simply too large for female immigration to allow a return to balance.

If policy changes can be successful in returning the SRB to normal levels, we expect that the purely demographic implications would be small, at least by 2030. The decline in saving by families observing improved marriage prospects for their boys would slow investment and income growth but there would be fewer disaffected men of reproductive age and so less crime. In our preliminary quantification of these effects, the reduced crime offers more growth benefits than are lost due to the reduced saving. Though the magnitudes of these effects, as we simulate them, lie within one

year's current Chinese growth, the results suggest that the gender imbalance represents another obstacle to continued rapid overall expansion.

That policy reforms to achieve gender balance is worth pursuing is supported in that, as other political tensions rise through time it is possible that the high SRB and the large number of unmatched and disaffected low-skill males could constitute the marginal pathology that tips China into Rodrik's political malaise and significantly slower per capita growth. Yet such policies will not come without cost. If a further relaxation of the "one child" policy is needed to help restore gender balance, for example, more rapid population growth will slow the growth of real per capita incomes and hence the growth in the welfare of individual Chinese.

## References


Angrist, Josh, 2002. "How do sex ratios affect marriage and labor markets? Evidence from America's second generation", *The Quarterly Journal of Economics* 117(3): 997-1038.

Antonovics, Kate and Robert Town, 2004. "Are all the good men married? Uncovering sources of the marital wage premium", *American Economic Review,* Vol 94(2): 317-21.

Attané, Isabelle and Christophe Z. Guilmoto (2005) *Watering the Neighbour's Garden: the growing female deficit in Asia,* OECD, Paris.

Becker, Gary S. (1981) *A treatise of the family,* Cambridge, Mass, Harvard University Press.

Becker, Gary S. (1985), "Human capital, effort and the sexual division of labour", *Journal of Labour Economics,* 3(1-2): S33-S58.

Becker, Gary (2007), "Is sex selection of births undesirable", downloaded from http://www.becker-posner-blog.com/2007/02/is-sex-selection-of-births-undesirable-becker.html in May 2012.

Bergsten, C.F., C. Freeman, N.R. Lardy and D.J. Mitchell (2008), *China's Rise: Challenges and Opportunities*, Washington DC: Peterson Institute for International Economics.

Bernanke, B. (2006), Speech to the Chinese Academy of Social Sciences, Beijing, Friday 15 December, www.federalreserve.gov/BoardDocs/Speeches/2006/20061215.

Bloom D.E. and D. Canning (2005b), "The effect of improvements in health and longevity on optimal retirement and saving", NBER Working Paper No.10919, Cambridge, MA: National Bureau of Economic Research, April.

Brooks, R. (2011), "Disaster looms in a world full of men", ABC Science Opinion, http://www.abc.net.au/science/articles/2011/06/15/3244023.htm, accessed 9 September 2011.

Brooks, Rob (2012), "Little China girls: how history's worst famine shifted the sex ratio" http://theconversation.edu.au/little-china-girls-how-historys-worst-famine-shifted-the-sex-ratio-6312, downloaded on May 20 2012.

Bulte, Erwin, Nico Heerink and Xiaobo Zhang, 2011. "China's One-Child Policy and the mystery of missing women: ethnic minorities and male-biased sex ratios", *Oxford Bulletin of Economics and Statistics, forthcoming.*

Cai, Yong and William Lavely (2007), "Child sex Ratios and their spatial variation" in Zhao, Z.; Guo, F (eds) *Transition and Challenge: China's Population at the Beginning of the 21st Century*, Oxford University Press, Oxford

Cai, F. (2010), "Demographic transition, demographic dividend and Lewis turning point in China", *China Economic Journal*, 3(2): 107-119, September.

Cai, Fang (2012), "The coming demographic impact on China's growth: the age factor in the middle-income trap", *Asian Economic Papers* Volume 11(1): 95-111. Cárdenas, Mauricio, 2007. "Economic growth in Colombia: a reversal of "fortune""?, *Working Paper Series, February,* No. 36.

Das Gupta, Monica Woojin Chung, Li Shuzhuo (2009), "Evidence for an incipient decline in the numbers of missing girls in China and India", *Population and Development Review* (35(2): 401-416.

Deer, L. and L. Song (2012), "China's approach to rebalancing: a conceptual and policy framework", *China & World Economy*, 20(1): 1-26.

Dimaranan, B.V. and McDougall, R.A., 2002. *Global Trade, Assistance and Production: the GTAP 5 data base*, May, Center for Global Trade Analysis, Purdue University, Lafayette.

Dixon, P.B., Parmenter, B.R., Sutton, J. and Vincent, D.P., 1982. *ORANI, a Multi-Sectoral Model of the Australian Economy*, North Holland, Amsterdam.

Dooley, M.P., D. Folkerts-Landau and P. Garber (2004), "Direct investment, rising real wages and the absorption of excess labor in the periphery", NBER Working Paper 10626 (July), Cambridge MA: National Bureau of Economic Research.

Du, Qingyuan and Shang-jin Wei (2010), "Sex Ratios, Savings Rates and Current Account Imbalances", unpublished version, Columbia Business School, December 6.

Du, Qingyuan and Shang-jin Wei, 2012 "A Darwinian Perspective on "Exchange rate undervaluation", http://www.nber.org/confer/2011/ease11/Du_Wei.pdf

Easterly, W. (2001), "The lost decades: developing countries' stagnation in spite of policy reform 1980-1998", Washington DC: World Bank, February.

Ebenstein, Avraham and Steven Leung (2010) "Son preference and access to social insurance: evidence from China's rural pension program", *Population and Development Review* 36(1): 47-70.

