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Will China's three-child policy defuse the demographic time bomb?

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Abstract: China is undergoing a particularly fast demographic transition. Accelerated through decades of political restrictions on family planning, the median age is rising and there is a growing share of retirees, while labour force potential is declining. Faced with dire consequences for both economic growth and wealth distribution, the government has gradually relaxed its one-child policy. Will this policy shift succeed? Our study simulates China's old-age dependency ratio and total dependency ratio until the end of the century, assuming total fertility rates between 1.0 and 2.0 with constant and increasing life expectancy. It shows that both ratios would substantially increase even in the best case. Therefore, China urgently needs reforms beyond family policy.

Keywords: Three-child policy, total fertility rate, demographic dividend, old-age dependency ratio, total dependency ratio, pension reform

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According to the latest census in 2020, China's total fertility rate (TFR) recently fell to 1.3 children per woman. During the press conference announcing the results of the census, the head of China's National Bureau of Statistics only reported this figure orally while answering questions from reporters (No Author, 2021). It was not officially mentioned in the press release itself (National Bureau of Statistics of China, 2021), thus demonstrating the critical perception of the development. Previously, official numbers had estimated a TFR of 1.8 (Chen et al., 2021). Together with a rising life expectancy, 18.7 % of the population are aged 60 or beyond and 13.5 % are 65 and beyond (National Bureau of Statistics, 2021). The combination of fewer young people and a rising number of retirees – the Chinese typically reach retirement by the age of 60 – seriously threatens Xi Jinping's ambitious development goals. The shrinking labour force is a major concern for China's economic growth perspectives (Wang and Conesa, 2022). Furthermore, the demographic shift may lead to higher income inequality (Wang et al., 2017b).[1]

Hence, the government has revised its family planning policy. However, the first step, 2016's replacement of the one- by a two-child limit, has not increased the TFR. The government addressed the issue in 2021. First and foremost, family size restrictions were relaxed towards a general three-child policy. In addition, the law includes measures to provide more childcare facilities, to subsidize education and to enhance the rights and opportunities of pregnant women and mothers in the labour market (NHC and China Daily, 2021). By mitigating the tangible and intangible expenditures of parenthood, the government is trying to boost China's birth rate.

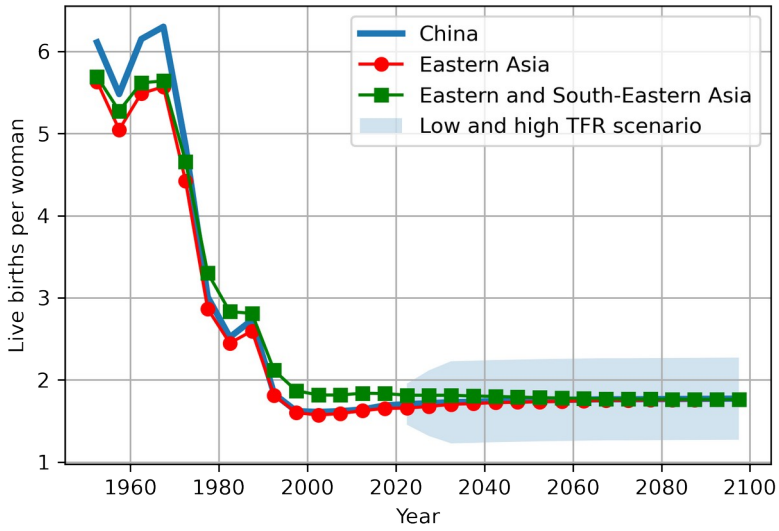
Are these reforms promising? In order to estimate the future development of China's population, we have performed simulations using various scenarios for the level of TFR. We differentiated between a first set-up assuming a static life expectancy and a second set-up assuming slightly rising life expectancy. To assess the impact of the TFR, we first focused on the dependency ratio (DR), i.e., the number of people below age 15 and above age 64 relative to 100 individuals aged 15 to 64. We then extracted the old-age dependency ratio (OADR), which represents the number of people beyond age 64 relative to 100 individuals aged 15 to 64. Our simulations start in 2020. The population is then extrapolated up to 2100 and TFR is used as an exogenous variable. Technically, TFR measures how many children are born in the lifetime of an average woman, i.e., by running through the entire reproductive years of her life. More specifically, the model assumes an average number of children born by each woman of a given age. The integral over this reproductive participation is the TFR (Wang et al., 2017a). An alternative indicator for the reproductive level is the crude birth rate, i.e. the number of children annually born per 1.000 individuals of the population.

