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RESEARCH BRIEFS

The Demographic Race between India and China

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Abstract
As India surpasses China as the world's most populous country, questions arise as to whether this demographic shift will lead India to overtake China economically. This paper examines this demographic race beyond population size. Using multi-dimensional demographic projections by age, sex, education, and labor force participation, we show that China's current apparent demographic travails will not necessarily threaten its leading status relative to India for most of the next half century given India's disadvantage in educational attainment and very low female labor force participation. India's young population could provide a demographic dividend later this century, but only if it makes substantial investments in education and increasing women's labor force participation rates. The demographic race between giants will be determined more by human capital development than simply by total population size.

Keywords Population · Projection · India · China · Labor force · Human capital · Education

Introduction and Background

Demography is defined as the scientific study of changing population size and structures. It is also, perhaps too often, defined as destiny. Although size and age-structures are indeed hard to influence, there is more leeway for policies on education and

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labor force participation structures. In terms of total population size the race between the world's two "demographic billionaires" is already over. India surpassed China in 2023 and will likely remain the most populous country of the world for the rest of the twenty-first century and beyond. Indeed, in January 2023 China recorded its second consecutive decline in total population size (Stevenson & Wang, 2024).

Many news stories state with near certainty the coming predominance of India (and other Emerging Markets) as China struggles with its demographic circumstances (The Economist, 2024). As a result of low fertility and, to a lesser extent, improved mortality, China is certainly aging rapidly and is projected to continue to experience a decline in its total population over the next century (United Nations, 2024). It is often remarked that this demographic struggle is an unintended, self-inflicted consequence of decades of strict family planning policies. In response to this demographic alarmism, both local and national governments in China have announced various incentive measures to reach a "sustainable fertility level" by boosting the number of births and creating "a new culture of marriage and childbearing and strengthen guidance on young people's view on marriage, childbirth and family" (Reuters, 2023). Such policies, including financial transfers and investing in childcare systems, have had only very limited effect on overall cohort fertility in other countries of the world, leading many to speculate their effect in China could also be minimal. Thus, looking at size and age structure alone, this seems to strengthen the argument that China's demographic circumstances are its "Achilles heel" in terms of shaping future economic growth and its geopolitical space in the world.

India still has a much younger population and higher fertility rates than China, particularly in certain states such as Bihar and Uttar Pradesh which have a combined population of well over 300 million people. For this reason, there is no doubt that its future pace and scale of population aging will be much slower than in China, and it is clearly still in a position of positive overall population growth.

Although overall population stagnation and losing the crown of "most populous country" maybe psychologically damaging for China, changing structures matter more than changing size. In this area too, according to conventional thinking, India appears to be 'winning', with a much younger population. Together, then, China's current and projected population decline, and rapid aging appear to present an existential threat to the continuation of its economic success story and to its relative economic and geopolitical power of the world's two "demographic billionaires."

However, total size, age and sex are just a few of the many dimensions of demographic change which matter for a country's economic standing (Golley & Tyers, 2012; Lutz et al., 2014). Indeed, it has been shown elsewhere that translating enhanced education into productivity within an expanded labor force can be a much more effective means of offsetting the challenges of population aging than, for example, increasing the fertility rate (Marois et al., 2021). A country's economy, and therefore its overall geopolitical power, depends more on the number of workers it has and how productive they are than on its gross population numbers (Jones, 2016). In this research brief, we therefore reassess the demographic race between India and China by looking more closely at the composition of the population, in particular the size of the labor force and its human capital. To this end, we forecast the labor force (LF) and the productivity-weighted labor force (PWLF), an indicator that takes into

account both the educational composition of the labor force and the overall quality of the education system, for China and India from 2020 to 2100, and compared the trends with traditional demographic indicators.

The demographic dynamics of India and China represent a critical inflection point in global economic development. Understanding the nuances of their demographic race is thus critical not only for these nations but also for international policymakers, investors, and institutions navigating an increasingly multipolar world. While much of the existing literature focuses on population size or age structure as determinants of economic potential, this study contributes to a growing body of research underscoring the primacy of human capital (Jones, 2016; Lutz et al., 2014). This analysis goes beyond simple population projections by introducing a productivity-weighted labor force (PWLF) measure that captures the qualitative dimensions of human capital, offering a more sophisticated lens through which to examine the future economic potential of these emerging economies.