Ebenstein, Avraham, Hongbin Li and Lingsheng Meng (2010), "The impact of ultrasound on the status of women in China, downloaded from http://ebookbrowse.com/ebenstein-li-meng-ultrasound-december-2010-pdf-d55208326

*Economist, The* (2011), "How real is China's growth?" June 1st: economist.com/blogs/freeexchange/2011/05/chinas_economy.

Eichengreen, B., D. Park and K. Shin (2011). "When Fast Growing Economies Slow Down: International Evidence and Implications for China," *NBER Working Paper*, 16919, Canbridge MA.

Edlund, L., H. Li, J. Yi and J. Zhang (2007), "Sex ratios and crime: evidence from China's one-child policy", IZA Discussion Paper 3214, Bonn: Institute for the Study of Labor.

Edlund, Lena, Hongbin Li, Junjian Yi and Junsen Zhang, 2010. "Marriage and Crime: evidence from China's rising sex ratios" http://empac.ucsd.edu/assets/001/501502.pdf

Garnaut, R. (2010), "Macroeconomic implications of the turning point", *China Economic Journal*, 3(2): 181-190, September.

Golley, J. (2012) "Uncertain numbers, uncertain outcomes", chapter in Barmé, Geremie (editor), *Red Rising, Red Eclipse,* forthcoming.

Golley, J. and Meng, X. (2011), "Has China run out of surplus labour?", *Chinese Economic Review*, forthcoming.

Golley, J. and R. Tyers (2012a), "Demographic dividends, dependencies and economic growth in China and India", *Asian Economic Papers*, 41(3) in press.

_____ (2012b), "Population pessimism and economic optimism in the Asian Giants", revision of Working Paper 10-2011, Centre for Applied Macroeconomic Analysis (CAMA), Australian National University, June.

Gu, Baocheng, Wang Feng, Guo Zhigang and Zhang Erli (2007). "China's local and national fertility policies at the end of the twentieth century", *Population and Development Review* 33(1): 129-147/

Guilmoto, Christopher "The sex ratio transition in Asia", *Population and Development Review* 35(3): 519-49, September 2009

Guinnane, T.W. (2011), "The historical fertility transition: a guide for economists", Journal of Economic Literature 49(3): 589-614.

Haber, S.H., D.C. North and B.R. Weingast (2008), "Introduction", Chapter 1 in S.H. Haber, D.C. North and B.R. Weingast (eds) *Political Institutions and Financial Development*, Stanford University Press: 1-9.

Harris, R.G, P.E. Robertson and J. Xu (2011), "The international effects of China's trade and education booms", *The World Economy*, 34(10): 1703-1725.

Henrich, Joseph, Robert Boyd and Peter Richerson, 2012. "The puzzle of monogamous marriage", *Philosophical Transactions of the Royal Society* 367:657-669.

Hertel, T.W. (editor). 1997. *Global Trade Analysis Using the GTAP Model*, New York: Cambridge University Press. Available: http://www.agecon.purdue.edu/gtap.

Horioka, C.Y. and A. Terada-Hagiwara (2011), "The determinants of long term projections of saving rates in developing Asia", NBER Working Paper 17581, November.

Hudson, Valerie M. and Andrea M. den Boer (2004), *Bare Branches: The Security Implications of Asia's Surplus Male Population,* Cambridge, MA: MIT Press.

Hudson, Valerie M. and Andrea M. den Boer (2008), 'China's Security, China's Demographics: Aging, Masculinization, and Fertility Policy', The Brown Journal of World Affairs XIV, no. 2 (Spring/Summer): 185-200.

Hvistendahl, Mara (2011), *Unnatural Selection: Choosing Boys over Girls and the Consequences of a World Full of Men*, New York: Public Affairs Press, 314pp.

Ianchovichina, E. I. and T. L. Walmsley, eds (2012), *Dynamic Modelling and Applications for Global Economic Analysis*, Cambridge University Press, January.

Jia, K. and Liu, W. (2009), "China's fiscal policies during the post-crisis era", Research Institute for Fiscal Science, Ministry of Finance, Beijing.

Klasen, Stefan and Claudia Wink (2003), "Missing women: revisiting the debate", *Feminist Economics* 9□(2-3): 263-299.

Korenman, Sanders and David Neumark, 1991. "Does marriage really make men more productive", *The Journal of Human Resources* 26(2): 282-307.

Krugman, P. (2010), "Taking on China", *New York Times* column, 30 September.

Kuijs, L. (2006), "How will China's saving-investment balance evolve?" World Bank Policy Research Working Paper 3958, Beijing, July.

Lardy, N.R., 2006. 'Toward a consumption-driven growth path" *Policy Brief* 06-6, Washington DC: Peterson Institute for International Economics.

Lardy, N.R. (2012), *Sustaining China's Growth after the Global Financial Crisis*, Washington DC: Peterson Institute for International Economics, January.

Li, Shuozhuo, 2007. "Imbalanced sex ratio at birth and comprehensive interventions in China", paper presented at the 4th Asia Pacific Conference on Reproduction and Sex Health and Rights, Hyderabad, India, October 29-31.

Lewis, W.A. (1955). *The Theory of Economic Growth*. London: Taylor and Francis.

Lin, Ming-jen, Jin-Tan Liu and Nancy Qian, 2010. "More missing women, fewer girls dying: the impact of abortion on sex ratios at birth and excess female mortality in Taiwan", downloaded from http://www.econ.yale.edu/~nq3/NANCYS_Yale_Website/Research_files/LinLiuQian_201002.pdf on May 20 2012.

Lu, F., G. Song, J. Tang, H. Zhao and L. Liu (2008), "Profitability of Chinese firms, 1978-2006", *China Economic Journal* 1(1).

Lucas, R.E. Jr (2009), "Trade and the Diffusion of the Industrial Revolution," *American Economic Journal: Macroeconomics*, 1:1, 1-25.