1 See Wu (2020) for a thorough discussion.

Base line of the Chinese population

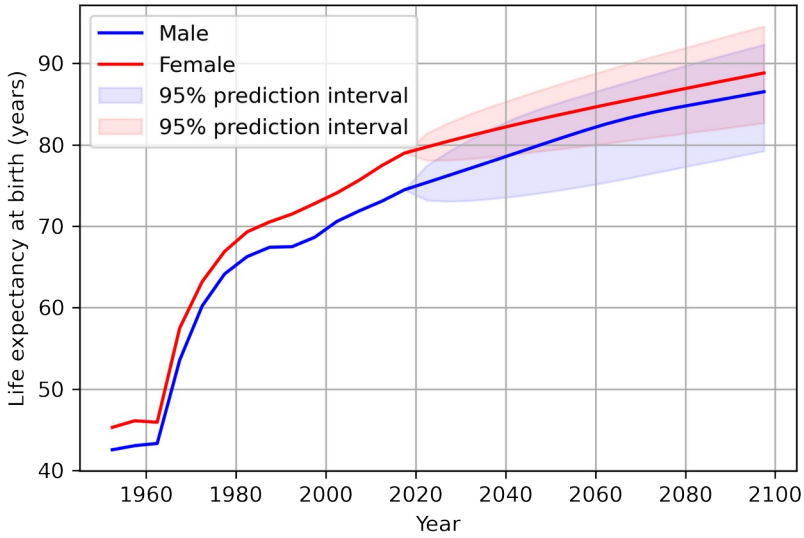
Standard demographic indicators demonstrate China's present situation: The TFR has declined substantially since the 1960s (Figure 1), life expectancy is increasing (Figure 2).

Figure 1 Live births per woman



Source: United Nations (2019a, 3).

Figure 2 Life expectancy at birth



Source: United Nations (2019a, 3).

As recently as 2019, the United Nation's estimate was 1.7. This is much higher than the latest 1.3, still lower than the so-called replacement fertility which is 2.1. It corresponds to the value that ensures a constant population size in the long run while neglecting migration effects (United Nations, 2017). Meanwhile, life expectancy has increased to a unisex average of 76.9 years in China (United Nations, 2019a). Rising life expectancy and low birth rates lead to a higher median age and an increasing OADR in many countries. The People's Republic is, however, expected to

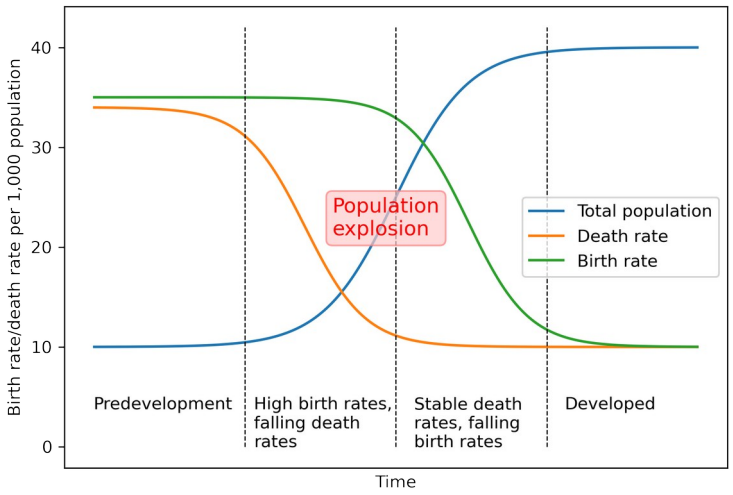
experience a particularly sharp increase in these indicators in the 25 years to come. It may even age faster than neighbouring Japan, which currently exhibits the highest median age in the world (Chen et al., 2019).