Data and Methods

The process of forecasting the labor force and the productivity-weighted labor force (PWLF) involves several different steps.[1] It begins with population projections by age, sex, and education. These projections are taken from the Wittgenstein Center Data Explorer (KC et al., 2024), which provide estimates of future population by age, sex, education level through multi-state cohort-component models. For our model, we used the Shared-Socio Economic Pathway 2 (SSP2–Middle of the road) scenario, which takes into account the impact of COVID-19 on the population structure as well as the latest estimates of demographic components as starting point. More details on the long-term assumptions can be found in Lutz et al. (2014, 2018). The projection results in an increase in educational attainment from an average of about 8 years of schooling in 2020 for the population aged 25–54 to more than 14 years in 2100 for India and from 10 to 15 years for China (see Online Supplement Section B3 and associated figures).

The next step is to estimate the labor force size. We follow the state-of-the-art approach of superimposing group-specific participation rates at time t on the population outputs (European Commission, 2015; Loichinger, 2015; Marois et al., 2020, 2021; Van Hook et al., 2020). These rates are calculated for specific demographic groups based on age, sex, and education level using the China General Social Survey 2010–2017, the Periodic Labour Force Survey (2017/2018) of India.

The productivity-weighted labor force size is then calculated by applying productivity factors to workers based on their human capital. In order to have internationally comparable and generalizable weights, we derive them using a Mincerian earnings function applied to pooled census data from multiple countries available on IPUMS-International. The equation accounts for the relationship between years of schooling and income, used as a proxy of productivity (Card, 1999), while also considering

[1] Here we provide only a basic overview of our approach. In the Online Supplement, we offer a more comprehensive treatment of the background (Section A) and methodology (Section B) of our approach.

the diminishing returns to education as overall education levels in a given society increase. We normalize the weights making use of the value for the world average number of years of schooling in 2015 (9.3). The resulting weights vary across countries and over time, based on the average years of schooling of the population, with workers with post-secondary education (16 years of schooling) being 2–3.5 times more productive than workers with the world average number of years of schooling (9.3 years; see Figures S1 and S2 in the Online Supplement).

To account for differences in education quality between countries, a quality adjustment factor is then incorporated in the equation. For this, we used Skill Adjustment Factors (SAF), which are derived from adult literacy assessments (Lutz et al., 2021) and normalized to 1 = world average of 2015. Future SAF values are projected using logit extrapolation, assuming convergence to the highest observed value. Thus, the education quality gap between India and China is assumed to narrow without closing, as India will still lag behind in 2100 (see Online Supplement Figure S4).

The productivity-weighted labor force (PWLF) is calculated by multiplying the number of workers at each education level by their corresponding productivity weight, summing across all education levels, and then multiplying by the country's Skill Adjustment Factor. This process is repeated for each year of the projection period, from 2020 to 2100. Summing up, the PWFL is equal to the number of workers with the 2015 world average human capital that would be equivalent in productive capacity to a country's actual labor force.

To validate this approach, the PWLF is used to predict 10-year GDP growth in a global sample of countries (297 cross-sectional observations of countries/time periods from 1970 to 2015 obtained by merging all IPUMS-I censuses). Its predictive power is improved compared to other population-based indicators such as total population, working-age population, and standard labor force size.

Given the uncertainty about future participation rates and educational attainment, we consider three scenarios. In the first one ("Constant LFP rates"), participation rates remain constant over time, as do most other labor force projections (Van Hook et al., 2020; European Commission, 2015). Although group-specific rates are assumed to remain constant over the projection period, rates at the aggregate level change due to the compositional effects (such as increasing educational attainment among more recent cohorts of women). In the second one ("Convergence to U.S. in LFP rates"), rates converge to those of the United States by 2100. The United States serves as a plausible benchmark for convergence because its participation rates are broadly representative of the average among developed economies. Assuming that India and China follow a similar economic development path, their participation rates could gradually converge with those of the U.S. and other high-income countries. For India, this scenario translates into a substantial increase in female labor force participation, as they are now among the lowest in the world (World Bank, 2025). For China, it mainly means an increase in the participation rate of women aged 50 and over and men 55 and over, as current pension system regulations still encourage early retirement. Given that the labor force participation is partly driven by the educational attainment, we have also built a third scenario ("Stalled development in education)" in which there is no further improvement in enrollment rates and in the quality of education. This scenario still yields a slight increase in the average years of schooling

(see Online Supplement Figure S4), as earlier-born cohorts with less education are replaced by more recent ones.