McKibbin, W. and W.T. Woo (2004), *The Global Economic Impact of China's Accession to the WTO*. OECD Trade Policy Working Paper No. 3, OECD Paris, 121 pages.

Murphy, Rachel, Ran Tao and Xi Lu, 2011. "Son Preferences in Rural China: patrilineal families and socioeconomic change", *Population and Development Review* 37(4):665-90.

Qian, Nancy, 2008. "Missing women and the price of tea in China" the effect of sex-specific earnings on sex imbalance" *Quarterly Journal of Economics* 123(3): 1251-85.

Riedel, J., J. Jin and J. Gao, 2007. *How China Grows: Investment, Finance and Reform*. Princeton NJ: Princeton University Press and Beijing: Peking University Press.

Riedel, J., 2006. "Seeing but not believing: technological progress and structural change in China", School of Advanced International Studies, Johns Hopkins University.

_____, 2007. "China needs many things but not a new growth engine", *Financial Times*, 21 February, Asia Edition.

_____, 2011. "The slowing down of long term growth in Asia: natural causes, the middle income trap and politics", School of Advanced International Studies, Johns Hopkins University.

Robertson, P.E. (2011) "Clash of the titans: comparing India and China", Chapter 14 in *Rising China: Global Challenges and Opportunities*, J. Golley and L. Song (eds), Canberra: ANU Press.

Rodrik, Dani (1998) "Where did all the growth go? External shocks, social conflict, and growth collapses" Manuscript, Harvard University, and NBER Working Paper 6350.

Seguino, Stephanie, 2000. "Accounting for Asian economic growth: adding gender to the equation", *Feminist Economics* 6(3):27-58.

Song, Shige (2012), "Does famine influence the sex ratio at birth? Evidence from the 1959-61 Great Leap Forward Famine in China", Proceedings of The Royal Society, downloaded from

http://rspb.royalsocietypublishing.org/content/early/2012/03/16/rspb.2012.0320.full.pdf+html

Song, L., J. Wu and Y. Zhang (2010), "Urbanization of migrant workers and expansion of domestic demand", *Social Sciences in China*, XXXI(3): 194-216, August.

Tyers, R. (2012a), "The rise and robustness of economic freedoms in China", in Moore, G. (ed), *The Open Society and its Enemies in East Asia*, Nordic Institute of Asian Studies Press, forthcoming, accepted January 2012.

Tyers, R. (2012b), "Looking inward for transformative growth in China", CAMA Working Paper No. 15/2012, Canberra: Australian National University.

Tyers, R. and I. Bain. 2006. "The global implications of freer skilled migration"; Working Papers in Economics and Econometrics No. 468, Australian National University, Canberra, July, revised September 2007.

Tyers, R., J. Golley, Y. Bu and I. Bain (2008), "China's economic growth and its real exchange rate", *China Economic Journal*, 1(2): 123 - 145, July.

Tyers, R. and L. Huang (2009), "Combating China's export contraction: fiscal expansion or accelerated industrial reform?" ANU CAMA Working Paper 2/2009, February, College of Business and Economics, Australian National University.

Tyers, R. and F. Lu (2008), "Competition policy, corporate saving and China's current account surplus", Working Papers in Economics and Econometrics No. 496, College of Business and Economics, Australian National University, July.

Tyers, R. and Y. Zhang (2011), "Appreciating the *renminbi*", *The World Economy*, 34(2): 265-297, February.

Walter, C.E. and F.J.T. Howie (2011), *Red Capitalism: The Fragile Financial Foundation of China's Extraordinary Rise*, Singapore: John Wiley and Sons.

Wang, X. and W.T. Woo (2011), "The size and distribution of hidden household income in China", *Asian Economic Papers*, 10(1): 1-31.

Wei, Shang-Jin and Xiaobo Zhang, 2009, "The competitive saving motive: evidence from rising sex ratios and saving rates in China" *NBER Working Paper* 15093.

Wei, Shang-Jin and Xiaobo Zhang, 2010. "The sexual foundations of economic growth: evidence from China, working paper.

Wei, Xing Zhu, Li Lu and Therese Hesketh, 2009. "China's excess males, sex selective abortion, and one child policy: analysis of data from 2005 national inter-census survey", *BMJ* 2009(338) b1211

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 (2010), "Escaping the middle-income trap", Chapter 3 in *East Asia and Pacific Economic Update 2010 Volume 2: Robust Recovery, Rising Risks*, November.

Yi, Gang (2011), "How China plans to strike an economic balance", *CaiXin Online* English, 4 February.

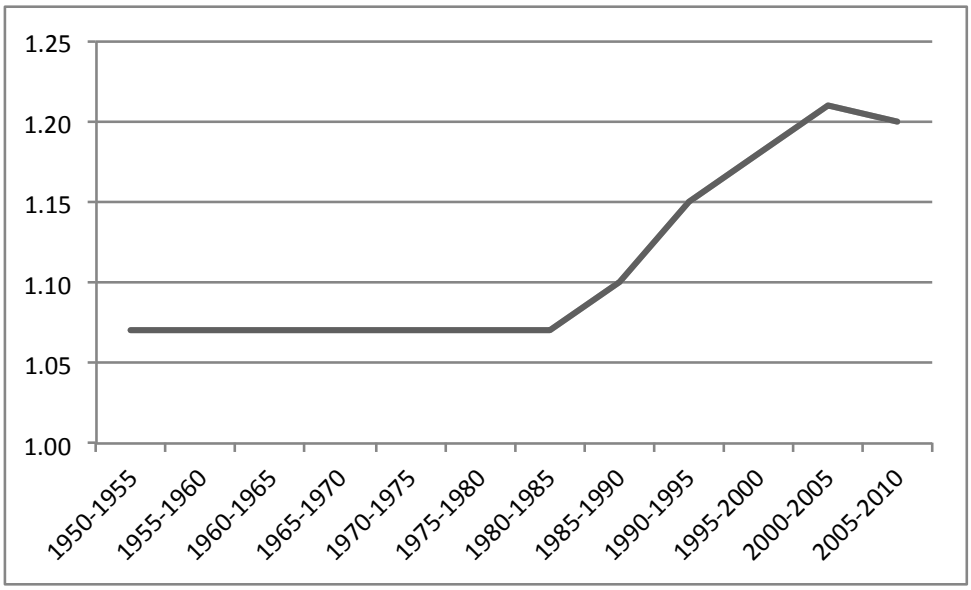
Zeng, Yi (2007), "Options for Fertility Policy transition in China", *Population and Development Review* 33(2): 215-46.

