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China and India, 2025

A Comparative Assessment

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Summary

In the past century, China and India have experienced frequently rivalrous relations, including two occasions of military conflict in 1956 and 1962, sharp changes in the issues and venues of their rivalry, and sometimes quite different stances toward the United States and its policies. These circumstances provide a backdrop for our report, although our approach is more narrowly focused, while also looking forward to the two countries' future prospects rather than to their histories.

The purpose of this document is to assess the prospects of India and China through 2025 in four domains: demography, macroeconomics, science and technology, and defense spending and procurement. We seek to answer these questions: Who's ahead? By how much? and Why? As the second question implies, we strive for quantitative answers as much as possible. In the process, we try to assess the balance between advantages and disadvantages that China and India will possess 15 years hence. This balance is relevant for potential cooperation between the two countries, no less than for their potential competition and rivalry. Although our focus is on quantitative answers, we repeatedly acknowledge the uncertainties created for the assessment by such qualitative unknowns as whether or not each country may encounter internal civil unrest, political disruption, external conflict, or natural disasters.

Demography

Chapter Two begins the comparative assessment by examining the demographic balance. China and India are the world's two most populous countries. India's current rate of population growth is about twice that of China (1.55 percent annually, versus 0.66 percent for China), and its total population will equal China's in 2025 (about 1.4 billion in each country), thereafter exceeding China's. The Indian population will continue increasing through at least 2050, while China's will peak at about 1.5 billion in 2032, declining thereafter.

From the standpoint of economic competition between the two countries, the age composition of their populations is more significant than their aggregate size. India's prime-working-age population will overtake that of China in 2028. Moreover, reflect-

ing the changing age composition of their populations, the two countries will experience very different patterns in their overall dependency ratios—that is, the ratio of the young and the elderly to those of prime working age. (The dependency ratio concept assumes that, on average, people aged 15–64 produce more than they consume, while the opposite is true for those who are younger and older. Rising dependency ratios are generally viewed as an impediment to economic performance, while falling ratios are considered an advantage.) Although India's overall dependency ratio is currently higher than China's, the ratio will be rising rapidly in China in the next two decades, while it will be declining in India.

Numerous other factors will affect the balance of demographic advantages and disadvantages, including the health, education, gender composition, and migration propensities of the respective populations. For example, China's population is generally healthier than India's, and China has the benefit of a more developed health care system. On the other hand, China's population is aging more rapidly than India's, in the sense that the elderly are becoming an increasingly larger proportion of China's population. India will have a lesser cost burden from this source because of its younger population.

China's population also has higher average levels of literacy and education than India's. If India can successfully meet this challenge by investing in human capital, it may be able to turn a disadvantage into an advantage through productive employment of its growing pool of younger workers.

The bottom-line answer to the "Who is ahead?" question as it relates to demography is evidently in India's favor. However, whether India's several demographic advantages—increasing numbers, younger age cohorts, declining dependency ratios—will be a dividend or drag on future economic growth will depend on the extent to which productive employment opportunities emerge from an open, competitive, innovative, and entrepreneurial Indian economy. Conversely, whether China's several demographic disadvantages—rapidly aging population, rising dependency ratios, rising health costs for the elderly, sharp gender imbalances—will be a drag or a dividend will depend on the extent to which these demographic circumstances provide a stimulus to improving technology and to raising the skill and productivity of a shrinking labor force.

Macroeconomics

In Chapter Three, we assess the macroeconomic balance between India and China through a meta-analysis of 27 recent studies of the two countries' prior economic growth and their forecasted growth through the 2025 period. The studies were selected from a larger set of 47 studies screened on the basis of the scope and reliability of the data needed for the meta-analysis. The studies, published between 2000 and 2008,

were from three different types of institutions: academic, business, and international organizations. The pooled data enabled comparisons to be made between China's and India's forecasted economic performance through 2025 in terms of four salient indicators: growth of capital, growth of employed labor, growth of total factor productivity, and growth of gross domestic product (GDP).

What is striking about the results is the narrow margins between the paired China-India comparisons. The forecasted average annual GDP growth rates in 2020–2025 are approximately the same: China at 5.7 percent, India at 5.6 percent. The corresponding maximum GDP growth rates of the forecasts are 9.0 percent for China and 8.4 percent for India, and their paired minimum growth rates are 3.8 percent and 2.8 percent, respectively. Estimates of the other three growth indicators (capital, labor, total factor productivity) show slightly larger differences.

