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DISCUSSION PAPER

// NITIN KUMAR BHARTI AND LI YANG

The Making of China and India in the 21st Century: Long-Run Human Capital Accumulation From 1900 to 2020

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The Making of China and India in the 21st Century: Long-Run Human Capital Accumulation from 1900 to 2020

Nitin Kumar Bharti[1] and Li Yang[2]

Abstract. We construct a novel dataset of human capital accumulation in China and India from 1900 to 2020 by combining historical records and educational reports to analyze the role of education in economic divergence. Three key findings emerge. First, China pursued a bottom-up strategy, first expanding primary education, followed by secondary and tertiary levels. India, in contrast, adopted a top-down approach, gradually expanding its educational system but prioritizing secondary and higher education before primary. Second, China prioritized quantity over quality, whereas India's expansion attempted to balance quality through teachers' emoluments. Third, China's system features more diversified secondary and tertiary education, with a strong emphasis on vocational education and engineering than India. We highlight the role of educational policies in shaping these trajectories. Our findings on differences in the human capital accumulation in India and China have significant economic implications: education inequality (gini) is not only higher in India but also accounts for a larger share of wage inequality in India (25%), compared with less than 12% in China. Despite a larger share of tertiary-educated graduates, India also struggles with high illiteracy, possibly impeding structural transformation by confining many to the low-productivity agricultural sector. In contrast, China's approach created a larger share of primary, secondary, and vocational graduates combined with more tertiary-educated engineers, generating human capital that is more suitable for the manufacturing sector. India's focus on humanities and accounting in tertiary education fueled service sector growth. Overall, our findings illustrate the importance of human capital composition in shaping long-run economic development. JEL Codes: D31, E02, E24, H52, I2, N30

[1]New York University Abu Dhabi; The World Inequality Lab at the Paris School of Economics; nkb2039@nyu.edu

[2]ZEW – Leibniz Centre for European Economic Research; The World Inequality Lab at the Paris School of Economics; li.yang@zew.de

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1. Introduction

The global literacy rate surged from 20% to 80% in the twentieth century, making it truly the "human capital century" (Goldin 2001). When adopting education policy, countries invariably face numerous trade-offs, due to resource limitations. A country may prioritize mass primary education or more limited tertiary education; may choose to emphasize vocational training or general education; may favor producing graduates in engineering or in the humanities; or may seek to rapidly expand access to education at the expense of quality. These choices shape a country's human capital composition, which is increasingly recognized as crucial for long-term economic development (Jones 2014; Joshua 2015; Caselli and Ciccone 2019).[1] We contribute to the literature on human capital development by documenting the composition of human capital in China and India over the past 120 years. To our knowledge, this is the first systematic effort to comprehensively examine the evolution of human capital over the long term.

While China and India both experienced rapid economic development from the 1980s onward, they also show marked divergence along several macro-indicators, including national income per capita, growth by sector, tax base development, and inequality.[2] Explanations offered by scholars concerning the reasons for this divergence have centered on aspects of economic liberalization [3] in tandem with relevant political, social, and cultural factors in each country. However, the role

[1]Two countries can have the same level of human capital development but different compositions. Consider two countries, C1 and C2, each with a population of 100 and varying educational levels: illiterates (no education), primary (5 years), secondary (12 years), vocational (11 years), and tertiary (16 years). In C1, the distribution is 5:50:30:10:5, while in C2, it is 20:35:20:5:20. Their average years of education are similar: 8.0 years for C1 and 7.9 years for C2. Despite this, their education systems and skill compositions differ. C2 has more high-skill graduates and higher illiteracy, while C1 has reduced illiteracy more and has a higher concentration in the middle education levels.

[2]China and India had a comparable national income per capita until 1980, after which China started growing faster, and today, China has more than two times the national income per capita. See Appendix Figure A.I for the evolution. China experienced growth across all three sectors – agriculture, industry, and services, whereas India's growth is led by the service sector (Bosworth and Collins 2008). Piketty and Qian 2009 highlights China's large tax base, helping it garner more public revenue. On the dynamics of income inequality, the top 10% and top 1% shares of the national income were similar in the 1980s, and in 2022-23, the top 10% share in India became 35% larger, and the top 1% share became 50% larger (Bharti et al. 2024).

[3]The economic liberalization in China occurred abruptly in 1978-79. Since India has always had a larger private sector, identifying a structural break is less straightforward and remains controversial. Balakrishnan and Parameswaran 2007, identifies the structural break in Indian GDP, occurring in 1978-79, precisely when China opened its economy. Virmani 2006 makes a case for a breakpoint in 1980-81. Basu 2008 argues for the breakpoint in 1991-93 when major market-oriented economic liberalization reforms were implemented.

played by the composition of human capital has received limited attention to date.

In this paper, we explore two overarching research questions. Firstly, did China and India adopt different strategies in their development of modern education systems over the course of the 20th century, thereby leading to distinct human capital reserves? Secondly, does this differing composition of human capital have a role in the post-1980 economic divergence? The data required to answer such a question are not directly available but must be gathered by synthesizing information from reports and policy documents. In this regard, one set of obstacles is logistical – finding reports, accessing them, and extracting relevant information. A second set of challenges pertains to the establishment of uniform methods, as concepts and terminologies vary over time and between countries. We overcome these challenges by linking information from different sources and harmonizing concepts in order to assemble a novel dataset that covers the entire spectrum of education variables from 1900-2020 for both China and India. This dataset forms the backbone of the paper (see Data Appendix).

We combine survey data, census data, as well as historical education records, which were unearthed from multiple volumes of official education reports and education statistical yearbooks dated back to the 1900s, which are under-explored in the previous literature. Using raw data on enrollment, graduates, teachers, and expenditure along with other macro-series, we construct a wide series of educational flow variables by education level. Some metrics are well-known, like the net/gross enrollment ratio and teacher–pupil ratio, while others, such as the education investment ratio (EIR) and its decomposition, are novel and enable the study of quality-quantity tradeoffs in the absence of learning-based outcome measures.[4] Next, nationally representative labor force surveys from the 1980s are used to construct a measure of the human capital stock based on decadal birth cohorts, thus furnishing a link to the flow variables. Appendix C.1.3 provides

[4]Appendix C.1 provides in detail all the reports used, raw data extracted, estimations when needed, and other steps in harmonizing. Appendix C.2 provides a full list of variables as well as their definitions. Other macro-indicators include: age-wise population distribution (India: Das Gupta 1971, UN Demography Yearbook 1964, 1972, 1984 and Census), exchange rates (World Bank Series for both countries), price indices, and national income series (India: Sivasubramonian 2000).

survey harmonization across countries and years. Furthermore, we link the observed educational outcomes to the educational policies (Appendix C.4 presents country-wise educational policies).

The education systems have become gigantic in both countries, generating millions of skilled graduates yearly, employing millions of teachers, and absorbing billions of dollars. The average flow of enrollments, graduates, teachers, and expenditure increased from the 1910s to 2010s. As a share of gross national income, educational spending has gone from as low as 0.1-0.2% in the early 20th century to 4-5% in the 21st century. Comparing the long-run educational trends in China and India, three striking differences emerge.

First, China followed a policy of *bottom–up* expansion, in sharp contrast to India's *top–down* approach. China initially focused on primary-level mass education (from the early 1900s, prior to communism). The emphasis shifted to secondary-level education (during the 1960s-80s, under communism), and finally to tertiary-level elite education (from the 1980s onward, in the post-communist era). On the other hand, in the Indian top–down approach, a primary focus was placed on secondary-level education until 1950 (during the British Raj era); the emphasis shifted to the tertiary level (in the post-colonial socialist phase), and finally to the primary level after the 1990s (post-liberalization). This progression is reflected in various metrics, including enrollment ratios, teacher-to-population ratios, and spending patterns, to name but a few.[5] Policy debates also mirror these priorities, with China focusing on compulsory education from the early 1900s, whereas India only began serious implementation post-1990.

Second, during the initial expansion of its education system, China prioritized quantity over quality, while India pursued slow and steady expansion with maintaining quality at each education level.[6] At the primary level, until the 1950s,

[5]The primary level received the highest share – 55% of total spending in pre-1950 China – whereas in India, secondary level education received the highest share of spending, at 50%. We find a similar pattern across all metrics – China starting with worse measures, due to its later start in developing modern education in the early 1900s, and in the 1950s, 1970s, and 2000s, the measures become better than India's at primary, secondary, and tertiary levels, respectively.

[6]By quantity, we mean gross enrollment rates. Quality has two sub-components – teacher–pupil ratio and expenditure per teacher normalized based on gross national income per capita. In section 3, we provide a detailed decomposition of the EIR measure into these three components. We do not have quality measures such as school repetition as employed in Frankema

China increased its gross enrollment rate, during which quality deteriorated. It was only after attaining a high enrollment rate (>70%) that it started improving the teacher-pupil ratio by hiring more teachers, and from the 1980s onward, it started improving teachers' salaries (relative to national income per capita). In India, since the beginning of the 20th century, the debate has focused on improving quality by increasing teachers' wages and creating a few "model" institutions of high quality. However, not hiring enough teachers led to a deteriorating teacher–pupil ratio. Post-1990, India shifted its stance, focusing more on increasing quantity (i.e., enrollment rates), which came at the cost of declining quality – an aspect that has been well-noted in the literature (Das and Zajonc 2010; Hill and Chalaux 2011).

Third, the Chinese education system is more diversified, with a strong vocational track and a varied mix of disciplines at the tertiary level. Nearly 25% of Chinese students at the secondary level and above are enrolled in vocational education, compared to about 2% in India. China produces a higher share of engineering, medicine, and teacher training graduates, while India produces a disproportionate share of graduates in social sciences, including accounting. One might think that China and India strategically adjusted their human capital production to avoid direct global competition, with China focusing on goods and India on services. However, this is unlikely. Differences existed even before economic liberalization (pre-1980), with China having 35% engineering graduates in the 1960s, compared to less than 5% in India, where humanities and social sciences dominated (60%). Both countries relied on developing heavy industry-based manufacturing post-1950, but China switched to a Soviet-style higher education system, emphasizing engineering and technical fields, while India retained its British-influenced system, maintaining a strong emphasis on humanities and social sciences (Arnove 1984).[7]

2009 for Latin American countries to show that large tertiary education bias in public education in the early 20th century resulted in poor quality performance.

[7]The overemphasis on social sciences in India is partly due to the persistence of colonial influences, as such courses helped one gain public administration jobs; however, as demand for higher education surged during the 1960s, it was also more cost-effective to accommodate this demand by expanding social science programs.

These different trajectories resulted in divergent human capital stocks in these two countries, the effects of which became particularly pronounced in the 1980s when both countries started opening their economies to the outside world. The share of illiterates and tertiary graduates was higher in India, while the share of primary, secondary, and vocational graduates was higher in China. The most glaring difference was in illiteracy rates. 60% of the adult population (age 20+) in India were illiterates, as compared to 22% in China. Though the differences have declined with each decadal birth cohort, qualitatively, this pattern is still visible (e.g., when one compares the 1990s cohorts from each country in surveys from 2018).

The neglect of compulsory primary education in India left a large population without the education needed to leave the low-productivity agricultural sector.[8] In 1987/88, 62% of the workforce in both India and China was in agriculture. Over the next 30 years, China reduced this to 15%, while India only reduced it to 40%. By 2018, China had 25 percentage points more of its workforce engaged in non-agricultural sectors than India. Additionally, a larger share of India's working-age population remained outside the economic workforce (34% in 1987/88, rising to 40% in 2018, compared to China's 10% and 23%, respectively), especially women, due to cultural norms against women working outside the household (Chen 1995; Field, Jayachandran, and Pande 2010). Last but not least, within each sector, China has a higher average years of education than India, implying a more skilled workforce. All of this contributed to the divergence in economic growth.

An artifact of high illiteracy is the prevalence of high educational inequality (based on Gini coefficients) in India. Decomposing total education Gini, following Morrisson and Murtin 2013, the share of illiterates contributed 81% to the total Gini in 1988 in India as compared to 63% in China. Thirty years later, in 2018, the contribution of illiteracy declined to 65% in India (which is still very high) while representing a meager 4% in China. India's high educational inequality,

[8] Moving from agricultural to the non-agricultural sector usually demands a certain level of education, and is accompanied by spatial relocation from the rural to urban areas, where again, a lack of education acts as a deterrent. The summary Figure I (pg 44) of Rhoda 1983, inspired by empirical studies on migration, shows that the rate of rural out-migration is the lowest at the lowest level of education.

in combination with rate of return to education, translates to higher wage inequality. Decomposing the (log) variance in wages, following Gregorio and Lee 2002, we show that education inequality explains 25% of wage inequality in India compared to 2-12% in China during 1988-2018.

Another goal of this paper is to establish a foundational framework for studying human capital composition. Over the years, studies have expanded the coverage and improved the quality of human capital measures. However, they have remained limited to central measures such as the literacy rate, average years of schooling, and enrollment ratio (Barro and Lee 2015; Lee and Lee 2016).[9] What is more, such measures do not provide some other fundamental differences in the education systems – such as the distribution of disciplines in tertiary education. Our study fills this gap by providing a framework for estimating the composition of human capital (presented in Section 3). This framework encompasses fourteen different measures (see Appendix C.2), thus allowing one to explore the effect associated with divergently composed human capital stocks.

Our consolidated dataset for China and India, which covers the period 1900-2020, offers significant improvements over existing education series along several dimensions. Specifically, it provides broader time coverage, better harmonization, and a higher level of comprehensiveness. Previous studies examining human capital variables in China and India have primarily used sources such as Mitchell 1998, UNESCO surveys from 1958, 1961, and 1966, Gao 2018 (for China) Leeuwen 2007 (for India): the first two for historical and the last two for contemporary time periods.[10] Our dataset enhances the UNESCO series for China, which includes enrollment and teacher data starting from 1930, and Mitchell's series beginning in 1950. It also addresses the complexity of the Indian education system, where primary-stage students often studied in secondary schools and grades XI-XII were part of college education before the 1960s and later classified

[9] See Fuente and Donénech 2000; Baier, Dwyer, and Tamura 2006; Cohen and Soto 2007; Morrisson and Murtin 2009; Barro and Lee 2013. For pre-2000 literature Psacharopoulos and Arriagada 1986; Lau, Jamison, and Louat 1991; Nehru, Swanson, and Dubey 1995.

[10] UNESCO datasets: (UNESCO 1958, UNESCO 1961b,UNESCO 1961a) We provide a detailed comparison with other studies in Appendix C.3. Chaudhary et al. 2012 provides primary school enrollment rates and expenditure level of BRIC, circa 1910.

under school education.[11] Existing series overlook these nuances, as even official statistical reports have not consistently harmonized the data over the years. Moreover, none of the existing series provide graduate shares by discipline in higher education going back to the early 1900s.

We showcase the importance of human capital composition as a factor driving China/India economic divergence post-1980 alongside other economic channels, including physical investment and capital accumulation, trade liberalization, and labor productivity (Herd and Dougherty 2007; Felipe, Laviña, and Fan 2008). With a view to China's specialization in manufacturing versus India's specialization in the service sector, China's higher share of engineering and vocational graduates combined with a higher share of primary and secondary graduates lends itself more readily to a focus on manufacturing. By contrast, India's high share of graduates in tertiary education, predominantly in the social sciences, lent itself to the development of the service sector. The literature that examines the wage gap between China and India, such as Bargain et al. 2009; Jong-Wha and Wie 2017, using Mincer's equation, has focused on the wage effect, i.e., the impact of increasing education by one year. By contrast, we highlight the role played by differences in education inequality as a source of wage inequality.

Lastly, we add to the literature that compares historical human capital development and its persistence, which is crucial for long-term economic growth. Our pre-1950 analysis contrasts British colonial India with the Republic of China, showing that colonialism developed human capital to serve colonial needs, not economic development.[12] Notably, British control over educational institutions in India was extensive, unlike their policies in Africa, making it similar to French colonial policies in Africa (Cogneau and Moradi 2014) or Japanese colonial policies in Korea (Go and Park 2019). From 1950 to 1980, we compare Indian social

[11] We have assigned grades XI and XII, previously known as intermediate education before 1960, to secondary level education based on the recommendations of the Calcutta University (Sadler) Commission in 1922 and formalized by the National Education Policy in 1966

[12] In pre-1950 India, the extractive colonial government and status-based elites (who came predominantly from the upper classes and castes) came together to create modern institutions in such a way as to preserve the hegemony of elite groups. The educational institutions served the colonial government with a western-educated workforce while it paid off local elites through government jobs. In China, modern educational institutions emerged due to the internal revolution, which demolished the traditional institutions responsible for creating elites (through civil services exams).

democracy with Chinese communism, highlighting the persistence of educational policies, in line with other studies, despite political change (Cogneau et al. 2003; Chaudhary and Garg 2015). China continued to promote mass education, while India continued to neglect widespread education. In tertiary education, both countries emphasized technical studies, but India maintained a focus on the social sciences. As a result, colonial human capital institutions in India led to lower economic growth (and higher inequality) after economic liberalization relative to China. This suggests that human capital institutions are a primary determinant of long-run economic development (Lipset 1960; Glaeser et al. 2004).[13]

The paper is structured as follows. In Section 2, we briefly discuss the origin of modern education and our data sources. Section 3 elaborates on the human capital composition framework and describes its operationalization, including all associated measures. Section 4 uses flow measures of educational outcomes to compare Chinese and Indian strategies for expanding education. It also describes the policies that underlie the observed differences. Section 5 connects the flow measures with the stock measures, and then studies the relationship between education and economic development in an attempt to explain the post-1980 divergence. Section 6 concludes.

2. Context and Data

Our study is concerned with China and India, the world's two most populous countries. According to Bolt and Van Zanden 2020, in the 1820s, these two nations accounted for approximately half of the world's (PPP-adjusted) GDP and 57% of the world's population. However, with the industrialization of Europe and the rise of colonialism in the 18th and 19th centuries, China and India lost their economic dominance. Indeed, by the 1950s, China and India each accounted for a

[13] The fundamental causes of long-term growth, in the sense of Acemoglu 2009, has been viewed through several frameworks: political institutions (Acemoglu, Johnson, and Robinson 2001), legal origin (La Porta et al. 2004), factor endowments (Gallup, Sachs, and Mellinger 1999; Sokoloff and Engerman 2000; Engerman and Sokoloff 2002) and human capital (Glaeser et al. 2004). Our paper adds to the debate. Bolt and Bezemer 2009, in Africa, suggests that human capital explains long-term growth trends rather than colonial institutions or legal legacies.

mere 5% of world GDP. Since the late 20th century, rapid industrialization and economic reforms have enabled both China and India to reclaim their economic significance. In 2023, they collectively represented 36% of the global population and ranked as the first and third largest economies in the world. China accounts for 19% of world GDP (PPP), while India accounts for 8% (IMF Economic Outlook).

2.1. **Origin of Modern Education.** The Charter Act of 1813 is often cited as the first notable step towards the development of a modern education system in India. However, the first comprehensive plan for mass education – Wood's Despatch – was issued four decades later, in 1854. This plan, in combination with the 1882 report issued by the Indian Education Commission (IEC), guided Indian educational policy in the Victorian era (i.e., 1858-1900). Education was primarily provided by private actors; the government did not serve as a direct provider of education but rather as a financier (via grants-in-aid), manager (via its Education Department), and supervisor (via inspections and reports).

In China, Western educational practices first took hold as part of missionary activities during the Opium War (1839–1842)[14], however, the reach of missionary activities remained limited prior to 1900. The introduction of modern education in China can be officially dated to the abolishment of the imperial examination system in 1905 (meaning China was some fifty years behind India). Prior to 1905, education was in China was predominantly based on the teachings of Confucianism, and the foremost goal was to prepare for the imperial civil service examination. However, in the face of Western technology and colonialism, this traditional system of education was increasingly exposed as inadequate.

[14]Supported by the Protestant and Catholic Churches, schools with Western-based curricula were established and subsequently grew at all levels of education. For example, St. John's University in Shanghai, one of the oldest and most prestigious universities in China, was established in 1879. Such institutions formed the nucleus for the development of modern education in China.

Despite dramatic differences, the traditional education systems of China and India were strongly geared toward buttressing the hegemony of ruling elites. Furthermore, both systems displayed conspicuous weaknesses in the area of accessibility to basic education. Such education was primarily provided by private bodies at the local level; the ruling classes were mainly concerned with higher education. Also, in both countries, the humanities (e.g., languages, literature) were predominant, while the hard sciences were scarce (Gao 2015; Naik 2000; Cantoni and Yuchtman 2013).

The geopolitical upheavals and megatrends of the 20th century led to dramatic social and economic changes in both China and India. To be sure, education was not only impacted by broader trends but shaped them in a reciprocal fashion. In the following, we outline the structure of the current education system in China and India, respectively.

2.2. **Current Education Structure.** While China's and India's education systems have evolved over the last century, their basic structure has remained the same. Table B.I in the Appendix details the structure of the education system in each country, quantifying the years of schooling at each education level.

We divide education into three broad stages: primary, secondary, and tertiary. In both countries, primary and secondary school education lasts 12 years. In China, there is an even split, with 6 years of primary education and 6 years of secondary education. In India, primary education is for 5 years, and secondary education is for 7 years.[15] The secondary level can be subdivided in both countries into lower and upper secondary education: in China, lower and upper education are evenly split at 3 years each. In India, lower secondary is the first 3 years after primary (also called upper primary); the next 2 years are secondary (ending with a national-level matriculation examination) followed by 2 years of senior secondary (ending with a national-level 12th exam or intermediate examination). We group

[15]The Indian National Policy on Education 1968 tried to create a 10+2+3 years common structure for all of India, including 5 years of primary education, followed by three years of upper primary education and two years of secondary education. In the past, there were differences between provinces – e.g., some had four years of primary education, and some had five years. The current uniform educational structure arose gradually. Post-independence statistical reports systematically provide primary-level enrollment figures for the first five years (grades I-V), excluding pre-primary.

the last 4 years in India together as upper secondary. In both countries, there is an option to go through vocational education after 8/9 years of school education; this vocational education lasts 2-3 years. At the tertiary level, China differentiates between vocational (or junior) colleges, which provide diplomas, and universities, which provide standard academic degrees (Bachelor's, Master's, PhD). The vocational tertiary education generally lasts for three years; by contrast, obtaining the first standard academic degree (Bachelor's) generally requires four years. Obtaining a Master's requires three years, PhD studies also require three years. India also differentiates between vocational degrees and standard academic degrees, but institutionally, this demarcation is not pronounced. Usually, a Bachelor's degree requires three years of study (although for certain courses, it takes longer); a Master's requires two years and a PhD takes a minimum of five years.

2.3. **Data Sources.** We use national-level administrative datasets (and educational surveys) to create long-run series of educational outcomes for the period 1900-2020. Both countries have a rich tradition of producing statistical reports, though, in the last 120 years, major political transitions have impacted the way these reports are produced. The challenge we faced was to build coherent educational series that were not only consistent within a country but also allowed cross-country comparison. In a subsequent step, we harmonized nationally representative employment surveys to explore how the education system impacts the workforce. Please look at Appendix C.1 for details about all the reports and surveys used and the estimation steps when required. All the important concepts related to the human capital framework are explained in Appendix C.2.

2.3.1. *Educational Statistical Reports.* Both China and India have a long tradition of compiling statistics regarding their education systems; for both countries, we have access to statistics on enrollment, graduates, teachers, and expenditure, though not in one report. In the case of China, the main reports are: Compilation of Materials on Modern Chinese Education History, Statistical Digest of the Republic of China 1935-1947, and Education Yearbooks. In the case of India,

the pre-independence period is covered by the quinquennial "Progress of Education in India" reports, while the post-independence period is covered by "Education in India: Annual Reports", DISE datasets (2005-2020), University Grants Commission reports, and the All-India Survey on Higher Education (2010-2020).

Since we are interested in understanding the expansion of the education system by educational level, we examine the above sources for data regarding enrollment, graduates, teachers, and expenditure. While this may sound like a straightforward task, it was complicated by two factors.

First, in India, schools have mixed stages, and Indian reports provide statistics (especially on teachers and expenditures) by school type but not by educational stages. A school that has grades I-X is a secondary type but with primary grades.[16] Due to this, not all the reported teachers in the secondary school type are teaching secondary-level students. Rather, some teach at the primary stage (grade I-V) as well. Hence, directly taking numbers from these reports would create an inaccuracy. Second, grades XI and XII were called intermediate until the late 1960s, and their reporting was done under college (tertiary-level) education. The adoption of the National Education Policy of 1968, which recommended considering grades XI-XII as school-level education, later changed the reporting methods.

Hence, we estimate teachers and expenditures following the steps explained in the Appendix C.1 to create a consistent series of educational levels. For example, the total number of teachers at the primary stage includes teachers of the primary school type as well as the (estimated) number of teachers who teach primary grades in secondary schools. As part of this estimation, we assume that teacher/student ratios in the primary school type are the same as in secondary schools. This is possible since enrollment figures are provided for both school types and education levels.

[16] The school type depends upon the highest grade in the school. So, a school with grade (VI/VII/VIII) is an upper primary school type, a school with grade (IX/X) is a secondary school type, and a school with grade (XI/XII) is senior secondary school type.

2.3.2. *Surveys.* We use standard nationally representative surveys for our education-economic analysis. For China, we use the CHIP (Chinese Household Income Project) survey for the years 1988, 1995, 2002, 2013, and 2018. For India, we used thick rounds of Employment and Unemployment surveys (EUS) for the years 1983, 1987, 1993, 1999, 2004, 2009, 2011, and the Periodic Labour Force Survey for 2018. They provide information on completed education level (degree), years of education, working status, wage earnings, and other demographic characteristics. For our analysis of the human capital stock and education inequality, we restrict the sample to the adult population (aged 20+). We further restrict the sample to ages 20-60 to calculate the working-age population share. For the education-wage inequality analysis, the sample is further restricted by having non-zero wages. The harmonization of variables is detailed in the Appendix C.1.

3. Conceptual Framework: Human Capital Composition

In this paper, the term "human capital" refers to the skills imparted through the education system. The accumulation of human capital in a country is often proxied by the literacy rate or average years of education, particularly in the literature on the relationship between education and economic growth. The average years of education is an improvement over the literacy rate, as it considers human capital accumulation beyond simple literacy. However, it lacks the power to distinguish between fundamental differences in education systems and differences that generate different forms of human capital. For example, skills gained by adding one extra year of education at the primary level will be different from those gained when adding one year at the tertiary level. Similarly, one year of vocational training has different human capital effects than one year of general education. Similarly, hard sciences at the tertiary level, such as in engineering or physics, impart different skills than the humanities. Lastly, the quality of schooling is an essential factor not captured by this metric. Accordingly, there is a clear need for measures that can capture additional nuances.

The important influence exerted by the composition of human capital has gradually become recognized after many decades of debate on how education affects growth. Specifically, recent studies suggest that the composition of human capital plays a critical role for economic growth. Inspired by labor specialization research, Joshua 2015 shows that after considering the composition of human capital and imperfect human capital substitution, human capital variation can account for the large income differences between rich and developing countries. (For detailed discussion see Jones 2014; Caselli and Ciccone 2019). Following the literature, we develop a human capital composition framework with four dimensions.

Mass versus Elite Education: This dichotomy captures the tradeoff between producing human capital with a large population with limited education (primary-level) versus a smaller population with more education (tertiary-level), especially in the initial phase of educational expansion. The endogenous growth model indicates that when holding the composition of human capital constant, an increase in aggregate level is always growth-enhancing. By contrast, when the level is held constant, the growth-enhancing properties of human capital depend both on the composition thereof and the distance to the technological frontier. In particular, higher education investment should have a bigger effect on a country's ability to produce leading-edge innovation. By contrast, the development of primary and secondary education would appear advisable for developing countries further from the technological frontier (Vandenbussche, Aghion, and Meghir 2006). Several empirical studies find a similar relationship. [17]

To operationalize the difference between mass and elite education using a flow perspective, we create a time series consisting of enrollment ratios (total, gross, and net), graduate ratios (gross), teachers (per school-going population), and expenditure allocation share by educational level. Appendix C.2 explains each variable in detail. The stock counterpart is the share of primary, middle, and tertiary graduates at different levels in a given year, as well as average years of education.

[17] In particular, while primary and secondary education appear most important for growth in the poorest and intermediate developing countries, tertiary education is important for growth in developed countries. See Wolff and Gittleman 1993; Gemmell 1996; McMahon 1998; Petrakis and Stamatakis 2002; Sianesi and Reenen 2003; Papageorgiou 2003; Self and Grabowski 2004; Pereira and St. Aubyn 2009; Lee 2012; Cinnirella and Streb 2017

General versus Vocational: This dichotomy is related to the post-primary level of education when educational systems begin diversifying. It captures the tradeoff between skilling for a specific job and an open-ended general skilling. Some countries like Germany and Japan have a large vocational education system, whereas the US and UK produce more general education graduates. Some studies indicate that general education is more growth-enhancing when a country is closer to the technological frontier; conversely, vocational education is asserted to be more growth-enhancing when countries are further from the productivity frontier. However, the empirical findings in this regard are mixed (Krueger and Kumar 2004; Vandenbussche, Aghion, and Meghir 2006; Aghion et al. 2009). [18]

To operationalize the difference between general and vocational education, we build a time series that shows the vocational enrollment share at the secondary and tertiary levels separately. The share is expressed as vocational enrollment divided by total enrollment. Available data on expenditure do not differentiate between general and vocational education. Hence, we restrict our measure to the enrollment ratio.

Disciplines at the Tertiary Level: This measure captures a form of variation within general education and refers to the relative weight of each discipline (engineering, medicine, economics, history, etc.) in terms of enrollment. There is wide consensus among economists that an emphasis on science and engineering in higher education supports economic growth (Woodhall 1992). Murphy, Shleifer, and Vishny 1991 shows that countries with a higher share of engineering graduates grow faster, whereas countries with a higher share of law graduates grow slowly. Meanwhile, other studies indicate that engineers and engineering-minded technicians are key for the invention of new technologies and diffusion of innovation [19]

[18] This thread in the literature implies that in the early phase of the development of a country, a bottom–up model of expansion combined with a strong vocational education system could be more growth-enhancing than the top–down model with limited vocational education development. However, such findings are empirically inconclusive. Another strand of research provides evidence that increasing higher education has a stronger effect on growth than expanding primary and secondary education (see Gyimah-Brempong, Paddison, and Mitiku 2006; Castello-Climent and Mukhopadhyay 2013; Castelló-Climent, Chaudhary, and Mukhopadhyay 2018).

[19] (see Romer 1990; Mokyr 2005; Hanson 2008; Toivanen and Väänänen 2016; Maloney and Caicedo 2017)

To operationalize this measure, we build a time series of enrollment and graduate shares for seven disciplines at the tertiary level. Our discipline categories are: social science, education, science, engineering, medicine, agriculture, and others. Social science is probably the most heterogeneous category, encompassing a range of sub-disciplines, including the arts, law, and business. The rest of the categories are self-explanatory; "others" includes all disciplines that cannot be grouped into the existing categories.

Quantity versus Quality: This dichotomy captures the classic tradeoff that occurs in a production situation subject to resource constraints; here, policymakers can encourage broad access to education at the expense of quality or, alternatively, can seek to emphasize quality while accepting limitations to accessibility. We focus on quantity–quality tradeoffs at each educational stage. A higher teacher/student ratio has been shown to have a positive impact on average learning outcomes,[20] and, with a particularly pronounced effect for minority students and those from lower socio-economic backgrounds. [21] Last but not least, studies of outcomes-based education quality underscore the significance of educational quality for economic development (Hanushek and Woessmann 2008; Hanushek and Woessmann 2020; Angrist et al. 2021).

In recent years, causal evidence highlighting that the traditional input-based measures are not being reflected in learning outcomes has increased the skepticism towards using input-based measures as quality variables.[22] However, this does not imply that spending and resources are irrelevant (Hanushek and Woessmann 2012), particularly when outcome-based measures are unavailable. For instance, when assessing educational quality over an extended historical period (such as

[20] A meta-analysis by Glass and Smith 1979 examines 77 studies dating back to early 1900s to document the positive effect on learning outcomes of a higher teacher/student ratio. The STAR project of the 1980s in US developed empirical evidence for the positive effect exerted by class size on student achievement. At the end of the 1990s, several papers found that reducing class size had a positive impact on achievement scores. Using STAR data, Krueger 1999 found the effect to be .20 SD for kindergarteners, .28 SD for first graders, .22 SD for second graders, and .19 SD for third graders. Similarly, Case and Deaton 1999 finds strong and significant effects of teacher/student ratios on enrollment, educational achievement, and test scores for numeracy in South Africa.

[21] Krueger 1999 finds a larger impact for black students; Angrist and Lavy 1999 finds that reducing class size induces a statistically significant and substantial increase in test scores for 4th and 5th graders.

[22] The 1990 World Conference on Education for All stressed that education quality should be assessed in terms of learning outcomes, and input-driven measures are simply a *means* to an end. The adoption and implementation of the Millennial Development Goals (MDGs) from the 1990s onward by several developing countries resulted in higher enrollment levels and promoted a shift toward outcome-based quality measures (Dundar et al. 2014; Hanushek and Woessmann 2008).

prior to World War II), data on education expenditures and the number of teachers are crucial metrics that one must rely on (Donohue III, Heckman, and Todd 2002). To operationalize the tradeoff between quality and quantity, we modified the school support ratio, which is proposed by Lindert 2003 and constructed an innovative index, the Education Investment Ratio (EIR), which is defined as follows:

$$EIR^{total} = \frac{\text{Education Expenditure}^{total} / \text{School-aged population}^{total}}{\text{GNI per capita}} \tag{1}$$

where GNI is gross national income; education expenditure includes both public and private expenditure; and the school-aged population refers to the population between 6 and 27 years old. Defined in this manner, EIR measures the education investment per school-aged population standardized by GNI per capita.[23] Given EIR is standardized by both economic and demographic factors, it is comparable across countries and years.[24]

EIR's most significant benefit lies in its decomposability, as it can serve as the cornerstone for a framework that compares education systems. First, through additive decomposition, EIR^{total} can be broken down into a weighted sum of EIR at each educational stage:

$$\begin{aligned} EIR^{total} &= \sum EIR^{j} * \text{Population share}^{j} \\ &= \frac{\text{Educ Exp}^{j} / \text{School-aged population}^{j}}{\text{GNI per capita}} * \frac{\text{School-aged population}^{j}}{\text{School-aged population}^{total}} \end{aligned} \tag{2}$$

[23] Lindert 2003 defines primary support ratio as public expenditure for primary school per primary-school-aged population divided by GDP per capita. It uses this measure to assess whether a country seeks to protect powerful groups from taxation or intentionally limits access to education for the masses unschooled population. In our paper, to analyze the quality-quantity tradeoff, we construct EIR^{total} using both public and private education expenditure and further break it down by educational stages.

[24] For instance, if the total education expenditure is equal to 4% of GNI and the children population is equal to 20% of the total population, EIR will be equal to 4%/20% = 20%. Intuitively, this means that each child receives an equivalent of 20% of per capita national income in the education investment, i.e. the equivalent of a 20% part-time teacher paid at per capita national income.

where $j \in P, S, T$ for primary, secondary and tertiary education respectively.

Furthermore, EIR^j can be multiplicatively decomposed into quantity and quality components:

$$\begin{aligned} EIR^j =& Quantity^j * Quality1^j * Quality2^j \\ =& \underbrace{GER^j}_{Quantity^j} * \underbrace{(TPR^j)}_{Quality1^j} * \underbrace{\frac{\text{Expenditure}^j/\text{Teacher}^j}{\text{GNI/Total Population}}}_{Quality2^j} \\ & \underbrace{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}_{Quality^j} \end{aligned} \tag{3}$$

The quantity component, $Quantity^j$, is nothing but the gross enrollment rate at education stage j, capturing the *quantitative* part of education expansion, while $Quality^j$ measures expenditure per student standardized by GNI per capita. $Quality^j$ can be further broken down into $Quality1^j$ which is teacher–pupil ratio (TPR) and $Quality2^j$, measuring expenditure per teacher standardized by GNI per capita. (See Appendix C.2 Equation:B.1 for intermediate steps)

The intuition to split $Quality^j$ into two components arises from two policy options, given specific expenditure per student level. The first option involves employing more teachers at a lower cost, thereby maintaining a more favorable teacher–pupil ratio. The second option is to hire fewer teachers at a higher cost, aiming to attract more skilled and talented individuals to the education sector. $Quality2^j$ proxies teacher's quality, signaling the attractiveness of the education sector relative to the overall economy. It captures teachers' salaries (a major component of total expenditure) and non-salary components (since a part of the expenditure goes into infrastructure, creating better working conditions). Hence, it is a broader measure than teachers' salaries.

To summarize, the human capital composition framework has four dimensions -– mass versus elite (large population with less education versus a small pool of tertiary educated); general versus vocational (relative size of vocationally trained

graduates compared to general graduates); disciplines within the tertiary level (shares of engineers, teachers, doctors, etc.); and quality of training within a specified education level (preferably outcome-based and if unavailable then input-based). They are a product of the long-run educational expansion paths that have been pursued (whether deliberately or not) under conditions of inherently limited public resources. The next section applies this framework to compare the educational expansion trajectories of China and India from 1900 to 2018.

4. The Development of Modern Education Systems: A Tale of Two Countries

The phenomenal expansion of the education systems in both countries during the 20th century represents an exemplary case of the "human capital century". Table 1 presents the averages for enrollment, teachers, expenditure, and tertiary-level graduates by decade. The total enrollment in China went up from an average of 4 M in the 1910s to 220 M in the 2010s. Similarly, it went up from 7 M to 288 M during the same period in India.[25] Both countries' gigantic education systems currently generate millions of high-skilled graduates every year, employ millions of teachers, and absorb billions of dollars.

There has been substantial growth in total (and public) educational spending since the early 1900s (Figure 1), except for one prominent dip in each country. During the 1910s, both countries' total education expenditure was 0.2% of Gross National Income (GNI), increasing to 0.6-0.7% in the 1930s. In the decade of the Great Depression and World War II, 1935-45, India experienced a downturn in education expenditure, resulting in a large gap in favor of China. In the 1960s, China spent 2.4% of GNI, and India 1.8%, on education. The dip in Chinese share came during the Cultural Revolution, shifting the advantage to India. In the 2010s, education expenditure totaled 5.8% of GNI in India and 4.3% in China.

[25] The average flow of graduates, teachers, and expenditure in the education system has increased by 417 times, 41 times, and 734 times, respectively, in China from the 1910s to 2010s. During the same period, it increased in India by 300 times, 35 times, and 194 times.

The public spending in education as a share of GNI (bottom part of the figure) shows a similar pattern, reaching 4.8% in India and 3.8% in China in the decade 2010s.

There are significant underlying differences in development trajectories underlying this big picture of overall expansion. We shed light on divergence in educational development strategies by analyzing long-term educational statistics and associated educational policies.

4.1. **Bottom–Up vs. Top–Down.** Chinese tended to expand its education system according to a bottom–up model, while India's expansion was more top–down.

4.1.1. *Total, Gross and Net Enrollment by Education Level.* The top part of Figure 2 illustrates the progression of total enrollment within the primary stage. Benefiting from its head-start of modern education, India had 4.1 M enrolled students at the start of the century (in 1906), [26]compared to 0.48 M in China. However, India rapidly ceded its initial advantage due to China's expansion of primary-level enrollment. By the 1930s, China achieved parity with India for the first time in terms of overall enrollment (11 M). By the time both countries gained independence from colonial subjugation, China had established a substantial primary-level enrollment lead of 10 M in 1950 (which rose to 59 M in 1960).[27] China had a clear-cut lead in primary education from the 1950s with higher NER (lower section of Figure 2; and higher GER Appendix Figure A.II).

China maintained its lead in the second half of the 20th century despite domestic political and social turmoil. In the 1970s, the NER in China exceeded 90%, with this milestone occurring prior to China's economic liberalization.[28] In 1975, China achieved its highest enrollment figures at the primary stage, boasting 151 M, in

[26]Pre-1900; India had 0.6 M in 1871, 2.1 M in 1881, 2.8 M in 1887, 3.1 M in 1892, 3.4 M in 1897 and 3.6 M in 1902

[27]The net effect of the partition of India in 1947 was a reduction of 3 M in enrollment in 1947. The independence of India came with India's ceding of Pakistan and Bangladesh. Also, several princely states that were not part of British India became part of the new India.

