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Gender 'Rebalancing' in China: A Global-Level Analysis

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Abstract

The rise in China's sex ratio at birth during the last two decades has had a wide range of economic and social consequences including excessive savings as families with boys compete to match their sons with scarce girls and rising disaffection and crime amongst the unmarried male population. These consequences are analysed using a global dynamic model that projects demographic behaviour and economic performance through to 2030. The results show that the proportion of unmatched unskilled Chinese men of reproductive age could be as high as one in four by that time, unless effective policies are put in place to rebalance the sex ratio at birth. Even then, it will take decades to reduce the sex ratio in the general population. This will come at a cost in terms of economic growth via the impact on reduced savings, although a lower saving rate offers some rebalancing on a global scale. Moreover, the results suggest that more than offsetting gains could accrue from productivity improvements stemming from reduced crime.

Keywords

China; Growth; Demography; Sex ratio; Imbalance

JEL Classification

D58; J11; J13; J16; J21

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Gender 'rebalancing' in China: a global-level analysis

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Key words:
China, growth, demography, sex ratio, imbalance

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Abstract

The rise in China's sex ratio at birth during the last two decades has had a wide range of economic and social consequences including excessive savings as families with boys compete to match their sons with scarce girls and rising disaffection and crime amongst the unmarried male population. These consequences are analysed using a global dynamic model that projects demographic behaviour and economic performance through to 2030. The results show that the proportion of unmatched unskilled Chinese men of reproductive age could be as high as one in four by that time, unless effective policies are put in place to rebalance the sex ratio at birth. Even then, it will take decades to reduce the sex ratio in the general population. This will come at a cost in terms of economic growth via the impact on reduced savings, although a lower saving rate offers some rebalancing on a global scale. Moreover, the results suggest that more than offsetting gains could accrue from productivity improvements stemming from reduced crime.

1. Introduction

Mara Hvistendahl's 2011 book entitled *Unnatural Selection: Choosing boys over girls, and the consequences of a world full of men* provides an eye-opening account of a phenomenon that is, or at least should be, attracting worldwide attention. Through the eyes of demographers, parents, economists, doctors, feminists, prostitutes, bachelors, brides and others, the book illustrates the wide range of conundrums relating to a world in which the number of men outweighs the number of women by a substantial margin. Nowhere do these conundrums reveal themselves as vividly as in China.

In 2011, China recorded an official sex ratio at birth (SRB) of 117.78 (boys for every one hundred girls), making it well and truly the most gender imbalanced country in the world, a rank it has held since the mid-1980s when the SRB first moved into the 'abnormal range' (above 107). This unpleasant statistic is compounded by China's severely abnormal rates of excess female child mortality (EFCM) – of eighty boys for every hundred girls in the first year of life in 2005, compared with a normal ratio of between 120 and 130. While women in China, as elsewhere, have higher life expectancies than men, the combination of high rates of SRB and EFCM has left China with the world's highest sex ratio in the total population, at 108 and rising in 2010, 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 one hundred million women were missing worldwide.[1] China was then, and remains, the major contributor to this global problem, accounting for approximately 40 million of the more

[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.

than 100 million missing women at the turn of the 21st century (Klasen and Wink, 2003)[2]. For every 'missing' woman there is a 'surplus', 'excess' or 'unmatched' man, and future projections suggest that, if the SRB remains at 2000 levels, by 2030 there could be close to thirty million Chinese men seeking a Chinese wife but unable to find one. As with most phenomena relating to China, the issue of rising gender imbalances is taking place on an unprecedented scale, with consequences, both local and global, that extend into all realms of economic, social, 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 2012, Cai, 2010, 2012). Rising gender imbalances compound this slowdown since, for given fertility levels, the declining share of women further reduces the growth rates of the population and hence the labour force. 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) and increased rates of crime (Edlund et al. 2007).

In this paper we review prior work on the causes and consequences of China's high SRB and attempt to quantify some of its key demographic and economic impacts, using a global dynamic model of demographic behaviour and economic performance through to 2030. The baseline simulations show that the proportion of unmatched low-skill males of reproductive age could be as high as one in four by 2030. The costs of an associated crime-induced productivity slowdown would outweigh the benefits of increased savings of families with boys, impacting negatively on Chinese per capita income growth overall. An alternative scenario in which 'gender rebalancing' policies are implemented reveals that the economic impacts of these policies will take time, and not all of them will necessarily be positive.

2. China's gender imbalances: causes and consequences

To explain the cause of rising sex imbalances in a range of Asian countries, Guilmoto (2009) begins with the observation that son preference is widespread (not only in Asia, but just about everywhere), and then 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-

[2] Klasen and Wink (2003) review the methods used since Sen and conclude with these figures based on their preferred methodology and the most recent census information from each country.

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. As illustrated in Figure 1, China does not appear to be alone in satisfying these conditions, but nor are they universal.

In China's case, the dramatic rise in its SRB can be traced to a long-standing cultural preference for sons alongside the introduction of the one-child policy in the early 1980s and the widespread use of Ultrasound B technology to detect gender from the mid-1980s onwards (Ebenstein et al. 2010). Although some research has pointed to the under-reporting of female births in China (which would give a false impression of a large number of 'missing' girls who are in fact just 'hidden'), the bulk of evidence indicates that sex selective abortion is primarily responsible for the rising SRB in recent years and that this rise is very real indeed (Cai and Lavely, 2007, Li, 2007, Ebenstein, 2008, and Zhu et al. 2009). This view appears to have been accepted by the Chinese government, with Wang Xia, head of China's National Population and Family Planning Commission (NPFPC), announcing in 2012 that 'the authorities will crack down further on illegal prenatal gender tests and selective abortions, which are believed to be the primary causes of the gender imbalance'.[3]

Although strict family planning policies are not the only source of a fertility squeeze sufficient to induce parents to consider sexual selection, they are surely a contributing factor.[4] Based on the 2000 census, Gu et al. (2007) show that China has implemented one-child policies, 1.5 child policies, two-child policies and three-child policies in different parts of the country, in which there are 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, appears to have been even more detrimental to China's SRB than the one-child policy itself.