The meta-analysis also included comparisons among the three separate clusters, covering 11 academic, 9 business, and 7 international organizations. The business cluster's forecasts are distinctly more optimistic about India's growth prospects and relatively pessimistic about China's, forecasting an average Indian growth rate of 6.3 percent and an average Chinese growth rate of 4.7 percent for the 2020–2025 period. The two other clusters (academic and international organizations) reverse this order, with markedly higher growth estimates for China than for India. We conjecture that an expectation of a more favorable business environment in India—for example, relating to the rule of law and protection of property rights—might account for this difference.

To reflect as well as to bound the uncertainties embedded in the meta-analysis forecasts, our assessment shows the GDP comparisons between India and China that result from five differing paired scenarios of their respective high, low, and average growth rates. Only in the scenario that posits the high-growth parameter for India and low-growth for China does India's GDP in 2025 approach that of China. In this scenario, India's GDP in 2025 is $12.3 trillion and China's is $13.8 trillion, employing purchasing power parity (PPP) rates to convert rupees and renminbi, respectively, to constant U.S. dollars.

We conclude that, concerning forecasted economic growth, our assessment places the two countries at equivalent rates, but with China's aggregate GDP likely remaining substantially larger than India's through 2025, as is currently their comparative status.

Science and Technology

We assess the science and technology (S&T) balance between India and China in Chapter Four. The assessment focuses on several indicators of S&T inputs and two output indicators. The input indicators include both financial and human resources. The financial input indicators involve spending on research and development (R&D). We focus on gross expenditures on R&D (GERD) as a percentage of GDP, as well

as GERD's four components: higher education R&D spending (HERD), business R&D spending (BERD), government R&D (GOVERD), and private, nonprofit organizations' R&D spending (PNPERD). The human resource input indicators are the number of doctoral degrees in engineering, life sciences, physical sciences, computer science, mathematics, and agriculture.

As output indicators, the assessment compares (1) publications in refereed scientific journals and (2) patents (especially triadic patents) produced by authors and inventors from China and from India. We acknowledge that these indicators are incomplete: For example, innovations and improvements in production and management practices often occur that are not reflected in either scientific publications or patents. Despite their limitations, these indicators are used in the assessment of Chapter Four to compare India's and China's recent S&T accomplishments and to develop a simulation model for projecting their future trajectories.

China currently has the world's third-largest GERD (after the United States and Japan). Also, the business component (BERD), which may have the greatest early effects on productivity, has increased from 0.25 percent of China's GDP in 1996 to more than 1 percent in 2006. China's GERD has subsequently risen further in absolute amounts and as a share of China's GDP. India's GERD is 0.8 percent of GDP; it is expected to triple in the next five years and to continue to rise through the 2025 period.

China currently graduates 70 percent more engineers annually than does India (600,000 and 350,000, respectively). However, there are questions about the reliability and comparability of these aggregate figures, and another difficulty arises in assessing the quality of similarly credentialed engineers in the two countries. As an example, according to a survey of multinational businesses, the quality ("employability") of graduate engineers from China is 60 percent less than that of graduate engineers from India.

The simulation model described in Chapter Four uses the input variables mentioned above, along with cost and output parameters. The parameters are sometimes based on current levels prevailing in India and China and sometimes based on current levels in South Korea, on the assumption that the parameter values in China and India will converge over the next 15 years to the higher levels prevailing in South Korea in 2008. Our assessment includes several simulation scenarios with differing combinations of these parameter values and differing degrees of optimism and pessimism about prospective S&T developments in India and China.

Whether outputs are registered in terms of full-time science and engineering researchers, holders of doctoral S&E degrees, triadic patents, or journal publications, the forecasted answer to the "Who is ahead?" questions is that our estimates for China exceed those for India by wide margins. The simulation estimates of China's researchers and S&E journal publications in 2025 exceed those of India by factors of 8 and 13, respectively. Only in the scenarios in which we adopt the qualitative discount cited

above for China's graduate engineers and their imputed productivity do these factors diminish substantially, falling to 1.5 and 1.7, respectively.