Zhao, Zhongwei (2011), 'Reflections on China's recent population statistics and current demography situation' in *Chinese Cross Currents,* July: 44-57.

Zhao, Zhongwei and Chen Wei (2011), 'China's far below replacement fertility and its long-term impact: Comments on the preliminary results of the 2010 Census', *Demographic Research,* Vol. 25, Article 26: 819-36.

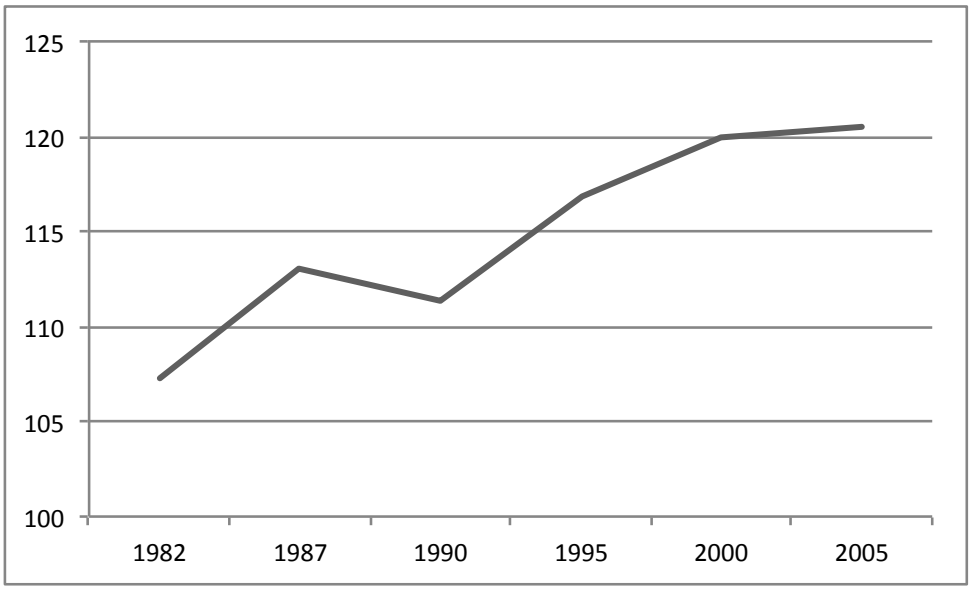
Zhu, Wei Xing, Li Lu and Therese Hesketh, 2009. "China's excess males, sex selective abortion, and one child policy: analysis of data from 2005 national intercensus survey", *BMJ* 2009(338) b1211

## Figure 1: Long-term trends in China's Sex Ratio at Birth



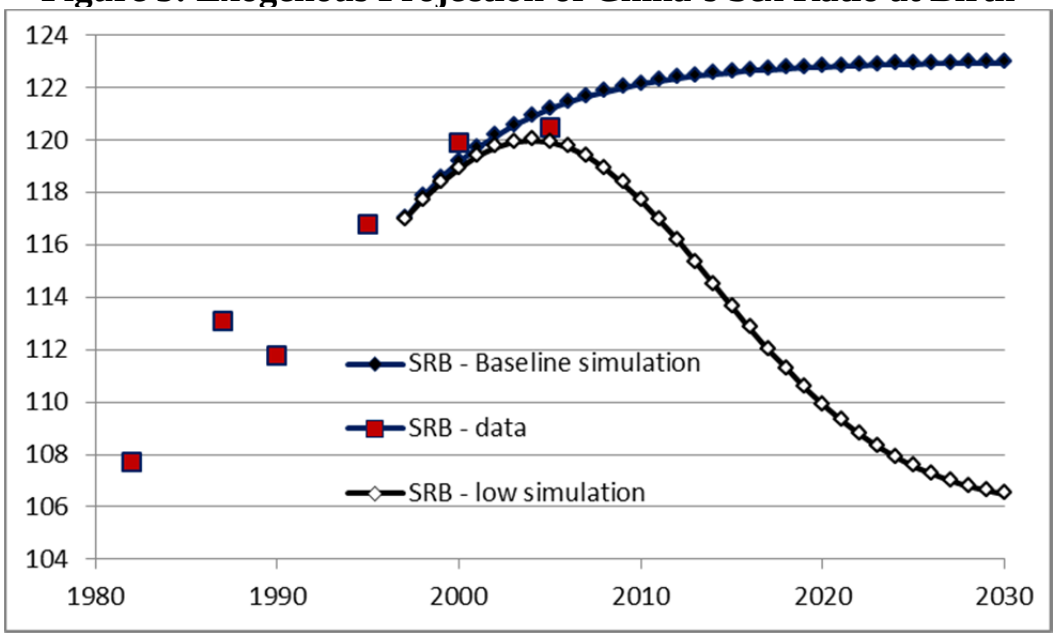

Source: United Nations (2010)