Impact of China's birth quotas on demographic development

China started birth regulation in the early 1970s. From 1953 through 1963, the population had increased from 600 to 800 million, despite the Great Chinese Famine (1959-1961) that led to several tens of millions of victims (Dikötter, 2017). Mao Zedong's original principle "more people, more power" (Zhang, 2017, 142) turned into "Later, Longer, and Fewer" (ibid, 143) in 1973: It encouraged later marriage and thus a higher age at the birth of the first child, birth spacing of at least three years, and a maximum of two children. The campaign was only technically voluntary. Nevertheless, in the early 1970s, population growth continued such that it exceeded 900 million. With some delay, the TFR shrank from 5.8 (1970) to 2.7 (1978). After Mao's death, his successor Deng Xiaoping imposed strict birth regulations, starting the one-child policy in 1979. It became an important component of his comprehensive economic reforms which ultimately strived for a higher Chinese standard of living. The reforms included the opening of China's markets and therefore enhanced economic growth. Consequently, China's TFR further decreased to 1.8 in 1995 (ibid).

It is a common pattern that societies with low living standards exhibit both high birth and death rates, whereas industrialized countries can be characterized by low birth rates and high life expectancy. The shift from the former to the latter in emerging economies is referred to as demographic transition and is true not only for China, but overall in Eastern and South-Eastern Asia (Figure 1). Mainstream demographic models subdivide the transition into four stages (Figure 3):

Figure 3 Standard model of demographic transition



Source: Yuan and Gao (2020, 27).

1. In pre-industrial societies, low life expectancy and frequent death of younger people are linked to high birth rates. Both effects compensate each other so that population growth is slow.
2. With wider access to sanitation, health care and food, life expectancy increases. The surplus in births causes the population to grow quickly.
3. Shrinking mortality, in particular child mortality, changes reproductive behaviour. With many children surviving, smaller family sizes become a societal standard. Population growth

decreases or stops altogether. At the onset of birth rate reduction, relatively large cohorts of the working age population take care of a declining number of children. This temporarily beneficial constellation is referred to as a demographic dividend (Bloom et al., 2003).

4. When birth rates stagnate at a low level, the population may find a new equilibrium. If TFR remains constant or once again exceeds replacement level, the population will again slowly increase. More often though, TFR stabilizes below the replacement level. Consequently, the population starts to shrink unless immigration compensates for birth deficits.[2]

In the People's Republic of China, demographic transition took roughly 30 years. That is a remarkably short period compared to 100 to 150 years experienced by most Western European countries (Yuan and Gao, 2020). Initially, China benefited from the demographic dividend. According to estimates, it contributed 12 - 27 % to overall economic growth since 1978 (ibid) and ranged over 35 years (Chen et al., 2021).

It is a challenge to divide the effects of the one-child policy from the general decrease in TFR on the way from a developing towards an industrialized economy. Several studies have tried to quantify the policy impact on fertility, using various approaches. A first group stressed the impact of government regulation for lower fertility. For example, Ahn (1994) focussed on urban-rural differentials and the sex of children. His results suggested that the one-child policy was effective in urban areas due to the higher costs of having children (i.e. higher penalties in the event of a second child) and stricter government controls. McElroy and Yang (2000) also concluded that fertility among Chinese counties significantly depended on the cost of an extra child. They nonetheless argued that it took large penalty increases to achieve small fertility reductions. Therefore, an inverse removal of any penalty would have few positive effects on births per woman. Li et al. (2005) confirmed large effects of penalties on fertility by comparing birth rates among Han Chinese (to whom the one-child policy applied) to birth rates among ethnic minorities (who were exempted from this rule). Fertility particularly decreased in urban areas and among educated women due to birth restrictions. The authors concluded that other policies or socio-economic change had little impact. Ebenstein (2010) examined regional and temporal variations in fines for unauthorized births and focused on the ratios of male to female children. He found that these ratios were higher, the stricter the fertility controls were, thus proving that the one-child policy significantly discouraged fertility. Recently, Yuan and Gao (2020) also attributed a high effectiveness to government regulation of family planning.