Spending on Defense and Defense Procurement

Comparing spending on defense and defense procurement in India and China involves problems of data reliability and comparability that are no less difficult than those encountered in the preceding S&T comparisons. The assessment in Chapter Five addresses these problems, as well as the additional problem presented by identifiable gaps in the defense spending and procurement data for both countries. While these gaps are evident in both cases, they are distinctly larger in China. The approach adopted in Chapter Five builds on each country's official data to arrive at estimates of their total expenditures on defense and on defense procurement, and to express these as shares of their respective GDPs.

Forecasts of these expenditures through 2025 are made using two methods. One method is based on a continuation of recent year-over-year real growth rates of defense spending, while the second method assumes that defense spending is a fixed share of GDP, thereby linking the defense spending estimates to the GDP forecasts provided in Chapter Three. The first method yields substantially higher forecasts for defense spending than the second, resulting in budget and GDP shares so high that they would likely be politically unacceptable in both countries. Each of the two methods was used to generate three different estimates for China and India, representing optimistic ("high"), pessimistic ("low"), and moderate ("best") scenario assumptions.

According to the first method, our "best" estimate for India's defense spending in 2025 is between $94 billion and $277 billion in 2025, in constant dollars depending, respectively, on whether market exchange rates or PPP conversion rates are used. The corresponding "best" estimates for China are between and four and seven times those for India. As noted earlier, the forecasts resulting from the second, GDP-based method are appreciably lower, lying between $82 billion and $242 billion for India, and between two and three times these amounts for China.

Turning to spending for defense procurement, we employ a single estimation method analogous to the year-over-year method cited above for estimating defense spending through 2025. The method posits a high and fixed (12.8 percent) annual growth of procurement spending for both countries from 2009 levels. Our resulting estimates for India's defense procurement in 2025 are between $63 billion and $186 billion (in constant dollars), depending on whether market exchange or PPP conversion rates are used to convert rupees to dollars. The corresponding "best" estimates for China are about 2.6 times and four times these amounts.

Observations and Implications

Chapter Six concludes with observations about the four dimensions of the assessment and with implications that may be drawn from the assessment. We reiterate the abundant sources of uncertainty surrounding our quantitative estimates and advise caution in treating our forecasts of economic growth, scientific and technological development, and defense spending as other than suggesting boundary conditions. While recognizing the uncertainties, our answers to the original questions about "Who is ahead?" and about the respective advantages and disadvantages of India and China can be briefly summarized:

- The demographic assessment suggests several distinct advantages for India (these are delineated in Chapter Two).
- The macroeconomic assessment suggests that the economic growth competition between India and China may be considerably closer than might otherwise be expected.
- In S&T, China's margins over India are likely to be substantial, deriving largely from the currently prevailing disparities between them that, in absolute terms, are likely to grow.
- In defense spending and procurement, a similar pattern is likely to emerge: The two countries show wide disparities in their current spending levels and, in absolute terms, these are likely to grow substantially over the next 15 years.

An important implication follows from the multiple high-versus-low/optimistic-versus-pessimistic scenarios described in our assessment. India and China, by adopting or failing to adopt suitable policies, can affect significantly the probabilities that one or another of the alternative scenarios materializes, thereby altering the balance of advantages and disadvantages between the two countries. For example, if India follows effective economic and social policies, its favorable demographic trends will result in a significant "dividend" for the economy's growth; conversely, if China's policies were to fall short of compensating for the adverse demographic trends it faces, the result will be a significant "drag" on its economic growth.

Also, though perhaps to a more limited extent, policies pursued by the United States and other "third" parties may be able to affect this balance. From this standpoint, an actionable inference can be drawn: Identify which among the multiple scenarios sketched in our assessment seems preferable, and develop a portfolio of policies conducive to enhancing the probability of that (or those) scenario(s) emerging over the next 15 years.

Explicating the specific policies and their effects in altering our forecasted outcomes is worthy of further attention, as well as beyond the purview of this study. Nonetheless, we suggest the following proposition: Prospects for India to pursue policies that will enhance its competitive position vis-à-vis China are better than are the reverse

prospects. This is because India's political-economic system entails at least a moderately greater degree of economic freedom than does China's, and this provides an environment more conducive to entrepreneurial, innovative, and inventive activity that may favor India's position in the long-term competition between the two countries.