While Chinese officials are reticent to attribute the rising gender imbalances to their family planning policies, they are well aware that the associated problems are looming large, with one official declaring publicly in 2004 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

[3] See 'Officials vow China will correct gender imbalance' at http://news.xinhuanet.com/english/china/2012-05/24/c_131608451.htm

[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 causes of China's high SRB. For a cynical interpretation of why this is the case, see Hvistendahl (2011).

and prostitution.[5] Den Boer and Hudson (2008: 191) expand the list of consequences of 'masculinised sex ratios' to include higher risk of HIV/AIDs transmission, and 'every day acts of random violence, violent protests, and organised criminal violence' by criminal gangs who pose an 'organisational and potentially political threat to the communist regime as well'.

In an effort to quantify some of these costs, Edlund et al. (2007, 2010) show that a one per cent increase in the sex ratio caused a three per cent increase in property and violent crimes in China 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. Although 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 are also 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 future productivity (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 eleven per cent 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. Thus it seems clear that the impact of rising sex ratios varies significantly across different members of society, both within and between the sexes. However, it is unclear what the aggregate impact will be in terms of productivity, wages, educational attainment, and other factors that impact on long-term growth performance.

[5] http://www.china.org.cn/english/government/94926.htm

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

There may be some benefits for a country with too many men, in economic terms at least. Wei and Zhang (2011a) argue that China's rising gender imbalances can explain close to half of its rising saving rates, stemming from 'male excess savings' that arise as the families of boys and young men seek to be competitive in the marriage market. They also show that the sex ratio imbalance stimulates entrepreneurial activities as these families are driven to increase their wealth, which boosts private sector growth and hence corporate, as well as household, savings (Wei and Zhang, 2011b).[7]

Although these high savings have undoubtedly impacted positively on China's economic growth, they have not necessarily been good for the global economy, nor for China's bilateral relations (with the United States in particular). Du and Wei (2010, 2012) describe how the increase in savings and the expansion of the supply of male workers both put downward pressure on the real exchange rate (using Balassa-Samuelson reasoning that assumes non-tradables are more labour intensive in China and that tradable prices are determined in world markets). This mechanism feeds into an overlapping generations model, which they use to demonstrate that the excess of domestic savings over investment has fuelled both China's current account surplus and the United States' current account deficit, and which leads 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' (2010: 2).

Future trends in China's SRB are impossible to predict with accuracy given the wide range of forces that will shape them. Evolutionary biologists have argued that sex ratios may level out in societies where hypergamy[8] is common, as high-status (rich) mothers give birth to more sons who match up with the relatively large number of daughters born to low-status (poor) mothers (Brooks, 2012). Demographers and sociologists argue that sex ratios have a tendency to level out over time as gender discrimination weakens and socioeconomic changes including higher education and agricultural mechanisation help to reduce the preference for sons (Guilmoto, 2009, Murphy et al. 2011). The rebalancing of South Korea's sex ratio since the early 2000s, as shown in Figure 1, is often cited as a case in point (das Gupta et al., 2009).[9]

[7] To the extent that productivity is higher in the private sector than the state sector, a rising sex ratio imbalance may also boost productivity via this channel. However, this is not something we consider in the analysis below.

[8] 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 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.

[9] 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).

Some (although not all) economists place their trust in the market, which they argue will drive up the value of women where sex ratios are high, thereby making it advantageous to 'produce' girls (Becker, 2007), an idea that is supported by Qian's (2008) evidence that a rising sex ratio has led to higher female income and higher survival rates among girls in rural China.

Given the considerable uncertainties that surround these 'natural' rebalancing forces the Chinese government has chosen not to wait for evolution or the market, recently identifying a lower SRB as a national priority and aiming for 115 newborn males for every one hundred females by 2015. Officials have credited the fall in the official SRB between 2009 and 2011, from 119.45 to 117.78, to their recent crackdowns on illegal prenatal gender tests and selective abortions, but also acknowledge that enhanced efforts to promote equal opportunities and the social status of females are fundamental solutions to the problem.[10]

Irrespective of the cause of the most recent moderating trend in China's SRB, the potential economic consequences of the world's most populous country having the world's largest proportion of unmatched men deserve careful consideration. As a step in this direction, the modeling exercise to be presented below puts emphasis on clarifying the demographic and economic channels through which gender imbalances impact.

3. Modelling demographic change and economic performance

3.1 The Model

The model we use is a development of *GTAP-Dynamic* that includes multiple households disaggregated by age, gender and earnings type, along with complete demographic behaviour.[11] We describe the key features of the model in this section, before presenting projections of demographic and economic consequences for China in the following two sections respectively.