## Figure 2: Recent trends in China's Sex Ratio at Birth



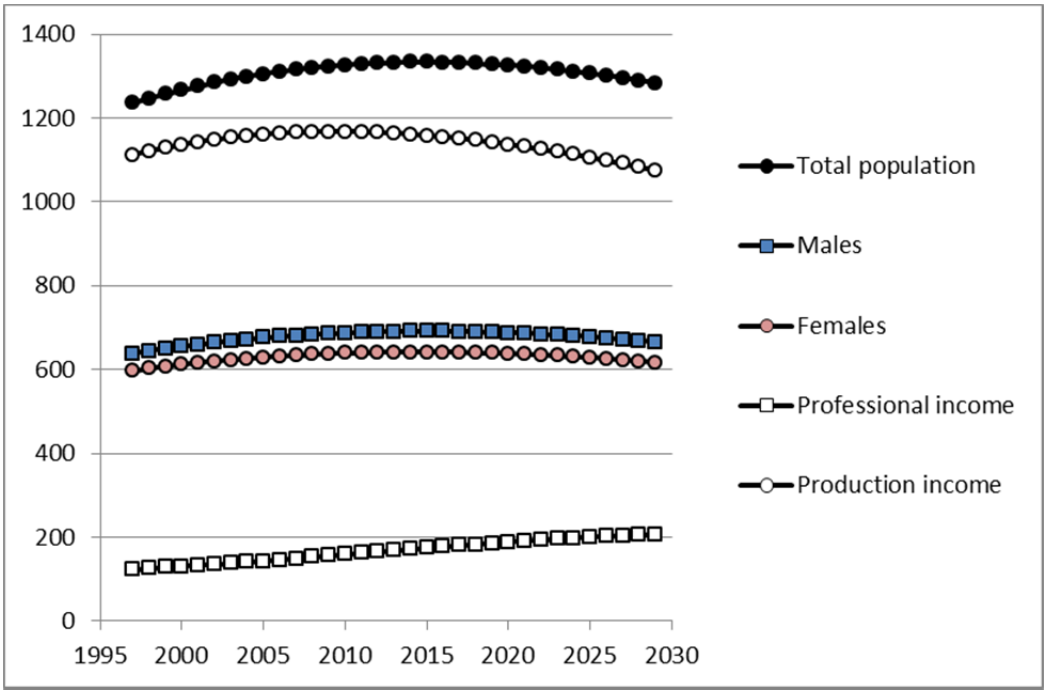

Source: Li (2007), based on China population censuses in 1982,1990 and 2000 and 1% population sample surveys in 1987,1995 and 2005.

**Figure 3: Exogenous Projection of China's Sex Ratio at Birth**



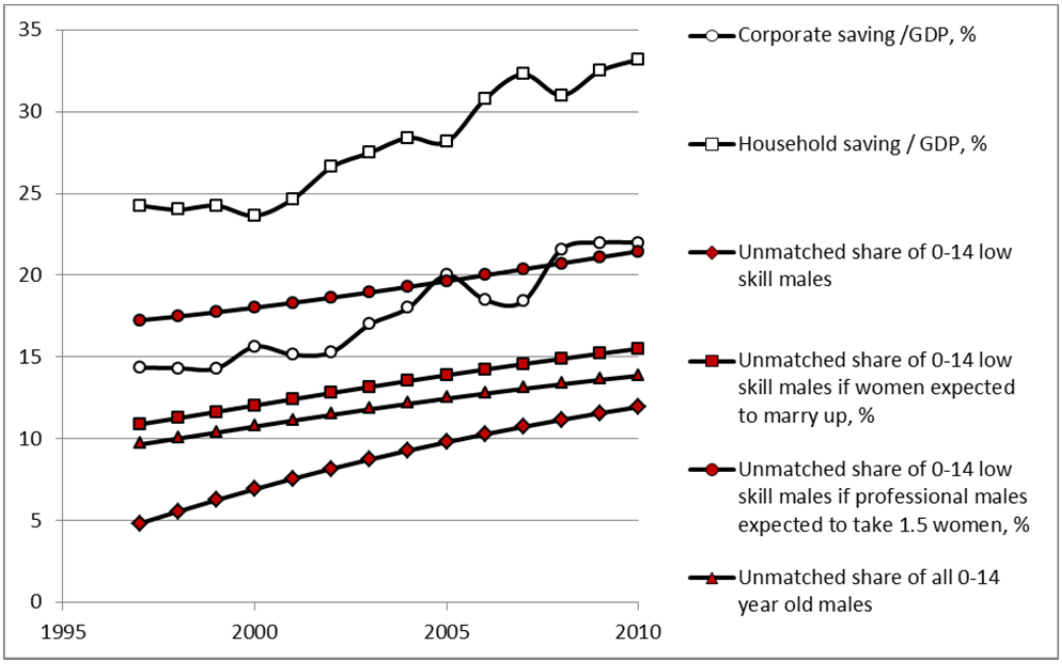

Source: Population census data (Li 2007) and exogenous projections described in the text