A second group of research, however, demonstrated that the rapidly shrinking TFR since 1970 can to some extent be attributed to broad socioeconomic developments rather than government intervention. For example, Zhang (1990) derived from China's 1985 In-Depth Fertility Survey that female education levels, male occupation status, durable goods ownership (as a proxy for permanent income), former and current (rural or urban) residence, family structure and preference for boys explained fertility patterns. Cai (2010) compared empirical fertility evidence both within China and with regard to other societies. The author showed that below-replacement TFR was mainly and globally driven by socioeconomic development, i.e. rising GDP per capita. Feng et al. (2012) compared Chinese birth rates in 1970, 1990 and 1998 with 16 countries which started at a similar rate in 1970. Their average birth rates fell to a much lower level than what the Chinese government had predicted for China without the strict family planning policy. The average, however, remained above the rates observed in China. Whyte et al. (2015) presented evidence that most of the fertility decline after the launching of the one-child policy stemmed from economic development.

2 Some scholars consider shrinking societies as a separate fifth stage or discuss various developments of the TFR.

A third group of papers reconciled these findings. For example, Schultz and Zeng (1995) showed for 1985 in three Chinese rural provinces that a combination of four factors contributed to explaining lower fertility, i.e. local family planning, availability of health programs, individual characteristics of women (such as age or education) as well as overall economic development of their communities. Accordingly, Zhang (2017) stated that the one-child policy accelerated the ongoing fertility decrease which fundamentally arose from economic development.

A strict one-child policy should bring the TFR below one, as some couples remain childless. However, the TFR never fell to such a low level, the main reason being exemptions for the rural population and ethnic minorities. Besides, the one-child limit was enforced much more strictly in urban areas compared to rural ones. Combined with societal gender preferences, female foetuses were more often subject to abortions, a practice euphemized as “sex-selection technology” (Zhang, 2017, 145) and primarily accessible to urban dwellers. In 2013, China’s government introduced a “selective two-child policy” (Wu, 2020, 1), allowing two children to parents who themselves grew up as an only child (Yuan and Gao, 2020). 2016 brought a general two-child policy for any couple (ibid). It is noteworthy that government regulation does not prohibit extramarital births. However, it is standard for Chinese parents to be married, and cost-intensive to start a family in any other way from a legal, social and financial perspective (The Economist, 2021).

The latest easing of Chinese family planning regulations occurred in 2021. After identifying the TFR at around 1.3 in the 2020 census, a three-child policy was publicly announced (Xinhua, 2021). This news was greeted with derision on social media and failed in an online survey carried out by Xinhua state news agency: Only 4.5 % of the respondents expressed willingness to have a third child (90 % would not even consider it). Financial burdens in terms of education and housing as well as the cultural heritage of the one-child policy seems to dominate the decisions of today’s couples – they would rather consider having one child or none than two or three children (Tatum, 2021).

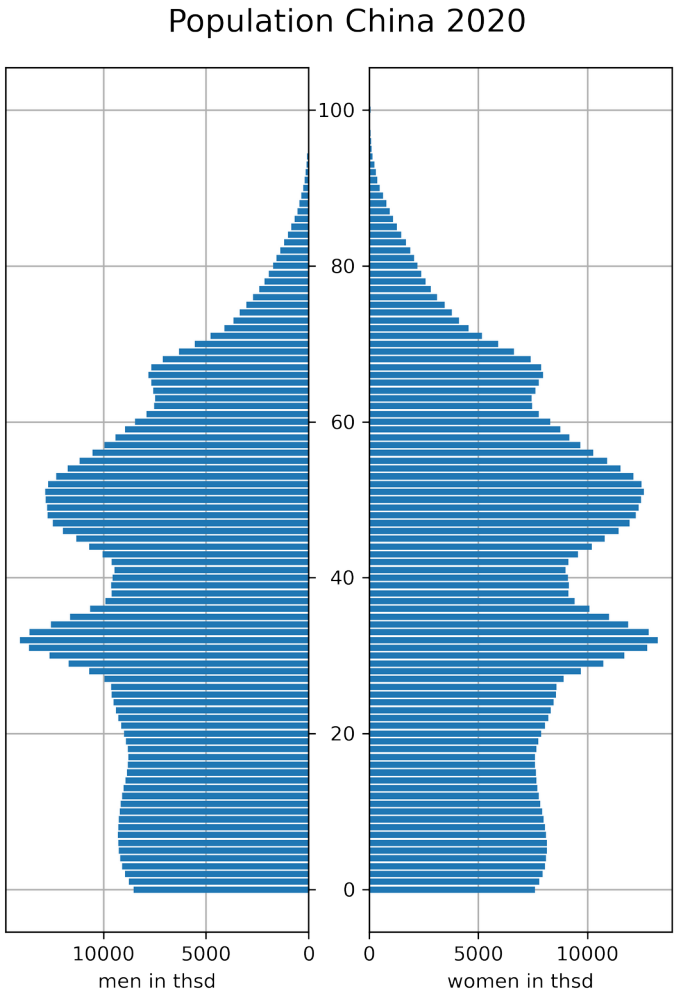
Previous simulations of the Chinese demographic development