[28]During the same period, the gross enrollment rate in China exceeded 100%, for the evolution of the gross enrollment rate of China and India; see Appendix Figure A.II

stark contrast to India's 66 M (less than half of China's). Notably, even the tumultuous cultural revolution period from 1966 to 1976 in China failed to impede the expansion of primary education. India registered significant growth, too, but at a slower pace than China. It took over three decades for India to reach its peak enrollment (in 2011), with 140 M students enrolled and the NER just reaching the 90% mark. In both countries, population control measures have put a brake on total primary-level enrollment (in 2020: India 122 M; China 100 M). [29] China also embarked on numerous large-scale adult literacy campaigns in addition to expanding primary education. These initiatives included the establishment of adult primary schools, which experienced a massive surge that reached its zenith during the Cultural Revolution. By 1976, enrollment in adult primary schools soared to 160 million in China, a stark contrast to the roughly 1 million in India. Prior to the 1990s, adult education was basically neglected in India (see Appendix Figure A.III).

The top part of Figure 3 shows GER in secondary education. The trend mirrors that observed at the primary level – India commences with a higher enrollment level, but China narrows the gap and eventually takes the lead. However, India's lead in this case endures to 1970s. The Chinese catch-up in secondary education thus takes two decades longer. The years of the Cultural Revolution were associated with a notable rise in GER at the secondary level. However, following the implementation of new educational policies in 1976, enrollment at the secondary level experienced a substantial decline. In 2020, GER in China reached 95%, in contrast to India's GER of 67%.

The bottom part of Figure 3 shows the evolution of GER at the undergraduate level (Bachelor's and short-cycle tertiary vocational education). By 1970, India's GER at the undergraduate level had reached 8.6%, a remarkable increase of over 15 times compared to its GER of 0.55% in 1947. By contrast, China's progress in tertiary education was impeded by the Cultural Revolution, which set the country back by almost a decade. By 1980, China's GER at the undergraduate level had only managed to recover to the level it had previously reached

[29] China adopted the one-child policy in the 1980s, and India achieved replacement level fertility in 2011 based on census data (See Appendix Figure A.IV for fertility rate trends).

in 1963 (namely, 1.7%). India's GER during the same period was five times higher. China's catching-up phase occurred in the late 1990s, three decades after its secondary-stage catching-up and five decades after its primary-stage catching-up. China then overtook India at the turn of the century with a massive expansion in tertiary/higher-level enrollment. Within a span of less than ten years, Chinese GER at the undergraduate level grew four-fold, surging from 9% in 1998 to 40% in 2006. This figure rose further to 72% by 2020. A comparable expansion in tertiary education in India took place in the late 2000s. India's GER at the undergraduate level surged from 24% in 2009 to 45% in 2020. Nevertheless, China had a substantial advantage in 2020, with 27pp.

To reinforce our point, it's worth noting that China has not succeeded in surpassing Indian development in Master's education, despite significant growth in Master's education concurrent with the expansion of undergraduate programs in the early 2000s (depicted in the upper part of Figure 4). Due to the top-heavy structure of the education system in India, even in the 1950s, GER in master's education was more than 0.2%, and close to 8-10% of all awarded degrees were Masters. In 2020, approximately 9% of the relevant age cohort in India were pursuing a Master's education, while the corresponding figure in China stood at a mere 4%.

Interestingly, the GER gap between China and India in doctoral education did not persist beyond 2000. With the Chinese economy gaining momentum after 2000, an increased demand for specialized experts emerged, particularly in fields such as engineering and science. This surge in demand coincided with a significant increase in doctoral student enrollment in China during the first decade of the century. Since 2005, there has also been a notable expansion in doctoral education in India. However, this expansion has not been sufficient to offset the advantage India lost during China's period of growth. In 1994, the average GER for doctoral education in India exceeded that of China by over twofold (0.11% vs. 0.05%). However, this relationship had reversed by 2020, as China's GER for doctoral education became twice as high as India's (0.65% vs. 0.31%). (See the lower part

of Figure 4). The Data Appendix Sheets A2a and A2b provide annual GER by education stages in China and India, spanning from 1900 to 2020.

It is also important to note the reduction in the gender gap at the primary level in China, which potentially explains the observed bottom–up pattern, became relevant only after 1950. Before then, India had a slightly higher share of females in primary education enrollment (See Appendix Figure A.V). [30]

4.1.2. *Graduation Rate.* The trends in Gross Graduation Ratio (GGR), calculated by dividing the number of graduates by the population of the relevant age cohort by educational level, mirrors that of enrollment. The sequence of China's catching-up in the 1950s in primary, 1970s in secondary, and 2000s in higher education indicate a **bottom–up** mode of education system expansion in China, in contrast to the **top–down** approach observed in India (see Data Appendix, sheets A3a and A3b).

4.1.3. *Teachers.* Fueled by a widespread surge in enrollment across all education tiers, the 20th century also bore witness to a substantial rise in the number of teachers, evident in both nations. Figures 5 and 6 illustrate the progression of teachers (per school-aged population) at the primary, secondary, and tertiary stages.[31] Notably, the trends observed in primary and secondary education echo the patterns identified through enrollment and graduation data: Initially, India held an advantage, yet China surpassed India in primary education during the 1950s and in secondary education during the 1970s. Regarding tertiary education, we do see a transition in the 2000s, with China surpassing India. However, prior to 2000, the teacher population was not significantly higher in India but was comparable to that of China. This is explained by China's quality-centric approach in tertiary education, which emphasizes having a larger number of teachers (see the

[30] Regarding secondary education, China consistently had a higher female enrollment share than India from the 1920s onward. For detailed data on female enrollment by education stages, please refer to the Data Appendix, sheets A5a and A5b.

[31] The ratio of teachers to the school-aged population is calculated by dividing the total number of teachers in a specific level of education by the eligible official school-age population corresponding to the same level of education in a given school year.

section 4.3 on Quantity vs. Quality for more on this tradeoff).

4.1.4. *Expenditure Allocation by Education Level.* The differences in educational spending also reflect contrasting priorities in education development between China and India. Table 2 shows the distribution of total (public+private) education spending across different stages for both countries from the 1910s to 2010s.

In China during the first half of the 20th century, primary education received the highest expenditure share, transitioning towards secondary education until the 1970s, after which the expenditure share for tertiary education began to rise. Conversely, in India, secondary education's expenditure share has consistently surpassed primary and tertiary education since the 1910s. Expenditure for tertiary education has risen since the 1950s at the expense of primary and secondary education up until the 1990s. From early 2000, we see an increased shift towards the primary stage in India.

Before 1950, China allocated 55% of its total education spending to primary education, while India allocated only 42%, favoring secondary education with a 50% share compared to China's 29%. This reflects China's early focus on primary education and India's emphasis on secondary-stage education. Examining total educational expenditure as a share of GNI reveals a similar pattern, with even more pronounced differences, particularly in primary education. The upper part of 7 illustrates a substantial increase in primary education spending (as % of GNI) in both countries over the past 120 years, with China consistently outspending India from the 1910s onward for more than half a century, despite the earlier introduction of modern education in India by fifty years. By the onset of the Cultural Revolution, China's primary education expenditure reached 1.3% of GNI, nearly double India's 0.7%. In contrast, India's expenditure on secondary education was higher than China's until the 1930s, when the Great Depression and World War led to a reduction in funding, causing it to fall below China's levels for about a decade since the early 1940s. By the late 1950s, however, India's secondary education expenditure had caught up once again (See upper part of Figure 8).

From the 1950s to the 1970s, China decreased primary allocations to boost secondary funding, while India shifted more resources toward tertiary education, increasing its share from 10% to 24%. This shift came at the expense of the shares allocated to both primary and secondary education. The Indian government spending (as % of GNI) increased by 7 times at the tertiary level as compared to 2-3 times at the primary and secondary stages, highlighting the increased prominence towards tertiary education in this period. The gap in primary education spending between China and India before 1970 is primarily driven by differences in public education funding. The lower part of Figure 8 illustrates public spending on primary education (as % of GNI), showing trends similar to total education spending. This alignment is largely because primary education has been predominantly government-funded. For a detailed breakdown of educational spending by public and private in each education level, please see Table 3 and Appendix table B.III.

Since 1980, China has increased spending on tertiary education, reducing allocations to primary education, while India's spending distribution across education stages has remained relatively steady. However, in the post-liberalization period, both countries saw a reversal in rising share in public spending trends, with private expenditure playing a larger role. India's steady distribution masks two key shifts - rising public and private spending in primary education since the early 2000s, with India consistently outspending China in this area—1.9% of GNI in 2016 versus China's 1.5%. This difference is influenced by demographic factors, like China's one-child policy and India's strategic shift from tertiary to primary education. Second, there has been a sharp increase in private spending on tertiary education in both countries, dropping the public share by 20 percentage points since the 2000s. China also experienced rising privatization in tertiary education in the 2000s, but tighter regulations on private schools in the 2010s have led to an increase in the public share there.[32] For a detailed education expenditure series, see the Data Appendix (Sheets B)

[32]The increasing privatization since the 1990s, in the privatization of resources, resulted in the usage of public school's resources for private gains. This led to an amendment to the existing law ("Law for Promoting Private Education 2002") in 2016, which forbids for-profit private schools from entering into compulsory education (Schulte 2017).

To summarize, India emphasized secondary education until post-independence, followed by a shift towards higher education, and post-2000 towards primary education, indicative of a top-down education expansion model. Contrastingly, in China, the allocation initially centered on primary education in the early 20th century, then gradually shifted to secondary education until the 1970s, ultimately transitioning to tertiary education. This pattern aligns with a bottom-up strategy.

4.2. **Diversification of Education.** This section deals broadly with two aspects of diversification – the development of vocational education and the expansion of different disciplines in tertiary education.

4.2.1. *Vocational Education.* Vocational education and training play a crucial role in UNESCO's global Education for All initiative, which aims to cater to the learning needs of all children, youth, and adults. UNESCO defines vocational education as the type of education or training that endeavors to equip individuals with the knowledge, skills, know-how, and competencies required for specific occupations or, more broadly, for success in the labour market. Notably, the evolution of vocational education in China and India has followed distinct trajectories.

In the context of pre-1950 China, the development of vocational education was intricately linked to the broader objectives of industrializing the country and strengthening its military capabilities. During the late 19th century, under the Qing Dynasty, specialized colleges were established to meet the country's military needs. This system formed the backbone of tertiary-level vocational education in the early 20th century. At the secondary level, during the Republic of China era, educational policies were put in place to guide the development of vocational education. This included directives to establish vocational schools in specific shares relative to non-vocational education. Notably, the issuance of the Vocational Education Law in 1932 marked the official establishment of an independent vocational education system at the tertiary level in China.

In India, by contrast, industrialization was not a primary focus prior to independence. Under colonial rule, India was primarily regarded as a supplier of

raw materials for British manufacturing industries and as a consumer of finished products (Wood's Despatch 1854).[33] Moreover, education was largely limited to the affluent segments of the population, predominantly the upper caste and class, who aspired to secure government positions. Consequently, there was limited demand for the development of vocational training. As a result, government "model" schools did not include vocational courses at the secondary level, providing no precedent for privately managed institutions to emulate (Naik 2000, Singh 2001).

This disparity helps explain the substantial difference in the enrollment share of vocational education in secondary education between China and India (as illustrated in Figure 9). Interestingly, in the area of tertiary education, the vocational-education enrollment share in India was significantly higher than that of China in the 1940s. The primary impetus for establishing vocational education in pre-independence India was to divert the influx of students away from university education, a concern that became evident in the 1920s, as reports highlighted the issue of unemployed graduates (Hartog Committee 1929).

The 1950s witnessed a notable increase in the growth of vocational education in China at both the secondary and tertiary levels. However, during the subsequent decade, the Cultural Revolution brought an almost complete stop to vocational education in China, while in India, vocational education remained unpopular, resulting in a declining share.

Since the 1980s, with the opening of the economy, there has been a significant resurgence in China's vocational education, particularly at the tertiary level. In the 1980s, the proportion of students enrolled in vocational education surged, reaching 54% at the tertiary level and 6% at the secondary level. Over the subsequent three decades, there was a gradual decline in the share of vocational education at the tertiary level, coupled with an increase at the secondary level. In the 2010s, approximately half of the students in tertiary education (49%) and 16% in secondary education were engaged in vocational education programs in China.

[33] "...secure to us a larger and more certain supply of many articles necessary for our manufactures and extensively consumed by all classes of our population, as well as an almost inexhaustible demand for the produce of British labor."

By contrast, in India, the corresponding figures were 10% for tertiary education and a mere 1% for secondary education (see Figure 9).

Comparing the vocational education and training system in China and India post-1990, Mehrotra, Gandhi, and Kamladevi 2015 highlights that China's success is founded on various factors, including the decentralized management of vocational education;[34] the presence of state-owned enterprises, which ensure industry participation in the VET system; the mandatory participation of the private sector, in line with the Vocational Education Law in 1996; a better teachers' training and recruitment system;[35] and financial assistance to students, including free tuition from 2009 onward for vocational education at the secondary level. Many of these features have been incorporated into the new policy measures adopted in India.

4.2.2. *Tertiary Level Disciplines: Engineering vs. Humanities.* In this sub-section, we analyze diversification within standard (non-vocational) degree programs (leading to Bachelor's, Master's, or PhD) by discipline.

Figure 10 provides the share of Bachelor graduates from these disciplines in both countries. There is a stark difference in the type of graduates both countries produce. First, the distribution of graduates across various disciplines in China has undergone significant and dramatic changes over time. Initially, the share of graduates in the field of social sciences experienced a sharp decline from the 1920s to the 1960s (during the Chinese Republic and Communism period), plummeting from over 60% to less than 10%. This decline coincided with the expansion of education in fields such as engineering and medicine. However, starting in the 1980s, a remarkable resurgence in the field of social sciences occurred. This resurgence was driven by economic reforms and a high demand for human capital in law and economics, leading to a substantial expansion in these fields. By

[34] In China, vocational curricula are decided by national and local government in cooperation with industry, while in India, curricula are centrally determined. (Mehrotra 2014)

[35] There are strict guidelines in China that require teachers at vocational secondary schools to be at least vocational graduates, and those only with post-graduate vocational degrees and the respective occupational certificate can teach vocational undergraduate classes. In India, under the Industrial Training Institute (ITI) system, most instructors are only ITI graduates (which is 11-12 years of education.

the 2010s, the share of graduates from social sciences had increased to 39%. In contrast, the share of graduates in engineering had been on the decline since the 1990s, decreasing from 36% to 26%.

Conversely, the distribution of graduates across various disciplines in India has remained stable. Until the 2000s, the social sciences and science collectively constituted over 80% of Bachelor's graduates, with social science taking the majority share. It was not until the 2010s that a notable expansion in the field of engineering occurred, increasing from 7% to 15%. However, when compared to China, the Indian percentages remain considerably smaller. Furthermore, the phenomenon of "brain drain" among top-tier engineers since the 1980s, coupled with the remarkable growth of the engineering discipline in India over the past 10-15 years, has contributed to the perception that India is a *land of engineers*. However, comparing engineering graduate shares over the last century, it becomes evident that China has placed a stronger emphasis on engineering education.

Interestingly, the commitment to educating engineers in China predates the Communist era. In the 1930s, a series of education reforms aimed at "meeting the needs of economic development" were implemented in Chinese higher education.[36] These reforms had two major focal points: strengthening central planning in higher education and promoting education in science, engineering, and medicine (Kirby 2017). Consequently, by the 1940s, the proportion of Bachelor's graduates in engineering had already reached 20%, whereas the corresponding figure in India was a mere 3%. This contrast becomes even more pronounced when we examine the gross graduation rate (GGR) at the discipline level (see Figure 11). Since the 1930s, the GGR of Chinese Bachelor's degree programs in engineering has consistently exceeded that of India (except in the 1970s, when China was affected by the Cultural Revolution). This stands in sharp contrast to the fact that India generally maintained a higher GGR for Bachelor's degrees overall. Finally, the evolution of higher education in China has also prominently included the robust expansion of the fields of education and medicine since the

[36]The reform was initiated based on policy recommendations from a diverse array of sources, including international scholars such as the Becker Commission, as well as Chinese intellectuals like Zhu Jianghua, the former Minister of Education of the Republic of China. For details, see Kirby 2017

1950s. In the first half of the century, China and India has comparable shares of Bachelor's graduates in education and medicine. However, China placed significant emphasis on these two disciplines during the Communist era, from the 1950s to the 1970s. In contrast to the 1940s, there was a remarkable transformation in China during the 1950s, as the share of Bachelor's graduates in education nearly tripled from 9% to 26%, while the share in medicine increased from 6% to 10%. Conversely, in India during the 1950s, the share of education graduates increased by only one-third, and the share of medical graduates decreased from 5% to 2%.

Despite the substantial disparity in graduate shares in education and medicine between China and India since the 1950s, the GGR for Bachelor's degrees in the fields of education and medicine in China did not surpass that of India in the 2000s. It was only with China's expansion of higher education that this shift occurred. In the 2010s, the GGR for education in China exceeded that of India by 50%, while China's GGR for medicine was a remarkable 250% higher than India's. Please refer to the Data Appendix (Sheet D3) for details.

A similar comparative analysis for Master's and PhD graduates yields findings comparable to that for Bachelor's graduates. However, in the case of Master's graduates, there has been a notable decline in the share of education graduates since the 1940s, whereas the growth in engineering is more pronounced. For further details, please refer to Appendix Figures A.VII, A.VIII and A.IX, as well as sheets D4 to D7 in the Data Appendix. In summary, the Indian education system has exhibited two prominent features: a lack of emphasis on "vocationalization" and an imbalanced emphasis on the social sciences within the non-vocational category. The overemphasis on social sciences courses can be attributed to the persistence of colonial influences in combination with pressures to expand higher education during the 1960s in a cost-effective manner. India's expansion of programs in business is similarly attributable to their cost-effectiveness. By contrast, the expansion of engineering and other professional disciplines only began in earnest after 2000, primarily driven by private sector involvement. Conversely,

China has demonstrated a greater diversification in vocational education and expanded professional course disciplines within higher education.

4.3. **"Prioritizing Quantity" vs. "Prioritizing Quality".** For our third dimension of analysis, we investigate the tradeoff between quantity and quality as part of educational expansion in India and China.

4.3.1. *Evolution of EIR in China and India.* As presented in Figure 12, both China and India have substantially increased educational investment since the early 20th century. Yet despite markedly different approaches to expanding education, EIR^{total} China and India demonstrate little divergence in terms of aggregate spending and associated growth over time. The correspondence is particularly pronounced prior to the 1940s and after the 1990s. From the 1950s to the 1980s, EIR^{total} in China underwent significant fluctuations due to the Great Leap Forward and Cultural Revolution, while India experienced a steady and gradual increase in EIR. Overall, from the 1930s to the 2010s, the EIR of both China and India experienced a growth of more than 700%, reaching approximately 14% to 15%. This means that in the 2010s, the average expenditure per school-aged individual was equivalent to 14% to 15% of per capita national income.

Further details regarding educational investment by education stage are revealed through the additive decomposition of EIR^{total}, based on equation 2. In summary, EIR in primary, secondary, and tertiary education follows a similar pattern to that of EIR^{total} (refer to Figure 13, Appendix Figures A.X and A.XIII). In the 2010s, the expenditure per school-aged individual in primary education reached 21% of per capita GNI in China and 17% in India. In contrast, eight decades ago, these figures were only 3% and 2%, respectively. Similarly, during the same period, the EIR for secondary education surged from 3% to 24% in China and 17% in India, while the EIR for tertiary education in both countries increased from less than 1% to 9%. For the annual series, please see Data Appendix Sheet C1.

As education investment expanded, both China and India transformed their education systems, shifting over the past century from a focus on quality-oriented

elite education to quantity-oriented popular education. By the 2010s, almost all school-aged children in both China and India were enrolled in primary education, two-thirds in secondary education, and approximately 40% in undergraduate tertiary education. The multiplicative decomposition of EIR at each education stage, following equation 3, sheds light on how these countries negotiated quality–quantity tradeoffs over the last 90 years.

The data indicate that China's strategy was first to prioritize quantity and, after a certain level of expansion, to improve quality by targeting the Teacher–Pupil Ratio (TPR). For a long period, the development strategy in India was to prioritize quality (a remnant of colonial policy) by investing in high quality teachers. The multiplicative decomposition of EIR enables us to examine quality and quantity trends simultaneously while also shedding light on associated trade-offs as education expands.

4.3.2. *Primary Stage: Evolution of Quantity and Quality Measures.* The upper part of Figure 14 illustrates the evolution of $Quantity^P$ (GER) and $Quality^P$ (expenditure per student in terms of per capita GNI) components from the 1910s to 2010s.

The rapid $Quantity^P$ surge in China from 24% in the 1930s to over 100% in the 1970s came with declining $Quality^P$ from 14% to 5%. After the 1970s, China witnessed a noteworthy improvement in $Quality^P$, reaching 19% in the 2010s. We characterize the Chinese strategy as a "quantity first and quality later" approach. By contrast, India adopted a more balanced "quantity with quality" approach. From the 1930s to the 1990s, India's GER increased, although at a much slower pace than China's, while $Quality^P$ remained stable at 8%. In the 2000s, India surpassed 100% GER for the first time, nearly 40 years after China. Subsequently, India experienced a significant improvement in quality, which reached 16%. The differing strategies pursued by China and India are partially reflective of their approaches to eradicating illiteracy.

The lower part of Figure 14 illustrates the evolution of $Quality1^P$ and $Quality2^P$ – a decomposition of $Quality^P$. From the 1930s to the 1990s, the flat trend of

$Quality^P$ in India decomposes into a continuous declining trend in TPR – from 1/28 to 1/45 – and a simultaneous increasing trend in the $Quality2^P$ from 222% to 352%. This suggests that, while targeting quality, India prioritized enhancing the quality of teachers, which came at the expense of increasing class sizes. Since the 2000s, when GER in primary education in India reached 100%, TPR started improving, reaching 1/32 in the 2010s, accompanied by a significant increase in $Quality2^P$ to 540%.

In contrast to India, China adopted an almost opposite strategy. From the 1930s to the 1950s, the sharp decrease in $Quality^P$ is attributable to a significant decrease of both $Quality1^P$ and $Quality2^P$, converging to the levels observed in India. Starting from the 1950s, however, there is a trend reversal in $Quality1^P$; TPR improves from 1/35 in the 1950s to 1/24 in the 1980s and further to 1/19 in the 2010s. $Quality2^P$ kept declining until the 1980s to reach 115%. This suggests that, while targeting quality, China prioritized keeping class sizes small [37]. Post-1980, the declining trend of $Quality2^P$ reversed, and by the 2010s, it reached 348% (the same as in the 1930s China, though lower than India).

This underscores the marked contrast in strategies pursued by China and India following attainment of political independence. China recruited more teachers at lower salaries, while India hired high-quality teachers at higher pay rates. Figure 15 plots the rank percentile of teachers in the overall wage distribution from surveys. In the 1990s, the average wage of primary teachers in China was at the 32nd percentile. On the other hand, the average wages of Indian primary teachers stood at 69th (1983) and 63rd (1993) percentiles. This argument is further supported by average years of education held by primary school teachers in China and India from the 1930s onward, as depicted in Figure 16. Corresponding with our observations, the quality of teachers in India, as measured by the average years of schooling, has consistently increased over time. In contrast, the quality of teachers in China declined before the 1960s, followed by an improvement after

[37] There has been a massive expansion of primary school teachers in China. In the 1930s, China had 80% as many teachers in relation to the primary school-aged population as India, but by the 2010s, the ratio between China and India increased to 190%. (Appendix Table B.II)

the 1980s.[38]

4.3.3. *Secondary Stage: Evolution of Quantity and Quality Measures.* Similar to primary education, China began with a significantly lower $Quantity^M$ (GER) but much higher $Quality^M$ than India in the 1930s (see the upper part of Appendix Figure A.XI). Over the subsequent decades, both countries experienced a notable increase in GER, accompanied by a sharp decline in quality — though this trade-off effect was more pronounced in China. To be more precise, in the 1930s, $Quality^M$ in China was three times higher than it was in India, while China's GER was only about a quarter of India's. However, by the 1970s, China's GER had surged to 129% of India's, but expenditure per student (as a share of per capita GNI) had diminished to 76% of India's. Post-liberalization, there was a reversal in the declining $Quality^M$ in both countries, which has now stabilized at 26% in both countries.

The lower part of the Appendix Figure A.XI shows the evolution of the two subcomponents of the quality measure. From the 1930s to the 1950s, both TPR and expenditure per teacher as a share of per capita GNI exhibited a diminishing trajectory in both nations. The 1950s marked a divergence in TPR between China and India, mirroring trends observed in primary education. From the 1950s to the 2010s, India witnessed a gradual decline in TPR, diminishing from 4.3% to 3.1%, while expenditure per teacher jumped from 532% to 865% of per capita GNI. In stark contrast, China's trajectory during the same period took a divergent course, with TPR increasing from 4.3% to 6.7%, while expenditure per teacher dropping significantly from 1750% to 230% of per capita GNI in the 1980s. Subsequently, there is a moderate increase in $Quality2^M$, reaching about 400% of per capita GNI by the 2010s in China. Nevertheless, this figure remains markedly lower than that of India.

Once again, the rank percentile of secondary school teacher wages supports our argument. In 1995, the average wage of secondary teachers in China was at the

[38] refer to Appendix Table B.IV for the distribution of primary teachers' educational attainment by education category – tertiary, upper secondary, lower secondary and below lower secondary. We use average years spent to complete educational categories to estimate years of education.

47th percentile. On the other hand, the average wages of Indian secondary teachers stood at 80th (1983) and 83rd (1993) percentiles (see Figure 15). Appendix Figure A.XII illustrates the trend in average years of education for secondary education teachers in China and India since the 1930s, which is consistent with the evolution of expenditure per teacher (as a share of per capita GNI): teacher quality in India has been improving since 1930s, while it declined in China until the 1980s, followed by a subsequent recovery. [39]

The contrasting trends of TPR and expenditure per teacher (as a share of per capita GNI) in China and India, even at the secondary stage, reconfirm the divergent strategic priorities: China prioritized the enhancement of TPR by recruiting more teachers at comparatively lower salaries. By contrast, India's strategy seems to have focused on improving the quality of teachers through higher wages while neglecting class size.

4.3.4. *Tertiary Stage: Evolution of Quantity and Quality Measures.* Between the 1930s and 2010s, tertiary education was transformed in both nations, as the focus on elite education was supplanted by an emphasis on widespread accessibility. This transition was marked by the expansion of access (GER in both countries reached about 20% in 2010s) at the cost of diminishing educational quality, albeit with slightly different patterns in each country.

Similar to secondary and primary education, in the 1930s, China began with lower GER (0.06% vs. 0.1%) and higher expenditure per student (as a share of per capita GNI) as illustrated in the upper part of Appendix Figure A.XIV. Over the subsequent eight decades, expenditure per student in China gradually decreased from 1559% to 46% of per capita GNI. Meanwhile, in India, following an initial decrease in $Quality^H$ from the 1930s to the 1950s, expenditure per student stabilized at around 100% of per capita GNI during the first half-century of India's independence and declined to 51% in the 2010s.

[39] See Appendix Table B.V for the distribution of secondary teachers' educational attainment by education categories. We use average years of education for different categories to estimate years of education.

The subcomponents of $Quality^H$ indicate that both components were more favorable in China – a higher TPR ($Quality1^H$) and higher expenditure per teacher as a share of per capita GNI ($Quality2^H$) in the 1930s. After the disruptions of the Cultural Revolution, there was a significant decline in $Quality2^H$. By the 1980s, this measure in China was roughly two-thirds that of India's, but stabilized thereafter. Concurrently, TPR in China stood at 1/9, double that of India's, facilitating a swift expansion of higher education enrollment in 2000s. In contrast to the situation in primary and secondary education, TPR in tertiary education in China gradually converged to the levels prevalent in India after the 1980s. Interestingly, despite the initial disparities in the 1930s, by the 2010s, GER, TPR, as well as expenditure per teacher (in terms of per capita GNI) in tertiary education in both China and India have converged to similar levels (see the lower part of Appendix Figure A.XIV)

4.3.5. *Growth Rates in EIR and its Subcomponents.* Tables 4 and 5 present annual growth rates for EIR and its components across different education levels during various periods. They reiterate the earlier conclusions: Both countries have witnessed substantial growth in GER at all levels since the 1930s. The expansion of GER, to some extent, comes at the cost of diminishing quality, as reflected in the expenditure per student (relative to per capita GNI) for both nations. However, this trade-off effect is more pronounced in China, particularly during the Communist era from the 1950s to the 1980s.

In the 1930s, China and India embraced education models with a heightened focus on quality and elite education. This was evident in the significantly high expenditure per student (relative to per capita GNI) and remarkably lower GER, with China demonstrating a more pronounced emphasis on quality. By the 1980s, primary and secondary education in China had become more popular compared to India, marked by lower expenditure per student (in terms of per capita GNI) and higher GER. This transition not only signified progress in modernization but also reflected a shift in ideology, particularly during the Communist period, as a key objective was to eliminate educational disparities. Regarding tertiary education, the transition to broad access has persisted in both countries, but it

took an additional two decades for China to align with India regarding the quality and quantity of tertiary education.

The decline in educational quality in China is primarily attributed to a reduction in the cost of teachers rather than a decrease in TPR. In fact, TPR for primary and secondary education consistently rose throughout the entire Communist period up to the 2010s. This rise in TPR is attributable to the large increase in the number of teachers, as discussed in previous sections. On the contrary, TPR in India has consistently decreased since the 1930s across nearly all education levels, with the exception of primary education during the post-1980 period. Starting from the 1980s, expenditure per student (relative to per capita GNI) in both countries converges at all education levels. However, a significant distinction becomes apparent: China showcases higher TPR but lower teacher quality, whereas India demonstrates lower TPR but higher teacher quality.

4.4. **Education Policies Guiding Education Development.** In this subsection, we examine the major educational policies that were responsible for developments in both countries, in order to add context to the findings presented in the foregoing. For ease of understanding, the discussion is subdivided into three periods: 1900-50, 1950-80, and 1980-present.

1900-50: Both China and India experienced significant upheaval on their respective paths to independent statehood. [40] The political transition in China from the Qing Dynasty to the People's Republic of China was associated with a shift from elitism to egalitarianism in educational policy, whereas in India, educational policy was primarily determined by the prerogatives of colonial hegemony.

China's strategy for developing its educational system focused on providing basic education to all; to this end, China enacted and expanded universal compulsory

[40] In China, the catastrophic socioeconomic conditions created by warlordism (1915–28), the Japanese invasion (1937–45), and the Chinese Civil War (1927–49) fueled the growth of the Communist party, which eventually gained power in 1949. In India, the struggle for independence went through several stages, from the non-cooperation movement of the 1920s and the civil disobedience movement in the 1930s to the Quit India Movement of the 1940s, which culminated in independence in 1947.

primary education.[41] In 1947, six-year compulsory education was written into the Constitution for the first time. During this period, the government's overriding priority was to increase the enrollment rate, mainly at the primary level. The quality of education was of secondary concern.

By contrast, India's educational system was not designed to serve nation-building prior to independence in 1947. Accordingly, the colonial government was generally uninterested in expanding primary-level education; the growth of primary education generally lagged behind secondary education over most of the period (Chaudhary 2007). After decades of struggle on the part of India's nationalist leaders, compulsory education was gradually introduced to each province from 1919 onward. [42] Meanwhile, India was facing a fierce quality/quantity debate sparked by the rapid pace of education expansion in the late 19th century. The Indian intelligentsia argued for continuing expansion[43] whereas the British government was geared towards improving quality (through increased government control). Government resolutions in 1913 accepted the policy of eradicating illiteracy but refused to affirm the need for compulsory education; instead of increasing the number of existing institutions, their current standard was to be raised. Similarly, the Hartog Committee of 1929 [44] was against the rapid expansion of primary education at the expense of quality. It proposed a policy of consolidation in order to enhance quality, and this view dominated official policy during the period 1927-37. Consequentially, improving quality was enshrined as the priority and implemented through several means, such as reducing the teacher–pupil ratio at the primary level, increasing the salary of teachers, training primary teachers, revising curricula, etc.[45] Free compulsory education was finally proposed by the

[41] In 1906, the first compulsory education law was promulgated; in 1912, a law requiring four years of compulsory education was introduced.

[42] The compulsory education was mostly restricted in urban areas to boys during this period. See "Free and Compulsory Primary Education in India Under the British Raj: A Tale of an Unfulfilled Dream" by Ajit Mondal; England introduced compulsory education in 1870, and it was effectively enforced in all parts of the country by 1902.

[43] Mr. Gopal Krishna Gokhale introduced a private bill on compulsory education in 1911 in the Imperial Legislative Council, which was not passed.

[44] Sir Phillip Hartog was appointed in 1929 to inquire into the organization of various aspects of education in India. The Committee's recommendations influenced government policy in later years. The Committee proposed establishing four years of compulsory education but without any haste.

[45] A government resolution in 1913 mentions that no teacher should be called on to instruct more than 50 pupils, and that the number should ideally be 30 or 40; furthermore, the resolution notes that trained teachers should receive no less than Rs 12 per month and that they should either be eligible for a pension or enrolled in a provident fund. The Hartog Committee

Sergeant Report of 1944; however, this plan was never officially implemented.[46] During the early part of the 20th century, Chinese education under the Qin Dynasty emphasized the liberal arts. [47] However, growing industrial and military ambitions led to a major course correction; primary and secondary education were expanded, and various policy initiatives sought to shift the focus in tertiary education to vocational subjects and scientific fields.[48]

Meanwhile, in India, the government began to take an active role in providing education, especially higher education.[49]. However, the strong emphasis on education in the humanities (which was primarily suitable for employment in government) led to an excess of graduates that could not be absorbed by the labor market in the 1930s, creating a problem of educated unemployment. In 1936-37, various studies and reports recommended a greater focus on vocational education and degrees that would enable careers in business and industry.[50] However, as India was a party to the Second World War, these suggestions remained on paper due to a lack of available financing.

1950-80: After 1950, the primary difference between India and China – namely, foreign rule versus domestic governance – ceased to exist. Nevertheless, the policies adopted under British rule in India cast a long shadow. For instance, once independence was achieved in 1949, India had an opportunity to allocate additional resources to primary education, but it only did so to a limited extent, and only during the 1950s. From the early 1960s, India was predominantly concerned

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also emphasized the need to inspect staff more frequently and improve standards, remuneration, and service conditions for teachers at both the primary and secondary levels.

[46] The Sargeant Plan of Education was a 1944 memorandum prepared at the behest of the British-run Government of India that outlined the future development of literacy and education in India. A central goal of the Sargent Scheme was the educational reconstruction of India. It recommended the introduction of free and compulsory education for all Indian children aged 6-11. The plan aimed to bring about universal literacy in India within 40 years of its introduction.

[47] In 1928, more than 60% enrollment was in law and art courses.

[48] Notable policy documents include the Educational Aims and Implementation Guidelines of 1929, Secondary School Law, Normal School Law, and Vocational School Law of 1932.

[49] The government would now maintain "model" institutions at the primary and secondary level and begin providing grants-in-aid for collegiate education.

[50] The Hartog Committee (1929) recommended channeling pupils towards industrial and commercial careers through a more diversified curriculum in middle-level vernacular schools and technical education in universities. In 1936, the British government called in two experts, A. Abbott and S.H. Wood, from Britain to study and plan the expansion of vocational education. The most important suggestion was to draw parallels between general and vocational education and to treat vocational studies as on par with general education.

with developing a world-class higher education system (Duraisamy 2015).[51] The lack of any comprehensive study regarding primary education following independence is a testament to primary education's neglected status and stands in sharp contrast to the concerted efforts to improve secondary and tertiary education.[52] The rapid population growth did not help either.

In Communist China, the implementation of compulsory education remain the top priority in educational policy.[53] Driven by the strong national policies of the Communist government, primary education coverage consistently increased. Notably, in 1982, compulsory education was included in the Constitution of the People's Republic of China. In India, compulsory education was only made a fundamental right in the Constitution in 2002. [54]

In Chinese education policy, a significant addition was the attention paid to expanding secondary education. During this period, the quality of primary and secondary education remained a second-order concern. Secondary-level enrollment soared during the Cultural Revolution period, largely fueled by the proliferation of locally managed ("minban") schools in rural areas (Zhu and Sicular 2022; Deng and Treiman 1997; Shirk 1979; Suzanne 1990; Robinson 1986). With the end of the Cultural Revolution in 1976, new educational policies were adopted, which aimed to reverse the equalization of quantity and quality between 1966 and 1976. Consequently, enrollment at the secondary level experienced a significant reduction (see Suzanne 1990, P95).

[51] The share of resources allocated to elementary-level education decreased from 56% (of planned funding) in the first Five Year Plan (FYP) to 35% in the second FYP and remained in a similar range up to the end of the 1980s. India adopted a five-year planning approach, which remained in place during 1951-2017.

[52] For example, the All-India Commission on Secondary Education, under Dr. A. Lakshmanswami Mudaliar's chairmanship, was set up in 1952-53 to examine the prevailing secondary education system and suggest measures for its re-organization and improvement. Indian University Education Commission under Dr S. Radhakrishnan was established in 1948-49 for a similar purpose for higher education.

[53] The Ministry of Education in 1951 proposed enrolling 80% of school-age children in primary school by 1957 and providing universal basic education coverage within ten years.

[54] Article 45 of the Constitution of India (1949) initially laid down the Directive Principles of State Policy, which included providing free and compulsory education for children up to the age of 14 years. However, it remained a guiding principle, and the state could not be taken to court for non-implementation. Only with the 86th Constitutional Amendment in 2002, introducing Article 21A, was compulsory education elevated to a fundamental right that could be adjudicated.

From the 1950s onward, Chinese universities and colleges were subjected to far-reaching reforms. Early in the century, higher education in China had been pattered after the US and Britain; however, the Chinese now embraced the Soviet model of higher education. As a result, all private universities were either nationalized or abolished; training in engineering, teaching, agriculture, and forestry was given even more emphasis to promote industrialization; and the humanities and social sciences were strongly de-emphasized. [55] Vocational education was also promoted through a "part-time work/part-time study" model. [56] Unfortunately, these reform plans were disrupted during the turmoil of the Cultural Revolution. [57]

In India, secondary education experienced unplanned growth and suffered from lower resource allocation due to the greater emphasis on higher education. Higher education was expanded and strengthened through increased budget allocations, the focused development of disciplines in science and technology, and the founding of state-of-the-art research centers.[58] However, similar to the 1930s, the expansion of higher education remained severely skewed towards the liberal arts while neglecting the hard sciences and vocational training. As stated in the sixth Five Year Plan (FYP) of 1980-85: "There has been an undesirable growth of facilities for general higher education, especially at the undergraduate stage in arts, commerce, and humanities, and in the consequent increase in the incidence of unemployment among the educated." Although all FYP documents emphasized the goal of developing basic vocational courses starting from the secondary stage

[55] In May 1952, following the guideline of "focusing on cultivating industrial construction talents and teachers, develop specialized colleges, rectify and strengthen comprehensive universities", the Central Ministry of Education put forward plans for the reform of colleges and universities nationwide (Zhang, 1984, P251)

[56] In 1958, the State Council issued the "Instructions on Educational Work" and proposed the establishment of two types of schools – agricultural middle schools (in rural areas) and technical schools (in urban areas). In 1964, Liu Shaoqi proposed "two education systems, two labor systems", including a part-time work/part-time study education system. (See Zhang, 1984, P149, 180)

[57] The adopted strategy was to cut off the top of the educational pyramid by lowering the quality and quantity of urban and tertiary-level education. New enrollments to universities were stopped for the next six years; the enrollment of graduate students was halted for 12 years. The impact was catastrophic, especially for vocational and higher education.

[58] The Scientific Policy Resolution of 1958 established the National Laboratories, the Indian Council of Agricultural Research, the Indian Council of Medical Research, the Indian Council of Social Science Research, and the Department of Atomic Energy, among others.

(grade IX) to increase vocational enrollment (after grade X), the enrollment share in vocational education remained abysmally low.[59]

As the Indian educational system was expanded, the trade-offs between quantity and quality were less pronounced in comparison to China. In the wake of the quality reforms, teacher quality was considered the most critical factor (NPE 1968), which led to an increased emphasis on teacher training as well as attractive pay and benefits at all levels of education.[60]

1980s-2020: Developments in China and India over the last 40 years have been heavily shaped by rapid economic growth, attributable in no small part to free-market reforms and increased global trade.

Over the last four decades in China, there has been a gradual transition away from universal and compulsory education as a primary focus, and toward high-quality tertiary education. A series of laws regarding compulsory education were promulgated in the 1980s, which sought to establish universal nine-year compulsory education by 2000.[61] At the same time, rapid economic growth in combination with demographic changes increased the volume of resources available per student, thus improving the quality of education.[62]

Market-oriented reforms paved the way for China's momentous expansion of higher education in the first two decades of 21st century. Since 1999, an ever stronger priority has been placed on expanding higher education. The reforms of the late 1990s granted additional autonomy to universities and colleges. Furthermore, disciplines that had been neglected under Communism (including law, management, and economics) were accorded much greater attention due to the

[59]The share of enrollment in higher secondary education remained less than 10% during the 1970s.