**Figure 4: Chinese Population Structure and its Change Through Time**



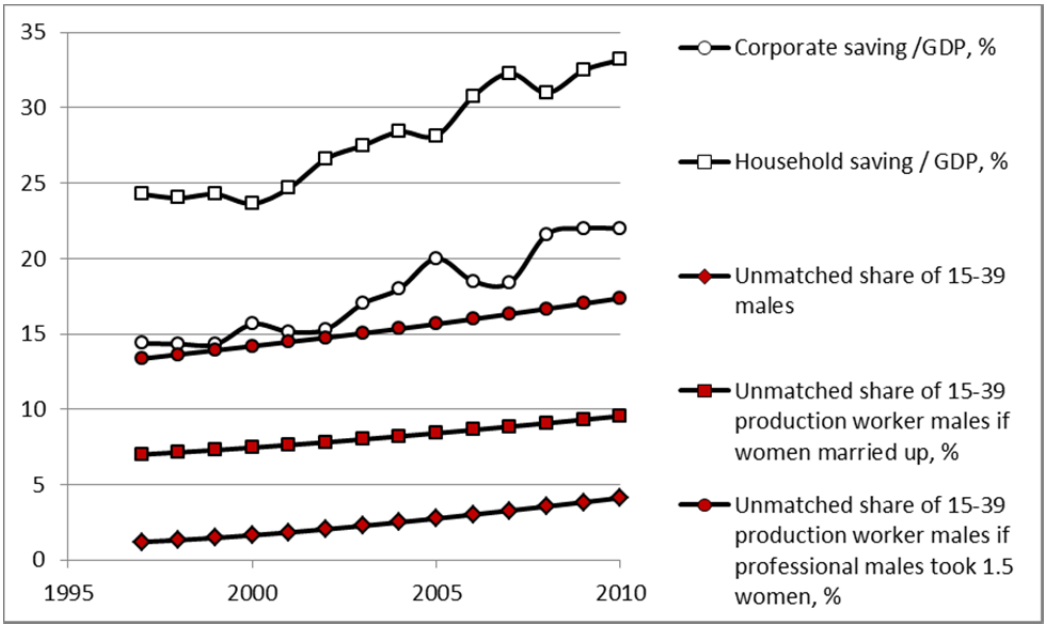

Source: Baseline simulation of the model described in the text.

## Figure 5: Chinese Saving and Unmatched 0-14 Male Shares, %




Source: Saving rates are derived from official macroeconomic statistics, including "flow of funds" data. The unmatched male shares are from a retrospective simulation under baseline assumptions about the SRB and fertility, as described in the text.

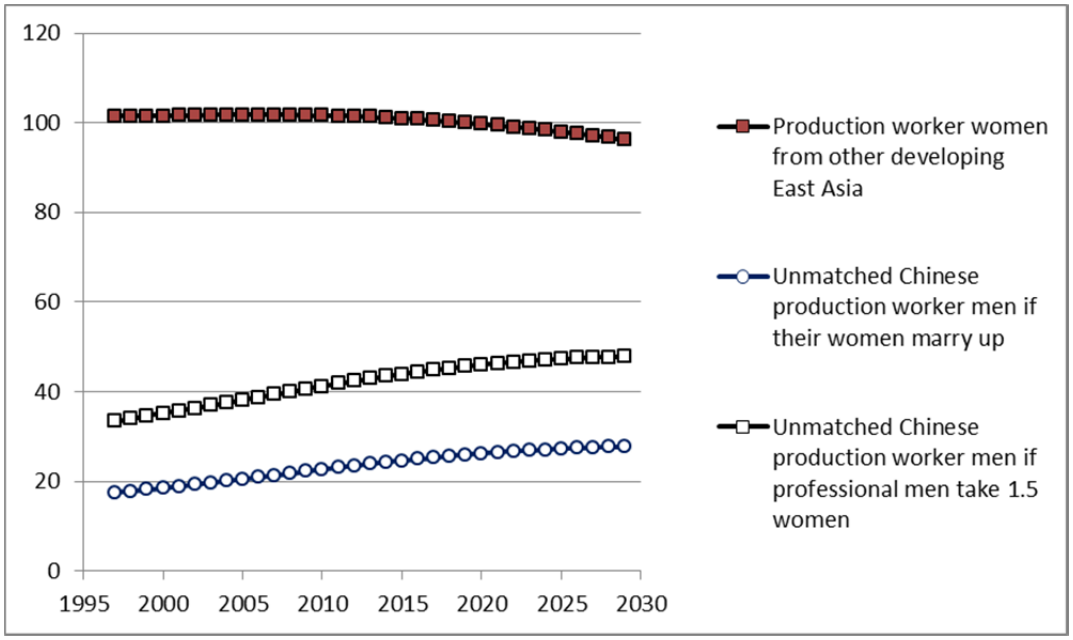
## Figure 6: Chinese Saving and Unmatched 15-39 Males




Source: Saving rates are derived from official macroeconomic statistics, including "flow of funds" data. The unmatched male shares are from a retrospective simulation under baseline assumptions about the SRB and fertility, as described in the text.

## Figure 7: Unmatched Chinese Males 15-39 in East and SE Asian Context[a]

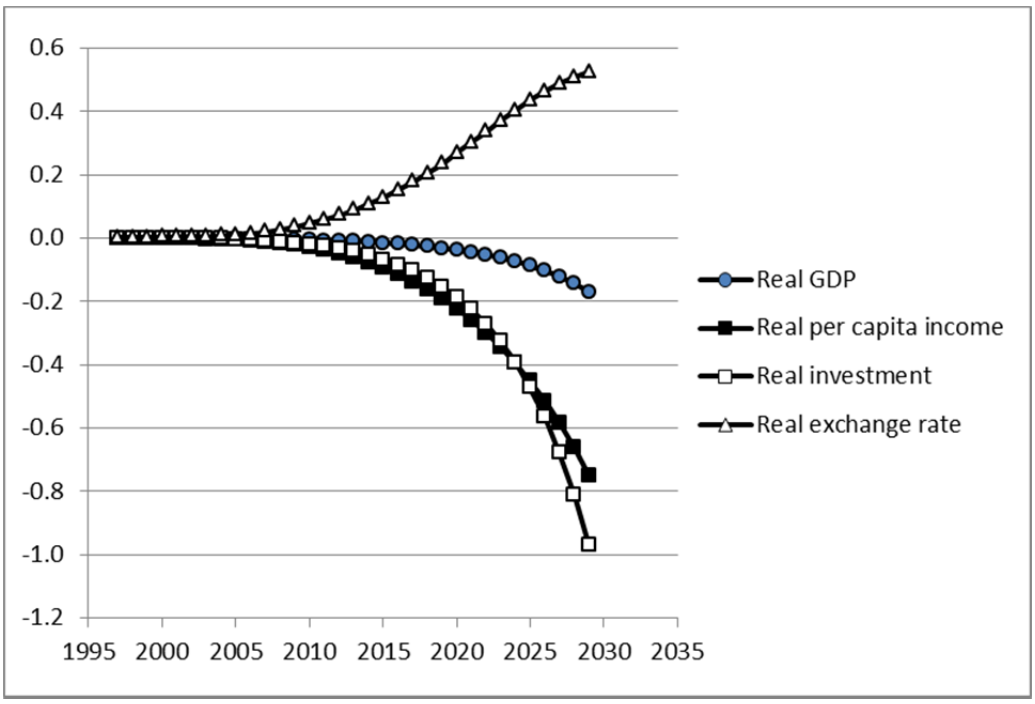
(Millions)