Scenario calculations of China’s demography usually range to 2050. Wang et al. (2017a) demonstrated that population aging cannot be stopped by a universal two-child policy: Even the extremely optimistic assumption of a TFR rising by 0.7 would not prevent the OADR from rising to 40 by the middle of the century. The authors also simulated an outcome based on the scenario of the government having dropped all fertility regulations back in 2015. This, they assume, would have raised the TFR by one child, a “radical estimate” (ibid, 57). However, the OADR would still increase to nearly 40 in 2050. Similar results stem from Li et al. (2019). Based on comprehensive research, they assumed a TFR of 1.57 and found corresponding aging, expressed by slightly different dependency ratios but consistent with Wang et al. (2017a). The authors were sceptical about government’s attempts to bring up the TFR to 2.1. Liu and Liu (2020) designed a three-period overlapping generation model to study the effectiveness of the two-child policy. They concluded that a mix of other forms of fertility policy – e.g. the income structure within families, perceptions of altruism or charges for childcare – were much more likely to increase the fertility rate and that even further relaxations towards allowing three children would result in little change. A further study by Wu (2020) found that relaxed fertility regulations would not stop but only mitigate the increasing OADR. He also analysed a scenario with extremely high birth rates (TFR above 4). This exhibits a DR of above 100 by 2050.

Scenario calculation of the Chinese population from 2020 to 2100

China's population in 2020 can be seen in Figure 4. After the cohorts born around 1970, a sharp decline is visible. The temporal peak around the cohort of 1988 stems from the larger proportion of potential parents. Furthermore, the diagram does not exhibit rising birth numbers in the last ten years, despite the strong cohorts in their early 30s. These cohorts have either postponed having children or they have reduced the average number thereof voluntarily.

Figure 4 Population China 2020



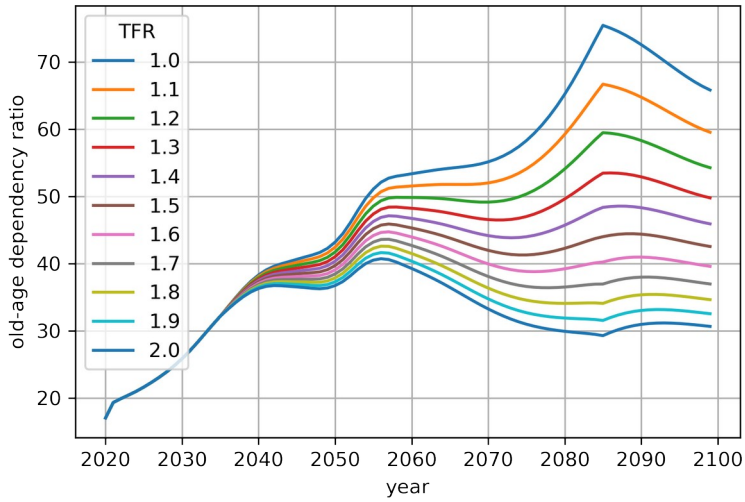
Source: Authors calculation (Data: United Nations 2019b, Population).