Each of the 18 regions in the model, one of which is Mainland China, has four age groups (the dependent young, adults of fertile and working age, older working adults, and the mostly retired over 60s), two genders and two skill categories (households that provide unskilled labour and those that provide skilled labour, based on the ILO distinction between 'production' and 'professional' workers). 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

[10] See 'Officials vow China will correct gender imbalance' at http://news.xinhuanet.com/english/china/2012-05/24/c_131608451.htm

[11] The approach adopted follows Tyers and Shi (2007). See also Golley and Tyers (2012) for a more comprehensive summary of the model than we provide here.

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. The birth rates, sex ratios at birth, life expectancy at 60, and age-specific death rates all trend through time, approaching exogenous targets asymptotically.

The economic component of the model has each region producing output in seven industries: agriculture, light manufacturing, heavy manufacturing, metals, energy, minerals and services and using five factors of production that include physical capital and production and professional labour. Products are differentiated by region of origin, with consumers and firms purchasing intermediates substituting imperfectly between goods from different regions. 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. Group saving rates change in response to changes in income and interest rates but, more importantly, regional average saving rates respond to changes in age and skill 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 the case of an old population, further aging raises the proportion of non-working aged, and so its average saving rate tends to fall. China is an exception here, in that its age-specific saving behavior is relatively flat, that is, there is not much decline in China's average saving rate as its projected population ages.[12]

As in other dynamic models of the global economy, the main endogenous driver of simulated economic growth is physical capital accumulation.[13] 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

[12] There is mixed evidence regarding whether China's saving rates age-profile follows the typical inverted U-shape predicted by the life cycle hypothesis (LCH). Modigliani and Cao (2004) find support for the LCH in the Chinese case, Chamon and Prasad (2008) find an 'unusual U-shape', that is high saving rates in younger and older cohorts, and Horioka and Wan (2007) find that demographic variables have little impact on Chinese saving rates, and that high saving rates are likely to persist for some time, despite rapid aging. The relatively flat age-profile of China's saving rates is a reflection of this mixed evidence.

[13] 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.

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.

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, its multiregional structure and its open capital accounts, which allows regional average saving rates to respond to changes in age distributions, with further implications for economic growth, as revealed below.

3.2 The demographic impacts

The key parameters of interest here are China's total fertility rate (TFR) and its sex ratio at birth (SRB). In our baseline we assume that China's TFR will decline from 1.9 in 1997 to 1.2 by 2030. 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 (reaching 1.8 in 2030) for China is too high.[14] Figure 2 illustrates recent trends in China's SRB based on the population census and 1% population sample survey. We use this, alongside recent evidence that suggests China's SRB has already begun to decline in some provinces,[15] to construct a baseline scenario that has the SRB converging upon a level not far above that already reached, as shown in Figure 3. Our alternative scenario, also shown in Figure 3, then assumes that policy actions regarding gender discrimination, combined with endogenous preference changes, bring about a return of the SRB to 106 by 2030.

Our comparatively pessimistic baseline path for Chinese fertility, combined with the SRB path shown in Figure 3, yields the population paths 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 populations. The skilled population rises continuously, and the unskilled population begins declining sooner and falls more sharply than the total population.[16] These baseline trends illustrate the pending contraction in the absolute level of China's labour force.

[14] See Golley (2012) for further details.
[15] See das Gupta et al. (2009) and Attané and Guilmoto (2007).
[16] We provide a detailed analysis of the implications of this baseline projection, for dependency and demographic dividends in particular, in Golley and Tyers (2012).

Unmatched men

The model's disaggregation of the overall population into four separate age groups and between households dependent on skilled and unskilled occupations enables us to move beyond the standard measure of the share of unmatched males as the difference between the male and female populations. For example, we can calculate the share of unmatched boys aged 0-14, which is a signal to the parents that there will be competition for partners for their sons; and the number of unmatched men of 'reproductive' age (15-39 years), which signals the extent of 'marriage squeeze'. Furthermore, to focus on unmatched low-skill males (those most likely to commit crime) we calculate three alternative shares that differ according to assumptions about who will partner whom:

1. the share of unmatched low-skill males of reproductive age if partnerships are between people of the same socioeconomic status (no hypergamy),
2. the share of unmatched low-skill males if women from low-skill families choose to marry up (hypergamy), ensuring that there are no unmatched skilled men, and
3. the share of unmatched low-skill males if sufficient numbers of low-skill women choose to be *second* partners of high-skill men so as to allow those men to have 1.5 partners on average.

Although 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.[17] The number is clearly larger than unity, though our choice of 1.5 is arbitrary and illustrative.

Key Demographic Outcomes

The key demographic outcomes for 2030 based on these four scenarios are summarised in Table 1. The baseline results reveal the extent of China's gender problem implied by a 'no policy change' stance: 27.7 million (or 11.6 per cent) of males between the ages of 15 and 39 would be unmatched, or 'excess', by 2030. This percentage is very similar to the 11 per cent estimate of Zeng (2007), even though his estimate is based on the 20-49 age group. In the worst-case (and least palatable) scenario in which skilled men take 1.5 women, there would be

[17] For fictional anecdotal evidence, watch the 2009 Chinese drama 'Dwelling Narrowness' (*Wo ju* 蜗居), which depicts this scenario to perfection. The show was cancelled by China's censorship board for having a 'serious negative influence on Chinese society' http://en.wikipedia.org/wiki/Dwelling_Narrowness , although numerous Chinese sources have commented that it was simply too close to the bone.

47.8 million unmatched *unskilled* males, suggesting that the social stability and crime-related problems described by Hudson and den Boer (2004, 2008) and Edlund et al. (2010) could be very substantial indeed.