Results

We first show in Fig. 1 the age, sex, education, and labor force pyramids for China and India for 2020, which highlights the heterogeneity in the population composition of both countries. Some major structural differences in these key dimensions can be expected to have long-lasting consequences. The Indian population, indeed, is much younger; but has a much higher proportion with no or only basic education, particularly among women. China, meanwhile, has heavily invested in universal primary and secondary education for girls and boys over the past decades (Wang, 2003; Wu & Marois, 2024). The much lower education of women in India also led to a slower fertility decline and thus a younger and still growing population (Wittgenstein Centre for Demography and Global Human Capital, 2023). Female labor force participation in India is also much lower than in China. In fact, it is among the lowest in the world (World Bank, 2025). This is true at all ages and levels of education, despite a fertility rate that is now slightly below replacement level (United Nations, 2024). Given the central importance of human capital for economic growth, this also contributed to the much better economic performance of China over the past decades (Li et al., 2017).

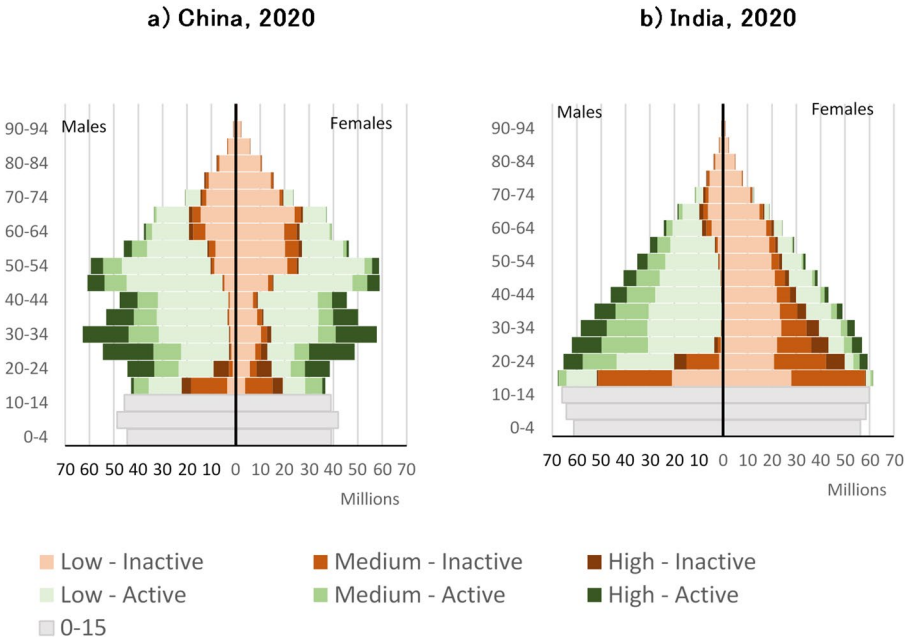

Fig. 1 Age Pyramids by Education and Labor Force Participation, China and India, 2020. Note. Low: Less than upper secondary. Medium: Upper secondary. High: Postsecondary. Source. Authors' calculations based on WIC projections (Wittgenstein Centre for Demography and Global Human Capital, 2023), Periodic Labor Force Survey 2017–2018, and China General Social Survey 2012–2021

What do these differences in demographic structures imply for the future? Although India has already surpassed China in terms of total population size (Fig. 2, panel a), it is projected to catch up with China in terms of the working-age population (20–64 years old) before 2030, as shown in Fig. 2, panel b. This outcome was anticipated in demographic projections from the 1990s, given that India's fertility decline occurred later and was less abrupt than China's, though the exact timing of convergence varied across forecasts.

However, not all individuals in the working-age population participate in the labor market, especially women in India. Therefore, when considering labor force size, a different picture emerges (Fig. 3). Under the assumption of constant labor force participation (LFP) rates, India is projected to reach the same labor force size as China between 2040 and 2050 (Fig. 3, panel a). After this point, India's advantage will largely depend on how its female labor force participation rate evolves. By 2100, if India's LFP rates reach the level of the United States, its labor force could be twice the size of China's (Fig. 3, panel b). However, if LFP rates remain constant, India's labor force would be about 50% larger than China's. The scenario of stalled development in education (Fig. 3, panel c) has only a limited effect on labor force size, as its lower participation rates among middle-aged women with low education are offset by higher participation among older workers aged 60 and above, particularly men. In contrast, China has less potential for labor force growth through increased participation, as female labor force participation is already much higher than in India. As a result, there is little room for further improvement.