To assess the development of the Chinese population, we performed simulations using a component-cohort model (Smith et al., 2002). We used population data of the United Nations World Population Prospects (WPP) as a starting point. The sex-specific population of 2020 was rolled forward. The simulation extends over 80 steps of one year, from 2020 to 2100. Mortality was assumed according to the WPP life table, which provides data points for five-year groups. These values were interpolated using a spline approach. Age-dependency of fertility was assumed to follow a Gaussian pattern (normal distribution along the age axis) with mean $\mu = 27.5$ and standard deviation $\sigma = 5$. The pattern was scaled according to the TFR which was given as an exogenous parameter in the range of 1.0 to 2.0. We consider this a likely interval for the future TFR, given the

experience from other industrialized countries. We neglected migration effects as these played a minor role for China's population development in the past. Our initial mortality assumption corresponds to a life expectancy at birth of 77.0/72.9 (female/male) as observed in 2020. In the first scenario for OADR and DR, we did not change life expectancy through the simulation period. In the second scenario, we slightly increased life expectancy, such that the values become 80.9/76.9 in 2100.

Our simulations reveal the difficulty of keeping the OADR at the present level. In each scenario at given life expectancy, we observe a steady increase until the mid-2030s (Figure 5). This is not surprising, because the number of births enters the OADR with a delay of 15 years. Therefore, the development until 2035 depends only on life expectancy, which does not change quickly. In any scenario with a TFR below 1.8, the OADR grows further. It could reach values beyond 70 in the case of a TFR of 1.0. In our most optimistic scenario with a TFR of 2.0, the OADR reaches a maximum between 2050 and 2060 of around 40. This would still represent a doubling of the population aged 65 and older relative to the working cohorts. In this scenario though, the long-term prospects would indicate a falling OADR, back to a level of 30. Other scenarios with lower TFR demonstrate how much a stable long-term level depends on the number of births. Clearly, even moderately higher TFRs reduce the OADR in the long run considerably.

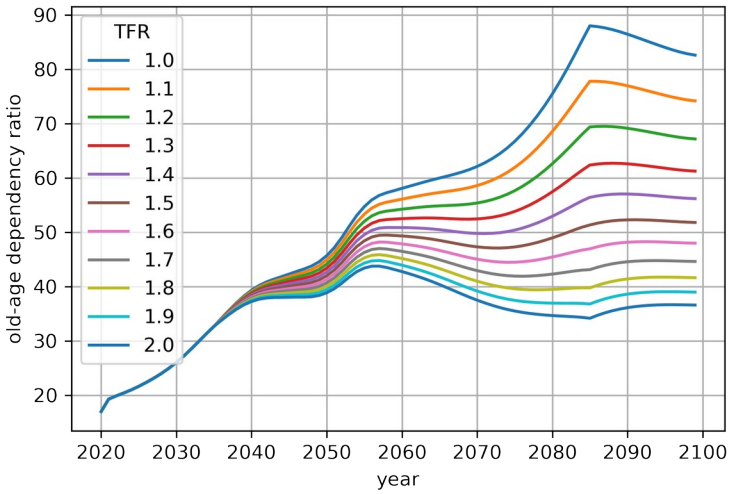
Figure 5 Old-age dependency ratios with constant life expectancy



Source: Authors calculation (Data: United Nations 2019b, Population and Mortality 2020, median estimation).

In the case of a rising life expectancy (Figure 6), the exact numbers of OADR become slightly higher, but the overall impression is similar.

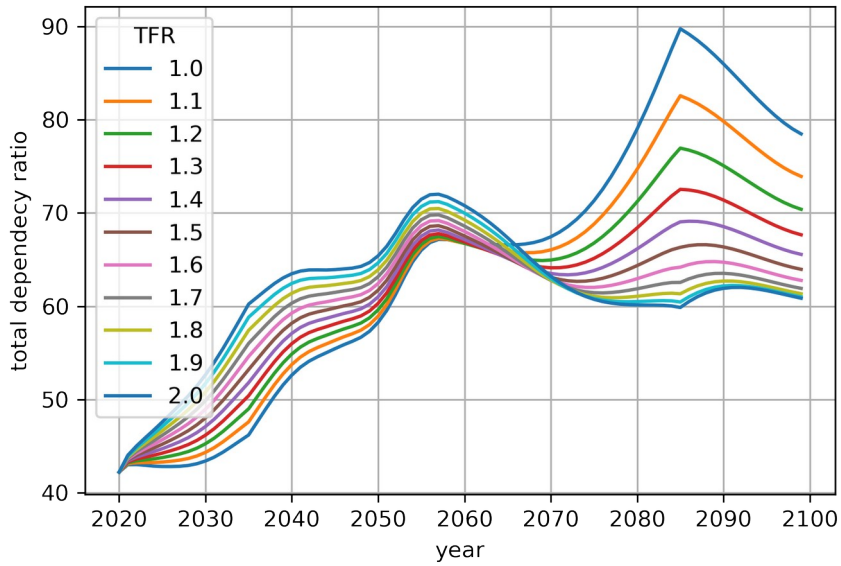
Figure 6 Old-age dependency ratios with increasing life expectancy



Source: Authors calculation (Data: ibid, median estimation).