The large proportion of unskilled Chinese men of reproductive age that is projected to be unmatched is placed in an East Asian context in Figure 5. 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 in other East Asian countries 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 conclusion is that, while trafficking of Asian women and a rise in marriage migration into China is likely to occur at the margin, female immigration cannot address the scale of the mismatch.

Considering the long lead times required for demographic changes to affect overall populations, it is not surprising that the demographic outcomes of Scenario 2, being identical in all other respects, are similar to those in the baseline. However, there is a considerable reduction in the gender imbalance by 2030, at least for children, with the sex ratio of 0-14 year olds reaching 111.5 compared with a baseline of 120.1, implying 10.3 per cent of excess males in this age group, compared with 16.7 per cent in the baseline.

3.3 Quantifying the saving and productivity impacts

Overall, the economic effects of the lower SRB trend reflected in Scenario 2 compared with the baseline are very small since a decline in the SRB alone supplies very little change in the levels and skill shares of the labour force by 2030. Nonetheless, as discussed in Section 2, gender imbalances may impact directly on saving rates and also indirectly on productivity via crime. We incorporate these impacts in the simulations discussed here.

Saving effects

As discussed above, Wei and Zhang (2011a) hypothesise 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 expect the

strongest association to be between the proportion of unmatched males 0-14 and the household saving rate. This comparison is illustrated in Figure 6, which demonstrates that the saving shares of GDP and the unmatched shares of male children both have upward trends. Moreover, the share of unmatched male children in production worker families appears to have a trend in common with the saving rates. This offers tentative support for the Wei-Zhang hypothesis.[18]

Their empirical work suggests that changes in the sex ratio explain 30-60 per cent of the change in the household saving rate. From Figure 6, household saving as a share of GDP rose by nine percentage points between 1997 and 2010. A liberal interpretation of the Wei-Zhang 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 all 0-14 males yields a 0.6 per cent rise in the share of China's GDP committed to saving.

Crime-related productivity effects

As described in Section 2, Edlund et al. (2007, 2010) use Chinese statistics to draw a clear link between the sex ratio and crime. They control for other causes and deduce that one per cent rise in the sex ratio is sufficient to cause property and violent crime to increase by three per cent. For modelling purposes, we require an estimate of the impact this increase in crime would have on Chinese productivity, but this is unavailable to our knowledge. We resort to "back of the envelope" reasoning, while hoping that quantitative studies will soon improve our simple estimate of this link.

We begin by noting that the economic costs of crime in the United States have been measured at around five per cent of GDP (Harwood et al. 2009) and we speculate that violent and property crime in China could impact its economy in at least the same proportion. This assumption, combined with the Edlund result, yields a conservative link between the sex ratio and the productivity impact of associated crime. It follows that a fall in the sex ratio by one percentage point would increase real GDP by 0.03*0.05=0.0015, or 0.15 per cent.

[18] Figure 5 also demonstrates that the most extraordinary thing about China's saving is the proportion due to corporations, not households, indicating that the Wei-Zhang link may be overstated. While we do not model corporate savings explicitly here, recall from Section 2 that Wei and Zhang (2011) provide a link between rising gender imbalances and corporate savings, as well as household savings.

This implies that a conservative estimate of the economy-wide productivity effect of a feasible fall in the sex ratio by 10 percentage points is a modest 1.5 per cent. Yet this may be too conservative, since crime is primarily an urban phenomenon that impairs the services sector more than others. Combine this with the fact that the first urban destination of most low-skill men is the construction sector, in which the majority of investment expenditure occurs, and the effects of crime are leveraged noticeably. Our model has a services industry and a capital goods sector that acquires products from all seven domestic industries and turns them into capital goods to serve investment. Recognising that services contribute close to half of China's GDP, we assume that crime impairs only the services sector's net output (to meet final demand) and the capital goods sector's total output, each by about a tenth. We make the link more direct by using the age group responsible for most violent and property crime. A rise of one per cent in the sex ratio of all 15-39 year olds thus yields a three per cent rise in this crime burden and hence a decline in total productivity of 0.3 per cent in services and capital goods production.

3.4 The economic implications

Simulation 1: A declining sex ratio with saving effects

Our first simulation is based on the decline in China's SRB from 120 to 106, as shown in Figure 3 for Scenario 2. As already shown, this lower SRB causes the unmatched share of boys to fall and we now assume that this induces a decline in saving as previously described. This manifests itself in two ways. In the short run, reduced saving causes a rise in consumption expenditure on home goods (which are more inelastic in supply than foreign goods) and a reduction in net outflows on the capital account. Other things equal, these cause a demand-driven boost to real home GDP in the short run. However, in the medium to long run, reduced saving leads to reductions in home investment and foreign assets from which income accrues later, both of which *reduce* real GDP.

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, as shown in Figure 7. Yet these net effects are small. The changes in real investment, real GDP and real per capita income are shown to amount to no more than one percentage point by 2030. 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. This raises the possibility that rectifying China's gender problem could actually have negative economic impacts in the future.

Following Du and Wei (2012), it is also possible to see from this simulation the effects of these shocks on China's real exchange rate. Again, the net effect is small. Reduced saving tends to appreciate the real exchange rate, as Du and Wei indicate, but, as we simulate it, with a magnitude of only half a per cent by 2030. This is primarily because the associated reduction in China's current account surplus is also small. Even though the current account surplus is $CA=S-I$, and there is a fall in S, as we model it domestic saving finances most domestic investment. This endogenous link therefore sees both S and I fall, with the difference narrowing but by a small margin, particularly as a proportion of China's rapidly expanding GDP.[19]

Simulation 2: A declining SRB with saving <u>and</u> crime-related productivity effects

In our second simulation, we assume the same decline in China's SRB to 106 by 2030 and we retain the link 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 whole 15-39 age group and total factor productivity in services and the capital goods sector. These have the effect of boosting productivity as the sex ratio declines toward balance. The results are illustrated in Figure 8.