[60]The Mudaliar Commission of 1952also suggested improving the quality of teachers, and recommended increasing the share of post-graduates for teaching at higher secondary schools. Other components of quality improvement include the establishment of "model" schools and autonomous colleges as "pace-setting" institutions. For example, the fifth FYP (1974-79) recommended establishing one model comprehensive secondary school in each district and one model primary school in each community development bloc. In addition, 10% of the institutions were selected at all levels for intensive development.

[61]In 1982, compulsory education was written into the Constitution of the People's Republic of China (PRC), which was followed by The Compulsory Education Law of the People's Republic of China (1986), Rules for the Implementation of the Compulsory Education Law of the People's Republic of China (1992), and Education Law of the People's Republic of China (1995).

[62]The birth control campaign of the 1970s and the implementation of the one-child policy in 1980 had major demographic effects.

strong need for a skilled managerial class to guide the economy's expansion. China also undertook initiatives to develop world-class universities.[63]

The reform policies of the 1980s and 90s also sought to improve the quality and scope of vocational education. Vocational education was gradually recognized as a crucial aspect of educational policy. Indeed, in 2018, vocational education was officially recognized as equally important as general education.

During 1980-2020, India also experienced tectonic shifts in its educational policies. Policymakers devoted greater attention to expanding primary level education, and also sought to correct the lopsided focus on the humanities. The National Policy of Education of 1986 emphasized the universal enrollment and universal retention of children up to 14 years of age, like all the previous government documents. However, this time, the government was committed to achieving results. Additional resources were allocated, and the government launched several initiatives, some of which were supported by foreign institutions.[64] Finally, in 2002, the Constitution of India was amended to make primary education a fundamental right.

Up to the end of the eleventh FYP (2007-2012), the expansion of the education system was the primary aim, which overshadowed any concerns regarding quality. However, various academic studies began highlighting the poor learning outcomes of Indian students; accordingly, since the twelfth FYP (2012-17), quality has been a major criterion. As a result, increased attention is now devoted to learning outcomes, rather than inputs or credential-based metrics.[65]

During this period in India, higher education also became much more diverse, reflecting a larger range of professional disciplines. The government policy of

[63] By the year 2010, there were a total of 112 universities selected in Project 211 and 39 top universities selected in Project 985. In 2009, the C9 League was founded, which has been compared to other elite university groups around the world, such as the Ivy League (US), Russell Group (UK), U15 (Canada), and Group of Eight (Australia).

[64] The major domestic schemes among them were Sarva Shiksha Abhiyan (SSA) and Mid-Day Meal (MDM). Foreign-funded projects include the District Primary Education Programme (DPEP) in 1994, the Mahila Samakhya Programme in 1998, and Janshala in 1998. The Government of India gradually took over these projects.

[65] Prior strategies relied on increasing teachers' salaries (to attract better human capital) and establishing teachers' training institutions to augment teacher availability.

opening the door for private actors at the tertiary level increased access to specific disciplines that were previously underrepresented, including engineering, management, medicine, and IT – disciplines of study for which students are willing to pay substantial fees. The vocationalization of education also received a strong impetus from policymakers in the wake of the economy's opening in 1990. However, India remained beset by the problem missing set targets. [66]

5. Human Capital Composition, Inequality, and Economic Transition

In the previous section, we highlighted the divergence between China's and India's educational development models. This section now turns to how these development models impacted the composition of the human capital stock, inequality, and economic development since the 1980s. We argue that educational strategies, by virtue of their impacts on the human capital stock, are a significant driver of economic development, inequality metrics, and the composition of the macroeconomy. In this section, our analyses are based on CHIP and EUS surveys (see Appendix C.1.3 for survey data harmonization).

In this paper so far, we have operationalized the *flow* component of the human capital framework in the context of educational systems. Drawing on surveys and census data, we now show that China and India have divergent human capital stocks, and we argue this divergence can be explained by their respective educational strategies.

Panel A of Table 6 presents the composition of the human capital stock over the survey years (1987-2018). The share of primary, secondary, and vocational (PSV) graduates is higher in China, whereas the share of non-vocational tertiary graduates is higher in India. In 1987/88, the first year when surveys allow comparability, we see primary, secondary, and vocational graduates are 13 pp, 22 pp,

[66] For example, the NPE of 1986 set a 10% target for higher secondary vocational enrollment (grades X-XII) by 1990 and 25% target by 1995. XI FYP revised the target to 25% by 2011, but at the beginning of 2012, XII FYP highlighted that only 4.8% of students were enrolled in vocational tracks.

and 5 pp higher in China compared to India. On the other hand, tertiary non-vocational graduates are 1.5 pp higher in India.[67] The same pattern is found in all other survey years (1995/93, 2002/04, 2013/11, and 2018) and when comparing the share of different graduates within each decadal birth cohort (1920s-1990s) in Panel B (Table 6). These findings substantiate our initial hypothesis concerning the bottom–up vs. top–down model pursued in each country.

5.1. **Human Capital Composition and Inequality.** In this subsection, we begin by examining the evolution of educational inequality and we also estimate the gender and caste disparities in education. Subsequently, we explore the impact of educational inequality on wage inequality in both China and India. Our findings indicate that the divergent educational strategies pursued by China and India led to distinct trends in educational inequality, which ultimately feed into the structure of wage inequality.

5.1.1. *Educational Inequality.* As a first step in our analysis, we use Gini coefficients to estimate the evolution of educational inequality by birth cohort in China and India; our results are shown in the first two columns of Table 7. The Education Gini ($gini^{total}$) in both countries was considerably higher during the 1920s cohort and has since been steadily decreasing. The disparity between China and India is pronounced, especially as it widened significantly during the 1920s and 1940s cohorts, from 0.16 to 0.35. This discrepancy remained consistent in the subsequent two birth cohorts. It wasn't until the 1970s cohort onwards that the gap in Education Gini between China and India began to decline, reaching 0.12 in the 1990s cohort. The downward trend in the Education Gini is primarily driven by the reduction of illiteracy.

To demonstrate this, $gini^{total}$ is decomposed into the illiteracy rate (n0) and Education Gini among literates ($gini^{lit}$), following Morrisson and Murtin 2013.

[67] In 1990, when census data allow comparability, the primary graduates were 28% of the adult population in China (16 pp more than in India), whereas tertiary-level graduates were 0.7% (4 pp lower than in India).

$$gini^{total} = n0 + (1 - n0) * gini^{lit} \tag{4}$$

The equation shows that the Education Gini calculated across the entire population is a linear combination of the illiteracy rate and the Education Gini among literates. The reduction of the illiteracy rate will directly lead to a decrease in the Education Gini. Therefore, as indicated in Table 7, the significantly faster rate of illiteracy reduction in China compared to that in India explains the widening gap in the Education Gini between the two countries from the 1920s birth cohort to the 1960s cohort.

According to the 1988/1987 surveys, individuals born in the 1920s cohort in both China and India exhibited remarkably high illiteracy rates – namely, 53% in China and 76% in India. However, even stronger divergence in illiteracy rates became evident in subsequent cohorts. By the 1960s cohort, China experienced a significant reduction in illiteracy to 10%, whereas in India, half of the population (49%) in this cohort remained illiterate. Consequently, the Education Gini decreased to 0.4 in China while remaining at 0.22 in India. The significant reduction in illiteracy in China can be attributed to the rapid expansion of primary education beginning in the 1930s, alongside extensive adult education initiatives implemented during the Communist era from the 1950s to the 1970s. Due to a lack of consistent efforts to promote primary education and the limited development of adult education after independence, India maintained a 37% illiteracy rate in its 1970s cohort (from the 2018 round), whereas China successfully eradicated illiteracy in the same cohort. China's bottom–up approach during the Communist era contributed significantly to this achievement. As the illiteracy rate continued to decrease in subsequent cohorts in India, a trend toward convergence is observed between the two countries, for both illiteracy rates and the Education Gini. Appendix Table B.VIII presents the same decomposition of Education Gini for the total adult population across various survey waves. The findings mirror those of the cohort-based analysis: the difference in Education Gini between China and

India is mainly driven by the disparity in illiteracy rates.

5.1.2. *Gender and Caste Gap in Education.* To further elucidate the factors contributing to India's markedly higher and stagnant illiteracy rate in comparison with China, we investigate educational disparities across two critical social dimensions: gender and caste.

Table 8 presents the illiteracy rate by gender across different birth cohorts. Both nations have demonstrated remarkable advancements in mitigating illiteracy since the cohorts of 1920s, during which illiteracy rates were alarmingly elevated for both genders. From the 1920s cohort to the 1960s cohort, China experienced a substantial reduction in illiteracy rates by 43 pp, with a reduction of 55 pp for women and 33 pp for men. The notably swifter reduction in illiteracy rates among women contributed to the narrowing of the gender gap, decreasing from 28 pp in the 1920s cohort to 7 pp in the 1960s cohort. Conversely, in India, the reduction in illiteracy rates was slower, decreasing by 27 pp, with equal rates of improvement for both women and men. The gender gap in India mirrored that of China in the 1920s cohort, standing at approximately 30 pp, and it persisted nearly unchanged until the 1960s cohort. By the 1970s cohort, China had nearly eradicated illiteracy for both genders, whereas India's illiteracy rate still persisted at a high 32%, mirroring China's rate in the 1930s cohort, accompanied by a 22 pp gender gap. By the 1990s cohort, India's illiteracy rate had decreased to 10%, with a 7 pp gender gap, closely resembling the situation in China during the 1960s cohort.

The gender gap in the average years of schooling (AYS) presents a similar trend, albeit with a notable difference in China's 1920s and 1930s cohorts, where the gender gap was significantly larger than that of India. With the rapid expansion of primary and secondary education in China, this gap started declining from its 1940s cohort, ultimately achieving gender parity by the 1980s cohort. In India, the reduction in the gender gap started only from the 1980s cohort, reaching a one-year gap in the 1990s cohort, equivalent to China's gender gap in the 1960s (Appendix Table B.VIII).

The observed pattern closely correlates with enrollment rates, as both countries started with a high gender gap and have made a consistent effort to narrow the gap over the last 100-120 years (see Appendix Figure A.V). In the 1930s, the proportion of female enrollment in China was notably lower than in India (18% vs. 23%), but it equalized by the 1940s at around 25%. Between the 1950s and 1970s, both countries experienced rapid reductions in the gender gap. In the 1980s, the female enrollment ratio in China was 45% and 40% in India. In the 1990s, gender parity was achieved in China, followed by India in the 2000s. The divergence at the secondary and tertiary stages between China and India began earlier in the 1930s due to higher female drop-outs in India at the primary level.

As for caste inequality, this dimension is specific to India and is one of the important stratifying factors in society.[68] Table 9 presents the illiteracy rate for Scheduled Castes (SC) and Scheduled Tribes (ST) across birth cohorts. The illiteracy rate for ST/SC is more than 80% up to the 1950s cohort, which is much higher than that of the non-SC/ST population. The caste gap (difference between SC/ST and non-SC/ST) was 20 pp in the 1920s, and increased to 26 pp by the 1960s cohort. Thanks to government policies to overcome historical injustice, including the reservation of seats in public educational institutions for lower castes, the caste gap started declining in the 1970s cohort. By the 1990s cohort, it stood at 6pp. The trajectory of SC/STs in this respect is similar to the gender gap in India, showing a strong cultural imprint, where women and lower castes were denied access to education, as stated in Deshpande 2011 - "Several scriptures (including Manusmriti) treat women and shudras (worker caste) identically in terms of religious privileges and denial of access to knowledge."

Moreover, when we examine the distribution of SC/ST adults compared to other adults across different education stages, we observe a progressive increase in the degree of under-representation for SC/ST individuals when moving from the primary to tertiary education levels. More recently, there has been a notable reduction in under-representation across all education levels when we compare

[68] Surveys capture three types of caste groups - Scheduled Caste, Scheduled Tribe, and Others. These are in administratively defined categories. The existence of jatis (a narrower form of caste with thousands of members) can be traced to one of the oldest types of ternary society; while data on jatis were collected during colonial censuses (Piketty 2019), collection of this parameter was abandoned post-independence.

data from from 1988 to 2018, except for the Below Primary group, where SC/ST adults are over-represented. This indicates a narrowing of the caste gap. For details, refer to Appendix Table B.IX.

Gender and caste disparities, especially in India, had a considerable influence on educational inequality up to the 1960s cohort. By the 1990s cohort, their impact had diminished considerably.

5.1.3. *Education Inequality and Wage Inequality.* How do long-term education policies influence economic inequality? To answer this question, we analyze the impact of education inequality on wage disparities in China and India. Following the human capital theory model (Gregorio and Lee 2002), the log variance in wages, as a measure of wage inequality, can be decomposed in the following way:

$$Var(lnwage_s) = \bar{r}^2 Var(S) + \bar{S}^2 Var(r) + 2\bar{r}\bar{S}Cov(r, S) + Var(u) \tag{5}$$

where S is years of schooling, r is the rate of return to education, and bar denotes the mean. The model predicts a clear positive relationship between education inequality, measured by the variance in average years of schooling ($Var(S)$), and wage inequality ($Var(lnwage_s)$). This implies that all else being equal, greater education inequality tends to result in higher wage inequality. Moreover, the correlation between education inequality and wage inequality is determined by the average return to education, represented by $\bar{r}$.

In the case of China and India, we estimate wage inequality using the log of the daily wage variance, drawing on data from CHIP and EUS for the years 1988/1987, 1995/1993, 2004/2002, 2013/2011, and 2018.[69] As for the average rate of return to education ($\bar{r}$), we estimate this figure using the well-known Mincer

[69]The daily wage is computed for China using the information on the total wages earned in a year divided by the total working days. Indian labor force surveys (except 2018) have collected information on working days (full day, half day, or no work) and wages earned in the last seven days for reference. The daily wage is weekly wages divided by total working days. The 2018 round captured monthly wages and working hours for the past seven days. If the number of hours was less than 4, we assume a half day of work. We compute weekly working days and multiply by 4 to get monthly working days. The daily wage is monthly wages divided by the estimated monthly working days.

equation, for each year.

$$ln(dailywage)_i = \beta_0 + \beta eduyr_i + \mu X_i + Prov_i + \epsilon_i \quad (6)$$

where $eduyr_i$ is years of education, X_i is controls such as age, age square, gender, and region (urban/rural). $Prov_i$ are provinces/state fixed effects. The dependent variable is the log of daily wage (in real 2018 $). When estimating, we restrict the sample to the working-age population between 20 and 60 years. The β coefficient provides an estimate of the average rate of return to education ($\hat{r}$). Furthermore, our sample also allows us to compute the variance in years of education.

Table 10 presents our estimation findings. Wage inequality consistently appears higher in India than in China across all survey years, albeit with a decreasing disparity between the two nations over time. For instance, in the 1988/1987 survey waves, earnings inequality stood at 0.21 in China, whereas it reached 0.74 in India. By 2018, these figures shifted to 0.56 in China and 0.65 in India.[70] Regarding rate of return, a similar trend emerges: the return to an additional year of education is initially higher in India than in China, but the countries gradually converge over time. By 2018, the rates of return to education in India and China become nearly identical – about 8% for an extra year of education. In terms of education inequality (measured by variance in years of schooling), the results echo our earlier analysis, indicating substantially greater inequality in the education distribution in India compared to China, driven by differing education expansion strategies.

Pooling our results, we estimate both the magnitude ($\hat{r}Var(S)$) and the share of earnings inequality ($\hat{r}Var(S)/Var(lnwage)$) directly attributable to education inequality. In India, education inequality accounts for approximately 0.16 of the magnitude of wage variance, and for nearly one-quarter (25%) of the wage variance from 1988 to 2018. This is considerably higher than in China, where education inequality explains only 0.004 of the magnitude of wage variance, and just

[70] It is worth noting that surveys in India are becoming increasingly non-representative over time, particularly at the upper tail of the income distribution. Bharti et al. 2024 highlights a growing trend in income and wealth inequality from 2011 to 2018 after adjusting for this non-representativeness. However, for our analysis, this concern is of marginal importance.

2% of the wage variance share in 1988. Even in 2018, despite the considerable increase in the rate of return to education and the persistence of education inequality, education inequality accounts for only 0.07 of the magnitude and 12% of the share of wage inequality. Certainly, the relationship between education and wage inequality is complex and dynamic. Nonetheless, the above analysis provides a clear indication that education inequality plays a much larger role in wage inequality in India than in China.

5.2. **Human Capital Composition and Economic Transition.** The preceding section explored the influence of education development policies on both education inequality and wage income quality. In this subsection, we delve deeper into how education development strategies influenced the economic transition from agriculture to manufacturing and services. We first explore a non-negligent share of the non-working population and then investigate human-capital composition trends in the working population across sectors.

5.2.1. *Share of Non-Working Adult Population.* The non-working adult population comprises a substantial segment of the working-age demographic in both nations. By analyzing this "missing" human capital, we can obtain insights into factors such as education levels and gender disparities that impact workforce participation. Such an analysis may reveal untapped potential for economic growth, insofar as these individuals can be integrated into the labor force. We define the non-working population as individuals who report their working status as neither working nor studying.[71] In the following analysis, we constrain the sample to the adult population aged 20 to 60 years old. India has a notably high non-working population share, which stood at 34% in 1988 and 2002, and increased

[71]The Indian survey asks about the usual principal activity status of each individual, where the non-working category includes: (1) did not work but was seeking and/or available for work; (2) attending to domestic duties only; (3) attending to domestic duties and also engaged in household production (sewing, tailoring, weaving, etc.); (4) rentiers, pensioners, remittance recipients, etc.; (5) not able to work due to disability; (6) others (including begging, prostitution etc.). In the Chinese surveys, the question pertains to the employment situation, where the non-working category includes: (1) retired; (2) unemployed/waiting for a job assignment; (3) full-time homemaker; (4) pregnant/maternity leave; (5) long-term sick leave; and (6) other (neither working nor at school).

to 40% in 2018. By comparison, China's non-working population share was 10% in 1988, 17% in 2004, and 23% in 2018 (see Figure 17).[72]

Examining the gender gap in economic participation in both countries reveals a higher proportion of non-working females compared to males, with India exhibiting a particularly concerning disparity. In 1988, 63% of females aged 20-60 in India were not working, while only 6% of males fell into this category. By 2018, the share increased to 73% for females and 8% for males. Similarly, in China, the proportion of non-working females increased from 15% in 1988 to 31% in 2018, although it remains lower than in India. The share of non-working males in China is comparable to that of India. The gap in non-working rates between China and India is primarily attributable to non-work among women (see Figure 17).

We then examine the proportion of non-working individuals by education level, categorizing them into primary education, PSV education (a combination of primary, secondary, and vocational education), and tertiary education.[73] As depicted in Figure 18), the non-working share decreases in line with education levels in both countries. However, contrary to expectations, non-participation in the labor force is not solely concentrated among individuals without any formal education in India. Even among the population with tertiary education, the non-participation rate is remarkably high. For instance, in 1988, it stood at 25% in India compared to just 4% in China. This situation appears to be worsening, as the share of non-working tertiary graduates in 2018 increased to 36% in India and to 8% in China. Similarly, among PSV graduates, a significantly higher proportion are non-working in India. Furthermore, to disentangle the gender/education overlap, we compute the share of non-workers by the three types of educational graduates among males and females separately (see Data Appendix E6b). We find that in all survey years, more than 60% of the overall female population with tertiary education were not employed in India, versus around 10% in China. The shares of non-working females in other educational categories are even higher.

[72] The share of the population aged 20-60 reported to be studying is 1-2% in China and about 2-4% in India.

[73] We combine primary, middle, and vocational education together for ease of expression. However, separate data is provided in the Data Appendix.

The significant non-participation rates among women in India, regardless of their education level, underscore the significant influence exerted by cultural norms the occupational participation of women. Integrating this segment into the workforce could significantly contribute to fostering more inclusive and sustainable socio-economic outcomes. Furthermore, high non-participation rates could be attributed to a mismatch between skills imparted through education and skills demanded in the labor market, as tertiary education is heavily oriented towards the humanities, arts, and business; these disciplines account for more than 70% of Bachelor's graduates. In addition, the non-participation of women is exacerbated by the underdevelopment of vocational education, as discussed in previous sections.

5.2.2. *Structural Transformation.* We now shift our focus to the adult working population, encompassing individuals aged 20-60 who are actively engaged in either self-employment or wage employment. In 1988, 62% of the adult working population in both China and India was employed in agriculture, with the remaining evenly split between the manufacturing and service sectors (see Figure 19).

Over the subsequent thirty years, both China and India underwent significant structural transformations characterized by a notable decline in the agricultural workforce alongside the expansion of the manufacturing and service sectors. However, the magnitude of this transition differs markedly between the two countries. By 2018, China had successfully shifted a larger proportion of its population out of agriculture, with only 15% remaining in the sector, compared to 40% remaining in India. These observations align with growth accounting analyses, such as that by Bosworth and Collins 2008, highlighting China's superior efficiency gains in the movement of workers away from agriculture compared to India.

A counterpart to a larger adult working population engaged in less productive agriculture in India is a relatively smaller workforce engaged in the more productive manufacturing and service sectors in 2018. In China, 85% of the adult working population operated in the non-agricultural sector, compared to 60% in

India. Although the gap is less pronounced in the manufacturing sector – 26% in India versus 29% in China – the service sector in China has experienced remarkable expansion, engaging 56% of the workforce compared to only 34% in India. For India, this means a "double whammy" of effects that impair growth: a higher non-working share and, among the working population, a higher share in a less productive sector.

A major factor contributing to India's inability to transition a larger proportion of its population away from agriculture has been its failure to effectively address illiteracy through mass educational initiatives. In 1987, 65% of India's working adult population had education levels below primary (including illiterates), compared to 20% in China in 1988. Despite significant progress in enhancing human capital, by 2018, approximately 30% of India's working population still had education levels below primary (see Figure 20). Nevertheless, India exhibited a visible advantage at the highest levels of the education distribution. This disparity underscores the divergent educational strategies pursued by the two countries over the past few decades, with China employing a bottom–up approach that focuses on quantity and vocational training, in contrast to India's top–down approach that prioritizes quality and places less emphasis on vocational education.

The distribution of graduates across educational levels in the agricultural, manufacturing, and service sectors, as shown in Figure 21, further substantiates this argument. It shows that individuals with education levels below primary are most likely to remain in the agricultural sector. In 1988, 92% of individuals with below primary education, 56% of PSV graduates, and 15% of tertiary graduates were engaged in agriculture in China. Similarly, in India, 74% of individuals with below primary education, 43% of PSV graduates, and 11% of tertiary graduates were engaged in agriculture. This pattern persists in 2018, but is now less pronounced, as both economies continue to transition away from agriculture. In 2018, 46% of individuals with below primary education, 13% of PSV graduates, and 1% of tertiary graduates were engaged in agriculture in China, while in India, 61% of individuals below primary education, 36% of PSV graduates, and 12% of tertiary graduates were engaged in agriculture.

In summary, the arrested development in primary education, as discussed in earlier sections, has served as a major impediment to India's attainment of a level of structural transformation comparable to that of China. Conversely, additional education increases suitability for employment in the more productive manufacturing and service sectors. Thus, the composition of human capital significantly shapes the distribution of labor across sectors, although several other factors also contribute to the overall workforce composition within sectors at the macro level.

5.2.3. *Labor Quality and Productivity.* China's and India's divergent educational development strategies have not only affected the transition to manufacturing but have also impacted the quality of labor within sectors. Figure 22 shows the distribution of the working adult population by sector and educational attainment. We observe that while the sectoral share of the working population was comparable in China and India during the 1980s, labor quality was significantly higher in China, particularly in agriculture and manufacturing.

In 1988, the agricultural sector in China boasted a substantial share of PSV graduates (69%), significantly larger than India's, where only 22% were PSV graduates. By 2018, as observed earlier, the overall agricultural workforce in China witnessed a significant decline, yet the proportion of PSV graduates remained the same. In India, the agricultural workforce became more educated by 2018, with the proportion of PSV graduates rising to 53%. However, this figure is still lower than the comparable figure for China's three decades prior.

The manufacturing sector typically employs a more educated workforce compared to agriculture. In China, the composition of the manufacturing workforce remained relatively stable over three decades, with over 85% of manufacturing workers being PSV graduates. In India, the share of PSV graduates in manufacturing significantly increased from 33% to 66%, mainly due to a decreasing share of the workforce with below-primary education. Tertiary-education attainment in India was slightly higher throughout the three decades, while in China, possibly more suitable graduates, such as engineers, may have compensated for this difference. Consequently, the average years of education for manufacturing workers

in 1988 was 9.2 years in China and 4.0 years in India, resulting in a 5.2-year gap. By 2018, India had narrowed this gap to 2.4 years.

In both China and India, the service sector workforce shows the highest level of educational attainment, exceeding that of manufacturing and agriculture. In 1988, China's service sector workers had an average of 10.2 years of education, including 90% PSV graduates and 7% tertiary graduates. In India, the average was 6.6 years, with 52% being PSV graduates, 12% being tertiary graduates (as well as over one-third without primary education). By 2018, both countries saw education levels rise, with India narrowing the gap faster. China's average increased to 11.2 years, with a slight rise in tertiary graduates from 7% to 13%. India, by contrast, rose to 10.2 years, with an increase in tertiary graduates from 13% to 29%, an increase in PSV graduates from 52% to 59%, and a corresponding decline in those without primary education.

Furthermore, to better understand how the evolution of education policy affects the labor force distribution by education in each sector, Table 11 present the working population by sector, education, and birth cohort. For the 1930s birth cohort, the quality of the Chinese workforce was superior to that of India's across all metrics. Particularly in manufacturing, China's share of PSV and tertiary graduates was three times higher than India's. Despite the impact of the Cultural Revolution, China maintained higher PSV shares than India in the 1940s and 1950s cohorts, especially in agriculture and manufacturing, while the share of the labor force with tertiary education decreased in China and became smaller than that of India's. This trend continues in the 1960s and 1970s cohorts, with the gap in tertiary educational attainment between India and China peaking in the 1960s cohort (due to the Cultural Revolution's repercussions and post-independence tertiary education expansion in India). In the 1980s cohort, China's stronger expansion of the educational system leads to a significant increase in the labor share with higher education. Accordingly, China once again takes the lead over India when it comes to educational attainment in the manufacturing and service sectors. This finding is in accordance with the growth accounting literature, such as Lee, Rao, and Shepherd 2007, which asserts that China's labor productivity was

much higher than India's in 1985, and that in subsequent decades, China has also enjoyed higher labor productivity growth.

To summarize, the non-working population share in India is particularly large, due to the extremely high share of non-working females; even females with tertiary education have low rates of workforce participation. Second, the delayed development in primary education has served as a major impediment to Indian structural transformation, as it has prevented a larger shift away from agriculture and toward the manufacturing and service sectors. Third, on average, Chinese workforce has higher levels of educational attainment, especially in the agriculture and manufacturing sectors. Accordingly, given China's higher labor participation rates, larger labor force in more productive sectors, and higher levels of educational attainment, it is not particularly surprising that China has exhibited better economic performance since the 1980s.

6. Conclusion

As we have shown, China and India pursued divergent development paths over the 20th century on their respective journeys to a modern education system. To be sure, each country's educational policies have been shaped in no small part by specific domestic factors, from long-standing cultural norms to more recent political transitions. We find that China's educational development path has been more closely aligned with the goal of fostering economic growth. Indeed, it is to this path that we should attribute China's higher rates of growth rate from the 1980s onward as well as its lower levels of economic inequality. India, by contrast, initially laid a much greater emphasis on the humanities, in part due to the human capital needs of the colonial administration. Given India's distance from the technological frontier, the specific features of the Indian strategy have not been wholly conducive to higher rates of growth. We believe our case study of China and India contains valuable insights for other developing countries seeking

to modernize their educational systems. However, one would be wise to heed the caveat that the 21st century is unlikely to be the same as the 20th.

The evidence we provide concerning the important role played by the composition of the human capital stock represents another important contribution of our research. The existing over-reliance on years of education as a measure of human capital has obscured crucial differences that can help to explain economic development patterns, including international divergence in growth and inequality. We believe that understanding the historical contexts that have shaped differences in educational systems is crucial for recognizing past mistakes and for adopting more effective policy. Our study underscores the need for additional country-specific research to deepen our understanding of historical educational policies and their origins.

Admittedly, our use of the term "human capital" is somewhat narrow, as we do not consider health. In addition, we assume that curricula and teaching practices in China and India are similar, which is a significant assumption. Exploring these aspects in detail would require a separate study. While this paper provides robust evidence based on long-term data, future research could explore within-country variations and potentially conduct causal studies to further elucidate such nuance.

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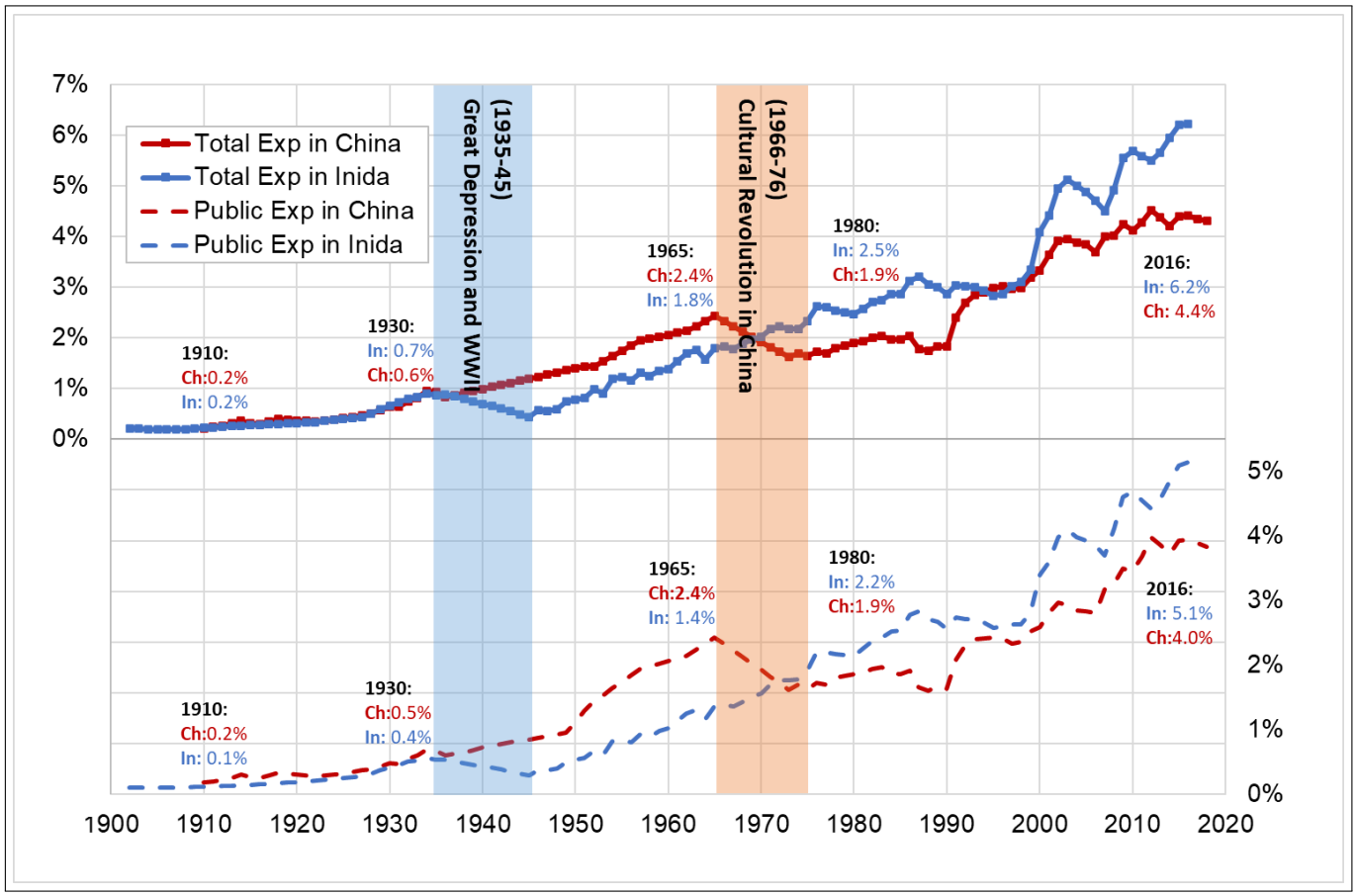
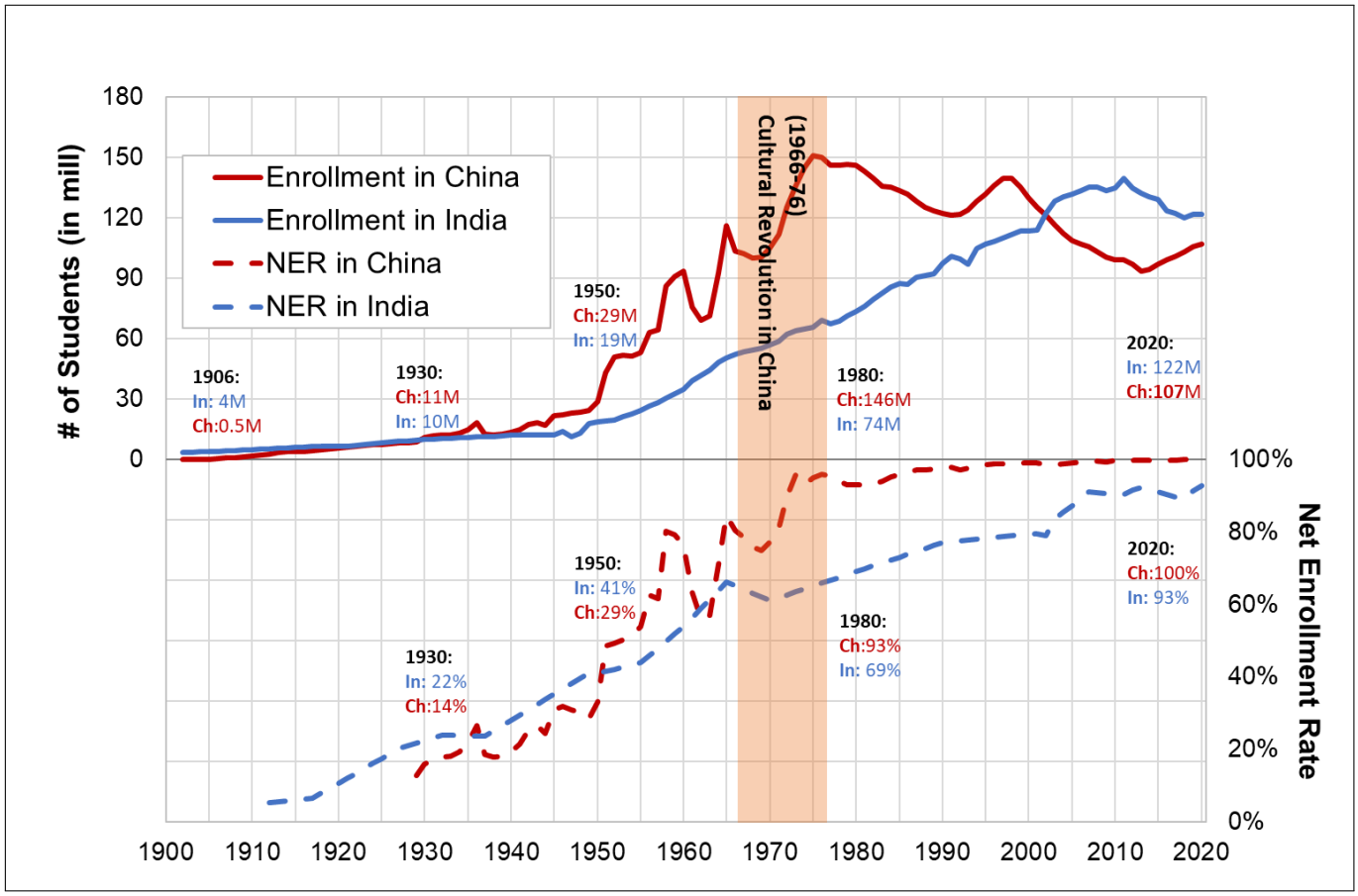
7. Figures

Figure 1. Education Expenditure as a Share of GNI



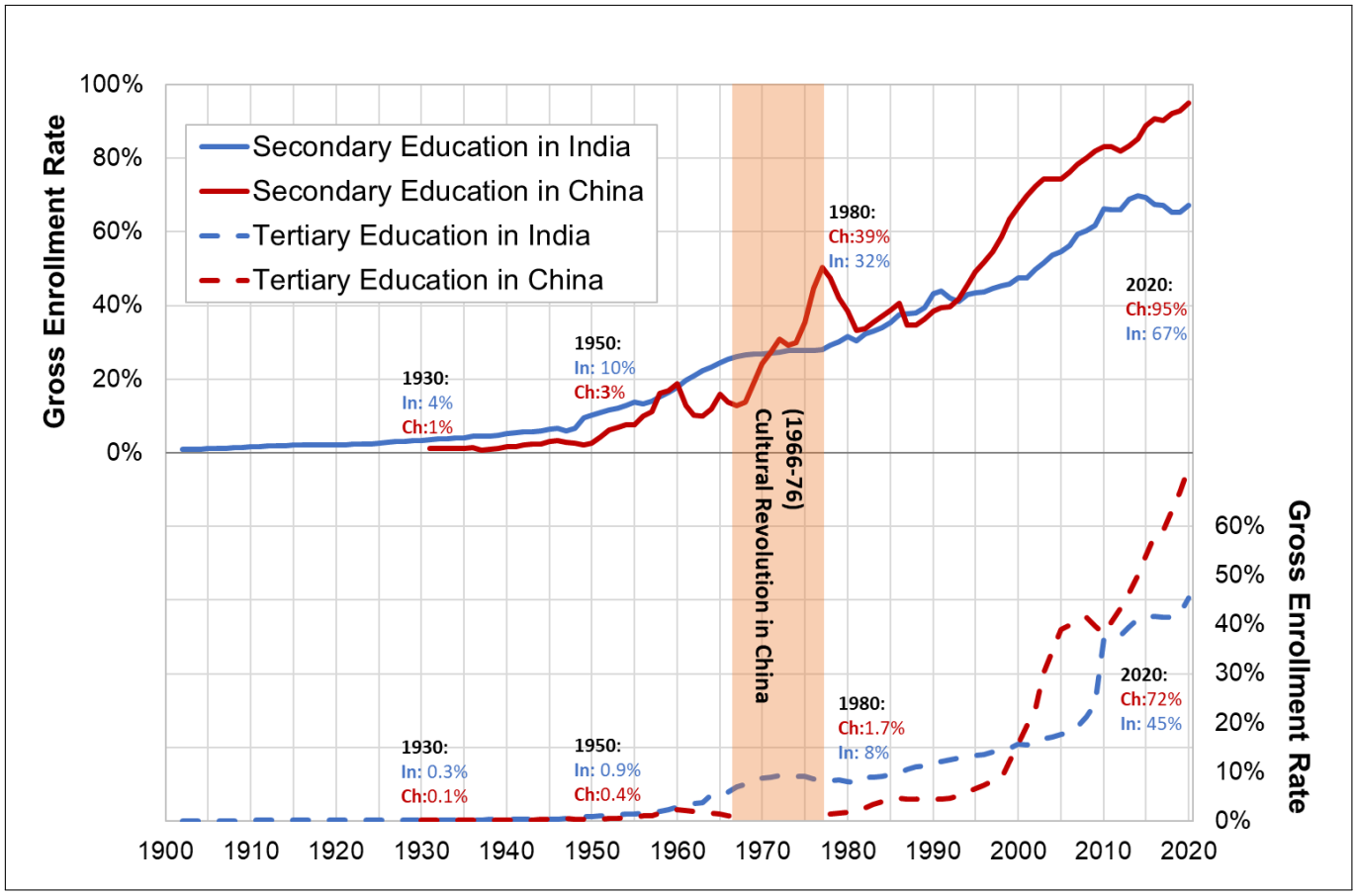
Notes: The figure plots the evolution of educational expenditure as a share of gross national income (GNI) in China and India from 1900-2018. The top part uses total educational spending, public and private. The bottom part is only for public educational spending. There has been substantial growth in total (and public) educational spending since the early 1900s, except for one prominent dip in each country. In the decade of the Great Depression and World War II, 1935-45, India experienced a downturn in education expenditure, resulting in a large gap in favor of China. The dip in Chinese share came during the Cultural Revolution, shifting the advantage to India. In the 2010s, education expenditure totaled 5.8% of GNI in India and 4.3% in China. The public spending in education as a share of GNI shows a similar pattern, reaching 4.8% in India and 3.8% in China in the decade 2010s.