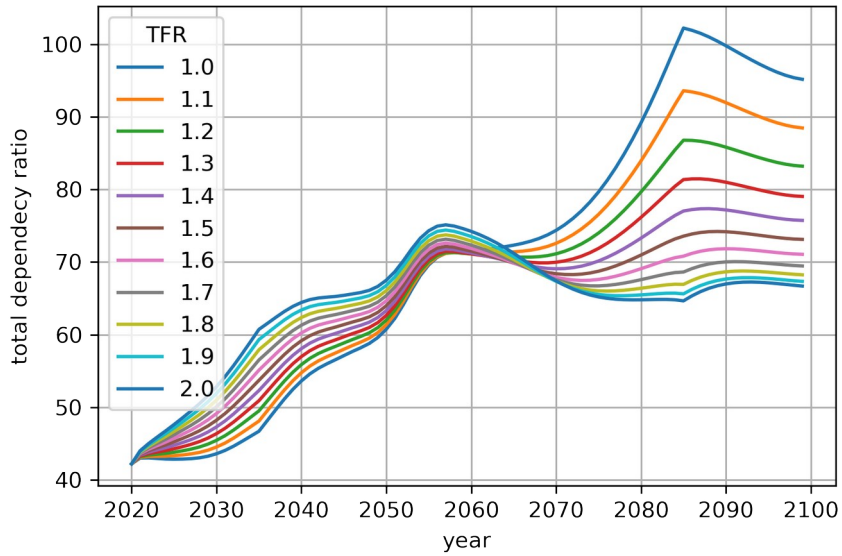
The (total) DR, as depicted in Figure 7 at given life expectancy, takes the number of children into account. High birth rates would contribute in the short run to the DR, pushing the scenarios with high TFR to the top until the mid-2050s. In the long run, the higher populated cohorts help to bring down the DR, such that the scenarios with the highest TFR stabilize at the lowest level of the DR. In contrast, the demographic dividend of the low-TFR scenarios becomes apparent, as in these scenarios the DR remains moderate in the upcoming 10 years. Nonetheless, they rise even more sharply from 2035 onward. Figure 8 shows the same scenarios with a rising life expectancy.

Figure 7 Total dependency ratios with constant life expectancy



Source: Authors calculation (Data: ibid, median estimation).

Figure 8 Total dependency ratios with increasing life expectancy



Source: Authors calculation (Data: ibid, median estimation).

Urgent need for political change

As can be seen from our scenario simulations, China's population will grow much older in the coming decades. In the event of very high birth rates, a relaxation in the second half of the century is not strictly impossible but still unlikely. It appears more realistic to assume a stabilization of the OADR on a level at least twice as high as is presently seen.

The definition of the OADR used in our analysis defined the DR and OADR based on international standards. Nevertheless, the approximation of the cohorts that contribute to the labour force, i.e., the individuals of age 15 to 64, does not correspond to China's regulation of the retirement age. State officials work until 55/60 (female/male), blue-collar workers reach retirement at 50/55 respectively (Jin, 2019). The increasing life expectancy and the corresponding improvement of working conditions raise the question whether these age limits can be maintained in an aging society. Otherwise, the burden of the pension system will weigh heavily on the government's budget.