The crime-related productivity shocks are shown to outweigh the slowing effects of lower saving and so they lead to stronger investment growth in the latter stages as the sex ratio of 15-39 year olds falls and productivity in construction rises. 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 made smaller than the baseline by the lower saving rate in this and the previous simulation.

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 lower domestic relative to foreign costs and therefore 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.

[19] For detailed modeling of China's real exchange rate, see Tyers et al. (2008). There, the effects of changes in the saving rate are compared with the many other determinants of the real exchange rate.

4. Conclusions

The dramatic rise in China's gender imbalances in the last two decades has coincided with its equally remarkable economic growth and integration into the global economy. Only recently have economists begun to pay attention to the possible links between these phenomena, such as the impact that the rising number of 'unmatched' Chinese males has had on Chinese savings, economic growth and rates of crime, and on global trade imbalances. This paper placed these ideas in the context of a global dynamic model to explore the implications of some alternative plausible trends in China's SRB through to 2030, now less than two decades away. The results from our baseline scenario, in which China's gender imbalances remain high suggest that, depending on the tendency for unskilled women to 'marry up', by 2030 the number of unmatched unskilled Chinese men of reproductive age could be as high as 48 million. This figure in and of itself, regardless of the economic consequences, deserves the attention of more than a handful of economists.

Even if policy changes succeed in reducing the SRB to normal levels, the economic implications remain uncertain. On the one hand, a reduction in GDP and per capita income growth could be caused by the decline in saving by families observing improved marriage prospects for their boys while, on the other, fewer unmatched men should yield positive productivity impacts from reduced rates of crime. Our results suggest the crime effects outweigh the saving ones and that reducing the gender imbalance will be good for China's external imbalance and for its overall economic performance. While the direction of effects on saving rates and China's external imbalance are comparatively robust, the magnitudes we assume are not. And in the absence of careful empirical analysis linking Chinese crime and productivity, our quantification of this link is even less robust. It should therefore be clear that, if the SRB effects on saving are quantitatively larger than assumed, or if the link between crime and productivity is smaller, correcting the gender imbalance would slow growth.

Even though our simulated effects of gender balancing on China's current account balance and its real exchange rate are qualitatively consistent with Du and Wei (2012), their magnitudes are small, at least over the next two decades. Within the global modelling framework, there is therefore little to suggest that rebalancing China's gender structure would do much, if anything, to rebalance the global economy. This finding contrasts with the more dramatic claim of Du and Wei, who see China's rising sex ratio as a 'significant' contributor to global trade imbalances, which would seem to imply that a substantial gender rebalancing would result in a correspondingly substantial reduction in the current account imbalance. This

result seems to ignore the endogenous nature of investment spending and the significant role played by home saving in investment financing, as captured in our modelling.

Yet none of the findings above should diminish the importance of keeping 'gender rebalancing' high on the Chinese leadership's policy agenda. Regardless of the uncertain links between gender imbalances, savings, crime and productivity, it seems indisputable that there is significant potential for social unrest in a country the size of China's with more than 25 million unmatched men who, as Wang Feng (2011) points out: 'may constitute a large group of unhappy, dissatisfied people. Claims that these future bachelors will harbor criminal intentions and a propensity to form invading forces against China's neighbors are unsubstantiated and overblown. Still, the fact that such a large number of Chinese men will not be able to marry is clearly a serious social concern, and the issue should not be neglected'.

In our view, Wang is correct to downplay the potential for international security threats arising from China's gender problem, but also to stress that the issue should not be neglected. Dani Rodrik's (1998) claim that social conflict has been a major determinant of growth collapses and stagnation in many countries since 1975 is echoed in The World Bank's *World Development Report 2011* on 'Conflict, security and development', and attests to the potential costs this could inflict on the Chinese economy, with obviously detrimental consequences for the global economy as well.

While Mara Hvistendahls' (2011) prologue begins in China, her epilogue begins in the United States, where she describes the rise of 'pre-implantation genetic diagnosis' (PSD), an add-on to IVF that offers 'virtually 100% accuracy' on gender selection and is gaining popularity not only among wealthy Americans (the only ones to prefer girls) but also in China, India, Cyprus, Thailand, Jordan, Egypt, Brazil and Russia. According to Hvistendahl (p. 253), "The sex ratio imbalance has long been an urgent – and yet assiduously ignored-problem. Pre-implantation technologies are quietly spreading through the developing world … At stake is much more than the global balance of males and females, as if that weren't enough.' It would be hard to reach the end of her book without realising that the economic costs and benefits of China's rising gender imbalances are just part of a concerning global trend. But they are a prominent starting point in a country with the policy resources and capacity to address them.