FIGURE 2. Total Enrollment and Net Enrollment Ratio at Primary Stage



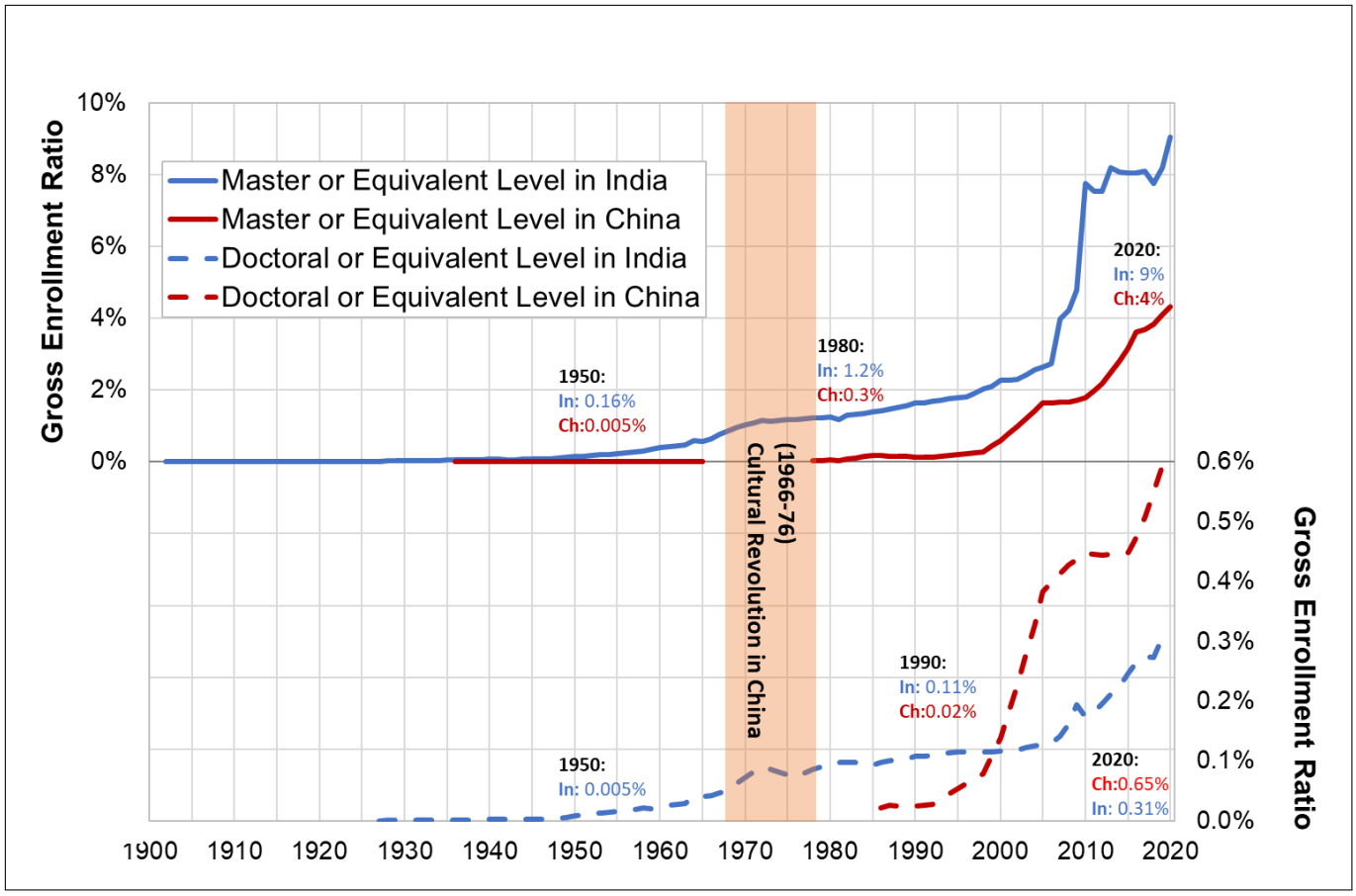
Notes: The figure plots the evolution of total enrollment (top) and net enrollment rate (bottom) at the primary level of education in China and India from 1900-2020. Enrollment in China's primary level surpassed India in the 1930s and NER in the 1950s. The NER is the total primary level enrollment in the age group 6-11 for China (and 6-10 for India) divided by the total population of the same age group. The Cultural Revolution period in China (1966-76) did not impact the progression of the primary level of education.

FIGURE 3. Gross Enrollment Ratio at Secondary and Tertiary Stage



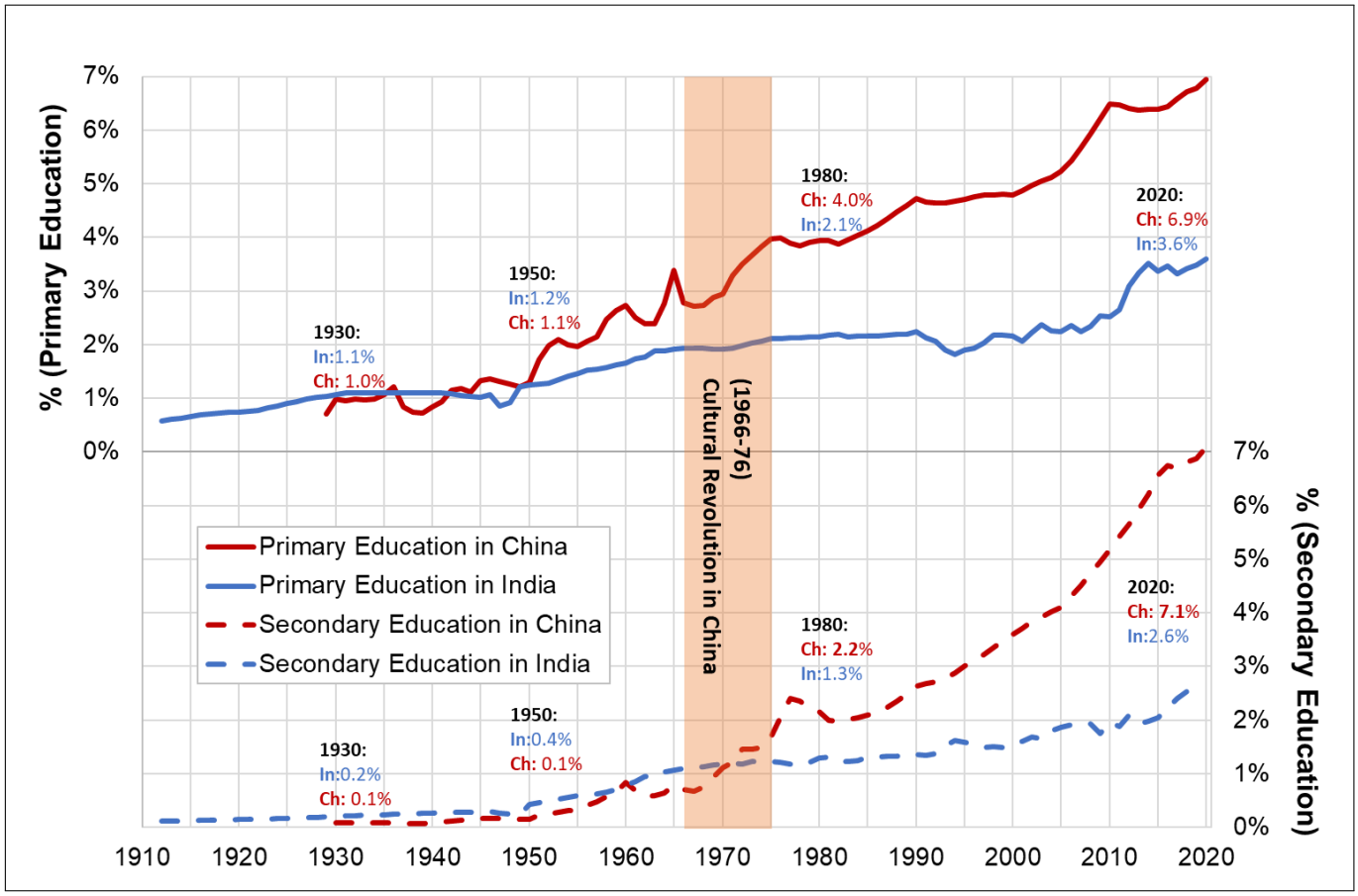
Notes: The figure plots the evolution of the gross enrollment ratio at the secondary (top) and bachelor (bottom) levels of education in China and India from 1900-2020. China surpassed India in the 1970s at the secondary level and in the 2000s at the bachelor level. The GER at the secondary level is the total enrollment in the secondary level divided by the total population in the age group 12-17 for China (and 11-17 for India). The GER at the Bachelor is the Bachelor's level enrollment divided by the total population in the age group 18-21 for China (and 18-20 for India). In 2020, the GER at the secondary level in China was 95% compared to only 67% in India. At Bachelor's level in 2020, the GER in China is also much higher at 72% compared to 45% in India.

FIGURE 4. Gross Enrollment Ratio at Masters and Doctoral Level



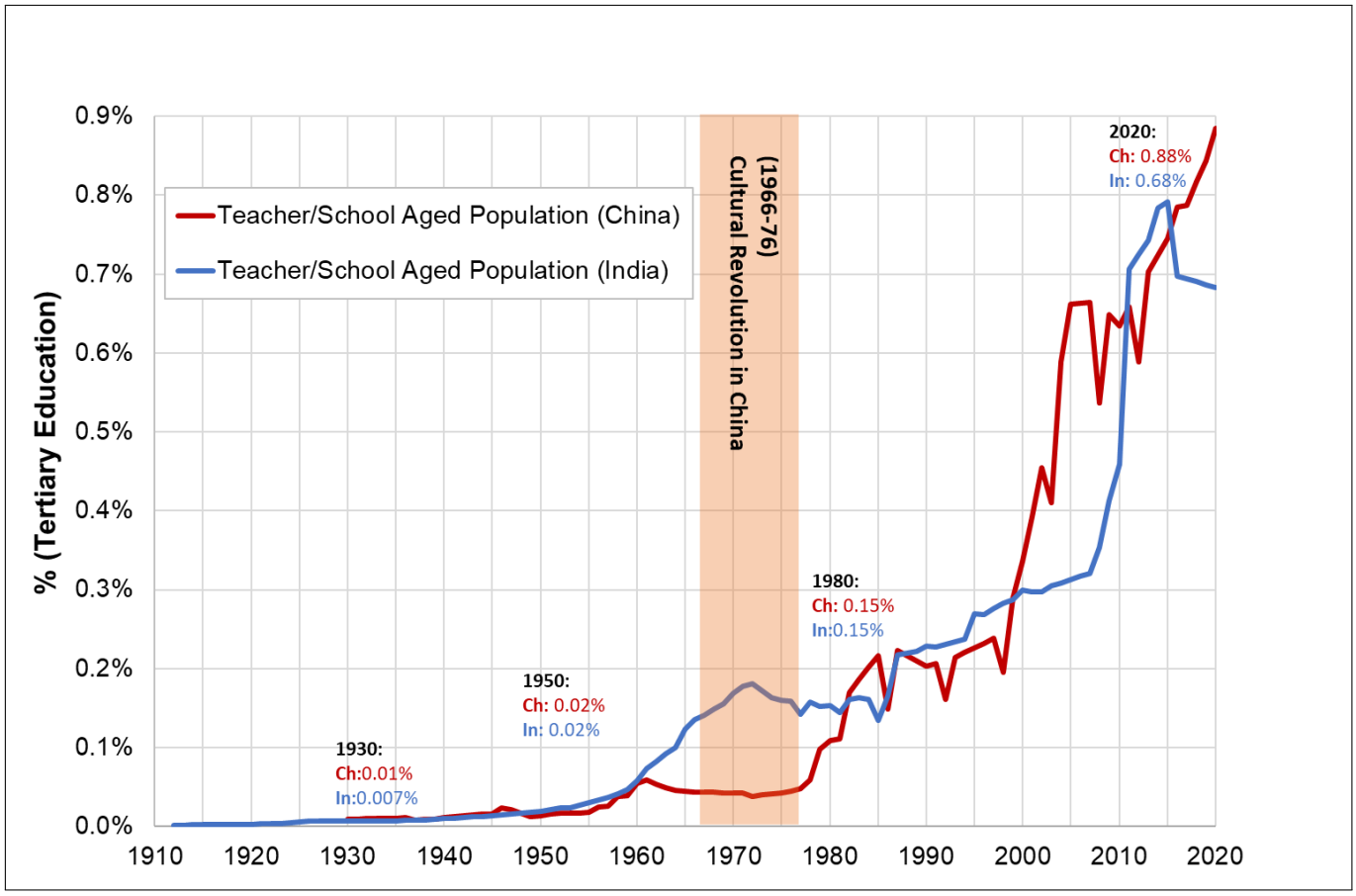
Notes: The figure plots the evolution of the gross enrollment ratio at the master (top) and doctoral (bottom) levels of education in China and India from 1900-2020. The GER at the Masters is the total Masters level enrollment divided by the total population in the age group 22-24 for China (and 21-22 for India). The GER at the doctoral is the PhD level enrollment divided by the total population in the age group 25-27 for China (and 23-27 for India). India still maintains an advantage at the Masters level, where in 2020, GER stands at 9% compared to 4% in China. However, at the doctoral level, after the 2000s, China has a higher GER.

FIGURE 5. Teacher per School-aged Population at Primary and Secondary Stages



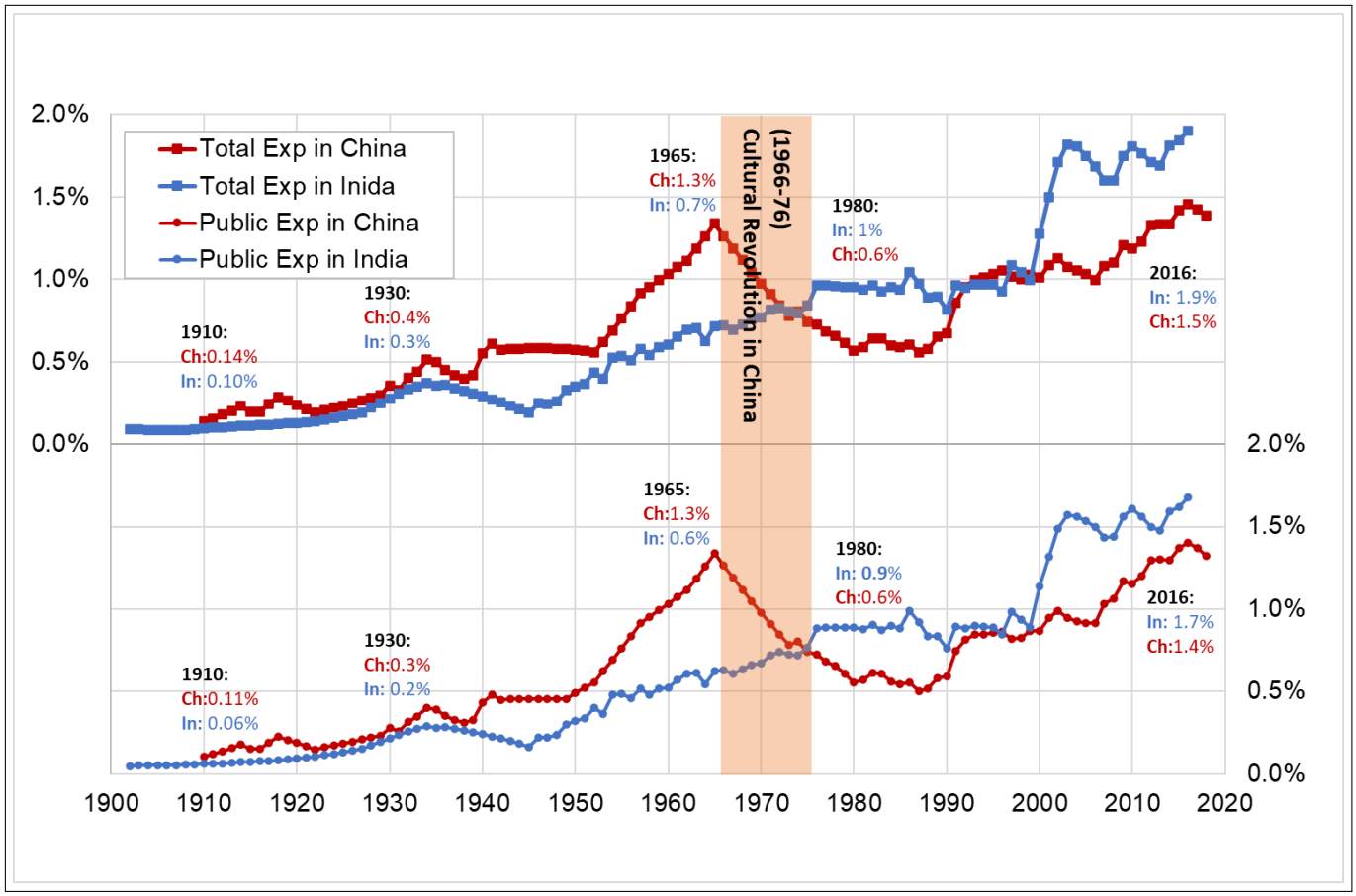
Notes: The figure plots the evolution of the teachers per school-aged population at the primary (top) and secondary (bottom) levels of education in China and India from 1910-2020. Teacher per school-age population at primary is the total number of teachers at the primary level divided by the total population in the age group 6-11 for China (and 6-10 for India). Similarly, the teacher per school-age population at secondary is the total number of teachers at the secondary level divided by 12-17 for China (and 11-17 for India). As with the enrollment ratio pattern, China surpasses India at the primary level in the 1950s and the secondary level in the 1970s due to its bottom–up expansion strategy.

FIGURE 6. Teacher per School-aged Population at Tertiary Stage



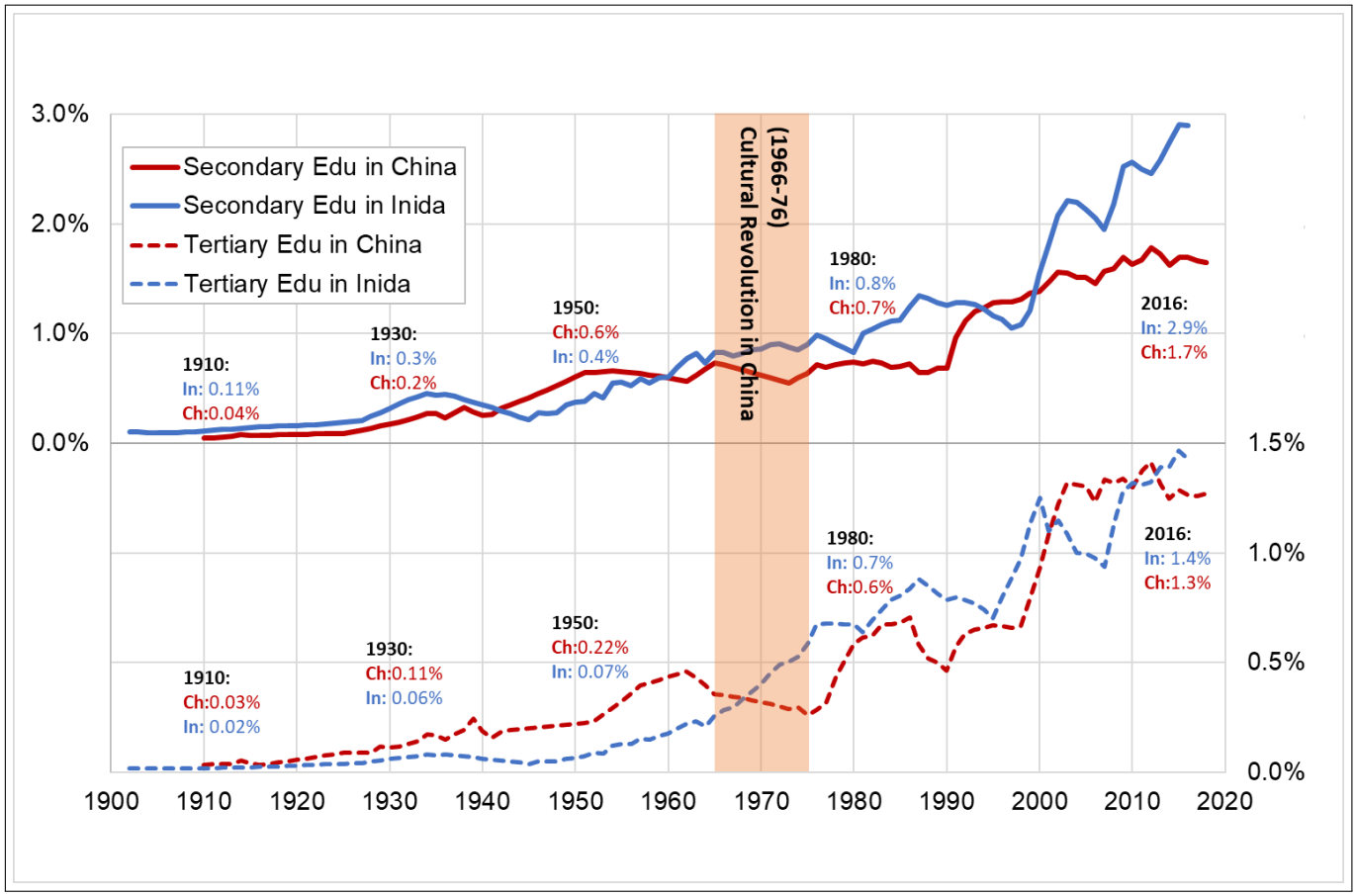
Notes: The figure plots the evolution of the teachers per school-aged population at the tertiary level of education in China and India from 1910-2020. Teacher per school-age population at tertiary is the total number of teachers at the primary level divided by the total population in the age group 18-27 in both countries. China surpassed India at the tertiary level in the 2000s, though the pattern is less stark than the gross enrollment ratio.

FIGURE 7. Primary Stage: Education Expenditure as a share of GNI



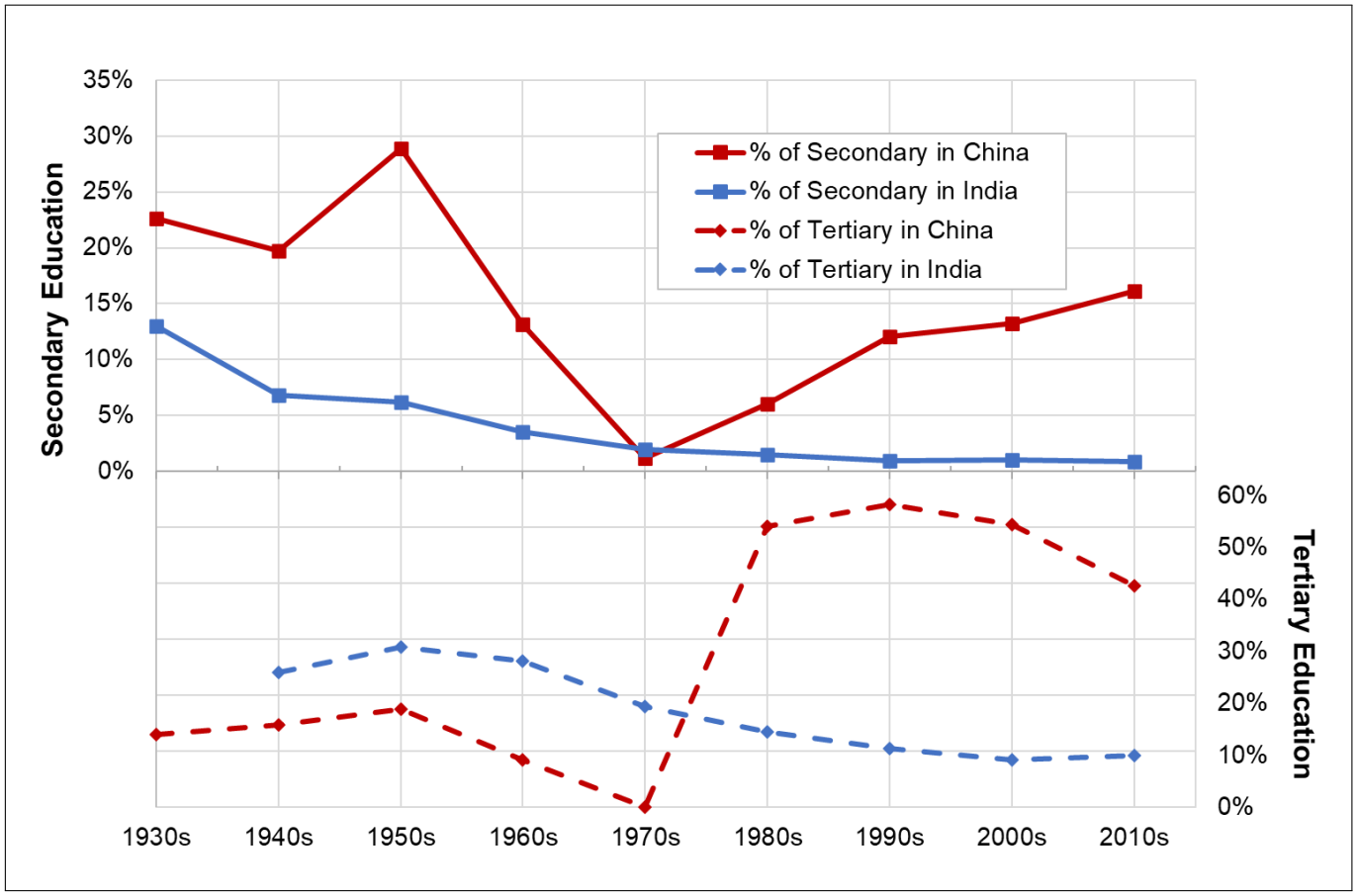
Notes: The figure plots the evolution of primary, secondary, and tertiary-level educational expenditure as a share of gross national income (GNI) in China and India from 1900-2018. The top part uses total educational spending, both public and private. The bottom part is public educational spending on primary education. There is a substantial increase in primary education spending (as % of GNI) in both countries over the past 120 years, with China consistently outspending India from the 1910s onward for more than half a century, despite the earlier introduction of modern education in India by fifty years. The renewed thrust towards primary education comes in India post-2000. Public spending shows a similar pattern, as it constitutes a considerable share of total spending.

FIGURE 8. Secondary and Tertiary Stage: Total Education Expenditure as a share of GNI



Notes: The figure plots the evolution of total (public + private) educational expenditure as a share of gross national income (GNI) at the secondary (top) and tertiary (bottom) stages in China and India from 1900-2018.

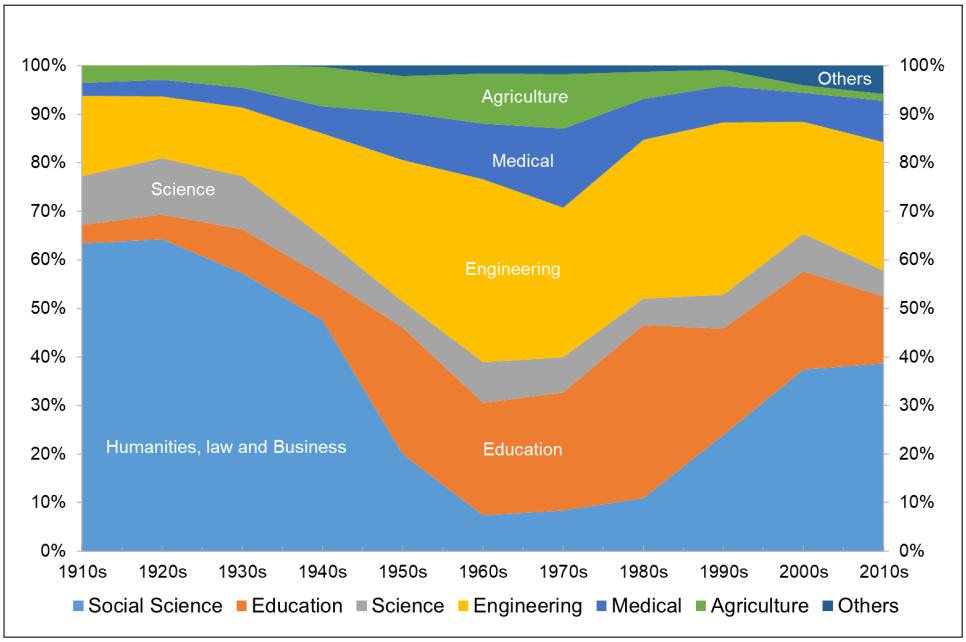
FIGURE 9. Vocational Enrollment Share at Secondary and Tertiary Stages



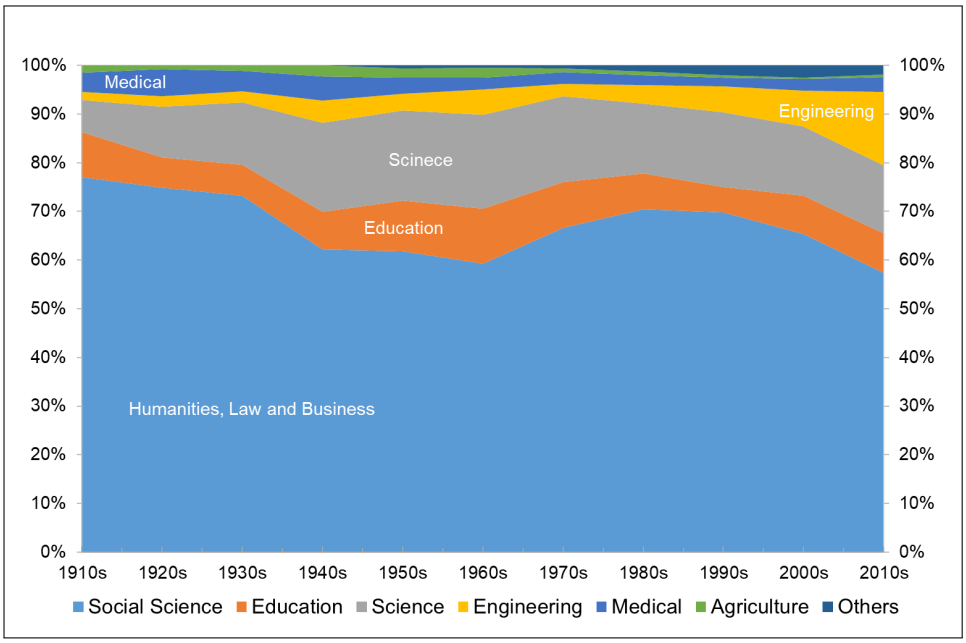
Notes: The figure plots the evolution of the vocational enrollment share at the secondary (top) and tertiary (bottom) levels of education in China and India from 1930s to 2010s. The values are decadal averages. Vocational enrollment share at the secondary (tertiary) level is total enrollment in the vocational track divided by total enrollment at the secondary (tertiary) level. The trend shows higher diversification of education in China, with higher vocationalization. At the tertiary level, 40% of students went through the vocational track in China compared to only 10% in India.

FIGURE 10. Discipline-wise Graduates Share at Bachelors Level

China

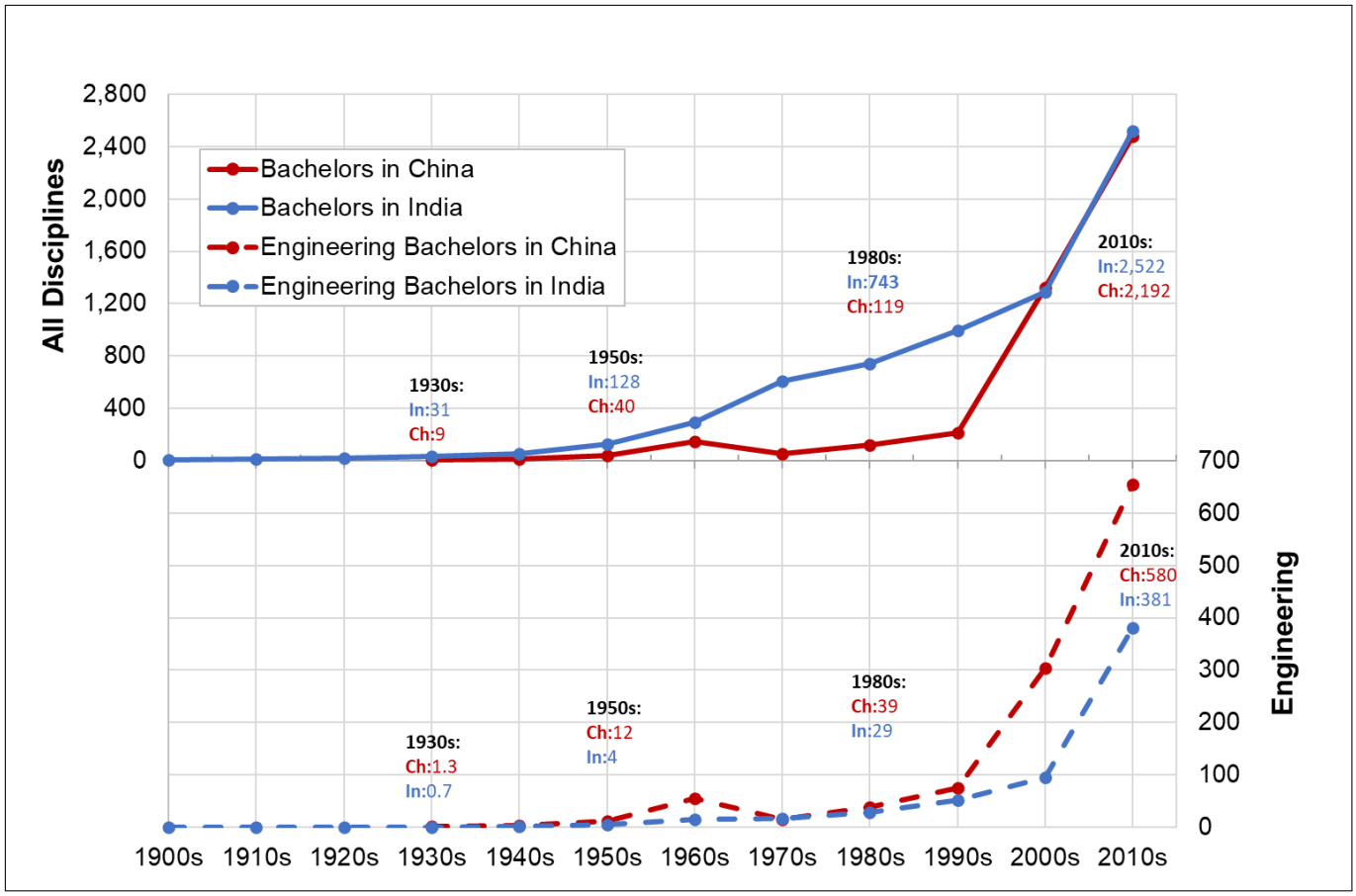


India



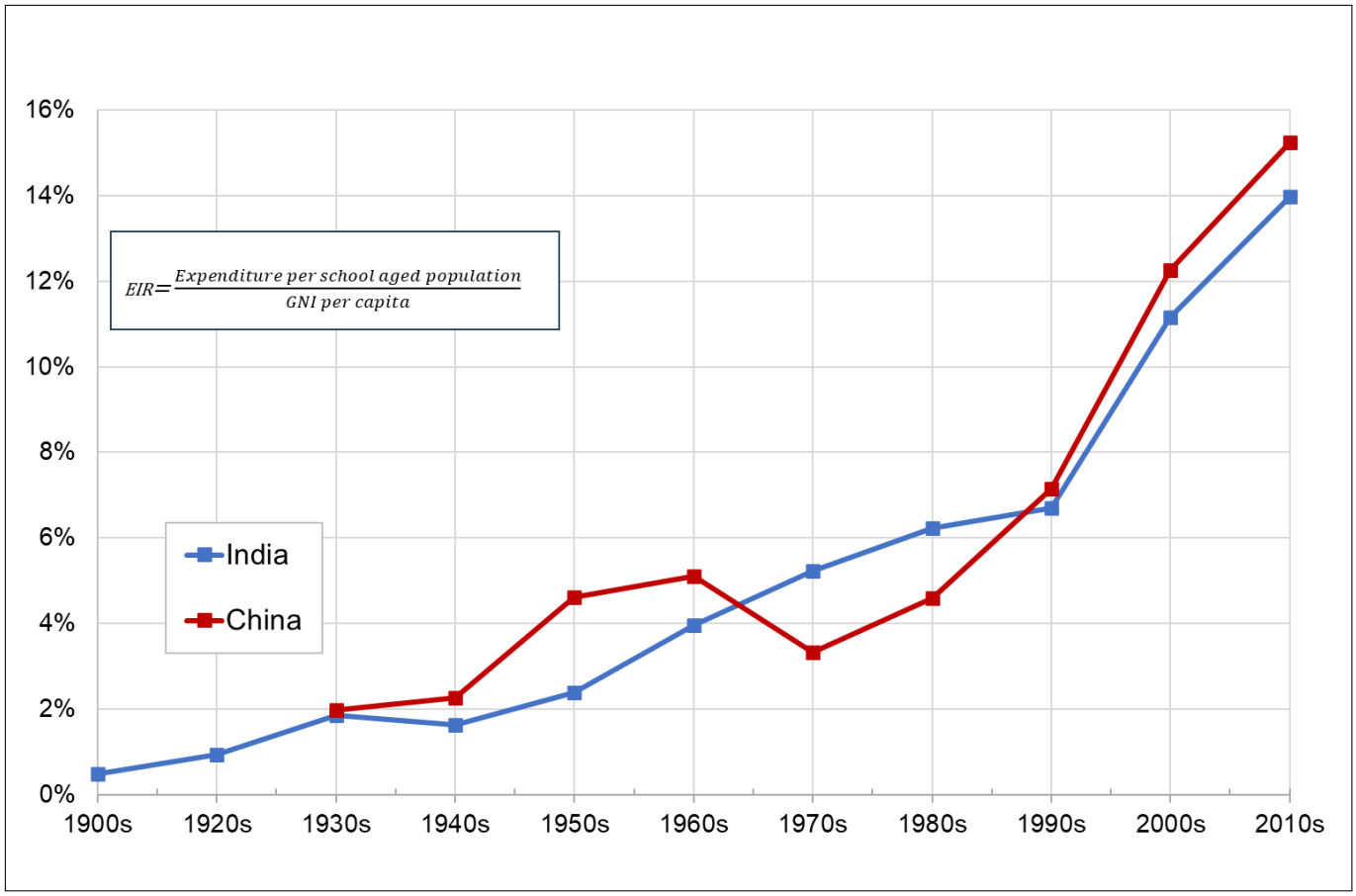
Notes: The figure plots the share of graduates in different disciplines at the bachelor's level in China and India between the 1910s and 2010s. The values are decadal average. Both countries produce a diverse mix of graduates, with China producing more diversified graduate shares. India has been producing predominantly social science graduates (more than 50% throughout the century), and the shares of other disciplines are low.