a This compares the number of unmatched mainland Chinese production worker males with the number of women in the same age group that are in production worker families in Taiwan, Hong Kong, Indonesia, Korea, Indochina and other Southeast Asia.

Source: Baseline (Chinese SRB and fertility) simulation of the model described in the text.

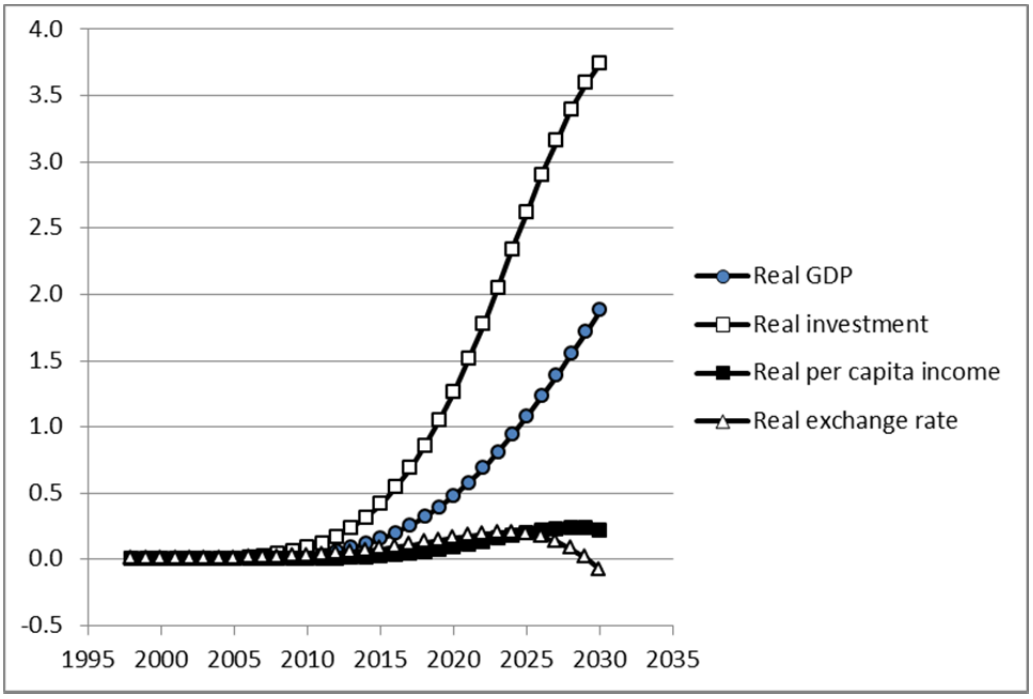
## Figure 8: Effects of Reducing the SRB - Saving and Labour Structure Changes Only[a]




a These are cumulative % deviations from the baseline simulation with high SRB.

Source: Simulations of the model described in the text.

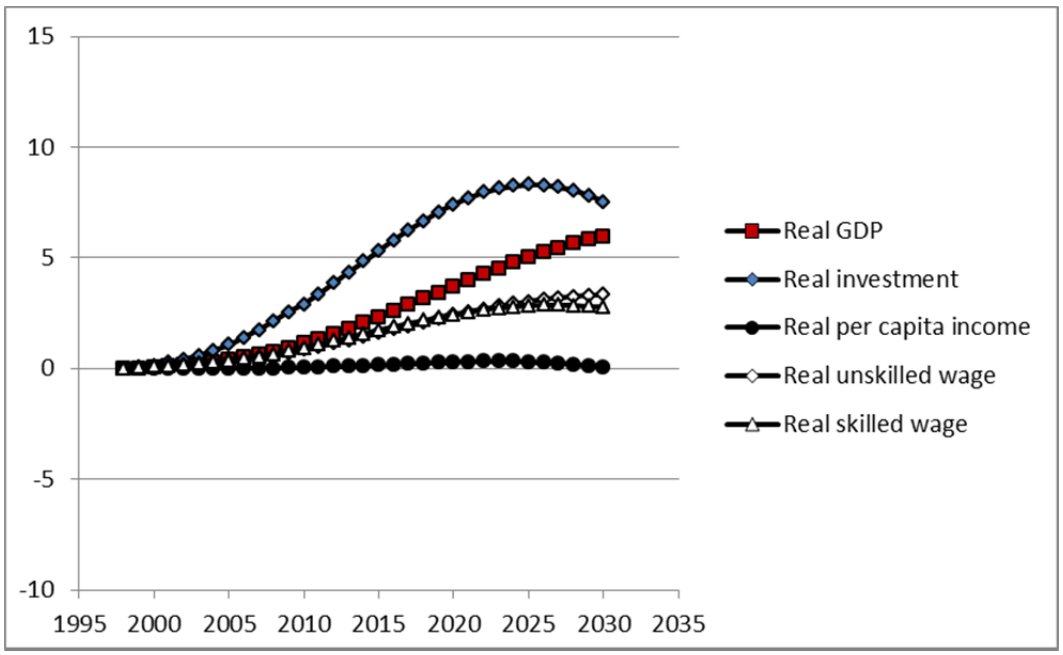
**Figure 9: Effects of Reducing the SRB, including Saving, Labour Structure and Crime-Related Productivity Changes[a]**




a These are cumulative % deviations from the baseline simulation.