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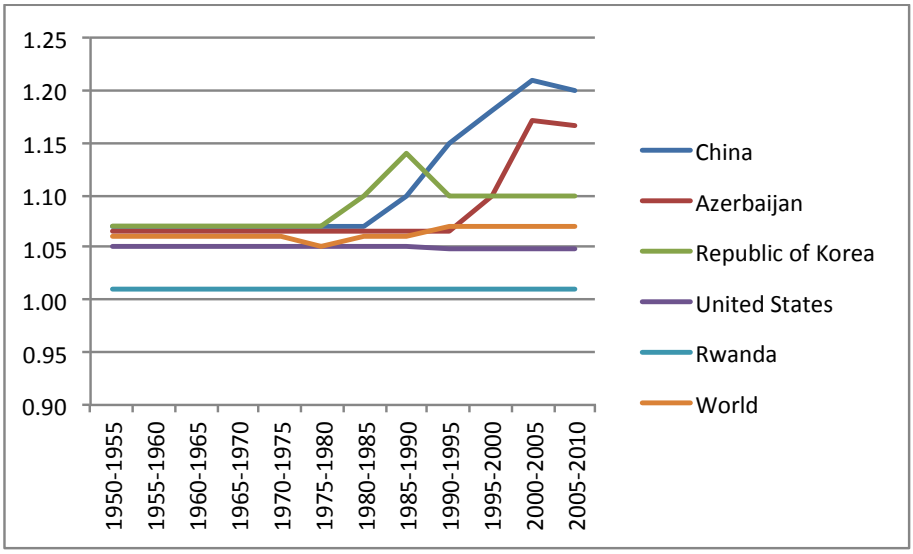
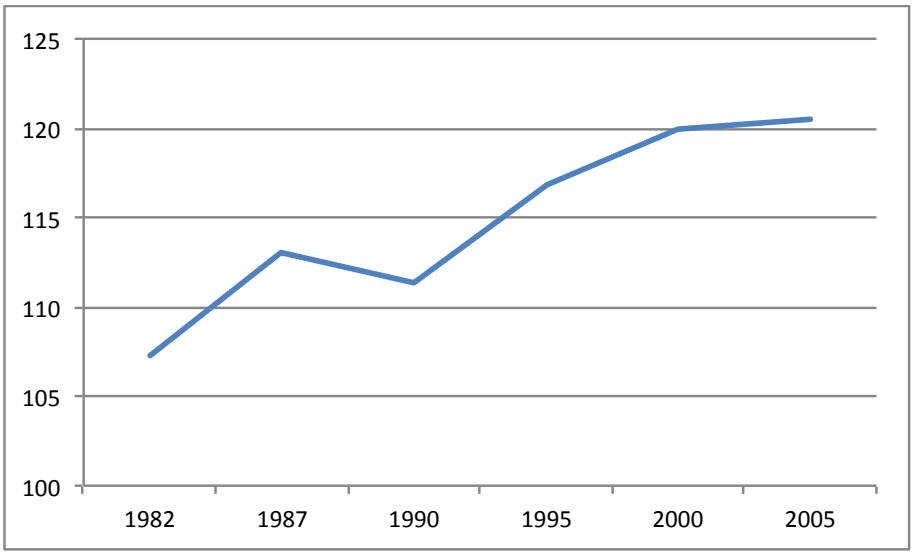
Figure 1: Long-term SRB trends in select countries worldwide



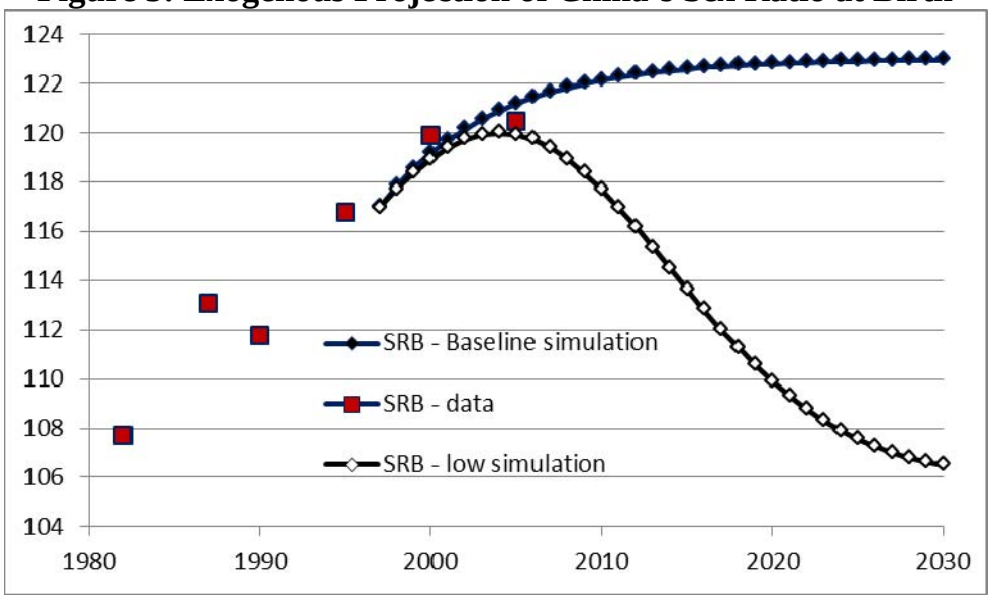
Source: United Nations (2010)