FIGURE 11. Gross Graduate Ratio at Bachelor stage (per 10k persons)



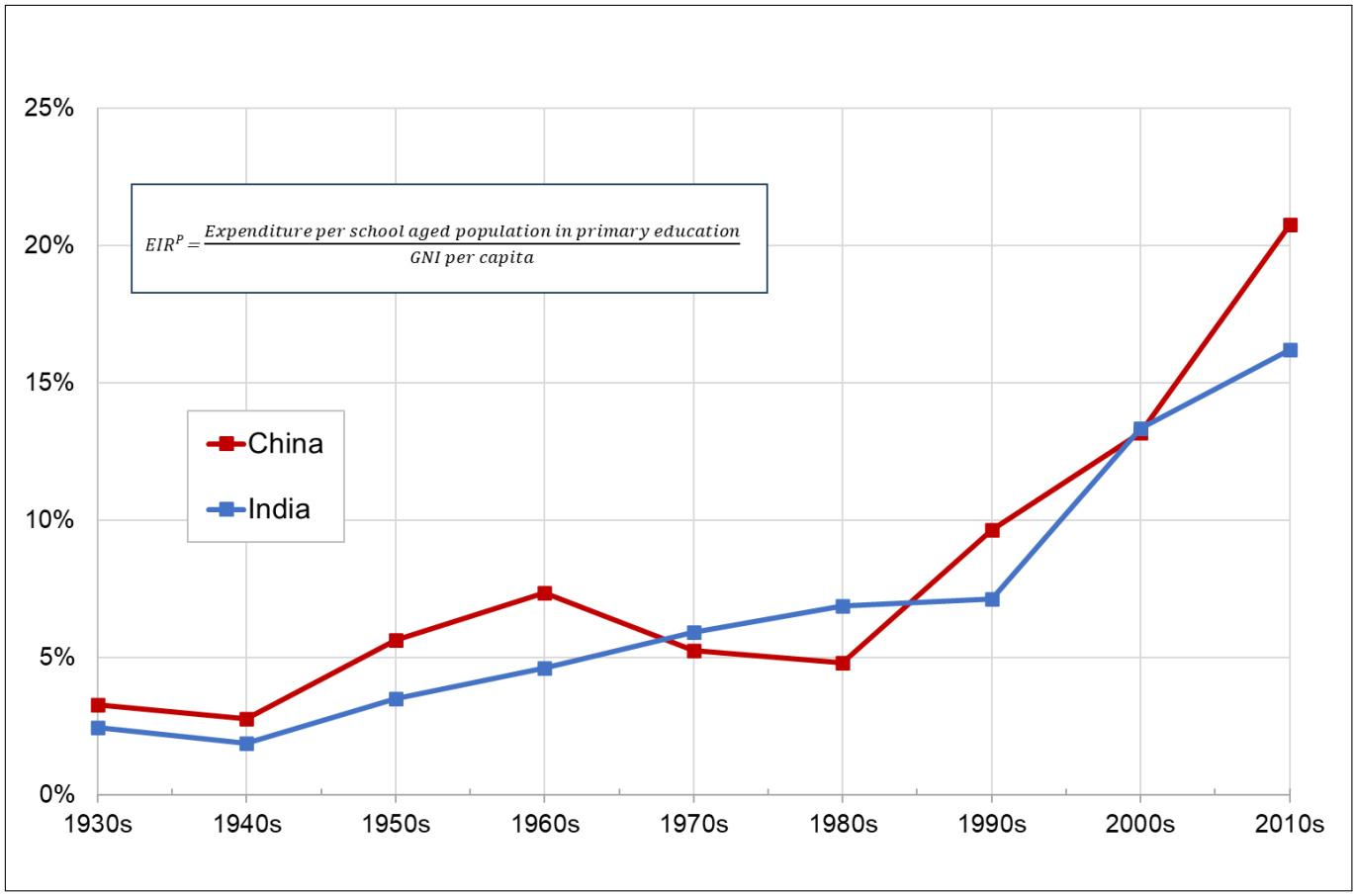
Notes: The figure plots the evolution of the gross graduate ratio at the bachelor's level for all disciplines in the top part and for engineering in the bottom, in China and India from the 1900s to 2010s. The gross graduate ratio is the total number of graduates from the bachelor level divided by the total population of age 22 for China (and 21 for India). The values are decadal average. Throughout the century, India has been producing more bachelor graduates (per 10k persons); however, when it comes to engineering graduates, China clearly produces much more than India.

FIGURE 12. Education Investment Ratio (EIR)



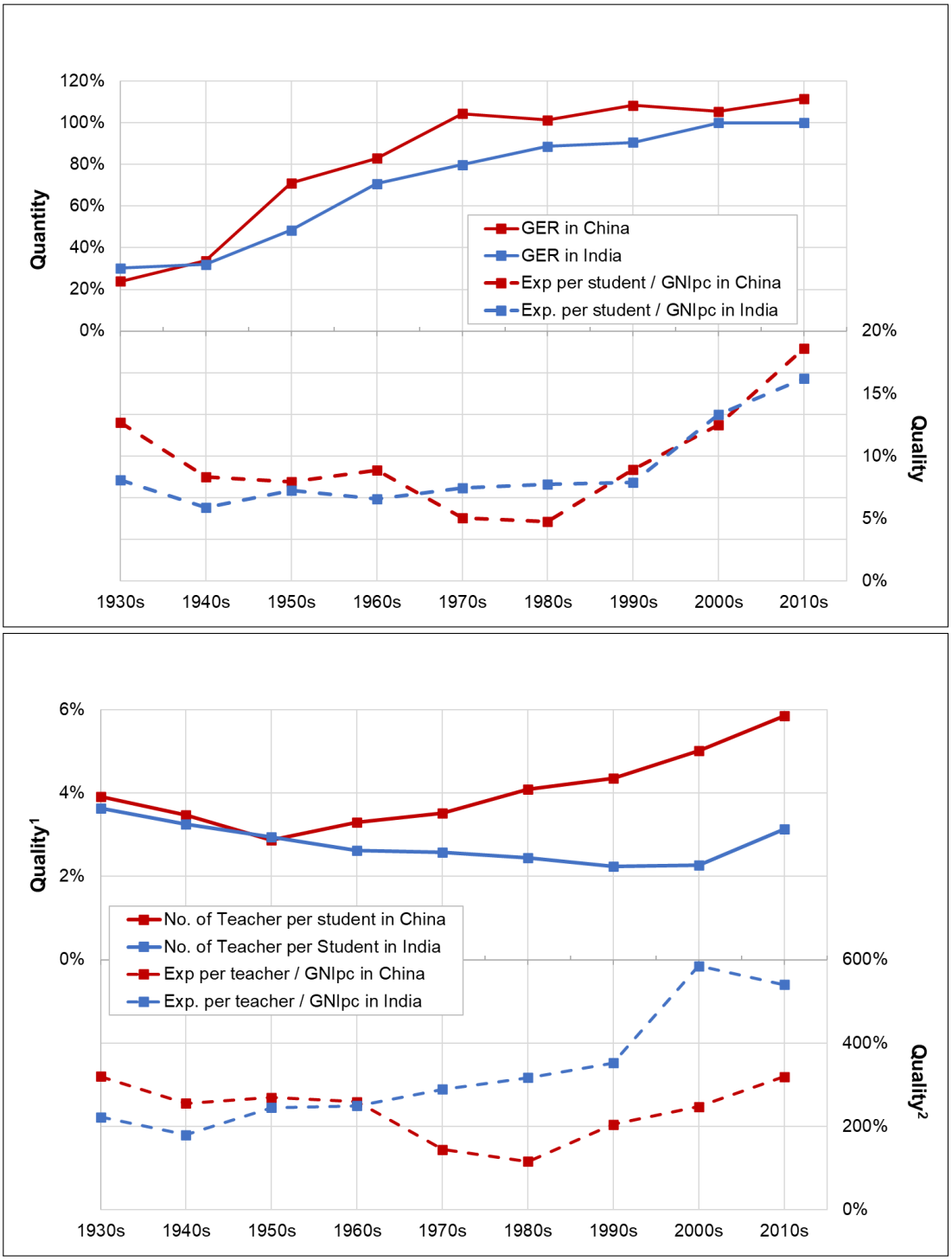
Notes: The figure plots the evolution of the Education Investment Ratio (EIR^{Total}) in China and India from the 1900s to the 2010s. EIR has increased in both countries in a similar fashion to reach about 15% in both countries in 2010s. Intuitively, it means the average expenditure per school-aged population is about 15% of the national income per capita.

FIGURE 13. Education Investment Ratio at Primary stage



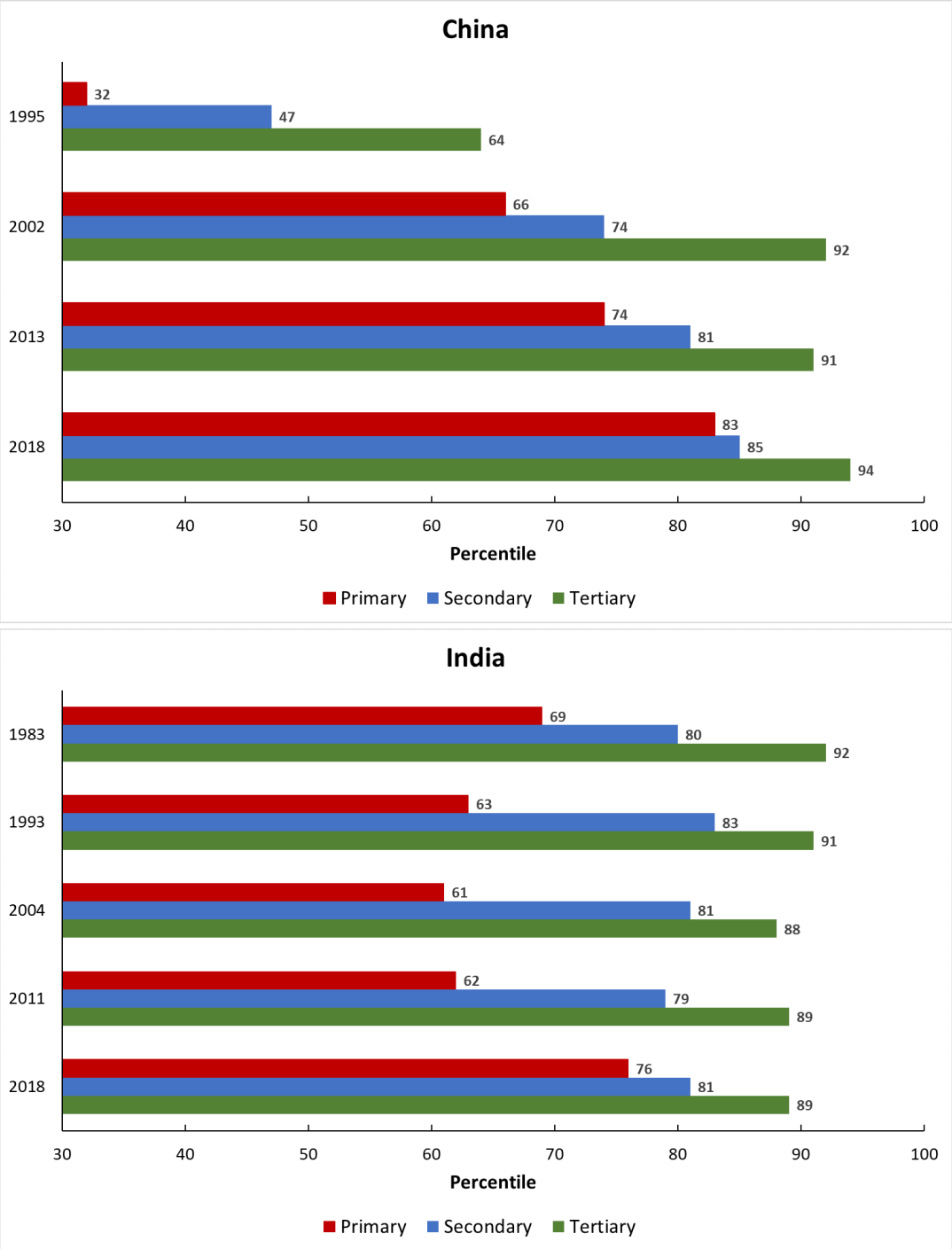
Notes: The figure plots the evolution of the Education Investment Ratio (EIR^P) at the primary stage in China and India from the 1900s to the 2010s. The long-run trend is similar in both countries. However, the average EIR^P in 2010s in China stands at 20%, much higher than India (15%).

FIGURE 14. Quantity-Quality Decomposition of EIR^P



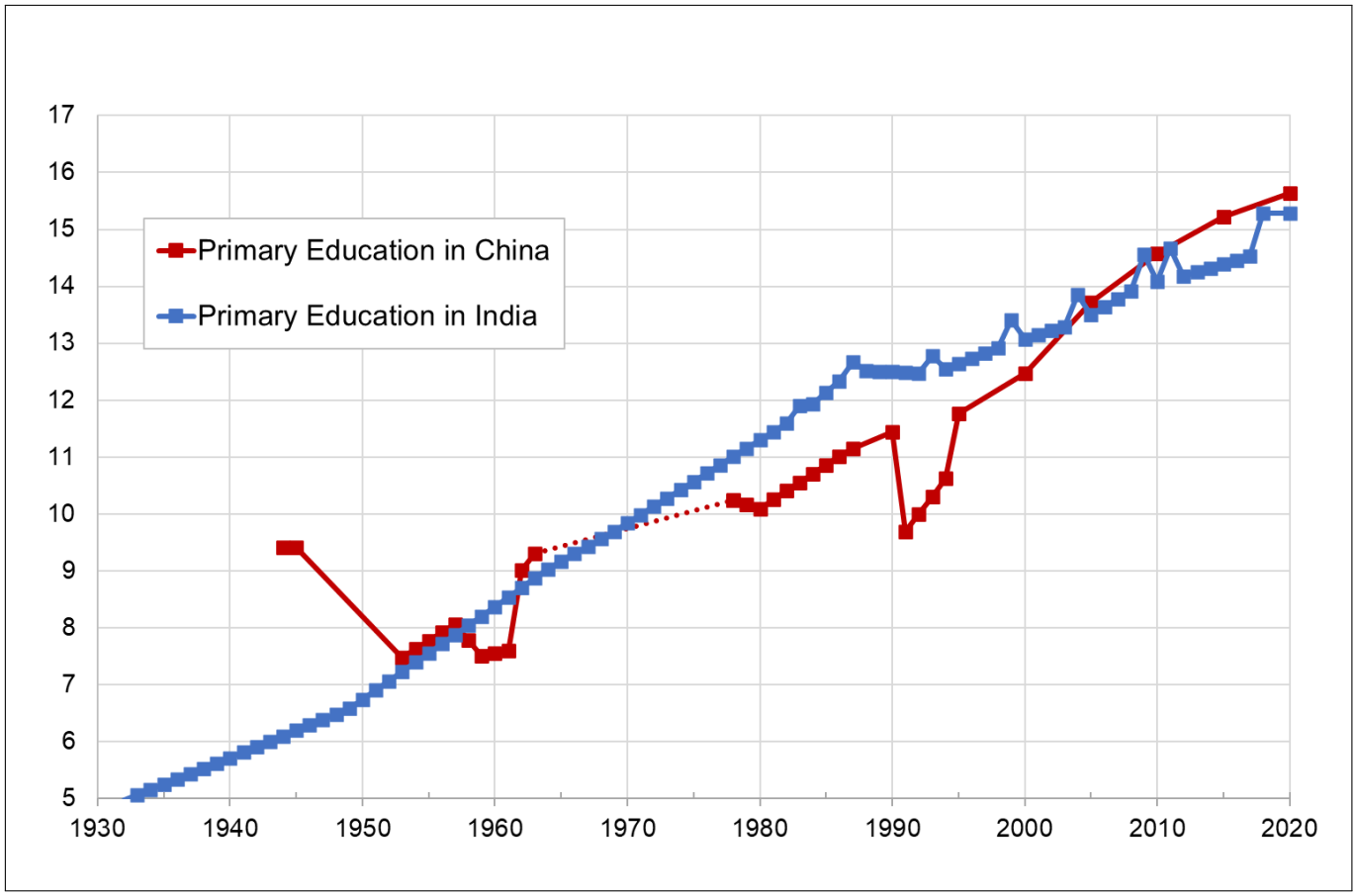
Notes: The top figure plots the evolution of two subcomponents of EIR^P, following equation B.1, $Quantity^P$ (GER) and $Quality^P$ (exp per student as a share of GNIpc) and the bottom figure plots the two subcomponents of $Quality^P$, following equation B.2, into $Quality1^P$ (Teacher Pupil Ratio) and $Quality2^P$ (exp per teacher as a share of GNIpc). China has targeted quality through hiring more teachers, whereas India has targeted quality through hiring teachers at higher salaries.

FIGURE 15. Rank Percentile of Average Wage of Teachers



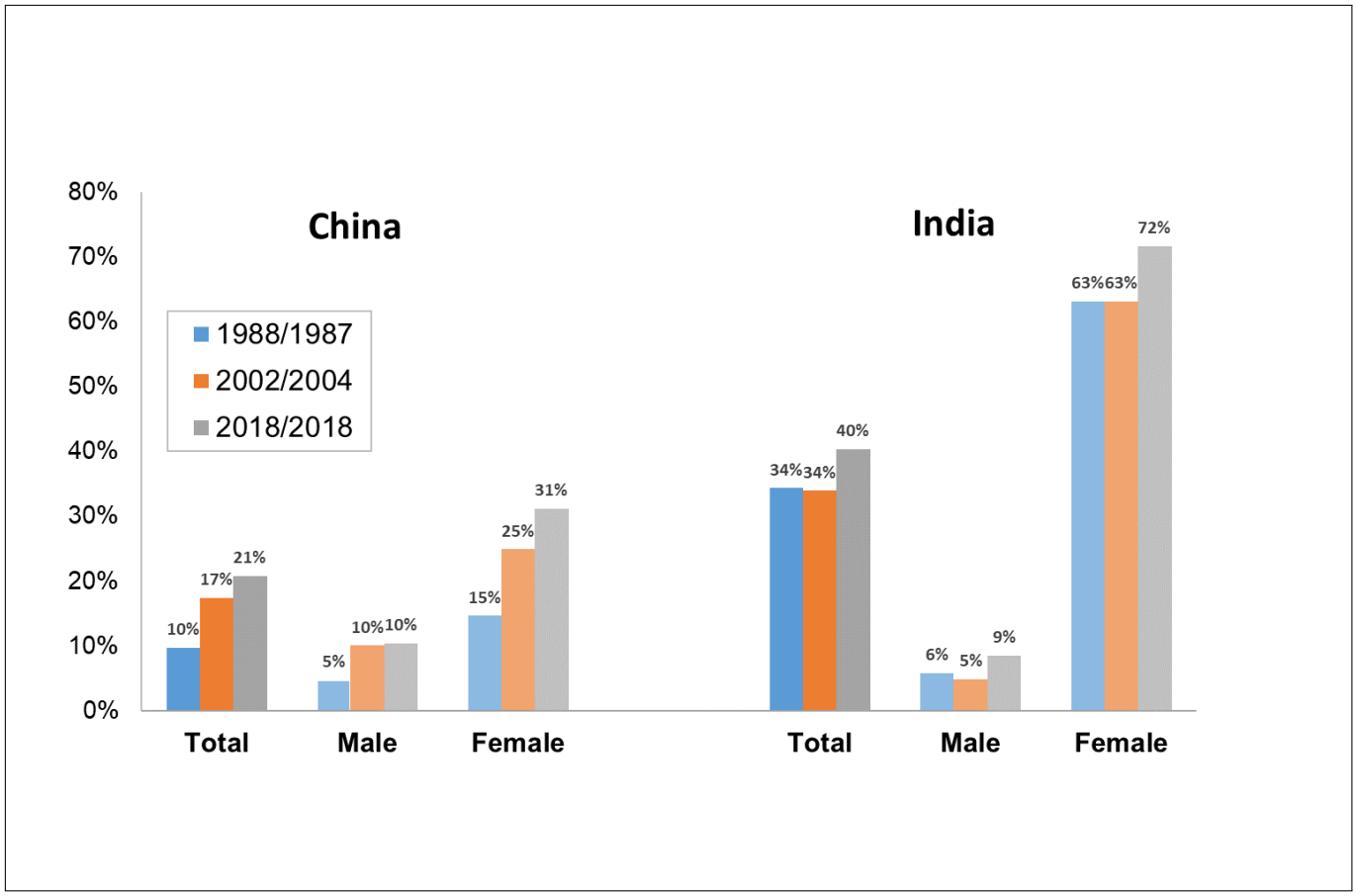
Notes: The figure plots the rank percentile of primary, secondary and tertiary level teachers' salaries in the wage distribution of the salaried population (in 20-60 years) from CHIP and EUS surveys. In the 1990s, the percentile of teachers was lower in China at all levels than in India. Post-2000, after China started focusing on quality, the rank percentile of teachers' salaries increased (and became similar to India). The surveys of 2011 and 2018 do not allow for splitting primary (grade I-V) and upper primary (grade VI-VIII) teachers' occupations. In 2018, there was a big jump in the primary (grade I-VIII) level teachers' salary rank in India.

FIGURE 16. Average years of Schooling of Primary Stage Teachers



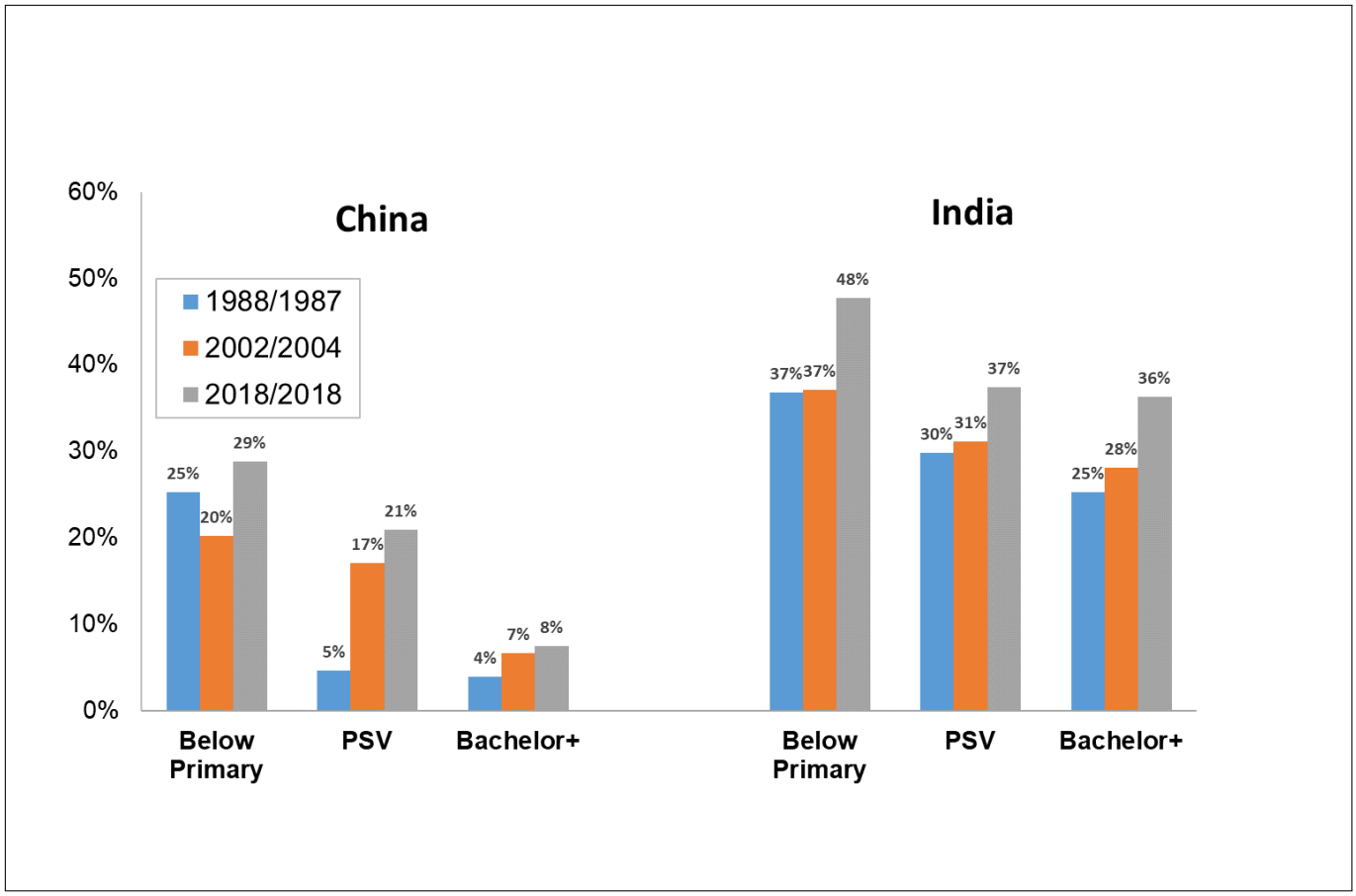
Notes: The figure plots the evolution of the average (estimated) years of education of primary-level teachers in China and India from 1930-2020.

FIGURE 17. Non-Working Population Share by Gender



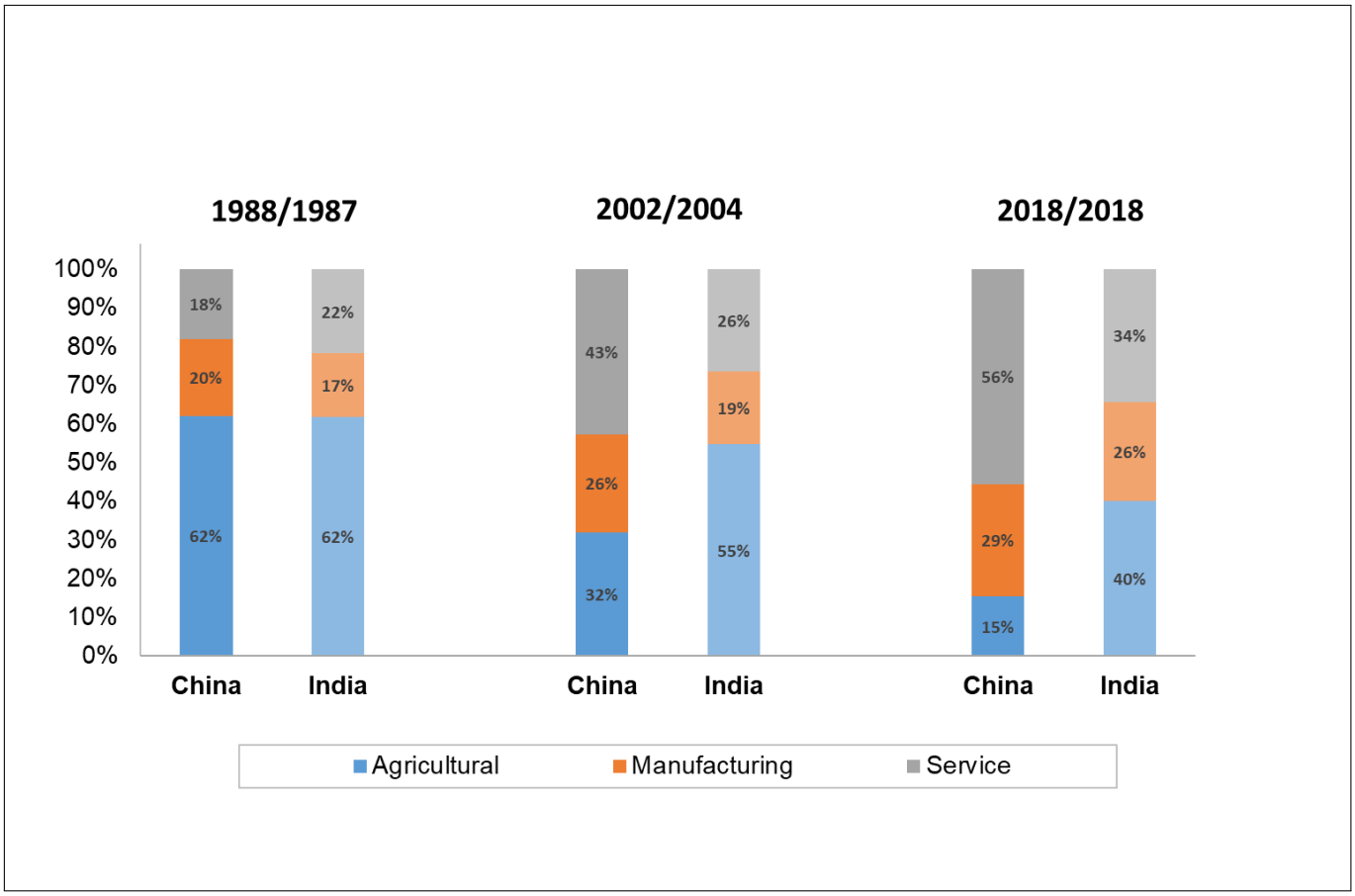
Notes: The figure plots the nonworking population share from CHIP and EUS surveys in 1988/87, 2002/04, and 2018. The sample is restricted to 20-60 years old and not studying. India has a notably high share of the non-working population, accounting for 34% in 1988 and 2002, increasing to 40% in 2018. In comparison, China's non-working population was 10% in 1988, 17% in 2004, and 23% in 2018. A high share of females are non-working in both countries. In 1988, 63% of females aged 20-60 in India were not working, while only 6% of males fell into this category. By 2018, the share increased to 73% for females and 8% for males. Similarly, in China, the proportion of non-working females increased from 15% in 1988 to 31% in 2018

FIGURE 18. Non-Working Population Share by Educational Stages



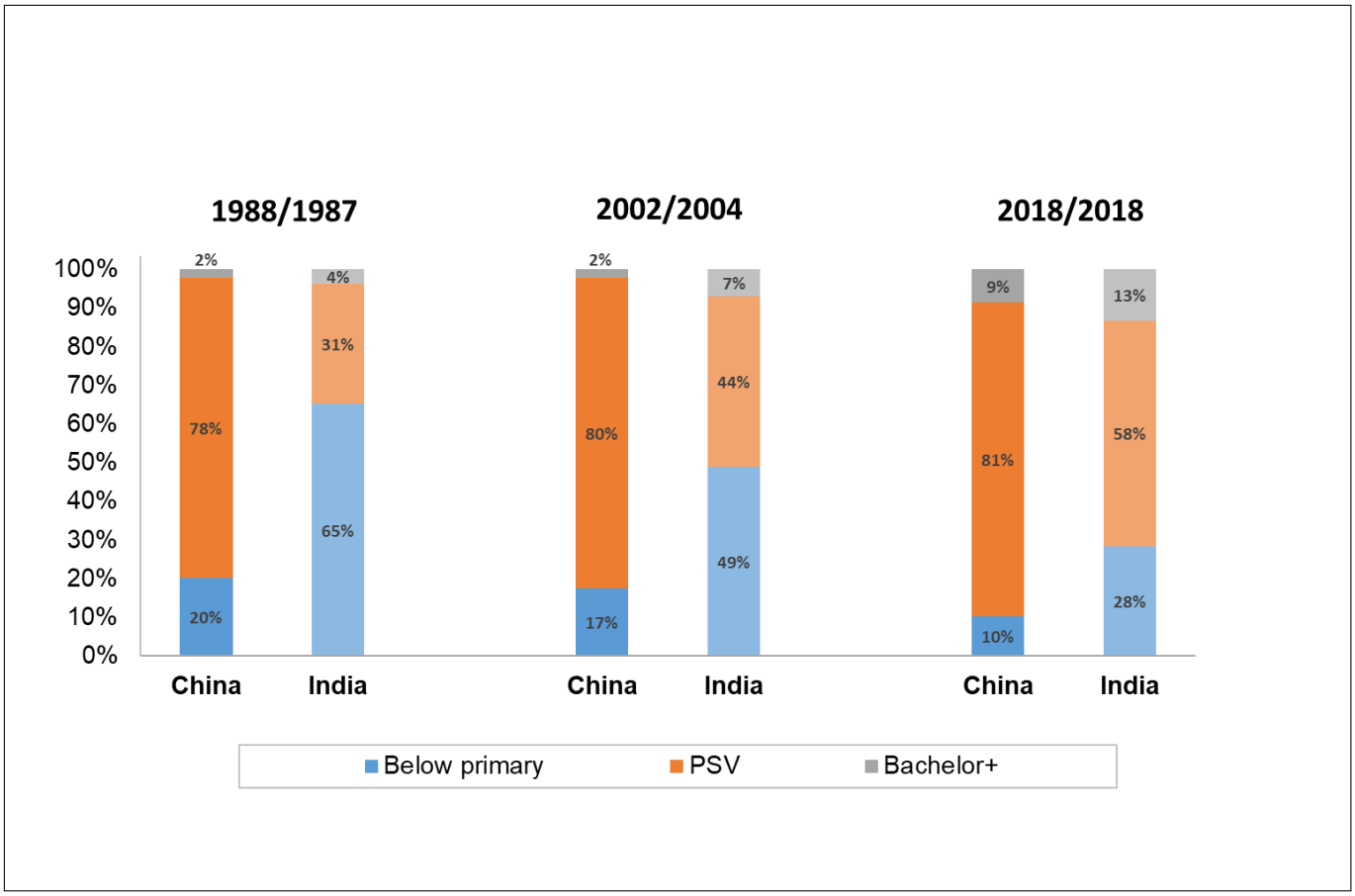
Notes: The figure plots the nonworking population share from CHIP and EUS surveys in 1988/87, 2002/04, and 2018. The sample is restricted to 20-60 years old and not enrolled in higher education. The non-working share decreases with education levels in both countries. The share of non-working tertiary graduates is also non-negligible. In 1988, it stood at 25% in India compared to just 4% in China. This situation appears to be worsening, with the shares of non-working tertiary graduates in 2018 increasing to 36% in India and 8% in China.

FIGURE 19. Working Population Share by Sectors



Notes: The figure plots the working population share by sector from CHIP and EUS surveys in 1988/87, 2002/04, and 2018. The sample is restricted to 20-60 years old and working. In 1988, 62% of the adult working population in both China and India was employed in agriculture, with the remaining evenly split between the manufacturing and service sectors. By 2018, China had successfully shifted a larger proportion of its population out of agriculture, with only 15% remaining in the sector, compared to 40% remaining in India.

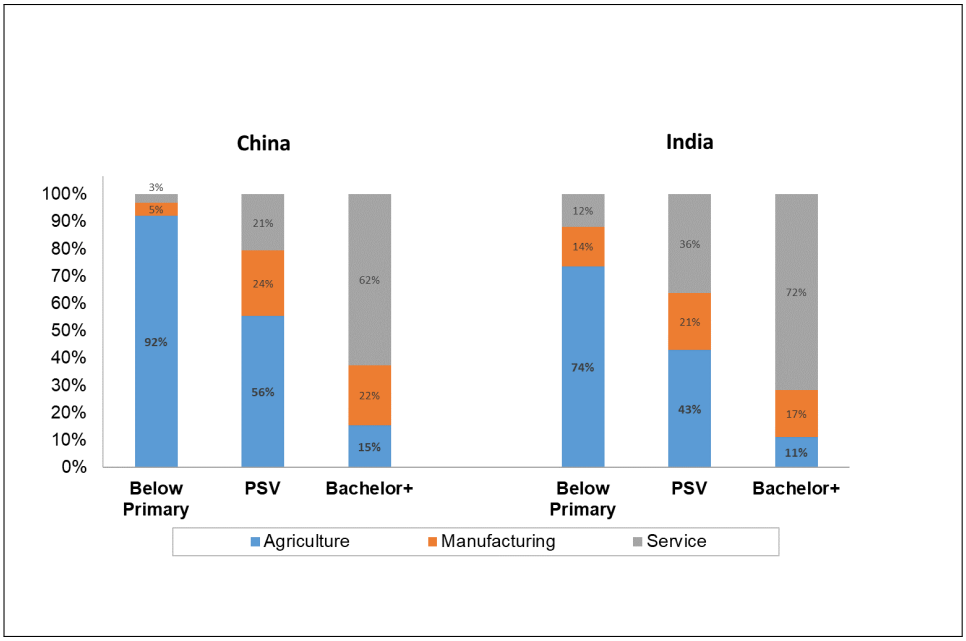
FIGURE 20. Working Population Share by Educational Stages



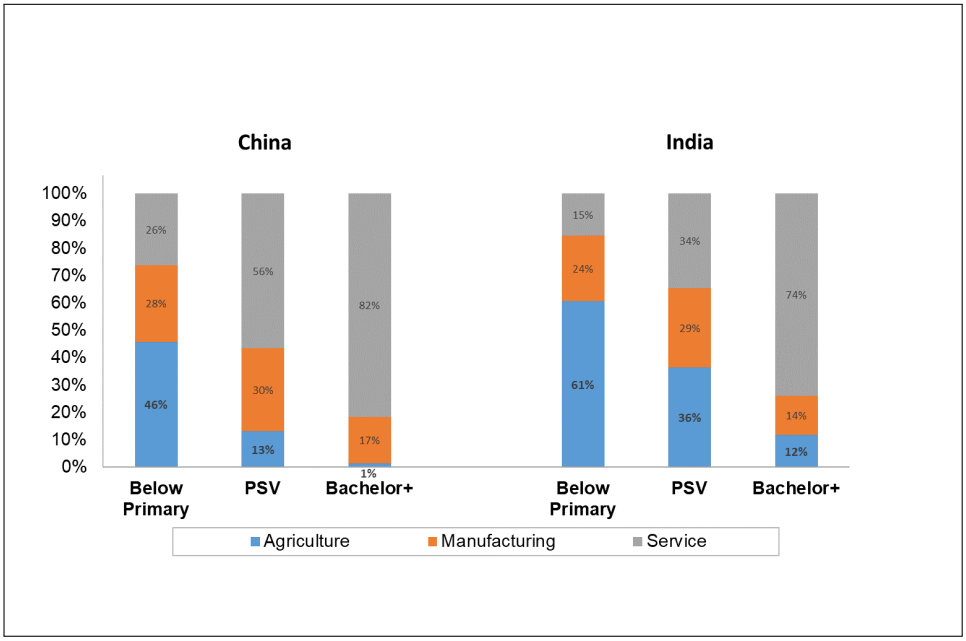
Notes: The figure plots the working population share by educational levels from CHIP and EUS surveys in 1988/87, 2002/04, and 2018. The sample is restricted to 20-60 years old and working. In 1987, 65% of India's working adult population had education levels below primary (including illiterates), compared to 20% in China in 1988. Despite significant progress in enhancing human capital, by 2018, approximately 30% of India's working population still had education levels below primary.

FIGURE 21. Working Population Share by Sectors Within Educational Level

Survey year: 1988/1987



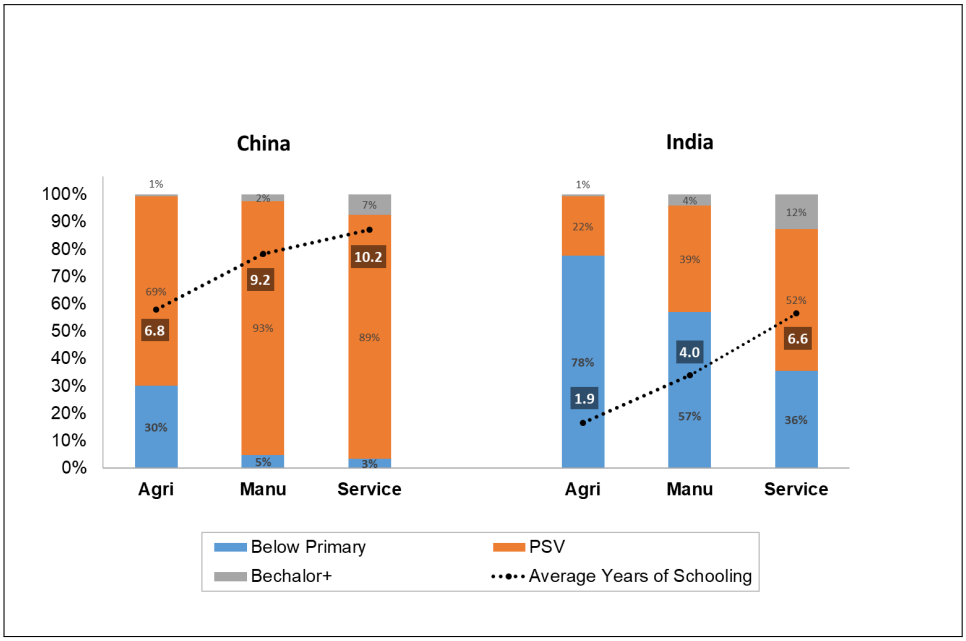
Survey year: 2018



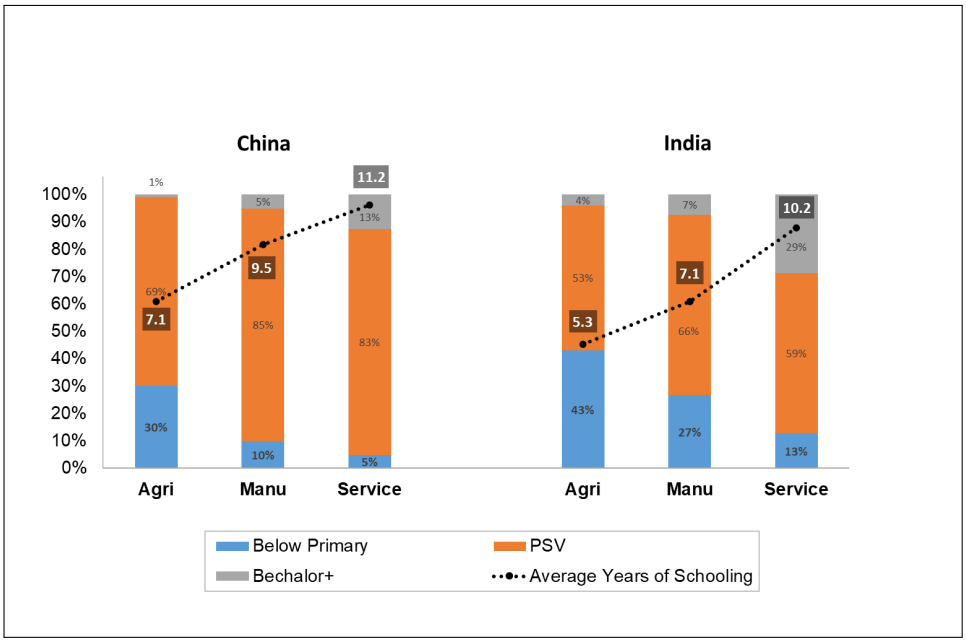
Notes: The figure plots the working population share by sector within educational categories from CHIP and EUS surveys in 1988/1987 (top) and 2018 (bottom). The sample is restricted to 20-60 years old and working. The educational categories are Below Primary (including illiterates), PSV (primary, secondary, and vocational graduates), and Bachelor+ (all non-vocational tertiary graduates). It indicates that individuals with education levels below primary are most likely to remain in the agriculture sector in any year.