Given the demographic situation, the People's Bank of China (PBoC) published a working paper suggesting abolishing any fertility restrictions and encouraging fertility (Chen et al., 2021). The working paper presents a thorough analysis of China's demographic past and future, but still assumes a TFR of 1.7. It concludes that the government's planning assumptions of a TFR of 1.8 were too optimistic. The authors consider the situation of various other countries, in particular the USA, India and Japan. Germany and Italy are also discussed as examples of countries that try to compensate demographic aging by enhanced immigration. A key finding is the demographic effect on economic growth potential: In contrast to the last 40 years, China's future GDP won't be driven by abundant and cheap labour supply. Education and technical innovation will be insufficient to compensate for aging. To cope with the demographic shift, the PBoC's working paper suggests massively encouraging childbirth, a higher savings rate, a later retirement age and more immigration. The publication was released with a disclaimer that findings and suggestions do not represent official positions of the People's Bank of China. Yet, together with the seventh census, these insights are likely one cause of the policy revision effectuated in 2021.

Continuous economic growth is a high priority for the Chinese government. Demographic development is a major threat to more and evenly distributed wealth. Measures to boost fertility can help to dampen societal aging. But aging will continue for the next decades even if many Chinese couples decided to follow the path indicated by the three-child policy. Therefore, government has to think of further political options to mitigate adverse demographic effects.

- Technical innovation in general and especially more automation via robots may alleviate the productivity losses of shrinking labour supply in an aging society.
- To keep retirement spending affordable, a drastically higher retirement age is indispensable. Compared to Western democracies, where later retirement is hard to achieve given an ageing median voter, China's political system may be in a much better position to realize this objective (Chen et al., 2021).
- China's pension system represents the biggest challenge of all: Besides raising the retirement age, it would be necessary to standardize its first pillar nationwide. This would also lead to a statutory pension scheme without differences due to gender or class, whereas the current system favours women over men and workers over state employees (Jin, 2019). Accordingly, additional savings components could contribute to securing the standard of living after retirement. More precisely, the role of occupational pensions could be strengthened and a private third pillar expanded (ibid; Ngai et al., 2019).
- Immigration has not been an issue in China so far. The term appears neither in Wu's (2020) comprehensive demographic study, nor in the presentation of the May 2021 census. Despite this, Chen et al. (2021) point out that even culturally conservative countries such as Japan and Germany are more and more aware of how important immigration is. Therefore, China should gradually liberalize and promote immigration. The authors do not specify where immigrants could come from. But member countries along China's Belt and Road Initiative (BRI) are often young and poor. Especially the potential to invite more African students to Chinese universities is huge.
- The strategy of increasing the female labour supply could help to compensate for the shrinking workforce. This is connected to women's better access to higher education. However, some see a trade-off with the objective of initiating higher birth rates (Li et al., 2019).
- China's population structure varies considerably both between urban and rural areas and among regions. Wu (2020) suggests family planning policies that take these differences into account. Accordingly, future pension reforms would have to take greater account of the specific financial needs of urban and rural residents as well as migrant workers (Jin, 2019).
- Finally, China's government will have to pay more attention to cultural norms that lead to having more or fewer children, as well as to second-round effects on fertility such as China's surplus of sons or a later start to retirement: E.g. without immigration, many sons will not find a wife and given a later retirement, working grandparents will be less able to care for their grandchildren (Wu, 2020).

Conclusion

China is undergoing a particularly fast demographic transition. Accelerated through decades of political restrictions on family planning, the median age is rising and there is a growing share of retirees, while labour force potential is declining. Faced with dire consequences for both economic growth and wealth distribution, the government has gradually relaxed its one-child policy. As of 2016, two children have generally been permitted, and a three-child policy became effective in 2021. Will this policy shift succeed? Previous studies have analysed the demographic perspectives, but rarely run beyond the year 2050. They expect both the old-age and the total dependency ratios to further increase even in the best case, i.e. assuming complete liberalization of childbearing. Our study simulates China's old-age dependency ratio and total dependency ratio until the end of the century, assuming exogenous total fertility rates between 1.0 and 2.0. It shows that at today's life

expectancy, the old-age dependency ratio would roughly range between 30 and over 65 by 2100. The total dependency ratio would climb beyond 60 even in the best case and up to nearly 80 in the worst case. Given the more realistic simulation of an increasing life expectancy, the old-age dependency ratio would further rise to a range beyond 35 and 80, respectively. The total dependency ratio would climb from more than 65 to around 95, depending on the assumption for the total fertility rate. We conclude that China urgently needs reforms beyond family policy.

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