Figure 2: Recent trends in China's SRB



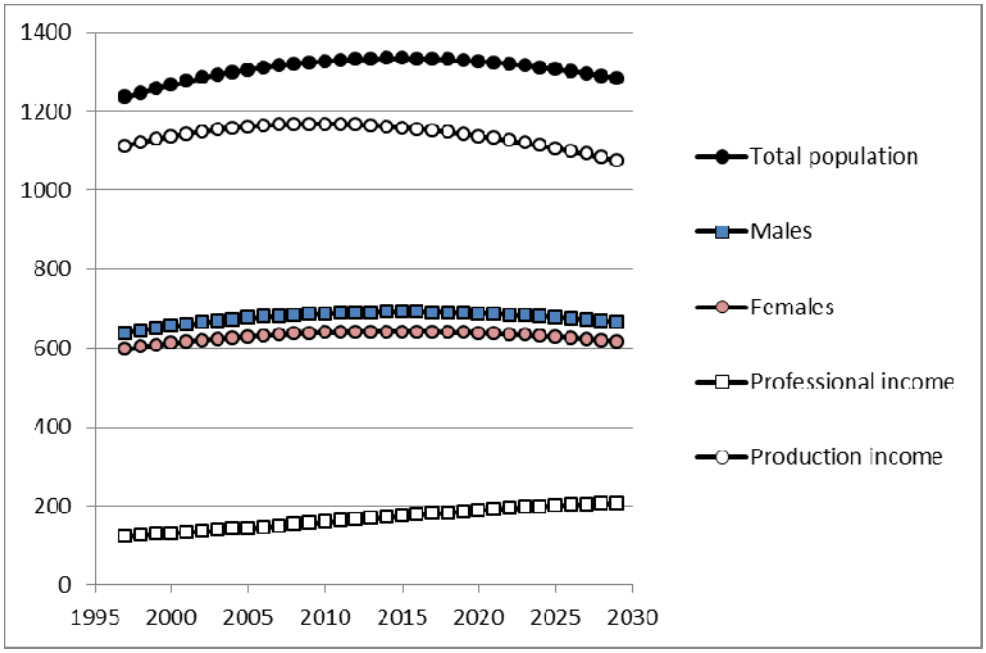
Source: Li (2007), based on China population censuses in 1982,1990 and 2000 and 1% population sample surveys in 1987,1995 and 2005.

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



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

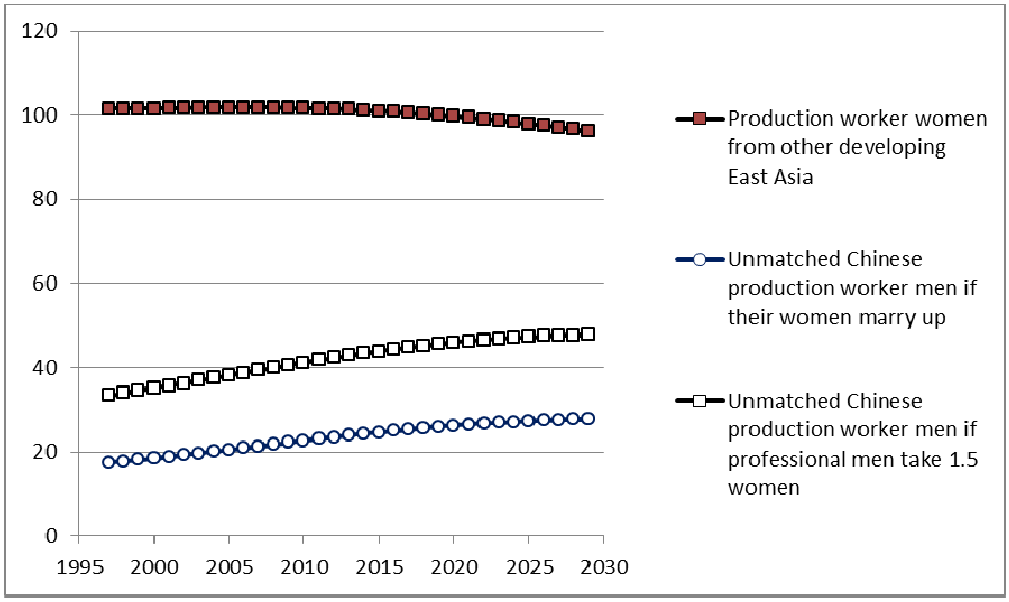
Figure 4: Chinese Population Structure and its Change Through Time



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

Figure 5: Unmatched Chinese Males 15-39 in East and SE Asian Context[a]

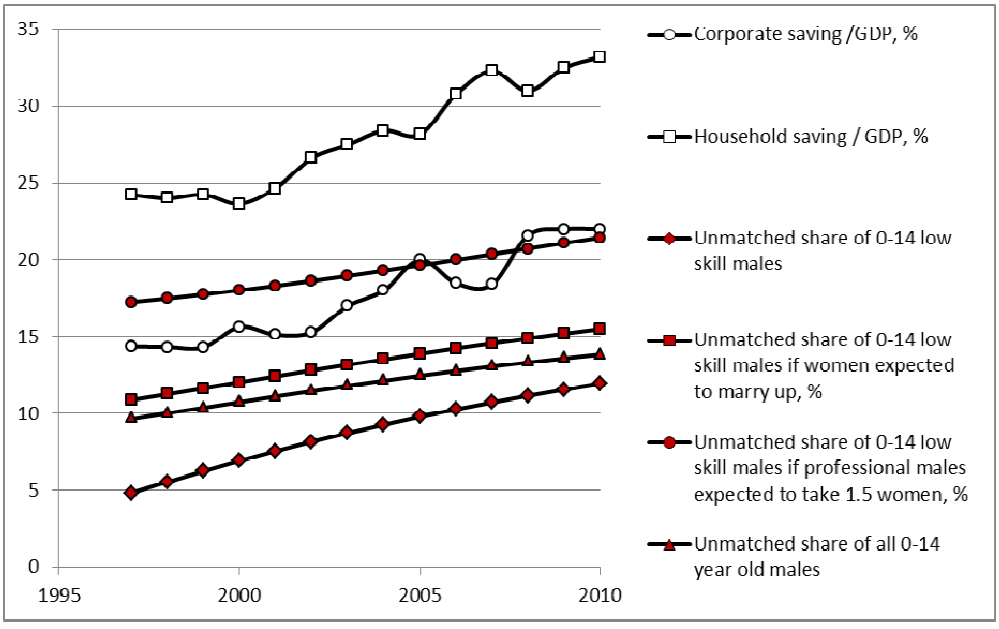
(Millions)



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.