FIGURE 22. Working Population Share by Educational Level Within Sectors

Survey year: 1988/1987



Survey year: 2018



Notes: The figure plots the working population share by educational categories within sectors from CHIP and EUS surveys in 1988/1987 (top) and 2018 (bottom). The sample is restricted to 20-60 years old and working. The educational categories are Below Primary (including illiterates), PSV (primary, secondary, and vocational graduates), and Bachelor+ (all non-vocational tertiary graduates). China has a more educated labor force in all sectors, even in 1987/88.

8. Tables

Table 1. Expansion in Education: Average Flow of Variables

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Enrollment		Graduates		Teachers		Expenditures	
	CH	IN	CH	IN	CH	IN	CH	IN
Unit	*million person*		*million person*		*million person*		*bn 2020 $*	
1910s	4	7	0.1	0.2	0.3	0.3	0.6	0.5
1920s	8	9	0.2	0.3	0.4	0.4	0.8	0.8
1930s	14	13	0.4	0.6	0.6	0.5	0.9	1.3
1940s	23	17	1	1	0.8	0.6	1	2
1950s	73	34	5	4	2	1	5	3
1960s	108	68	13	8	4	2	11	6
1970s	191	96	36	15	8	3	13	10
1980s	189	135	35	24	9	4	16	14
1990s	206	177	40	36	10	5	31	15
2000s	231	239	57	56	12	7	111	40
2010s	226	288	54	73	13	10	437	102

Notes: The table presents the decadal averages of enrollment, graduates, teachers, and expenditure. The education system has become gigantic - absorbing billions of dollars, providing direct employment to millions of teachers and staff, and generating millions of skilled labor force every year. It shows a piece of impeccable evidence for the term "human-capital century" for the 20^{th} century.

TABLE 2. Total Education Expenditure by Stages

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	China				India			
	Primary	Secondary	Tertiary	***Total***	Primary	Secondary	Tertiary	***Total***
1910s	66%	21%	13%	*100%*	41%	51%	8%	*100%*
1920s	57%	24%	19%	*100%*	42%	49%	9%	*100%*
1930s	51%	30%	19%	*100%*	41%	50%	9%	*100%*
1940s	49%	34%	17%	*100%*	43%	49%	9%	*100%*
1910s-1940s	***56%***	***27%***	***17%***	*100%*	***42%***	***50%***	***9%***	*100%*
1950s	44%	38%	18%	*100%*	44%	46%	10%	*100%*
1960s	53%	30%	18%	*100%*	40%	45%	15%	*100%*
1970s	44%	37%	19%	*100%*	37%	39%	24%	*100%*
1950s-1970s	***47%***	***35%***	***18%***	*100%*	***40%***	***43%***	***16%***	*100%*
1980s	31%	37%	32%	*100%*	33%	40%	27%	*100%*
1990s	35%	42%	23%	*100%*	32%	40%	28%	*100%*
2000s	28%	40%	32%	*100%*	34%	43%	23%	*100%*
2010s	31%	39%	30%	*100%*	31%	46%	24%	*100%*
1980s-2010s	***31%***	***39%***	***29%***	***100%***	***33%***	***42%***	***25%***	***100%***

Notes: This table presents average decadal total (public + private) education expenditure shares. Col (1)-(3) is the share of educational spending allocated to primary, secondary, and tertiary stages in China, and Col (5)-Col (7) is for India. It highlights the bottom–up strategy of China, with allocation centered on primary education in the early 20th century, then gradually shifted to secondary education until the 1970s, ultimately transitioning to tertiary education. India emphasized secondary education until the 1950s, followed by a shift towards higher education, indicative of a top–down education expansion model.

TABLE 3. Share of Public Education Expenditure by Stages

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	China				India			
	Total	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary
1910s	82%	78%	91%	88%	53%	67%	42%	46%
1920s	78%	78%	75%	81%	62%	78%	50%	49%
1930s	72%	79%	61%	73%	61%	80%	49%	46%
1940s	72%	79%	62%	73%	65%	88%	47%	45%
1910s-1940s	***74%***	***79%***	***66%***	***76%***	***61%***	***80%***	***48%***	***46%***
1950s	99%	99%	99%	99%	70%	90%	55%	50%
1960s	100%	100%	100%	100%	75%	87%	70%	59%
1970s	100%	100%	100%	100%	83%	91%	82%	73%
1950s-1970s	***100%***	***100%***	***99%***	***100%***	***78%***	***90%***	***72%***	***66%***
1980s	94%	92%	90%	100%	89%	94%	88%	82%
1990s	82%	84%	78%	85%	88%	91%	90%	82%
2000s	78%	92%	79%	65%	82%	88%	86%	62%
2010s	89%	97%	91%	76%	82%	88%	87%	63%
1980s-2010s	***85%***	***92%***	***84%***	***78%***	***84%***	***90%***	***87%***	***70%***

Notes: This table presents average decadal public share in total education expenditure. Col (1) and Col(5) is total public educational expenditure share in China and India respectively. Col (2)-(4) is the share of educational spending allocated to primary, secondary, and tertiary stages in China, and Col (6)-Col (8) is for India. The public share in China has been overall larger than in India. In India, the public spending was quite low in the beginning of the century, which increased upto 1980s, before the reversal in trend. Post-liberalization, public share declined in both countries, especially in the tertiary education level.

TABLE 4. Multiplicative Decomposition of EIR Growth by Period

	[1]	[2]	[3]	[4]	[5]	[6]
		China			India	
	EIR	Quantity	Quality	EIR	Quantity	Quality
	1930s-1950s					
Primary	**3.1%**	***5.6%***	***-2.3%***	**1.8%**	***2.4%***	***-0.5%***
Secondary	6.3%	*10.9%*	*-4.1%*	0.5%	*5.9%*	*-5.1%*
Tertiary	5.2%	*9.7%*	*-4.0%*	1.8%	*9.5%*	*-7.0%*
	1950s-1980s					
Primary	-0.5%	*1.2%*	***-1.7%***	2.3%	*2.0%*	***0.2%***
Secondary	-0.9%	*4.8%*	***-5.4%***	2.7%	*3.3%*	***-0.6%***
Tertiary	1.9%	*5.0%*	***-3.0%***	6.8%	*6.5%*	***0.3%***
	1980s-2010s					
Primary	5.0%	*0.3%*	*4.7%*	3.0%	*0.5%*	*2.5%*
Secondary	5.4%	*2.9%*	*2.4%*	3.2%	*2.2%*	*1.0%*
Tertiary	2.6%	*8.7%*	*-5.6%*	2.0%	*5.0%*	*-2.9%*

Notes: The table presents the annual growth rates of EIR and its two multiplicative components following equations 3 and B.1 for the three educational stages in three time periods - 1930s-50s, 1950s-80s, and 1980s-2010s. The *Quantity* component in Col (2) and (4) is the gross enrollment ratio, and the *Quality* component in Col (3) and (5) is expenditure per enrolled student (as a share of GNIpc). The first three columns are for China, and the last three are for India. It highlights the quantity first quality later approach of China, where quantitative expansion occurred at the expense of quality (negative growth rate up to 1980s). India has tried to balance quantity and quality, especially post-1950, with more positive growth rates in *Quality*, along with positive growth rates in *Quantity*.

TABLE 5. Multiplicative Decomposition of EIR (Quality) Growth by Period

	[1]	[2]	[3]	[4]	[5]	[6]
	China			**India**		
	Quality	Quality1 (TPR)	Quality2	Quality	Quality1 (TPR)	Quality2
	1930s-1950s					
Primary	**-2.3%**	***-1.5%***	***-0.9%***	**-0.5%**	***-1.0%***	***0.5%***
Secondary	-4.1%	*-2.7%*	*-1.5%*	-5.1%	*-1.3%*	*-3.8%*
Tertiary	-4.0%	*-4.6%*	*0.2%*	-7.0%	*-2.1%*	*-5.1%*
	1950s-1980s					
Primary	-1.7%	*1.2%*	*-2.8%*	0.2%	*-0.6%*	*0.9%*
Secondary	-5.4%	*1.1%*	*-6.5%*	-0.6%	*-0.5%*	*-0.1%*
Tertiary	-3.0%	*1.8%*	*-4.8%*	0.3%	*-0.5%*	*0.9%*
	1980s-2010s					
Primary	4.7%	*0.9%*	*3.8%*	2.5%	*0.8%*	*1.8%*
Secondary	2.4%	*0.4%*	*1.8%*	1.0%	*-0.6%*	*1.7%*
Tertiary	-5.6%	*-3.5%*	*-1.8%*	-2.9%	*-0.2%*	*-2.7%*

Notes: The table presents the annual growth rates of *Quality* (expenditure per student as a share of GNIpc) and its two multiplicative components following Equation 3 and B.2 for the three educational stages in three time periods - 1930s-50s, 1950s-80s, and 1980s-2010s. *Quality*1 is Teacher–Pupil Ratio, and *Quality*2 is expenditure per teacher (as a share of GNIpc). The first three columns are for China, and the last three are for India. It highlights the Chinese strategy of managing quality by keeping TPR in check, whereas, in India, the emphasis is more on the second component (increasing teachers' salaries).

Table 6. Human Capital Composition Among Adult Population

Human Capital Composition Among Adult Population																	
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
		China								India							
Survey Year	Birth Cohort	Total	Illiterates	Literates	*Below Primary*	*Primary*	*Secondary*	*Vocational All*	*Bachelor and above*	Total	Illiterates	Literates	*Below Primary*	*Primary*	*Secondary*	*Vocational All*	*Bachelor and above*
PANEL A: By Survey Year																	
1988/1987		100%	22%	78%	*8%*	*24%*	*39%*	*5%*	*2%*	100%	60%	40%	*8%*	*12%*	*17%*	*0%*	*3%*
1995/1993		100%	12%	88%	*23%*	*28%*	*25%*	*10%*	*1%*	100%	53%	47%	*10%*	*11%*	*22%*	*0%*	*5%*
2002/2004		100%	6%	94%	*16%*	*24%*	*38%*	*14%*	*2%*	100%	45%	55%	*8%*	*12%*	*27%*	*1%*	*7%*
2013/2011		100%	4%	96%	*12%*	*23%*	*37%*	*17%*	*7%*	100%	35%	65%	*10%*	*12%*	*34%*	*1%*	*9%*
2018		100%	5%	95%	*13%*	*24%*	*36%*	*16%*	*7%*	100%	29%	71%	*5%*	*12%*	*39%*	*1%*	*13%*
PANEL B:By Birth Cohort																	
1988/1987	1910s	100%	68%	32%	*18%*	*8%*	*5%*	*1%*	*1%*	100%	77%	23%	*8%*	*8%*	*6%*	*0%*	*1%*
1988/1987	1920s	100%	53%	47%	*14%*	*17%*	*12%*	*2%*	*2%*	100%	76%	24%	*9%*	*8%*	*7%*	*0%*	*1%*
1988/1987	1930s	100%	32%	68%	*10%*	*28%*	*21%*	*6%*	*4%*	100%	71%	29%	*9%*	*9%*	*10%*	*0%*	*2%*
1988/1987	1940s	100%	19%	81%	*6%*	*31%*	*34%*	*7%*	*3%*	100%	62%	38%	*9%*	*11%*	*14%*	*0%*	*3%*
1988/1987	1950s	100%	15%	85%	*5%*	*23%*	*50%*	*6%*	*2%*	100%	54%	46%	*8%*	*13%*	*20%*	*0%*	*5%*
1988/1987	1960s	100%	10%	90%	*6%*	*22%*	*58%*	*3%*	*1%*	100%	49%	51%	*8%*	*14%*	*25%*	*0%*	*4%*
2018	1970s	100%	2%	98%	*12%*	*28%*	*40%*	*14%*	*4%*	100%	32%	68%	*6%*	*14%*	*37%*	*1%*	*10%*
2018	1980s	100%	0%	100%	*3%*	*16%*	*41%*	*25%*	*14%*	100%	21%	79%	*5%*	*14%*	*44%*	*1%*	*14%*
2018	1990s	100%	0%	100%	*1%*	*10%*	*38%*	*33%*	*18%*	100%	10%	90%	*3%*	*10%*	*53%*	*2%*	*21%*

Notes: The table presents the human capital composition by survey year (Panel A) and by decadal birth cohorts (Panel B) from CHIP and EUS surveys. First is the total literate and illiterate shares in both countries. Col (2) and (9) are literate shares in China and India; Col (3) and (10) are the shares of illiterates. Second, the share of graduates by educational categories - Below Primary (Col (4) and (11)); Primary (Col (5) and (12)); Secondary (Col (6) and (13)); Vocational (Col (7) and (14)); and Bachelors and above (Col(8) and (15)). The table depicts the imprint of different education expansion strategies in China and India, where China has higher shares of primary, secondary, and vocational graduates due to its bottom–up strategy and higher diversification. India has higher shares of tertiary-level graduates due to its reliance on a top–down model.

TABLE 7. Education Gini Decomposition by Birth Cohort

Birth Cohort	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	$Gini^{Total}$			n0			(1-n0)*$Gini^{Lit}$	
	China	India	Δ	China	India	Δ	China	India
Survey year 1988/1987								
1920s	0.67	0.83	-0.16	0.53	0.76	-0.23	0.14	0.07
1930s	0.48	0.80	-0.32	0.32	0.71	-0.39	0.16	0.09
1940s	0.32	0.73	-0.41	0.19	0.62	-0.44	0.13	0.11
1950s	0.26	0.66	-0.41	0.15	0.54	-0.40	0.11	0.12
1960s	0.20	0.61	-0.41	0.10	0.49	-0.39	0.10	0.13
1960s-1920s	-0.47	-0.22	-0.26	-0.43	-0.27	-0.16	-0.04	0.05
% of total change	*100%*	*100%*	*100%*	*91%*	*125%*	*61%*	*9%*	*-25%*
Survey year 2018/2018								
1970s	0.21	0.48	-0.27	0.02	0.32	-0.31	0.19	0.16
1980s	0.18	0.39	-0.21	0.005	0.21	-0.21	0.17	0.17
1990s	0.15	0.27	-0.12	0.003	0.10	-0.09	0.15	0.17
1990s-1970s	-0.06	-0.21	0.15	-0.01	-0.23	0.21	-0.04	0.02
% of total change	*100%*	*100%*	*100%*	*24%*	*107%*	*138%*	*76%*	*-7%*

Notes: The table presents the Gini decomposition, following equation 4, by decadal birth cohort from CHIP and EUS surveys (age 20+). Col (1) and (2) are total education gini in China and India; and Col (3) is the gap between the two countries (China-India). between Col (4) and (5) are illiterate shares in China and India; and Col (6) is the gap between the two countries (China-India). Two important messages could be drawn from here. First, China has lower $Gini^{Total}$ than India in all the cohorts. The gap, though, has started declining from the 1970s cohort onwards. Second, the illiteracy rate plays a major role in education gini, and the inability to liquidate illiteracy has kept the $Gini^{Total}$ at a higher level. This is due to China's long-run focus on educating the masses through primary education and adult literacy campaigns.

TABLE 8. Illiteracy Rate by Gender Across Birth Cohort

Birth Cohort	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	China				India			
	Total	Female	Male	*Gender Gap*	**Total**	Female	Male	*Gender Gap*
Survey year 1988/1987								
1920s	**53%**	68%	40%	*28%*	**76%**	89%	63%	*27%*
1930s	**32%**	50%	17%	*33%*	**71%**	85%	57%	*28%*
1940s	**19%**	31%	7%	*24%*	**62%**	78%	47%	*31%*
1950s	**15%**	24%	4%	*20%*	**54%**	69%	40%	*28%*
1960s	**10%**	13%	7%	*7%*	**49%**	62%	35%	*27%*
1960s-1920s	-43%	-55%	-33%	*-22%*	-27%	-27%	-28%	*0%*
Survey year 2018/2018								
1970s	**2%**	3%	1%	*2%*	**32%**	43%	21%	*22%*
1980s	**0%**	1%	0%	*0%*	**21%**	29%	14%	*15%*
1990s	**0%**	0%	0%	*0%*	**10%**	13%	6%	*7%*
1990s-1970s	-1%	-2%	-1%	-2%	-23%	-30%	-15%	-15%

Notes: The table presents the illiteracy rates by decadal birth cohort from CHIP and EUS surveys (age 20+). The illiteracy rates are computed for the full population (Col (1) and (5)), females (Col (2) and (6), and males (Col (3) and (7)) within each cohort. Col (4) and (8) are gender gap in China and India. Both countries started with a high gender gap; China has been able to liquidate it from the 1980s cohort, whereas the last observable decadal cohort (1990s) shows a gender gap of 7pp in India.

TABLE 9. Illiteracy Rate by Caste Across Birth Cohort in India

	[1]	[2]	[3]	[4]
	Total	SCST	Other	*SCST Gap*
Survey year 1988/1987				
1920s	**76%**	91%	71%	*20%*
1930s	**71%**	87%	65%	*21%*
1940s	**62%**	80%	56%	*24%*
1950s	**54%**	73%	48%	*26%*
1960s	**49%**	68%	42%	*27%*
Survey year 2018/2018				
1970s	**32%**	46%	27%	*19%*
1980s	**21%**	30%	18%	*13%*
1990s	**10%**	14%	8%	*6%*

Notes: The table presents the illiteracy rates by decadal birth cohort from EUS surveys (age 20+). The illiteracy rates are shown for the full population (Col (1), SCST in Col (2), and NonSCST in Col (3) within each cohort. Col (4) is the gap in illiteracy between SCST and others in India. The gap remained between 20-27pp until the 1960s cohort and started declining after. It has now declined to 6pp in the last observable decadal cohort (1990s).

TABLE 10. Decomposition of Wage Gini in China and India

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	China					India				
	Var(lnwage)	$\hat{r}$	Var(S)	$\hat{r^2} * Var(S)$	$\frac{\hat{r^2} * Var(S)}{\text{Var(lnwage)}}$	Var(lnwage)	$\hat{r}$	Var(S)	$\hat{r^2} * Var(S)$	$\frac{\hat{r^2} * Var(S)}{\text{Var(lnwage}}$
1988/1987	0.21	0.02	7	0.004	2%	0.74	0.08	25	0.16	22%
1995/1993	0.41	0.05	10	0.02	5%	0.87	0.08	21	0.12	14%
2004/2002	0.65	0.08	11	0.06	9%	0.83	0.09	20	0.17	20%
2011/2013	0.51	0.07	11	0.06	11%	0.81	0.09	23	0.18	22%
2018	0.56	0.08	11	0.07	12%	0.65	0.08	24	0.17	26%

Notes: The table presents the decomposition of wage gini, following equation 5, from CHIP and EUS surveys (age 20+ and positive earnings). Var(lnwage) in Col (1) and (6) is the variance of log daily wages. $\hat{r}$, in Col (2) and (7), is the estimated rate of return to education, following Mincer's equation 6. Var(S), in Col(3) and (8), is the variance of years of schooling. Col(5) and (10) are the shares of variance in wages, which is explained by education inequality (in combination with the rate of return). Education inequality explains about 20-25% of the wage inequality in India as compared to 2-12% in China.

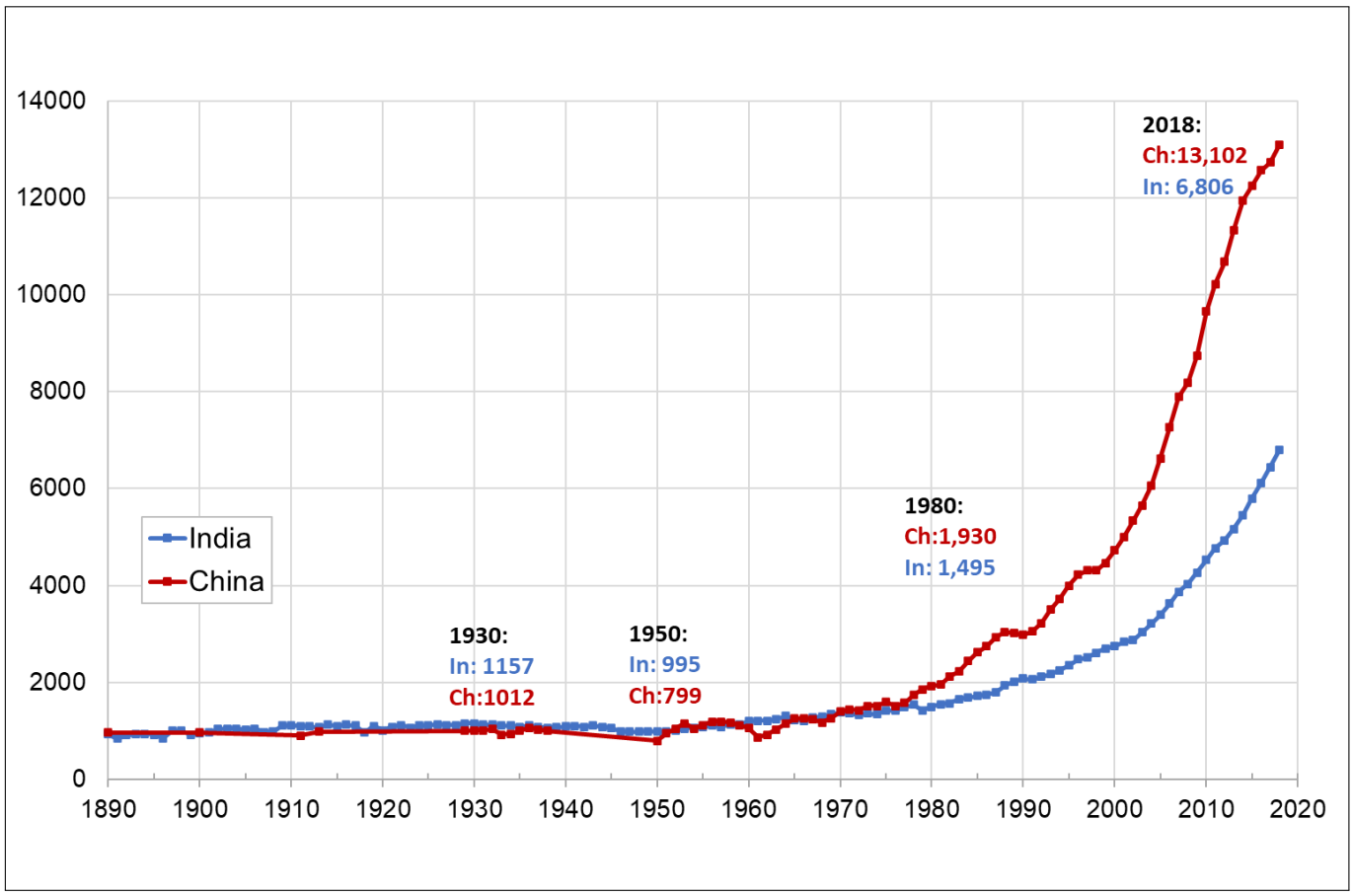
TABLE 11. Distribution of Working Population (20-60) by Sectors and Education Stage Within Birth Cohort

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
	1988/87						2018					
	China			India			China			India		
Birth Cohort	1930s	1940s	1950s	1930s	1940s	1950s	1960s	1970s	1980s	1960s	1970s	1980s
Agricultural	65%	60%	58%	66%	61%	59%	29%	15%	7%	50%	43%	35%
Below Primary	*33%*	*21%*	*17%*	*57%*	*50%*	*44%*	*11%*	*5%*	*1%*	*30%*	*21%*	*12%*
PSV	*31%*	*39%*	*41%*	*9%*	*11%*	*14%*	*19%*	*10%*	*6%*	*19%*	*21%*	*21%*
Bachelor+	*0.7%*	*0.4%*	*0.2%*	*0.1%*	*0.3%*	*0.6%*	*0.0%*	*0.1%*	*0.1%*	*1.2%*	*1.3%*	*2%*
Manufacturing	15%	20%	23%	13%	16%	17%	27%	30%	31%	19%	24%	28%
Below Primary	*2%*	*1.2%*	***0.9%***	*9%*	*10%*	***9%***	*5%*	*4%*	***1%***	*8%*	*8%*	***7%***
PSV	*12%*	*18%*	***22%***	*4%*	*6%*	***7%***	*22%*	*25%*	***27%***	*10%*	*15%*	***19%***
Bachelor+	*0.9%*	*0.7%*	***0.3%***	*0.3%*	*0.7%*	***0.9%***	*0.2%*	*0.6%*	***3%***	*2%*	*1.4%*	***2%***
Service	21%	19%	19%	21%	23%	24%	44%	55%	62%	31%	33%	37%
Below Primary	*1%*	*0.7%*	***0.4%***	*10%*	*8%*	***7%***	*4%*	*3.9%*	***1.2%***	*6%*	*5%*	***4%***
PSV	*16%*	*17%*	***18%***	*10%*	*12%*	***13%***	*38%*	*47%*	***49%***	*17%*	*20%*	***21%***
Bachelor+	*3%*	*2%*	***1.0%***	*2%*	*3%*	***4%***	*1%*	*4%*	***12%***	*8%*	*8%*	***12%***

Notes: The table presents the distribution of the working population share by sector and education levels within decadal birth cohorts from CHIP and EUS surveys, limiting to (age 20-60). The imposition of an age ceiling of 60 years since it is the retirement age in India. It shows that the Chinese workforce in each sector has predominantly been comprised of higher shares of primary, secondary, and vocational graduates, starting from the 1930s-born cohort. For e.g., in 1988, the 1930s-born cohort working in the manufacturing sector and PSV graduates was 12% (out of a total 15% population in manufacturing). In India, for this time and cohort, PSV graduates are just 4%, and the majority are below primary (including illiterates) 9%.

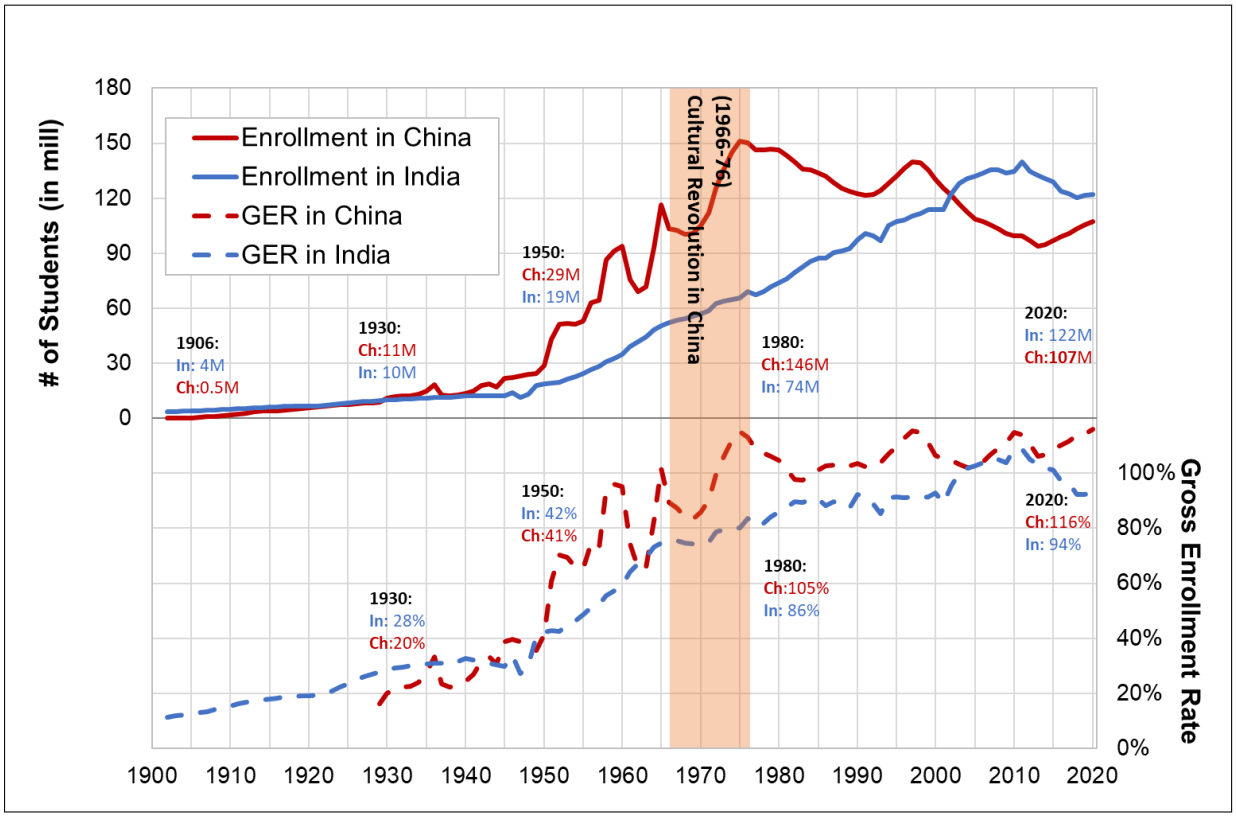
Appendix A. Figures

Figure A.I. Economic Divergence Between China and India



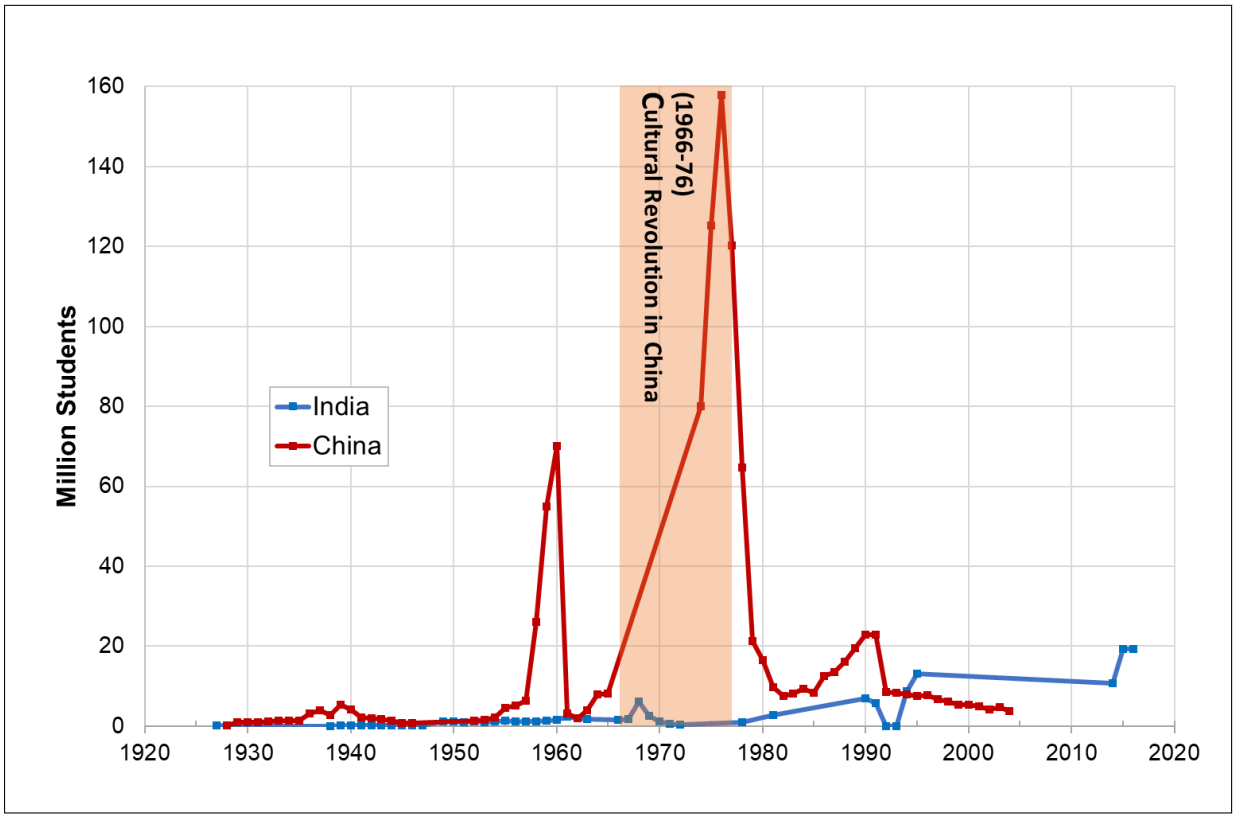
Notes: The figure presents the evolution of GDP per capita ($) from 1890-2018. Both countries have very similar GDP per capita until 1980, post which China starts growing at a much faster rate. Today, its GDP per capita is $13,102, almost twice that of India ($6,806).

FIGURE A.II. Total Enrollment and Gross Enrollment Ratio at Primary Stage



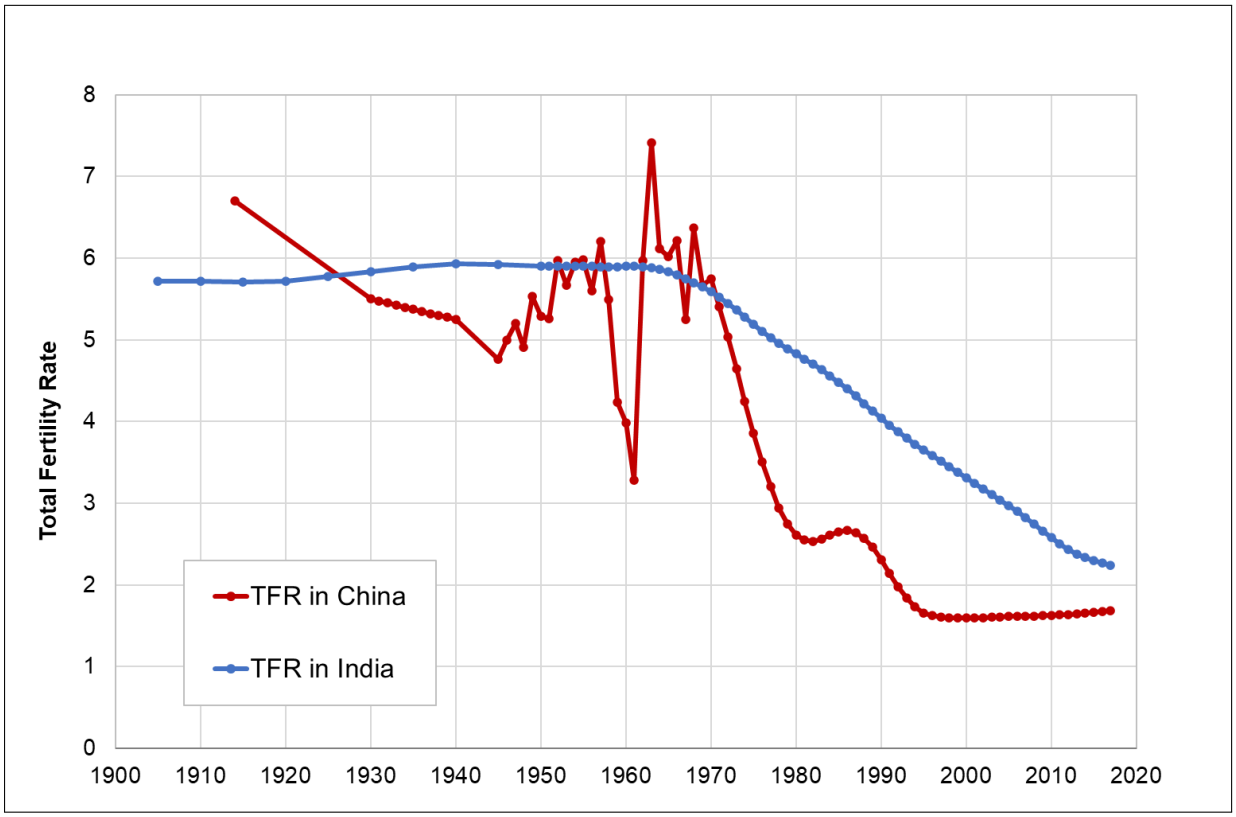
Notes: The figure plots the evolution of total enrollment (top) and Gross Enrollment Rate (bottom) at the primary level of education in China and India from 1900-2020. The GER at the primary is the total enrollment in the primary level divided by the total population in the age group 6-11 for China (and 6-10 for India). Enrollment in China's primary level surpassed India in the 1930s and GER in the 1950s. The Cultural Revolution period in China (1966-76) did not impact its primary level of education.

FIGURE A.III. Enrollment in Adult Literacy



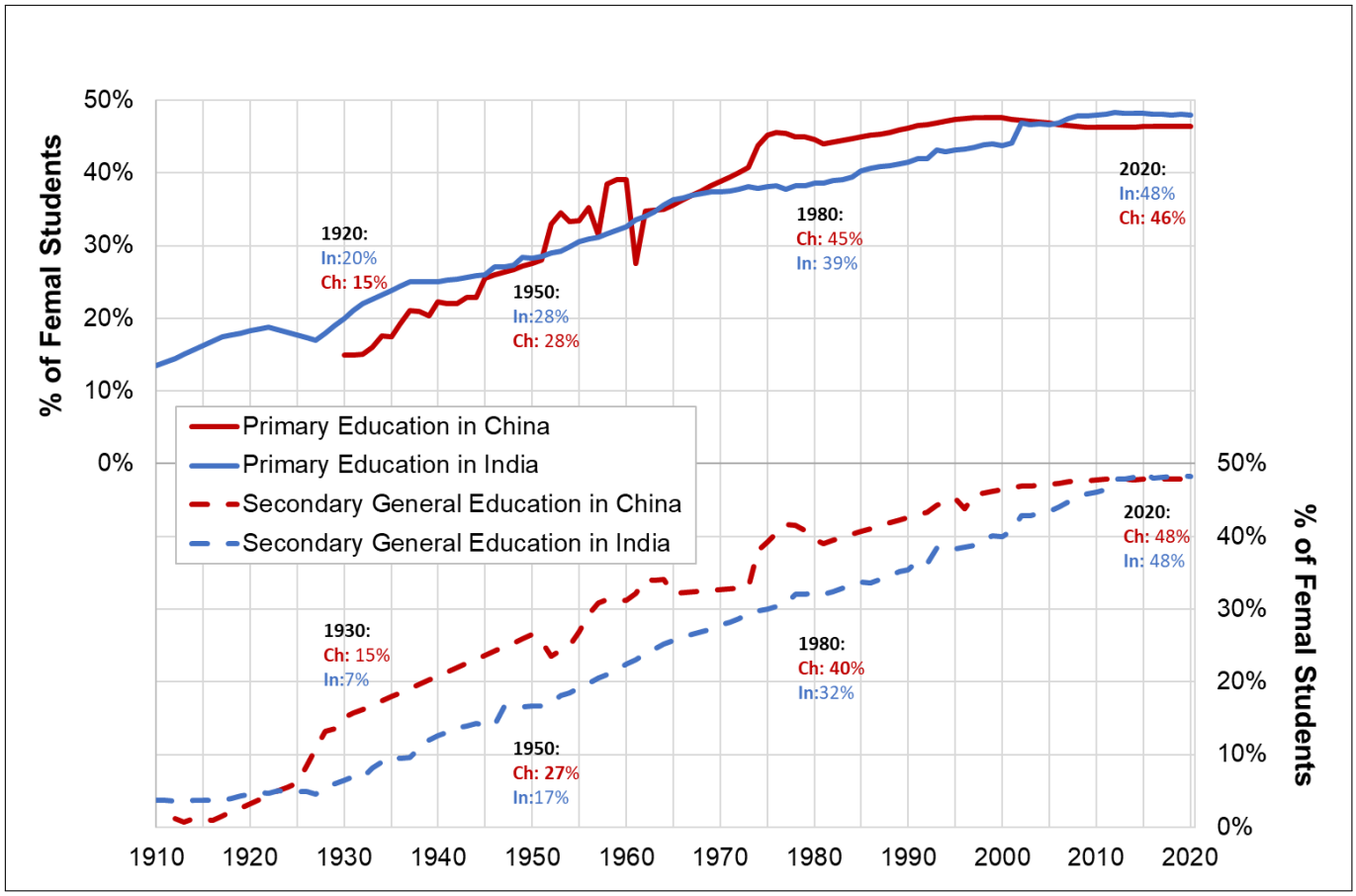
Notes: The figure plots the enrollment in adult education in China and India from 1920-2020. This is often a neglected branch of education in both countries. The exceptional periods are in China - first, in the mid-1950s, and second, during the Cultural Revolution period, enrollment was high. In India, after 1990, the adult literacy campaign has become more active.