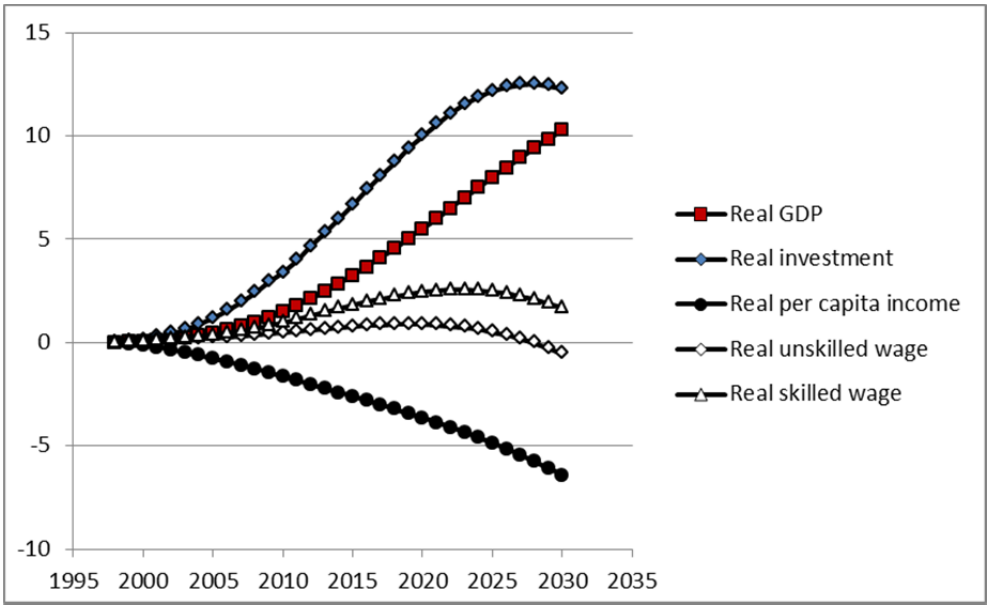
Source: Simulations of the model described in the text.

**Figure 10: Departures from the Baseline of a Counterfactual with Constant SRB=106 and Associated Differences in Saving, Labour Structure and Crime-Related Productivity[a]**




a These are cumulative % deviations from the baseline simulation.
Source: Simulations of the model described in the text.

## Figure 11: Departures from the Baseline of a Counterfactual with Constant SRB=106, *Higher Fertility* and Associated Differences in Saving, Labour Structure and Crime-Related Productivity[a]




a These are cumulative % deviations from the baseline simulation. These results parallel those in Figure 10, except that they also include higher fertility, with the TFR remaining at 1.8 through 2030. The differences between the two figures are therefore due only to this fertility change.
Source: Simulations of the model described in the text.

## Table 1: Demographic Effects of Declining SRB after 2004[a]

(Levels for 2030)

| | Base | Declining SRB |
|---|---|---|
| Unmatched males 0-14, millions | 18.7 | 11.2 |
| Unmatched % of males 0-14 | 16.7 | 10.3 |
| Sex ratio 0-14, % | 120.1 | 111.5 |
| Unmatched males 15-39, millions | 27.7 | 23.5 |
| Unmatched % males 15-39 | 11.6 | 9.9 |
| Sex ratio 15-39 | 113.1 | 111.0 |
| Unmatched *unskilled* males 15-39 (millions), if | | |
| class segmented | 18.1 | 14.4 |
| women marry up | 27.7 | 23.5 |
| skilled take 1.5 women | 47.8 | 43.4 |
| Skilled workforce | 115.6 | 115.5 |
| Unskilled workforce | 488.1 | 487.7 |

a This compares the baseline simulation for 2030 with an alternative in which the only difference is that the SRB for China declines after 2004 as per Figure 2.
Source: Simulations of the model discussed in the text.

## Table 2: Demographic Differences Between the Baseline and the Counterfactual with SRB Fixed at 106 and Higher Fertility[a]

(Levels for 2030)

| | Base | Counterfactual Base fertility | Counterfactual Higher fertility |
|---|---|---|---|
| Unmatched males 0-14, millions | 18.7 | 8.4 | 8.4 |
| Unmatched % of males 0-14 | 16.7 | 6.0 | 6.0 |
| Sex ratio 0-14, % | 120.1 | 106.4 | 106.4 |
| Unmatched males 15-39, millions | 27.7 | 15.2 | 16.3 |
| Unmatched % males 15-39 | 11.6 | 6.5 | 6.4 |
| Sex ratio 15-39 | 113.1 | 106.9 | 106.8 |
| Unmatched *unskilled* males 15-39 (millions), if | | | |
| class segmented | 18.1 | 7.2 | 8.3 |
| women marry up | 27.7 | 15.2 | 16.3 |
| skilled take 1.5 women | 47.8 | 34.9 | 37.0 |
| Skilled workforce | 116 | 115 | 120 |
| Unskilled workforce | 488 | 487 | 520 |

a This compares the baseline simulation for 2030 with a "counterfactual" simulation in which the SRB begins and remains at 106. Two cases are considered, in the second of which China's fertility is permitted to remain higher, at the UN mean projection level, attaining a value of 1.8 in 2030. This contrasts with the baseline 2030 level of 1.2.
Source: Simulations of the model discussed in the text.

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