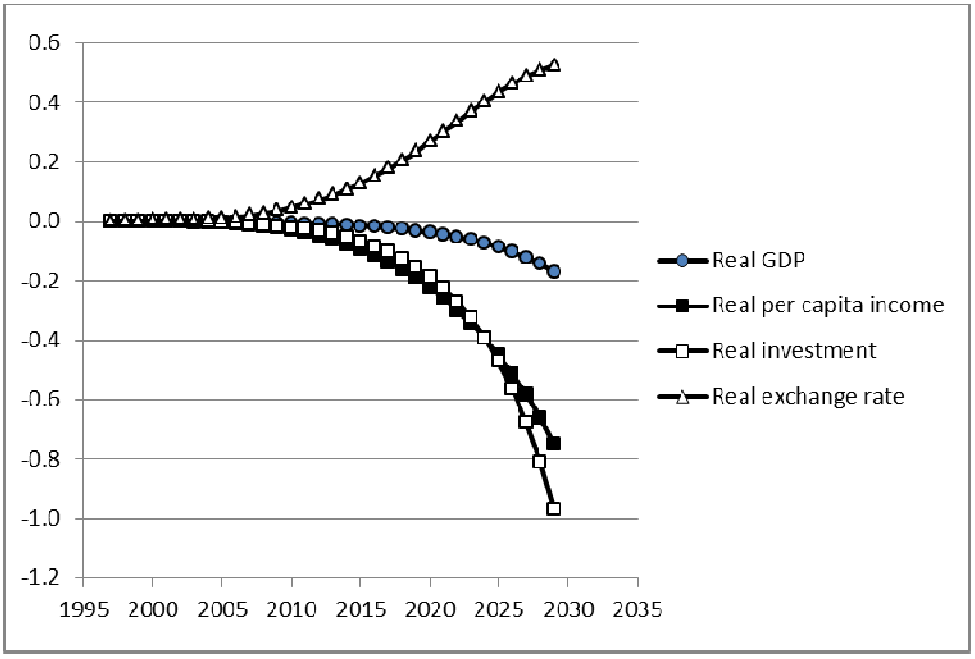
Source: Baseline (Chinese SRB and fertility) simulation of the model described in the text.

Figure 6: Chinese Saving Rates 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.

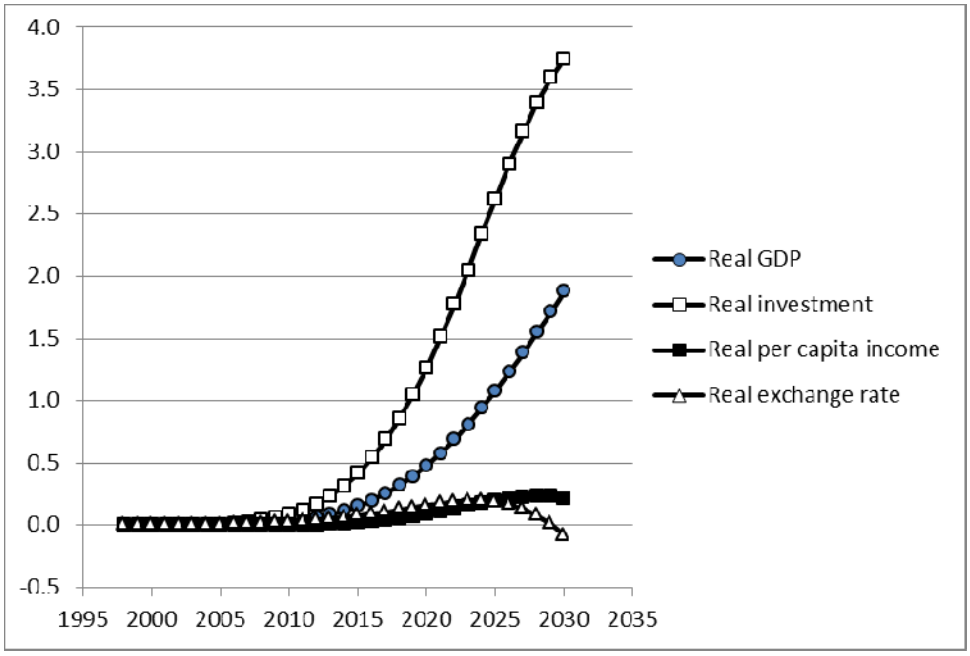
Figure 7: Reducing the SRB with Saving Effects[a]



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

Source: Simulations of the model described in the text.

Figure 8: Reducing the SRB with Saving and Crime-Related Productivity Effects[a]



a These are cumulative % deviations from the baseline simulation.

Source: Simulations of the model described in the text.

Table 1: Demographic Outcomes of China's gender imbalances

(Levels for 2030)

	Baseline	Scenario 2
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	116	115.5
Unskilled workforce	488	487.7

Note: Scenario 2 is lower SRB,

Source: Simulations of the model discussed in the text.