FIGURE A.IV. Total Fertility Rate in China and India



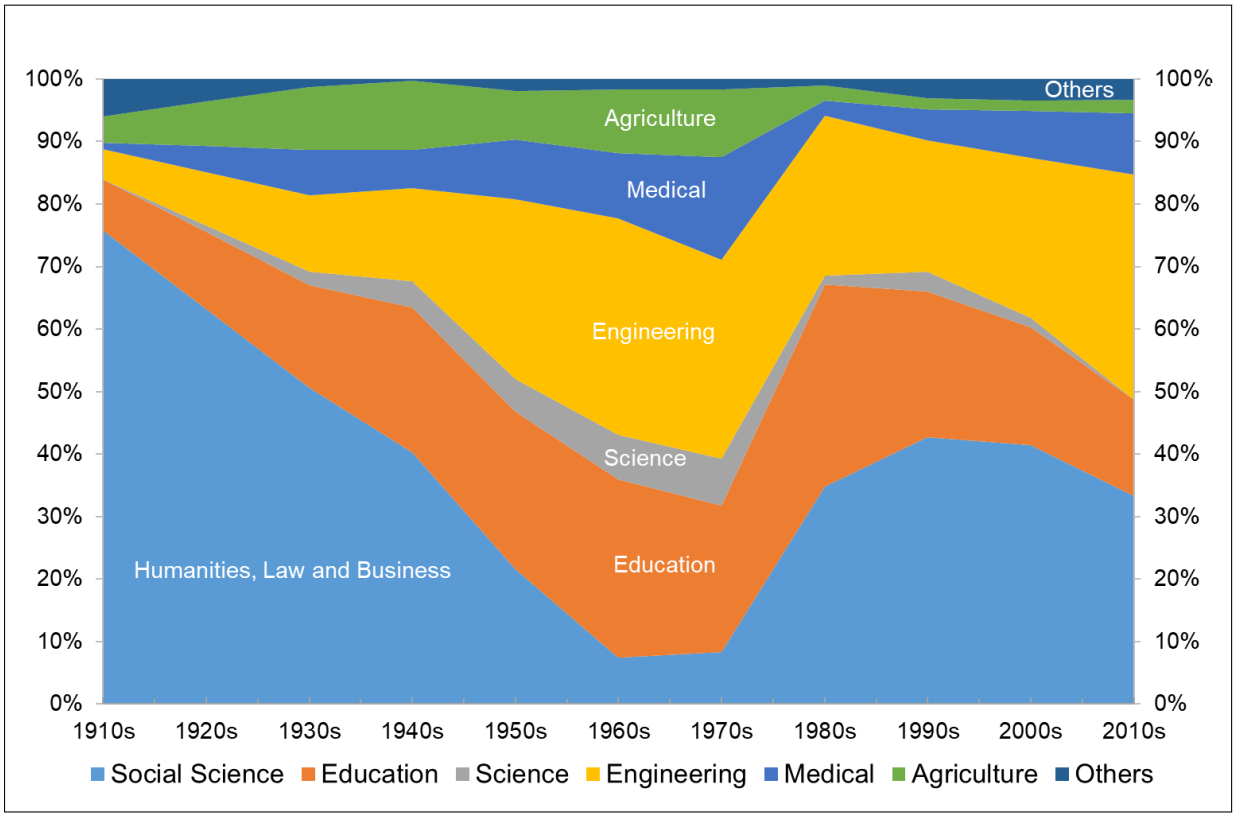
Notes: The figure plots the evolution of the total fertility rate in China and India from 1900-2018. Starting from a high fertility rate, it has come down at the replacement level (2.1) in India and below the replacement level in China. The sharp decline in TFR during the 1970s in China is an impression of the adoption of the one-child policy.

FIGURE A.V. Female Enrollment Share in Primary and Secondary



Notes: The figure plots the evolution of the share of professors among all teachers at the tertiary level in China and India from 1930-2018. Both countries started with a huge gender gap, and over a long time span, they have been able to remove the gender gap in primary and secondary enrollments.

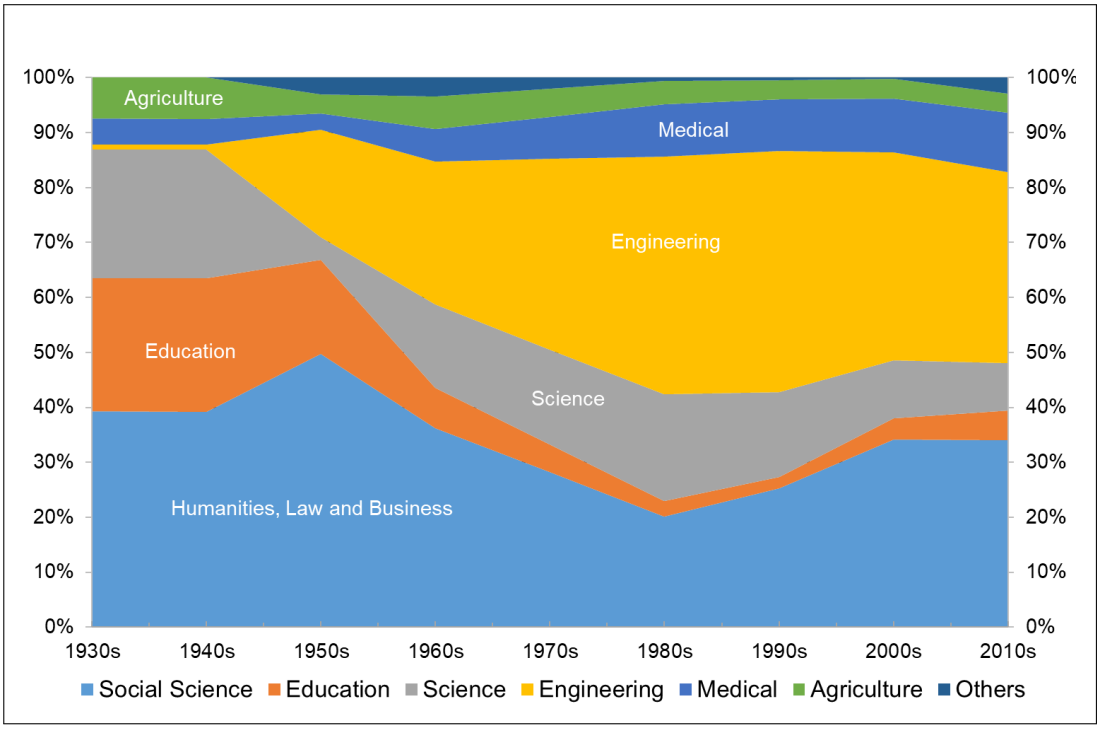
FIGURE A.VI. Discipline-wise Graduates Share at Tertiary Vocational in China



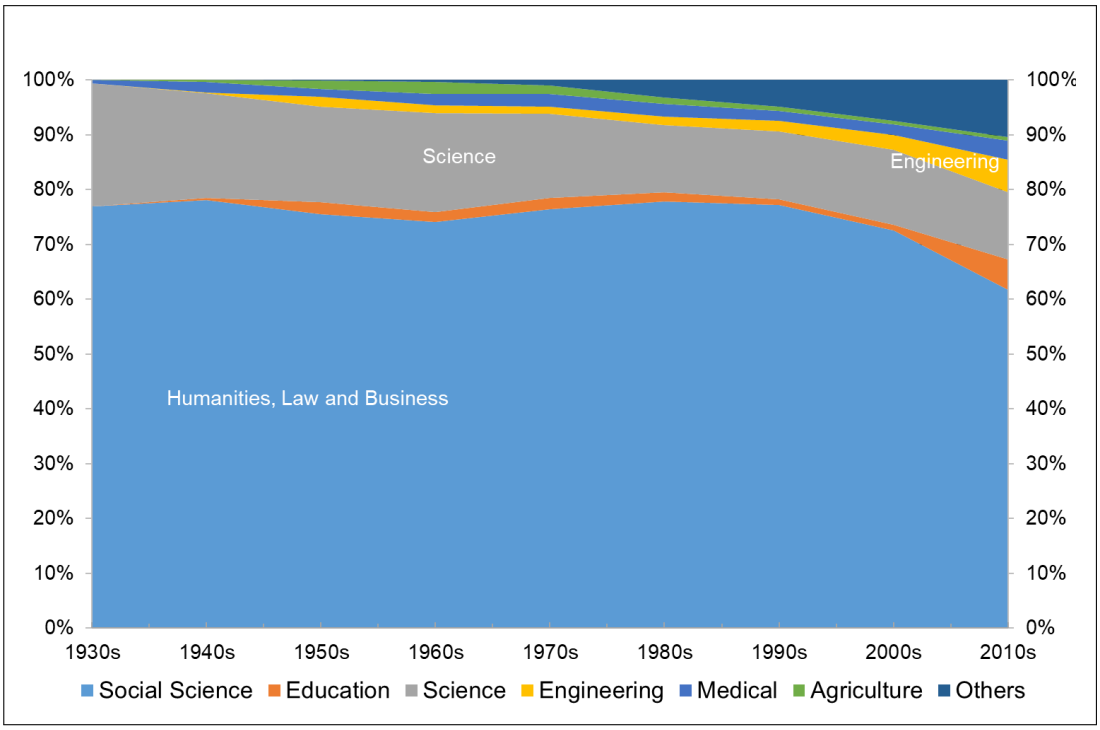
Notes: The figure plots the evolution of the discipline-wise shares of tertiary vocational graduates in China from the 1910s and 2010s. The pattern is very similar to the non-vocational disciplines, where social sciences shares have fluctuated, and engineering and education have been encouraged throughout the century.

FIGURE A.VII. Discipline-wise Graduates Shares at Masters Level

China



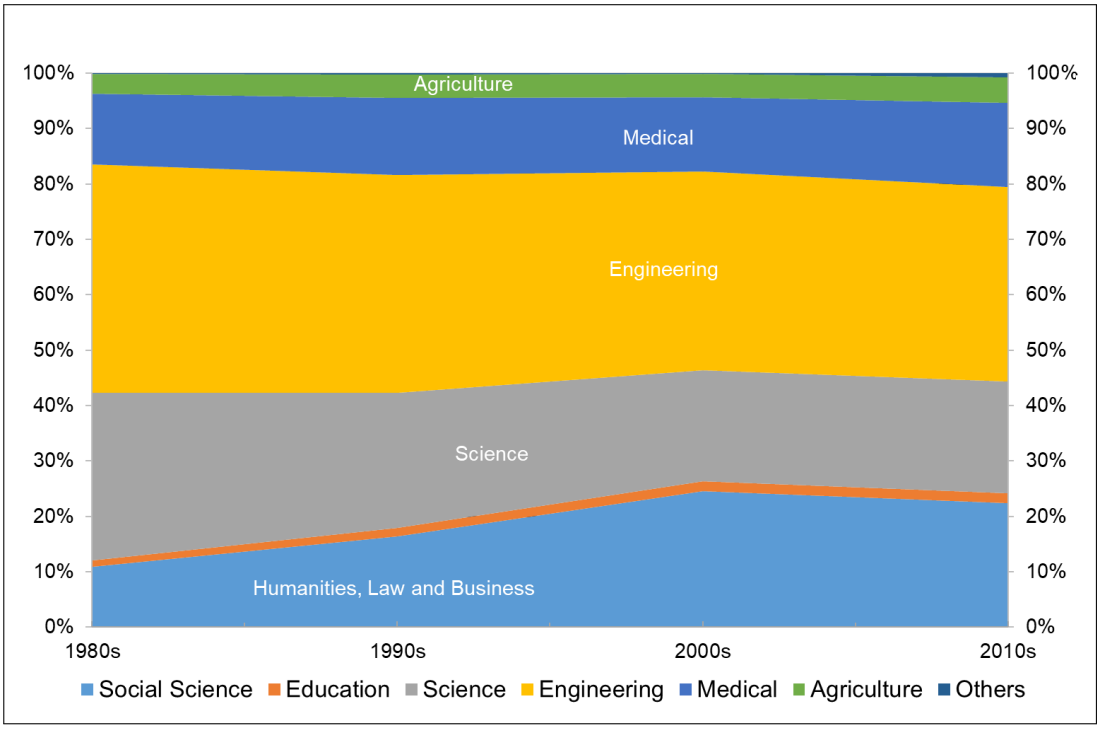
India



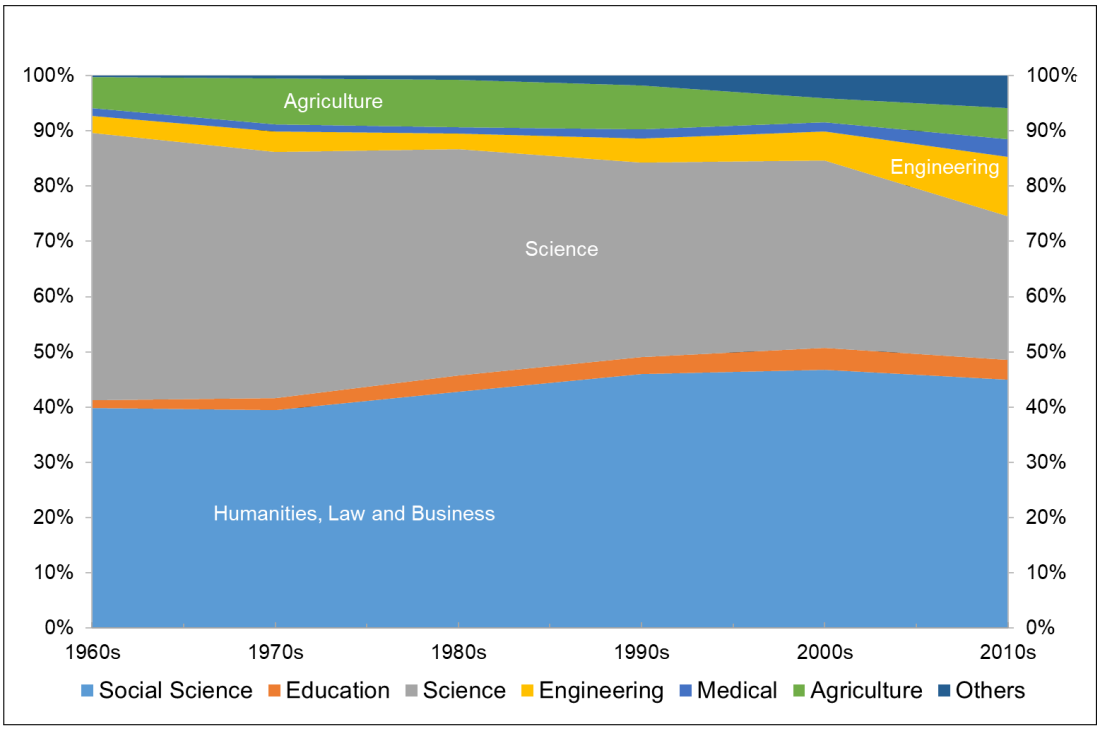
Notes: The figure depicts the share of graduates in different disciplines at the master's level in China (top graph) and India (bottom graph) between the 1930s and 2010s. The evolving patterns are similar to what is observed at the Bachelor's level. The share of engineers in China and the share of social sciences in India is the highest master's degree awarded.

FIGURE A.VIII. Discipline-wise Graduates Share at PhD Level

China

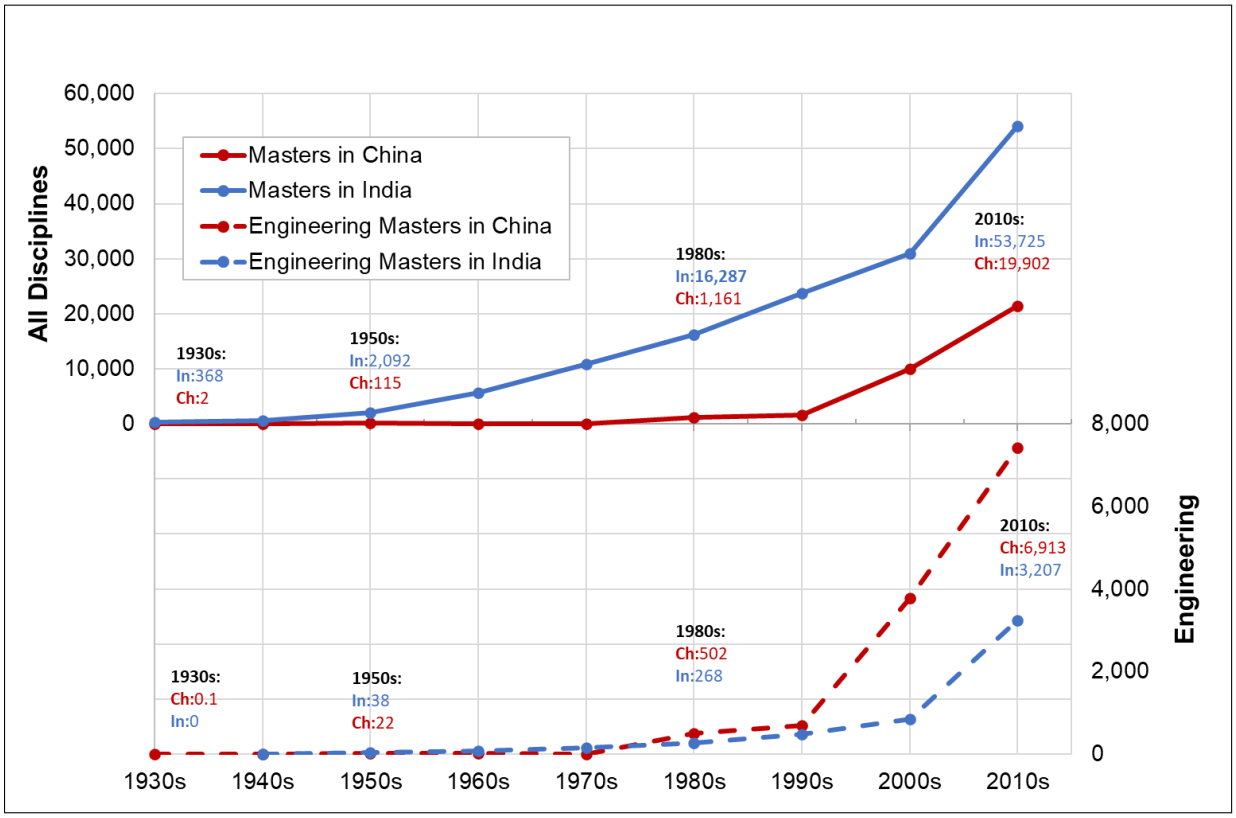


India



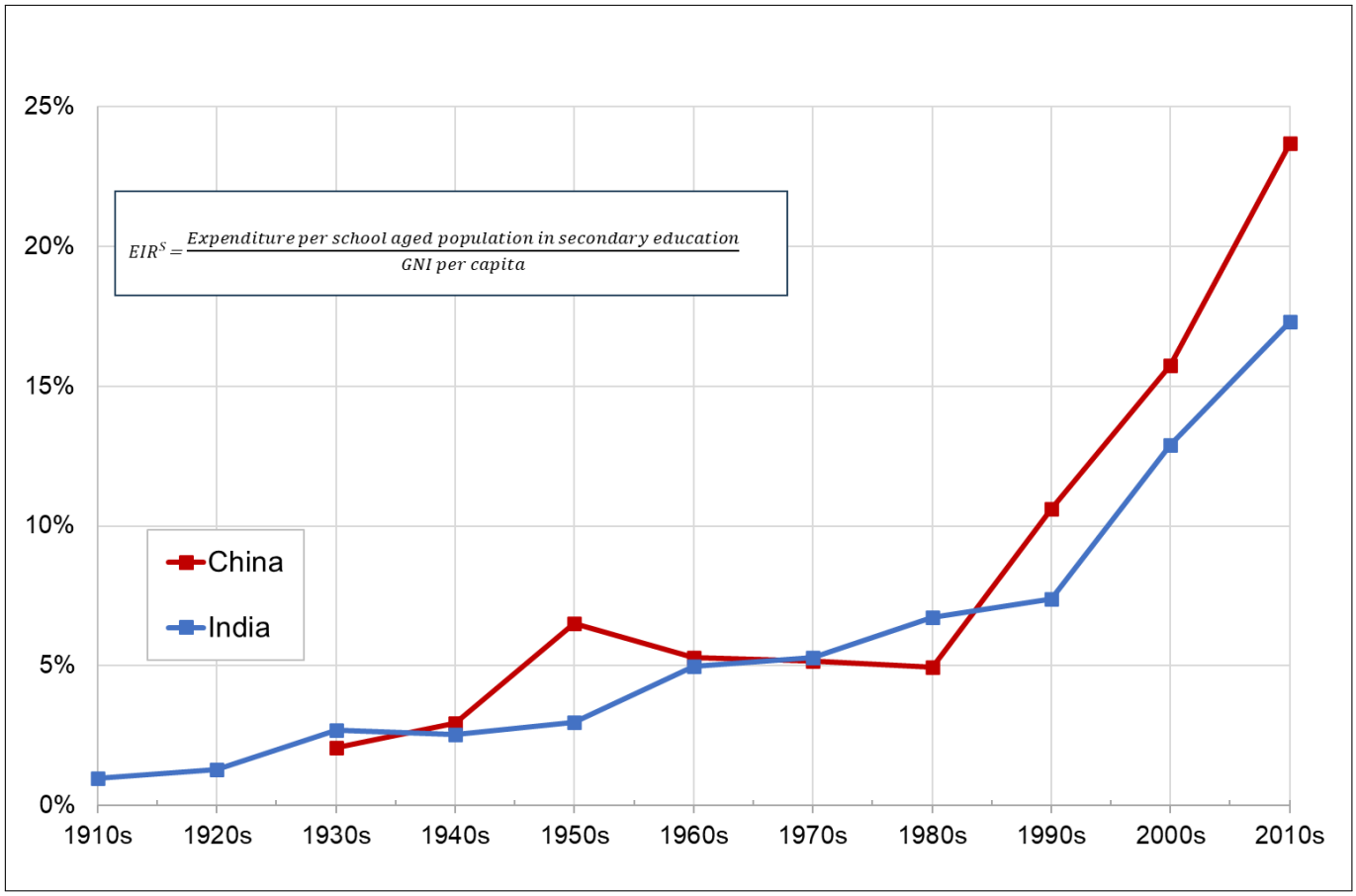
Notes: The figure depicts the share of graduates in different disciplines at the Doctoral (PhD) level in China (top) and India (bottom) between the 1960s and 2010s. The patterns are similar to what is observed at the Bachelor's level, the predominance of social science and basic sciences in India, as compared to a varied mix in China.

FIGURE A.IX. Gross Graduation Ratio at Masters Level (per million persons)



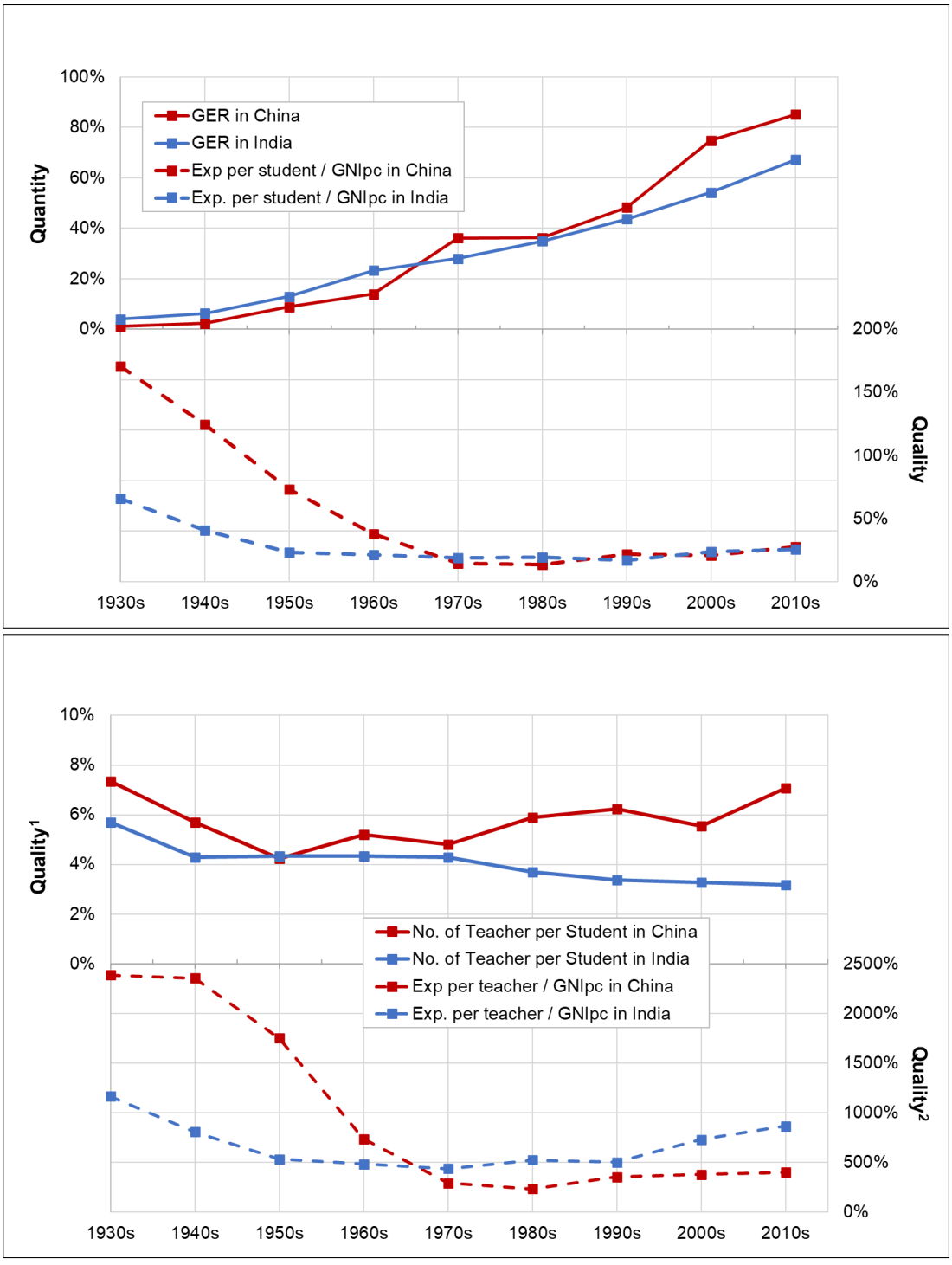
Notes: The figure plots the evolution of the total graduation rate in China and India from the 1930s to the 2010s. The gross graduate ratio is the total number of graduates from the master level divided by the total population of age 24 for China (and age 22 for India). The values are decadal averages per million population.

FIGURE A.X. Education Investment Ratio at Secondary Stage



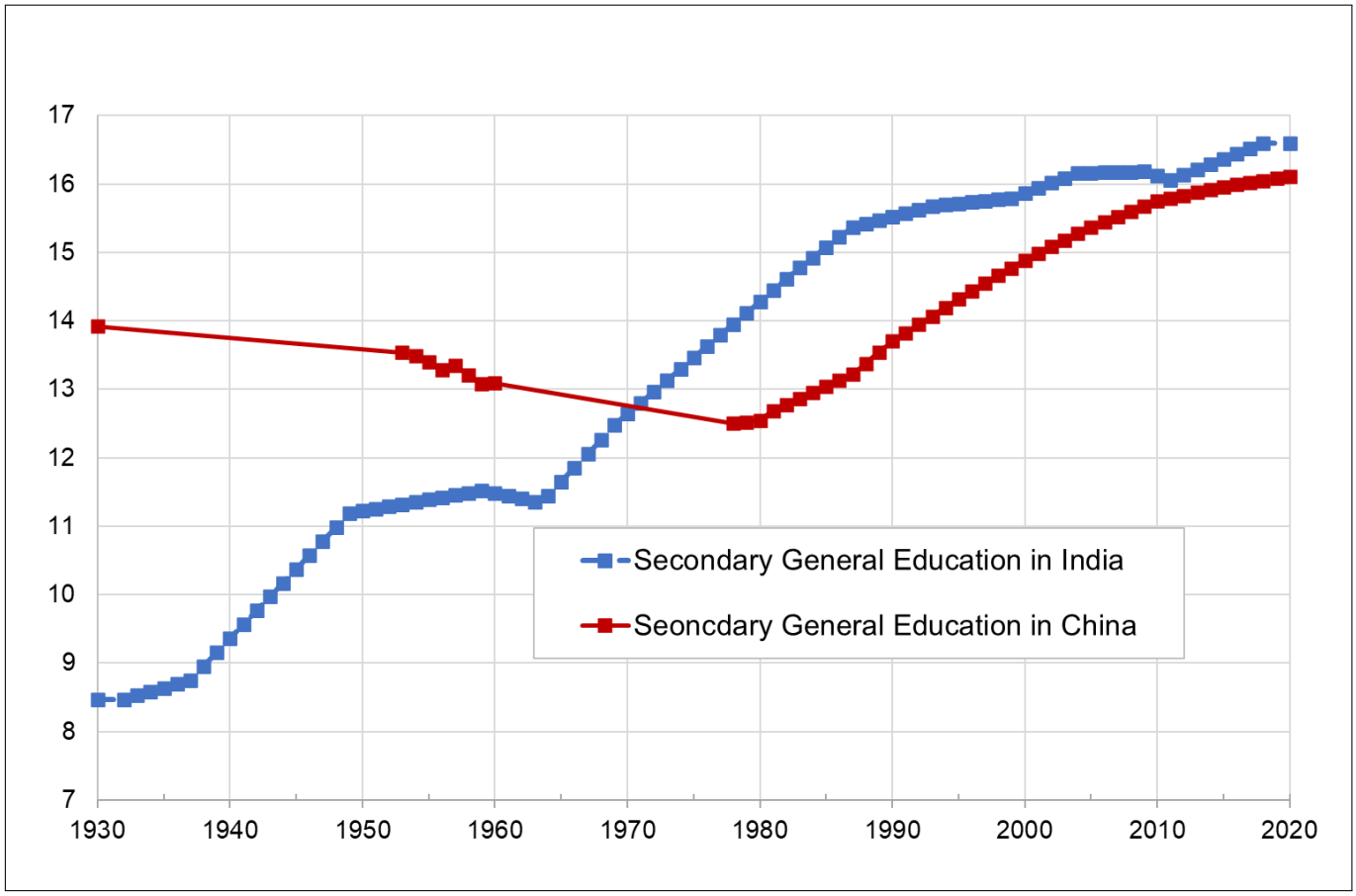
Notes: The figure plots the evolution of the Education Investment Ratio (EIR^S) at the secondary stage in China and India from the 1910s to the 2010s. The school-aged population in secondary education is 13-18 years in China and 12-18 years in India. The long-run trend is similar in both countries. However, the average EIR^S in 2010s in China stands at 25%, much higher than India (18%).

FIGURE A.XI. Quantity-Quality Decomposition of EIR^S



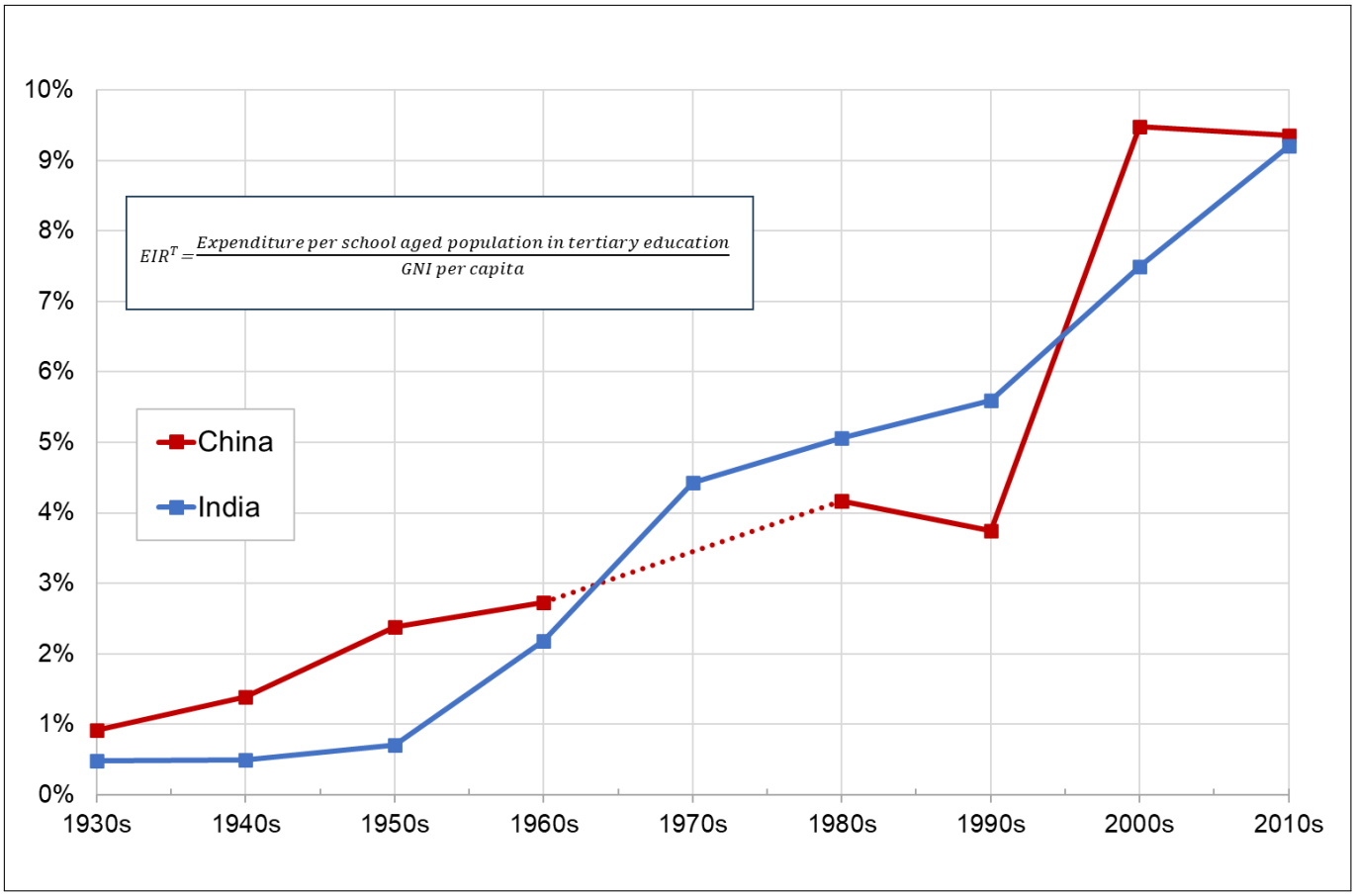
Notes: The top figure plots the evolution of two subcomponents of EIR^S, following equation B.1, $Quantity^S$ (GER) and $Quality^S$ (exp per student as a share of GNIpc) and the bottom figure plots the two subcomponents of $Quality^S$, following equation B.2, into $Quality1^S$ (Teacher Pupil Ratio) and $Quality2^S$ (exp per teacher as a share of GNIpc). China has targeted quality by hiring more teachers to keep the teacher-pupil ratio in check, whereas India has tried maintaining quality by hiring fewer teachers at higher salaries.

FIGURE A.XII. Average Years of Schooling of Secondary Stage Teachers



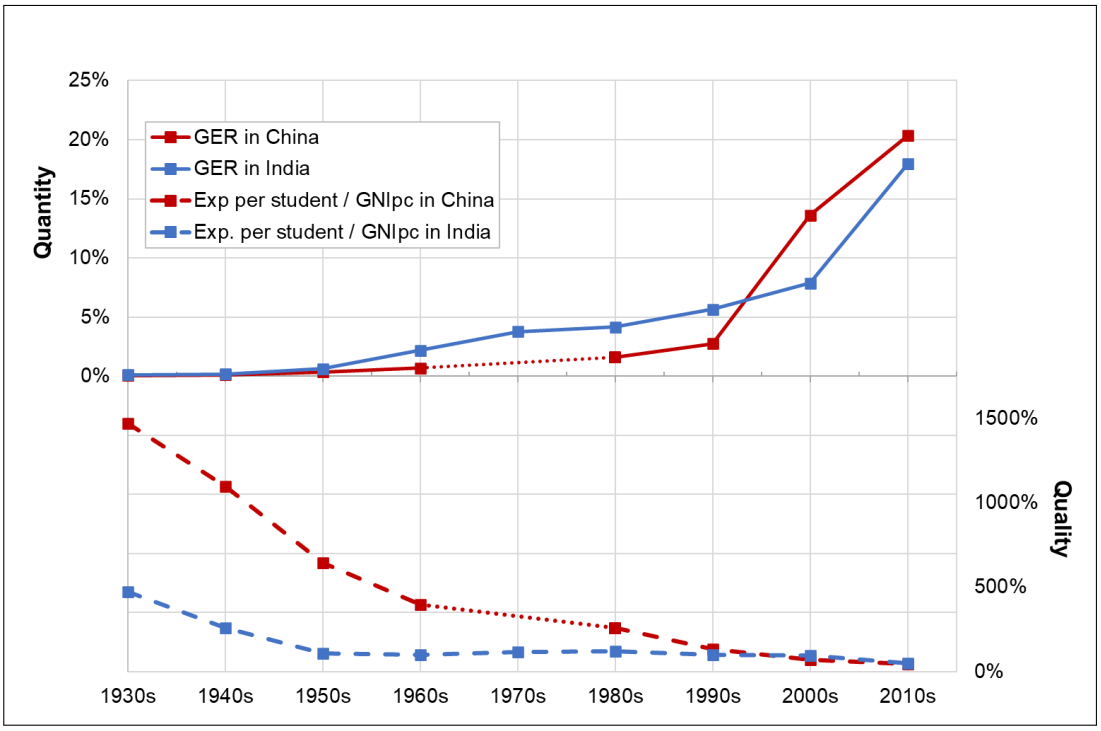
Notes: The figure plots the evolution of the average of the estimated years of education of secondary-level teachers in China and India from 1910-2020.

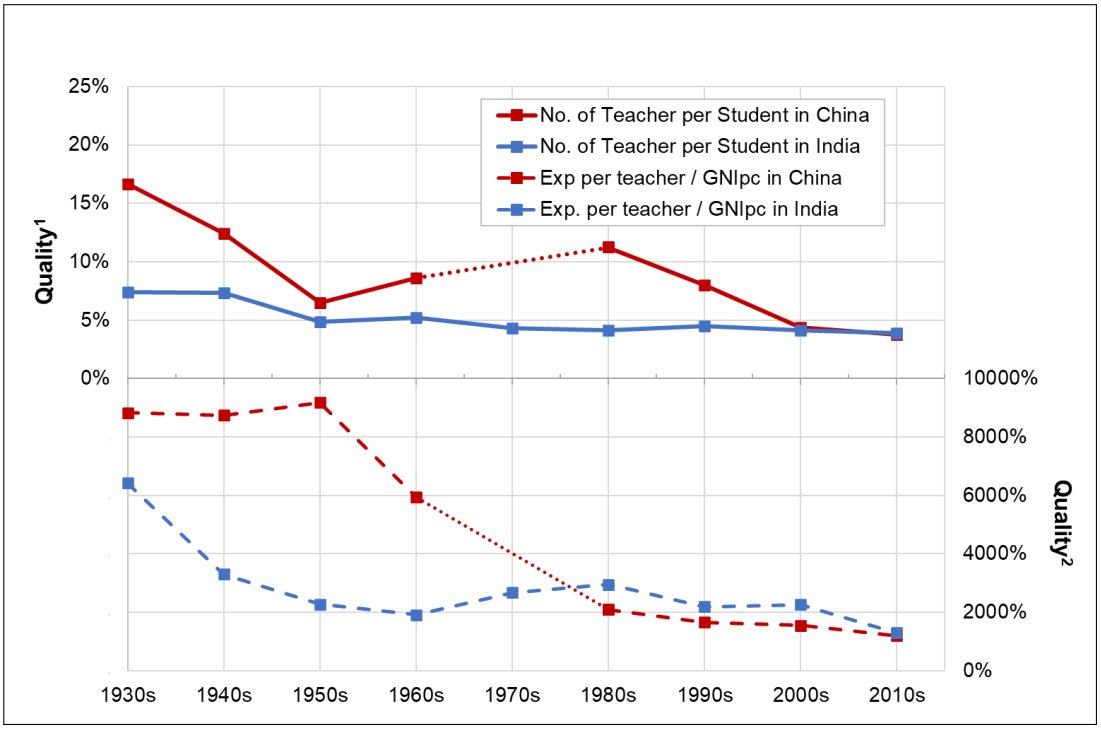
FIGURE A.XIII. Education Investment Ratio at Tertiary Stage



Notes: The figure plots the evolution of the Education Investment Ratio (EIR^T) at the tertiary stage in China and India from the 1910s to the 2010s. The long-run trend is similar in both countries. The average EIR^T in 2010s in China stands at 9% in both countries.