Yet, labor force size alone does not fully capture a country's productive capacity, as workers contribute differently to economic output based on education and skills. To capture these differences, Fig. 4 presents productivity-weighted labor force (PWLF) projections under the three scenarios. These projections highlight a more complex long-term competition between India and China. Due to differences in education levels and female labor force participation, China's PWLF is expected to remain more

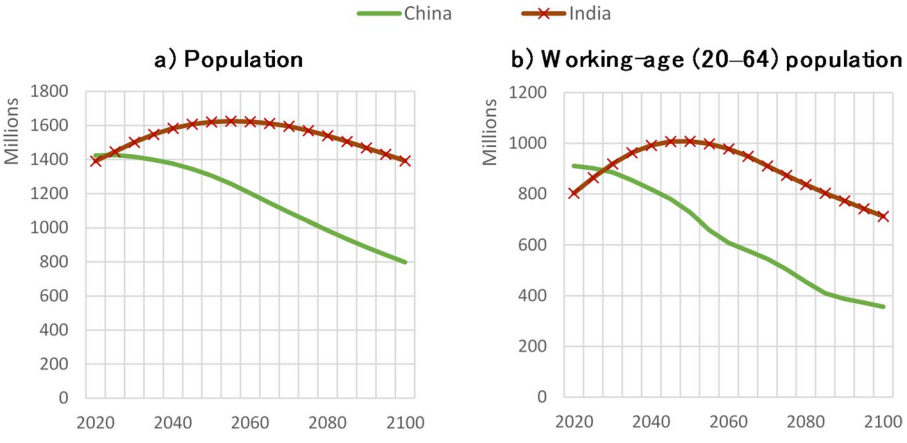

Fig. 2 Projected Population and Working-Age (20–64) Population, China and India, 2020–2100. Note. See Online Supplement Section B for details. Source. WIC projections (Wittgenstein Centre for Demography and Global Human Capital, 2023)

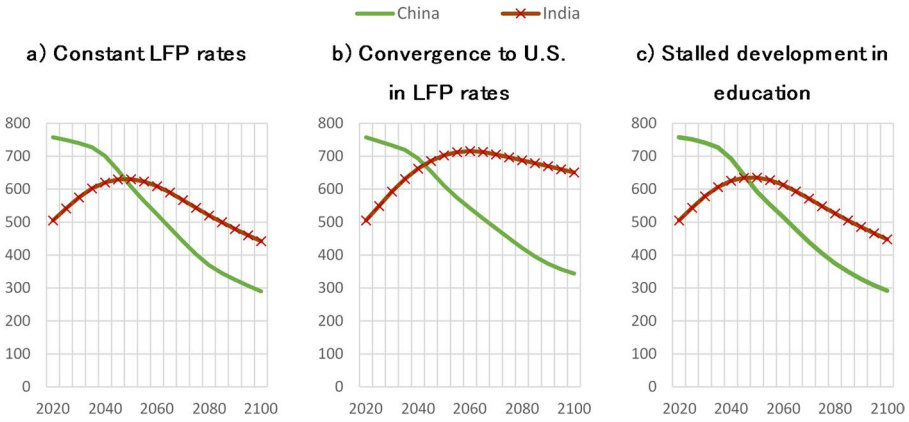

Fig. 3 Projected Labor Force Size According to Three Scenarios, China and India, 2020–2100. Note. Panel a) Constant LFP rates = no change in labor force participation rates by age, sex, and education; Panel b) Convergence to U.S. in LFP rates = labor force participation rates by age, sex, and education converge to those of the United States by 2100; Panel c) Stalled development in education = no further improvement in enrollment rates and in the quality of education, no change in labor force participation rates. See Online Supplement Section B for details. Source. Authors' calculations based on WIC projections (Wittgenstein Centre for Demography and Global Human Capital, 2023), Periodic Labor Force Survey 2017–2018, and China General Social Survey 2012–2021

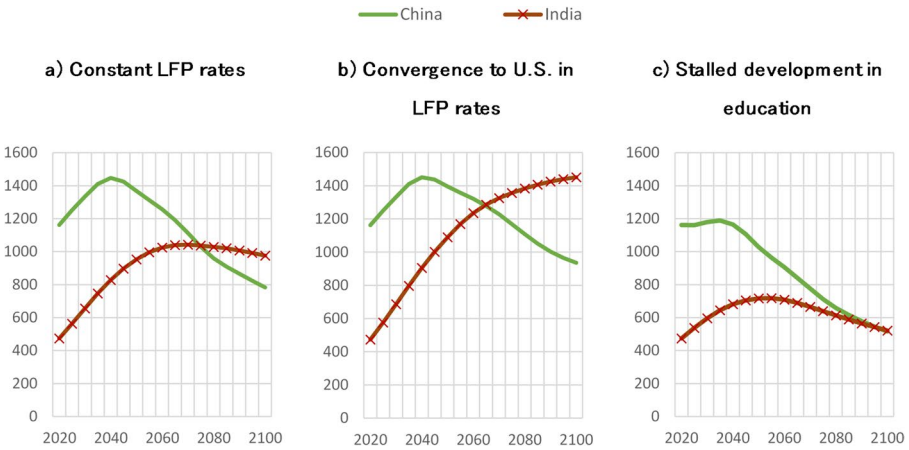

Fig. 4 Projected Productivity-Weighted Labor Force Size (PWLF) According to Three Scenarios, China and India, 2020–2100. Note. Panel a) Constant LFP rates = no change in labor force participation rates by age, sex, and education; Panel b) Convergence to U.S. in LFP rates = labor force participation rates by age, sex, and education converge to those of the United States by 2100; Panel c) Stalled development in education = no further improvement in enrollment rates and in the quality of education, no change in labor force participation rates. See Online Supplement Section B for details. Source. Authors' calculations based on WIC projections (Wittgenstein Centre for Demography and Global Human Capital, 2023), Periodic Labor Force Survey 2017–2018, and China General Social Survey 2012–2021.

than twice as large as India's for the next two decades. After that, India's ability to integrate women into the labor force will be a key factor in its economic trajectory. If India does not make progress in education and female labor force participation (Fig. 4, panel c), it may never catch up with China in terms of PWLF, especially if China maintains the pace of its past progress in education. On other hand, if India successfully integrates more women into labor market and continues to expand educational attainment, it could surpass China's PWLF much earlier (Fig. 4, panel b), and its advantage would become significantly more pronounced by end of the century.

In China, the future trend of the PWLF will depend on continued improvements in education. If China maintains the rapid progress in education observed in recent years—assumed in both the constant LFP and Convergence to U.S. scenarios—its PWLF will first increase and then gradually decline. However, under the stalled development in education scenario, China's PWLF would decline at a similar rate to its working-age population or labor force size, shrinking by slightly more than 50% by the end of the century. This highlights the crucial role of education in maintaining China's economic strength despite demographic changes.

Discussion and Conclusion

Factoring labor force participation and education into the demographic race between India and China suggests that China's current apparent demographic travails will not necessarily threaten its leading status relative to India for most of the next half century. By the same rationale, the rapid change in India's productivity weighted labor force strongly indicates that the country could occupy an economically leading role in the last-third of the current century. Yet, this should not be taken as a given.

India's continuing population growth and enormous youth population could eventually become an economic advantage, but only if the country makes substantial investments in education and effort in reducing gender inequality in the labor force participation. To address these challenges, India has introduced several policies aimed at expanding educational access and improving workforce inclusion. For example, the National Education Policy 2020 emphasizes gender-inclusive schooling, the Mahila Shakti Kendra scheme supports skill development for rural women, and reforms such as the amended Maternity Benefit Act seek to reduce workforce dropout among mothers. However, progress remains uneven due to gaps in implementation (Drèze & Sen, 2013), persistent cultural norms (Afridi et al., 2018), and a lack of formal job creation (Mehrotra & Parida, 2019). Boosting female education and labor force participation will be critical in determining not only when India can catch up to China economically but also how predominant India's position will be by the end of the century, as suggested by cross-country studies linking gender parity to GDP growth (Ostry et al., 2018). Meanwhile, China is actively addressing its aging workforce through increasing productivity, industrial automation, gradual increases in the retirement age (Zhang et al., 2023) as well as demographic initiatives such as in healthy ageing, poverty reduction and trying to increase the fertility rate through various family policy interventions and pronatalist incentives. For now, demographic structures favor China as the world's largest economy for the foreseeable future.

Although India has surpassed China as the world's most populous country, China is likely to remain the dominant economic power for the coming decades due to more favorable labor force and education structures. China's higher levels of human capital and a still sizable working-age population mean China will maintain a much larger productivity-weighted labor force over the next 50 years.

In sum, the key to economic success over the remainder of this century is likely to be more based on what people can do and are doing rather than just how many there are (or even their ages). In this sense, the economic future of the European Union, the United States, and, indeed, other traditional and emerging markets should not be written off in comparison to the demographic billionaires. Enabling all people to reach their full potential through investing in health, education, income protection, poverty reduction, and promoting a productive, inclusive labor market providing decent employment is critical to the future.

Fundamentally, this is a positive message that the economic and social future of India, China, and anywhere else in the world is not already written and is going to be grounded in investment in people. This message is important for the policy planners who will develop interventions as well as those focused on political demography and shifting geopolitical positions and alignments. However, the message of considering population from a multidimensional, holistic perspective is perhaps even more important for those in the media and other commentators who inevitably often prefer a simple story of decline versus prosperity.

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Declarations

Conflict of interest Authors declare that they have no competing interests.

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