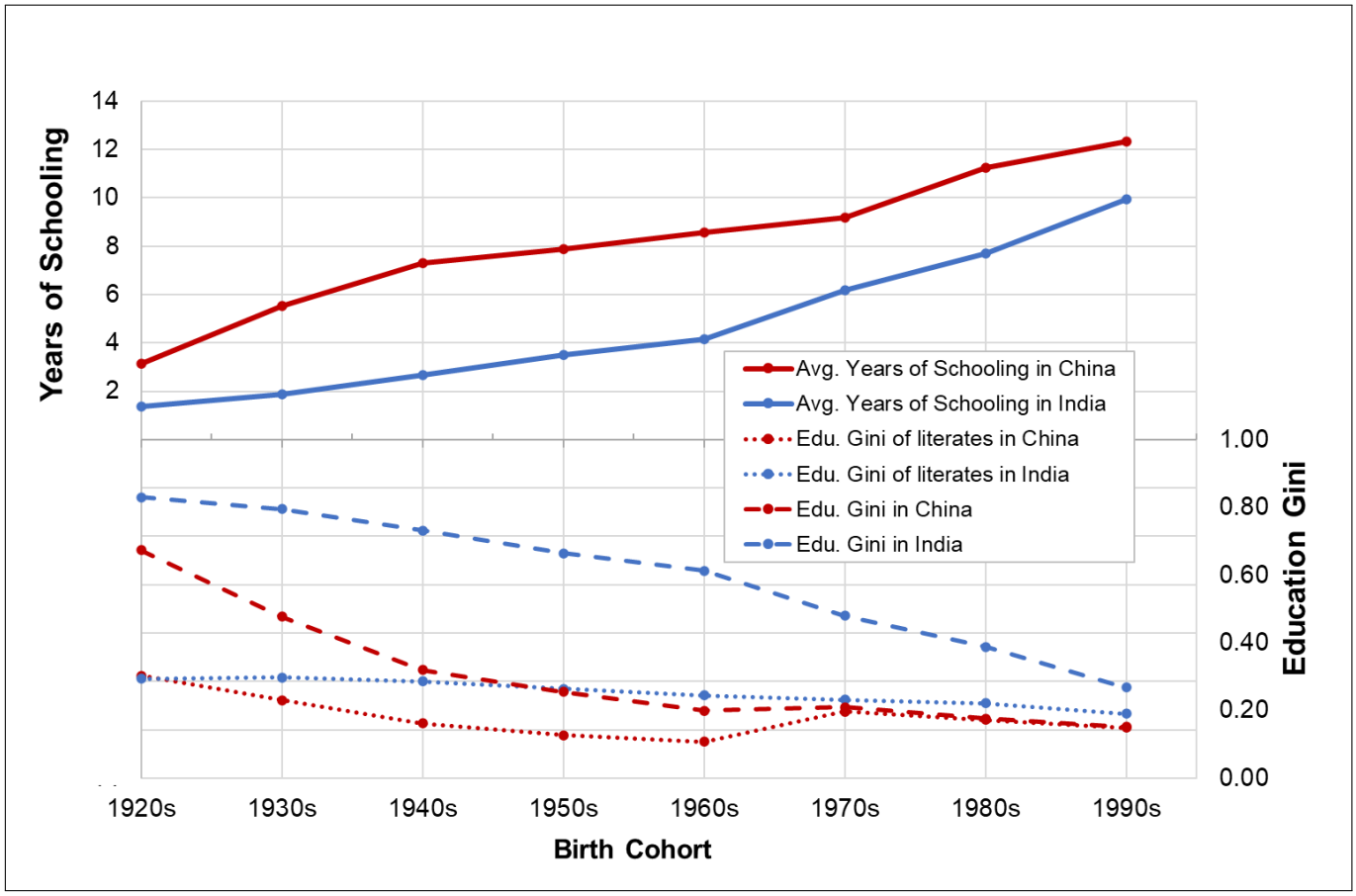
FIGURE A.XIV. Quantity-Quality Decomposition of EIR^T





Notes: Notes: The top figure plots the evolution of two subcomponents of EIR^T, following equation B.1, $Quantity^T$ (GER) and $Quality^T$ (exp per student as a share of GNIpc) and the bottom figure plots the two subcomponents of $Quality^T$, following equation B.2, into $Quality1^T$ (Teacher Pupil Ratio) and $Quality2^T$ (exp per teacher as a share of GNIpc).

FIGURE A.XV. Average years of Schooling and Education Inequality by Decadal Birth Cohort



Notes: The figure plots the evolution of the estimated average years of schooling and education gini (in full population and within literates) by decadal birth cohort using CHIP and EUS surveys. The decadal birth cohort from 1920s-1960s is based on 1988/1987 survey rounds; and later cohorts are based on 2018 survey rounds. China has a higher average number of years of education throughout, an outcome of educational expansion that focuses on mass education (focusing on primary and adult literacy) early on. On the other hand, India has higher educational inequality levels throughout due to its relative neglect of educating all for a long time and focusing more on secondary and tertiary education.

Appendix B. Tables

Table B.I. Age and Duration for Attending Educational Stages

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Official start-age of Enrollment		**Normal last-age of graduation**		**School-going age**		**School-going duration**	
	China	India	China	India	China	India	China	India
Primary	6	6	11	10	**6-11**	**6-10**	**6**	**5**
Secondary	12	11	17	17	**12-17**	**11-17**	**6**	**7**
Lower Secondary	12	11	14	13	*12-14*	*11-13*	*3*	*3*
Upper Secondary	15	14	17	17	*15-17*	*14-17*	*3*	*4*
Tertiary	18	18	27	27	**18-27**	**18-27**	**10**	**10**
Junior College graduate	18		20		18-20		3	
Bachelor	18	18	21	20	18-21	18-20	4	3
Master	22	21	24	22	22-24	21-22	3	2
Doctorate	25	23	27	27	25-27	23-27	3	5

Notes: The table presents the age and duration for attending different educational levels in China and India. At the primary level, the official start age is age 6 in both countries. The duration of the primary level is of 6 years in China, whereas it is 5 years in India. The normal (without repetition) last-age to finish primary level is 11 years in China and 10 in India. So the school-going age in primary school in China is age 6-11 and in India is age 6-10 (including both years).

TABLE B.II. Comparison (China/India) of GER and Teacher per School Aged Population

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Gross Enrollment Ratio				Teacher per School Aged Population		
	Primary	Secondary	Tertiary (Graduate)	Tertiary (PostGrad)	Primary	Secondary	Tertiary (Professors)
1930s	0.8	0.3	0.6	0.01	0.8	0.4	
1940s	1.1	0.4	0.7	0.03	1.1	0.5	
1950s	1.5	0.7	0.6	0.06	1.4	0.5	
1960s	1.2	0.6	0.3	0.03	1.5	0.7	0.9
1970s	1.3	1.3		0.03	1.8	1.4	
1980s	1.1	1.0	0.4	0.1	1.9	1.7	2.0
1990s	1.2	1.1	0.5	0.2	2.3	2.0	1.7
2000s	1.1	1.4	1.7	0.6	2.3	2.3	2.8
2010s	1.1	1.3	1.1	0.5	2.0	2.9	2.5

Notes: The table presents the decadal average ratio (China/India) of GER and Teachers per school-aged population measures. The ratios are provided for different educational stages - primary (Col (1) and (5)); secondary (Col(2) and (6)); tertiary split into bachelors and postgraduate for GER in Col (3) and (4), and combined tertiary for teachers measure in Col (7). It shows the catching up by China - the GER ratio turning more than 1 at the primary level in the 1940s, secondary level in the 1970s, and Bachelor level in the 2000s. India still has higher GER at postgraduate level. The same catching up is seen through teachers at primary and secondary stages.

TABLE B.III. Public-Private Education Expenditure as a share of GNI

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]
	TOTAL						PRIMARY EDUCATION				SECONDARY EDUCATION				TERTIARY EDUCATION			
	China			India			China		India		China		India		China		India	
	Total	*Public*	*Private*	*Total*	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*
1910s	0.3%	*0.26%*	*0.06%*	0.3%	*0.14%*	0.13%	0.2%	0.05%	0.1%	0.04%	0.1%	0.01%	0.1%	0.1%	0.04%	0.005%	0.01%	0.01%
1920s	0.4%	*0.3%*	*0.1%*	0.4%	*0.3%*	0.2%	0.2%	0.05%	0.1%	0.04%	0.1%	0.03%	0.1%	0.1%	0.07%	0.02%	0.02%	0.02%
1930s	0.8%	*0.6%*	*0.2%*	0.8%	*0.5%*	0.3%	0.3%	0.09%	0.3%	0.07%	0.2%	0.1%	0.2%	0.2%	0.12%	0.04%	0.03%	0.04%
1940s	1.2%	*0.8%*	*0.3%*	0.6%	*0.4%*	0.2%	0.5%	0.12%	0.2%	0.03%	0.2%	0.2%	0.1%	0.2%	0.14%	0.05%	0.02%	0.03%
1910s-1940s	***0.7%***	***0.5%***	***0.2%***	***0.5%***	***0.3%***	***0.2%***	***0.3%***	***0.08%***	***0.2%***	***0.04%***	***0.1%***	***0.1%***	***0.1%***	***0.1%***	***0.09%***	***0.03%***	***0.02%***	***0.02%***
1950s	1.7%	*1.7%*	*0.0%*	1.1%	*0.8%*	0.3%	0.7%	0.01%	0.4%	0.05%	0.6%	0.01%	0.3%	0.2%	0.3%	0.00%	0.06%	0.06%
1960s	2.2%	*2.2%*	*0.0%*	1.7%	*1.3%*	0.4%	1.2%	0.00%	0.6%	0.09%	0.6%	0.00%	0.5%	0.2%	0.4%	0.00%	0.15%	0.11%
1970s	1.7%	*1.7%*	*0.0%*	2.3%	*1.9%*	0.4%	0.8%	0.00%	0.8%	0.08%	0.6%	0.00%	0.7%	0.2%	0.3%	0.00%	0.41%	0.16%
1950s-1970s	***1.9%***	***1.9%***	***0.0%***	***1.7%***	***1.3%***	***0.4%***	***0.9%***	***0.0%***	***0.6%***	***0.1%***	***0.6%***	***0.0%***	***0.5%***	***0.2%***	***0.34%***	***0.0%***	***0.21%***	***0.1%***
1980s	1.9%	*1.8%*	*0.1%*	2.9%	*2.5%*	0.3%	0.6%	0.05%	0.9%	0.06%	0.6%	0.07%	1.0%	0.1%	0.61%	0.00%	0.64%	0.14%
1990s	2.8%	*2.3%*	*0.5%*	3.0%	*2.6%*	0.4%	0.8%	0.16%	0.9%	0.08%	0.9%	0.25%	1.1%	0.1%	0.55%	0.10%	0.69%	0.15%
2000s	3.8%	*3.0%*	*0.9%*	4.8%	*3.9%*	0.9%	1.0%	0.09%	1.5%	0.19%	1.2%	0.33%	1.8%	0.3%	0.80%	0.44%	0.68%	0.41%
2010s	4.3%	*3.8%*	*0.5%*	5.8%	*4.8%*	1.1%	1.3%	0.04%	1.6%	0.22%	1.5%	0.14%	2.3%	0.4%	1.00%	0.31%	0.87%	0.51%
1980s-2010s	***3.1%***	***2.7%***	***0.5%***	***4.0%***	***3.5%***	***0.7%***	***0.9%***	***0.1%***	***1.2%***	***0.1%***	***1.1%***	***0.2%***	***1.5%***	***0.2%***	***0.74%***	***0.2%***	***0.72%***	***0.3%***

Notes: The table presents the decadal averages of public-private share in China India. Col (1) - Col(6) is for combined educational spending (i.e., primary, secondary and tertiary). The public and private spending shares in different educational levels are: primary [Col (7) - Col (10)]; secondary [Col (11) - Col (14)]; and tertiary [Col (15) - Col (18)].

TABLE B.IV. Teacher's Education Background in Primary Education

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	China				India			
	Tertiary Education	Upper Secondary	Lower Secondary	Below Lower Secondary	Tertiary Education	Upper Secondary	Lower Secondary	Below Lower Secondary
1940					0%	5%	40%	55%
1945	2%	43%	31%	24%	0%	7%	47%	46%
1955	0%	14%	45%	41%	0%	11%	52%	37%
1960	0%	11%	44%	45%	1%	24%	48%	28%
1980	0%	50%	40%	10%	20%	61%	19%	1%
2000	20%	77%	2%	1%	47%	49%	4%	0%
2020	98%	2%	0%	0%	76%	24%	1%	0%

Notes: The table presents the evolution of the shares of teachers with different educational backgrounds at the primary level in China and India. Over the years, both countries have transitioned to more skilled teachers at primary levels. In China, 98% of teachers in 2020 are tertiary-level graduates, which is 76% in India.

TABLE B.V. Teacher's Education Background in Secondary Education

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	China				India			
	Post Graduate	Bachelor	Higher Vocational	Below Tertiary Education	Post Graduate Graduate	Bachelor	Upper Sec Graduates (XII/X pass)	Below Upper Secondary Graduates
1930	1%	34%	33%	32%	0.0%	9%	22%	69%
1955	0.0%	28%	30%	43%	3%	26%	43%	28%
1960	0.0%	13%	36%	51%	2%	28%	46%	24%
1980	0.0%	10%	12%	77%	21%	44%	30%	5%
2000	0.2%	24%	65%	11%	42%	45%	11%	2%
2020	6%	85%	8%	0%	54%	42%	4%	0%

Notes: The table presents the evolution of the shares of teachers with different educational backgrounds at the secondary level in China and India. Over the years, both countries have transitioned to more skilled teachers at primary levels. In China, all teachers in 2020 are tertiary-level graduates, with 6% postgraduates. In India, there are 54% postgraduate teachers in 2020. The quality of teachers has remained high at the secondary level in India throughout the period, showing India's targeting of quality through hiring more qualified teachers (at high pay).

TABLE B.VI. Decomposition of Education Gini in China and India (Pop 20+)

Survey year	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	$Gini^{Total}$			**n0**			**(1-n0)***$Gini^{Lit}$		
	China	India	Δ	China	India	Δ	China	India	Δ
1988/1987	0.35	0.71	-0.36	0.22	0.60	-0.38	0.13	0.11	0.02
1995/1993	0.32	0.66	-0.34	0.12	0.53	-0.41	0.20	0.13	0.07
2002/2004	0.26	0.58	-0.32	0.06	0.45	-0.39	0.20	0.14	0.07
2013/2011	0.24	0.50	-0.26	0.04	0.35	-0.30	0.20	0.16	0.04
2018/2018	0.25	0.45	-0.20	0.05	0.29	-0.25	0.20	0.16	0.04
1988-2018	-10%	-25%	15%	-17%	-30%	13%	8%	5%	3%
% of total change	100%	100%	100%	176%	119%	83%	-76%	-19%	17%

Notes: The table presents the Gini decomposition, following equation 4, by survey years from CHIP and EUS surveys (age 20+). Col (1) and (2) are total education gini in China and India; and Col (3) is the gap between the two countries (China-India). between Col (4) and (5) are illiterate shares in China and India, and Col (6) is the gap between the two countries (China-India). Two important messages could be drawn from here. First, China has lower $Gini^{Total}$ than India in all the cohorts, though the gap has narrowed. Second, the illiteracy rate plays a major role in education gini, and the inability to liquidate illiteracy has kept the $Gini^{Total}$ at a higher level. This is due to China's long-run focus on educating the masses through primary education and adult literacy campaigns.

TABLE B.VII. Illiteracy Rate among Adult Population

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Survey years	China			India			(India - China) Gap		
	Total	Male	Female	**Total**	Male	Female	**Total**	Male	Female
1988/1987	**22%**	13%	32%	**60%**	46%	74%	**38**	33	41
1995/1993	**12%**	6%	18%	**53%**	39%	67%	**41**	33	49
2002/2004	**6%**	2%	9%	**45%**	32%	57%	**39**	30	48
2013/2011	**4%**	2%	7%	**35%**	24%	45%	**30**	22	38
2018/2018	**5%**	2%	7%	**29%**	20%	38%	**25**	19	31

Notes: The table presents the illiteracy rates by survey years from CHIP and EUS surveys (age 20+). The illiteracy rates are computed for the full population (Col (1) and (4)), females (Col (2) and (5), and males (Col (3) and (6)) within each survey year. Col (7)-(9) the illiteracy gap between India and China in percentage points. India has a higher illiteracy rate than China throughout, though with a declining trend. The gender gap is higher in India, showing a strong cultural imprint.

TABLE B.VIII. Average Years of Schooling by Gender across Birth Cohort

Birth Cohort	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	China				India			
	Total	Female	Male	*Gender gap*	**Total**	Female	Male	*Gender gap*
Survey year 1988/1987								
1920s	**3.1**	1.6	4.5	*-3.0*	**1.4**	0.5	2.2	*-1.7*
1930s	**5.5**	3.4	7.3	*-3.9*	**1.9**	0.9	2.8	*-2.0*
1940s	**7.3**	5.8	8.8	*-3.0*	**2.7**	1.4	3.9	*-2.5*
1950s	**7.9**	6.6	9.2	*-2.6*	**3.5**	2.2	4.7	*-2.5*
1960s	**8.6**	8.0	9.1	*-1.1*	**4.2**	2.9	5.4	*-2.5*
1960s-1920s	5.4	6.5	4.6	*1.9*	2.8	2.4	3.2	*-0.8*
Survey year 2018								
1970s	**9.2**	8.8	9.6	*-0.8*	**6.2**	4.9	7.4	*-2.5*
1980s	**11.3**	11.2	11.3	*-0.2*	**7.7**	6.7	8.7	*-2.0*
1990s	**12.3**	12.5	12.1	*0.4*	**9.9**	9.4	10.5	*-1.1*
1990s-1970s	3.1	3.7	2.5	1.2	3.7	4.4	3.0	1.4

Notes: The table presents the estimated average years of schooling by decadal birth cohort from CHIP and EUS surveys (age 20+). The AYS computed is for the full population (Col (1) and (5)), females (Col (2) and (6)), and males (Col (3) and (7)) within each cohort. Col (4) and (8) are gender gap in China and India. Both countries started with a high gender gap; in fact, China had a higher gender gap up until its 1940s cohort. China has been able to liquidate it from the 1980s cohort, whereas the last observable decadal cohort (1990s) shows a gender gap of 1.1 years of education in India.

TABLE B.IX. Distribution of Education Level Within Social Group in India

	[1]	[2]	[3]	[4]	[5]	[6]
	Survey year 1988			Survey year 2018		
	SCST	Other	Other/SCST	SCST	Other	Other/SCST
Population share	*26%*	*74%*		*28%*	*72%*	
Tertiary	1%	4%	*483%*	7%	15%	*212%*
Secondary	8%	20%	*250%*	35%	43%	*124%*
Primary	7%	13%	*173%*	13%	12%	*91%*
Below primary	84%	63%	*75%*	45%	30%	*67%*
Total	100%	100%		100%	100%	

Notes: The table presents the distribution of educational levels within social groups (SCST and non-SCST) from EUS surveys (age 20+). Columns (1)-(3) are from the 1988 round, and (4)-(6) are from the 2018 round. With increasing levels of education, the caste disparity increases. However, with time, there is some reduction in this gap. However, it has not been removed yet.

Table B.X. Distribution of Working Population by Education and Sector

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
	1988/1987								2018/2018							
	Agriculture		Manufacturing		Service		***Total***		Agriculture		Manufacturing		Service		***Total***	
	China	India	China	India	China	India	*China*	*India*	China	India	China	India	China	India	*China*	*India*
Below Primary	19%	48%	1%	9%	1%	8%	*20%*	*65%*	5%	17%	3%	7%	3%	4%	*10%*	*28%*
PSV	43%	13%	18%	6%	16%	11%	*78%*	*31%*	11%	21%	25%	17%	46%	20%	*81%*	*58%*
Bachelor+	0%	0%	0%	1%	1%	3%	*2%*	*4%*	0%	2%	1%	2%	7%	10%	*9%*	*13%*
Total share in Working Population	*62%*	*62%*	*20%*	*17%*	*18%*	*22%*	*100%*	*100%*	*15%*	*40%*	*29%*	*26%*	*56%*	*34%*	*100%*	*100%*
Average years of schooling	6.8	1.9	9.2	4.0	10.2	6.6	7.9	3.3	7.1	5.3	9.5	7.1	11.2	10.2	10.1	7.4

Notes: The table presents the distribution of the working population share by sector and education levels within the survey year from CHIP and EUS surveys, limiting to (age 20-60). The imposition of an age ceiling of 60 years since it is the retirement age in India. It shows that the Chinese workforce in each sector has predominantly been comprised of higher shares of primary, secondary, and vocational graduates, an artifact of their expansion of the education system.

Appendix C. Appendix Notes

C.1. **Data in Detail.** In this section, we outline the numerous primary sources of educational data specific to China and India spanning the years 1900 to 2020. Furthermore, we clarify the harmonization process employed to ensure consistent and comparable estimates between these two nations over time.

C.1.1. *China.*

C.1.1.1. **Late Qing and China Republic (1900-1948)**

Following the abolition of the Imperial Examination System in 1906, education gained widespread recognition as a paramount instrument for attaining modern nationhood and economic prosperity. This heralded the inception of the first golden age of education in modern China. Concurrently, as a byproduct of the evolution of modern education, detailed educational statistics have been consistently published by both the Qing imperial and China Republic governments.

At the close of the Qing dynasty, the most systematic educational statistics publications comprised three volumes of "Educational Statistics and Figures," issued by the Education Board established in 1905.

- The First Education Statistics and Figures (1907) (Guangxu Sanshisannian Diyici Jiaoyu Tongji Tubiao)
- The Second Education Statistics and Figures (1908) (Guangxu Sanshisinian Dierci Jiaoyu Tongji Tubiao)
- The Third Education Statistics and Figures (1909) (Xuantong Yuannian Disanci Jiaoyu Tongji Tubiao)

In the Republic of China, there has been a notable increase in the publication of various works focusing on education statistics. Among these, the "China Republic Education Yearbook" comprises two volumes that are widely utilized. The

initial volume, published in 1934, presents a comprehensive spectrum of educational data spanning from 1911 to 1933. The subsequent volume, issued in 1948, extends its coverage to include data from 1911 to 1948.

- The First China Republic Education Yearbook (1934) (Diyici Zhonghuaminguo Jiaoyu Nianjian)
- The Second China Republic Education Yearbook (1934) (Dierci Zhonghuaminguo Jiaoyu Nianjian)

Our educational dataset for China, spanning from 1900 to 1949, primarily relies on the aforementioned five publications. Additionally, in instances where specific data are absent from the primary sources, especially for education expenditure, we supplement our dataset by incorporating information from various additional materials, such as:

- Compilation of Materials on the History of Modern Education in China: General Education: Basic Education 1993 (Zhongguo Jindai Jiaoyushi Ziliao Huibian: Putong Jiaoyu, 1993)
- Compilation of Materials on the History of Modern Education in China: General Education: Higher Education 1993 (Zhongguo Jindai Jiaoyushi Ziliao Huibian: Gaodeng Jiaoyu, 1993)
- Materials on the History of Modern Education in China, 1961 (Zhongguo Jindai Jiaoyushi Ziliao)
- National Education Expenditure Statistics, 1935 (Quanguo Jiaoyu Jingfei Tongji, 1935)
- National Education Expenditure Statistics, 1937 (Quanguo Jiaoyu Jingfei Tongji, 1937)
- Compendium of National Education Statistics, 1935 (Quanguo Jiaoyu Tongji Jianbian, 1935)

- 23rd Annual National Higher Education Statistics, 1936 (Ershisan NIandu Quanguo Gaodeng Jiaoyu Tongji)
- The Fifth Education Statistics and Figures of the Republic of China, 1916 (Zhonghuaminguo Diwuci Jiaoyu Tongji Tubiao, 1916)

C.1.1.2. **Communism China (1949-1981)**

During this period, systematic publications on education statistics were notably sparse, largely attributed to the disruptions caused by the Great Famine (1960-1962) and the Cultural Revolution (1966-1976). Consequently, existing literature covering this period is quite limited, with the primary resource being the China Education Statistics Yearbook, 1949-1981 (Zhoangguo Jiaoyu Tongji Nianjian, 1949-1981), published in 1984 and China's Educational Achievements, 1949-1985, published in 1985 (Zhongguo Jiaoyu Chengjiu). Our educational dataset for China, spanning from 1949 to 1981, predominantly draws from this yearbook.

During this period, comprehensive data on total education revenue and expenditure categorized by education stages are not available. However, the China Education Statistics Yearbook, 1949-1981 provides information on expenditure per student across various education stages. Consequently, we estimate the total education expenditure by multiplying the expenditure per student by the number of enrollments for each education stage.

C.1.1.3. **Post-reform China (1986-2020)**

Since 1987, China has annually published the Education Statistics Yearbook of China (Zhongguo Jiaoyu Tongji Nianjian), which provides detailed headcount figures, including the number of students and graduates and the number of teachers categorized by gender and educational stages. However, it does not include information on education expenditure.

Starting in 1997, detailed data on education expenditure were documented in the Education Revenue and Expenditure Statistics Yearbook (Zhongguo Jiaoyu Jinfei Tongji Nianjian), which is released annually. This resource furnishes data on

education revenue and expenditure categorized by educational stages. For the period spanning from 1978 to 1990, we rely on data sourced from "The Basic Analysis of Education Revenue and Expenditure Data in China from 1978-1990" (Zhongguo Jiaoyu Jinfei Jiben Shuju Fenxi, 1992), published in 1992 by the National Education Commission Finance Department. Additionally, national-level educational revenue data from 1991 to 1996 is obtained from the website of the National Bureau of Statistics.

C.1.1.4. **Remarks on data harmonization**

1. **Adult Education**: We exclude adult education from all statistics except expenditure. Therefore, enrollment figures only pertain to regular students. However, there are overaged children attending school, comprising approximately 20% of the student population from 1949 to 1981. No data is available for overaged children attending school beyond this period. In education budget data that includes revenue and expenditure at the primary stage, adult primary enrollment figures are also included, though they represent a small share (<0.1%).

2. **Net Enrollment Rate**: Data on the net enrollment rate at the primary stage from 1951 to 2018 are sourced from reported values in the education yearbooks.

3. **Number of Teachers**: non-teaching staffs at school are not included.

4. **Primary Education**: Educational statistics for primary schools do not include church schools. From 1902 to 1931, primary schools include lower primary schools, upper primary schools, and complete primary schools. From 1932 to 1945, primary schools include people's nucleus schools, people's schools, complete primary schools, lower primary schools, short-term primary schools, and short course primary schools. From 1949 to 2020, primary schools include only regular primary schools.

The number of graduates from primary schools from 1931 to 1945 only covers graduates from upper primary schools. The reform to replace the 4+2 years system with 5 years of primary education began in 1950 in China; however, by 1953,

the reform was halted due to a shortage of teachers. Since 1960, the primary education system in China has consisted of a mixture of 5-year and 6-year programs. From 1906 to 1930, it is assumed that the students per graduate ratio is equal to 37, which is the average of the ratio between 1931 and 1945.

5. Vocational Education: According to UNESCO, vocational education refers to the type of education or training aimed at providing individuals with the knowledge, skills, know-how, and competencies necessary for specific occupations or, more broadly, for success in the labor market. In China, secondary vocational education encompasses both upper secondary vocational education and lower secondary vocational education. Upper secondary vocational education includes secondary technology schools, teacher training schools, and vocational high schools. Lower secondary vocational education comprises vocational middle schools. Tertiary vocational education consists of short-cycle tertiary vocational education programs lasting equal to or less than three years.

C.1.2. *India.*

C.1.2.1. **Pre-independence India (1900-1947)**

British India produced quinquennial reports titled "Progress of Education in India" during the colonial period, containing extensive tables on enrollment, graduates, teachers, and expenditure for all levels of education. These reports provided changes occurring over a five-year period. The first report came in 1887-88, containing education progress during 1882-1887. These reports came uninterruptedly until 1937. Due to World War 2, the next (and final) report came in 1947, containing ten years of education progress (1937-47). These reports have two volumes, with Volume 2 containing statistical tables. Except for some nominal changes over successive reports, these are valuable sources for consistent aggregate-level statistics. We use all-India tables, which are formed from provincial-level tables. These reports account for only directly ruled British India and not princely states.

C.1.2.2. **Post-independence (1950-2020)**

The new Indian government continued to report on a similar structure as before, however, for altered territory. There were two major changes. First, British India was partitioned with the creation of a new country – Pakistan, and post-independence Indian reports exclude statistics related to Pakistan. Second, the princely states that were not under direct British administration earlier became part of India, and reports include information related to them. The resulting change was such that one doesn't find a significant jump in this period.

- Education in India (1950-51 to 1986-87) annual reports are another source of relatively consistent reports which are aggregated from state-level reports. The National Education Policy of 1968 recommended a 10+2+3 structure, which was gradually adopted in India. Its impression in reports is also visible, where the statistics related to intermediate-level students (class XI and XII), which were earlier part of University-level education, started appearing in secondary schools. There were also some changes in the structure of the reports over the years.[74] They provide information on enrollment, graduates, teachers, and expenditure for all education levels. From the year 1987-88, there was a major administrative change in publishing reports, segregating schools and tertiary-level education reports publishing bodies, which resulted in a gap in consistent higher education statistics for the next two decades.[75] Upto 1963-64, level-wise data with respect to professional education (i.e., except basic science and humanities) at the tertiary level was not collected [76], hence, they are estimated based on the proportion of graduates.

[74] Until 1965-66, there were two volumes as before, with Volume II containing all-India tables. From 1966-67, the pattern changed slightly, and only one combined report was published. In 1975-76, another major change occurred, and three Volumes were produced: Volume I (enrollment and teachers), Volume II (financial data: income and expenditure), and Volume III (examination results). For the next three years, 1984-85, 1985-86, and 1986-87, Volumes I and II were further segregated into school-level and tertiary-level education.

[75] The Department of Education under the Ministry of Human Resource was now only to provide statistics related to school education and non-affiliated tertiary institutions. The University Grants Commission (UGC) was given the responsibility to produce statistics for the affiliated higher education without enough resources and expertise.

[76] The Department of Education (Statistics and Information Division) published a report called - Education in India since Independence: A Statistical Review - in 1972, compiling information from Education in India reports.

- Education in India (1988-2000): During this period, these annual reports provided statistics of school-level education (grades I-XII) in three volumes: Volume I (enrollment and teachers), Volume II (financial data: income and expenditure), and Volume III (examination results).

- Selected Educational Statistics (2001-2006-07)

- Statistics of School Education (primary and secondary education) and Statistics of School Education(higher education information)

- Digital Information on School Education (DISE): is synonymous with AISHE for institutions providing school-level education, where each school fills enrollment numbers, graduates, and teachers. We use the information on the "Class V pass" for primary-level graduates from this data post-2005.

- Results of high school and higher secondary examination (1971-2020): These annual reports provide the total number of students clearing two national-level standardized exams within the secondary level of education. These exams are crucial in the Indian context and are conducted after 10 years of education (after grade X) and another after 12 years (grade XII/Intermediate). The number of students clearing these exams is our secondary level graduates.

- University Grants Commission (UGC) reports (1963-2020): provides information on a number of professors at the non-vocational tertiary level, split into Professor, Associate Professor, Lecturer, and Demonstrator/Tutor.

- All India Survey on Higher Education, initiated in 2011, was necessitated as the complete picture of tertiary/higher education was missing for almost two decades.[77] It covers both - university-level institutions (non-vocational) and stand-alone institutions (predominantly vocational in nature, like polytechnics, teacher training institutions, nursing, etc.)

[77] The survey intended to cover all tertiary-level institutions, bringing all the major stakeholders, such as University Grants Commissions, the All India Council for Technical Education, the Medical Council of India, and State Governments, to participate in the data collection exercise. It covers all institutions providing education completing 12 years of schooling or equivalent and is of the duration of at least nine months (full time) or after completing 10 years of schooling and is of the duration of at least 3 years.

C.1.2.3. **Remarks on Data Harmonization**

It is important to note that Indian reports often provide information on teachers and expenditure by school type. School type is defined by the highest grade present in the school. Suppose a school has grades 1-10; it will be classified as a secondary school, and the reports will classify their statistics under the secondary level. Statistics by school types are not synonymous with stages of education. Hence, great care is taken first to pick the correct enrollment by education stage, and based on that, teachers and expenditure by stage of education are estimated.

Income and Expenditure: There are mainly three types of sources that are utilized to estimate stage-wise expenditure for different periods.

(1) *Expenditure from Educational Statistics Report (upto 1985)*: provides income and expenditure receipts by type of institutions[78]. The income receipts are split by source type: government funds, universities, and local body funds (all 3 forming the public component); fees, endowment, and other sources (forming the private component)[79]. The expenditure is split by the type of institution and not by the stage of education. Hence, we follow the procedure below to estimate expenditure by education stage.

   (a) Total primary stage expenditure = (expenditure/student in primary schools)*(total enrollment at the primary stage), i.e., we use the expenditure per student in primary schools, often provided in the reports, and multiply with the total enrollment at the primary stage to arrive at total expenditure at the primary stage.

[78] It also splits into Recurring and non-Recurring. The recurring expenditure is incurred annually by an educational institution, e.g., on salaries, maintenance, scholarships, direction/inspection, etc. Non-recurring expenditure, as the name suggests, is not recurring but can occur in a given year, like the construction of buildings, equipment, libraries, etc.

[79] It covers only recognized institutions. The surveys from post-1996 also capture unrecognized schools, which have become important due to the huge expansion of the unrecognized schools.

(b) Total secondary stage expenditure = Total expenditure at secondary type (provided in reports) - (Total primary stage expenditure (estimated above) - Total expenditure in primary school) + Total intermediate stage expenditure. Total intermediate-stage expenditure is computed based on expenditure per student within tertiary institutions.

(c) Total tertiary stage expenditure=Total expenditure in tertiary institutions-total intermediate stage expenditure (estimated above)

These reports stopped providing expenditure for higher education from 1987-88 and for all levels of education after 1999-2000. Hence, expenditure calculations from 1987-88 involve using Analysis of Budget Expenditure reports (annual; capturing public expenditure exponent) and NSS Education Surveys (1986, 1995, 2007, 2014, and 2018; capturing household-level private expenditure).

(2) Estimation post-1985:

(a) Public component: comes from *Analysis of Budget Expenditure Reports 1951-2018*, which are annual publications compiled from the Demands for Grants made by Central and State governments[80], which we compiled from 1950 till the recent year. The stage-wise analysis requires one extra step since the categories provided don't match the definition of stages. The categories provided in these reports are elementary (grade I-VIII), secondary (grade IX-XII), university & higher education, adult education, technical education, and others. We split the elementary into primary(grades I-V) and upper primary (grades VI-VIII), using enrollment shares at these levels. The upper primary is then included in the secondary to get complete secondary stage (grade VI-XII) public expenditure.

[80]There are three expenditure estimates - budget(BE), revised(RE) and actual(AE). The actual estimates are the final expenditure that comes after two years. The revised estimates are the pre-final estimates, which come after one year. The budget estimates are the budgeted estimate. We use actual estimates when present or rely on RE or BE. It provides Plan and Non-Plan Expenditure for various sub-sectors of Education. The expenditure is split under revenue and non-revenue(capital, loans & advances account). The non-revenue portion is $\sim$1-2% of the total expenditure, which goes into capital works. One limitation of these reports is that up to 2003, it was double counting the centrally sponsored schemes as it is entered both under Centre and State.

(b) Private component: comes from *NSS Participation in Education Surveys*, which are all-India representative surveys to capture the expenditure details for currently enrolled students. These surveys are available for 1986, 1995, 2007, 2014 and 2018. It captures a broad range of expenses like tuition, examination, other fees, stationery, uniforms, transport, private coaching, etc. The first three (i.e. only fees) are used to compute private expenditure to make it comparable with pre-2000 years. For the intermittent years, the data is interpolated linearly. The current level of enrollment is used to compute stage-wise average expenditure.

We combine public and private components by educational levels to arrive at total expenditure.

Teachers: We estimate total teachers by stages of education as the reports usually provide total teachers by institution type (and not by stage of education).

(1) Total primary stage teachers for a given year (Y) is estimated by multiplying the teacher–pupil ratio in primary school type with total primary stage enrollment.

$$\text{Primary-stage Teacher}_Y = \frac{\text{Teachers in Primary schools}_Y}{\text{Primary School Enrollment}_Y} * \text{Primary Stage Enrollment}_Y$$

(2) Total secondary stage teachers are all teachers teaching secondary stage students. There are two important steps - first, remove the teachers who are reported to be part of secondary schools but are teaching primary-stage students; second, bring in the teachers who were teaching intermediate-level students (before the 1960s), which was considered to be part of tertiary-level education. To estimate intermediate-level teachers, we distribute teachers based on enrollment numbers.

$$\text{Secondary-stage Teacher}_Y = (\text{Teachers in Secondary schools}_Y) -$$
$$\text{(Total primary stage teachers - Total teachers in primary school)} +$$
$$\left(\frac{\text{Teachers in Tertiary institutions}_Y}{\text{Tertiary Enrollment}_Y} * \text{Intermediate Stage Enrollment}_Y\right)$$

(3) Total tertiary stage teachers is estimated by subtracting the teachers who are apportioned to the intermediate level when reports clubbed intermediate level to tertiary level. =Total teachers in higher stage-total intermediate stage teachers

$$\text{Tertiary-stage Teacher}_Y = (\text{Teachers in Tertiary institutions}_Y) -$$
$$\left(\frac{\text{Teachers in Tertiary institutions}_Y}{\text{Tertiary Enrollment}_Y} * \text{Intermediate Stage Enrollment}_Y\right)$$

C.1.3. *Surveys for China and India.* We provide a brief description of the surveys and the harmonization undertaken to compute cohort-wise stock of human capital composition from post-1980 surveys. First, we use surveys that capture both employment and education information for years and are close to each other. We use the CHIP surveys, which are available for the years (1988, 1995, 2002, 2013, and 2018) for China, and use comparable years of NSS Employment and Unemployment surveys (1987, 1993, 2004, 2011, and 2018) for India. We keep the adult population, which is defined as age 20 and above. Second, important harmonization is with respect to educational variables.

The Indian surveys capture the educational categories and years of education in two rounds, 1983 and 2018. In the rest of the rounds (1987, 1993, 2004, and 2011 only educational categories are captured. The educational categories capture the highest level of education achieved by a person. They are first harmonized into five categories in all rounds, as follows:

- Illiterate (with Literate w/o formal schooling): Illiterate implies no formal education and is consistently captured in all rounds. Literate w/o formal schooling is another category (a small share of the population) for those who report to be literate but have not been to any formal school ever. Every round captures this. We combine these two.

- Below primary: are those who have attended formal schools but have not passed grade V.

- Primary: is reported for those who have passed grade V and have a minimum of five years of schooling. They have not finished grade VIII.

- Secondary (including Middle): in rounds 1983 and 1987, it is reported for anyone who has passed matriculation (grade X), intermediate/higher secondary (grade XII) but has not cleared any degree examinations. In subsequent rounds, the secondary is split into secondary (IX-X) and secondary (XI-XII). Indian surveys also report a category- "Middle"- for those who have passed grade VIII but have not finished grade X. We combine Middle and Secondary.

- Graduate: In 1983, there was just one category with any degree (bachelor's, master's, doctorate, etc.) in any subject. The rounds of 1987 and 1993 report graduation in agriculture, engineering, medicine, and others. Later rounds again stopped providing subject-wise split but provided bachelors-level and post-bachelors category. We combine all rounds with tertiary-level degree graduates.

We impute years of education in 1987, 1993, 2004, and 2011 by the average of harmonized educational categories and decadal birth cohort (the 1910s, 1920s, 1930s, 1940s, and 1950s) from the 1983 round and for the decadal birth cohort (1960s, 1970s, 1980s, and 1990s) from the 2018 round. The decadal birth cohort is made using age. For e.g. in 2018 round- i) 1990s birth cohort is $19 < age \leq 28$ ii) 1980s cohort is $28 < age \leq 38$ iii) 1970s cohort $38 < age \leq 48$ iv) 1960s cohort

$48 < age \leq 58$ v) 1950s cohort $58 < age \leq 68$. Lastly, if the imputed year of education is less than 0.2 years, we make it zero.

The CHIP surveys, except the 1988 round, capture both educational categories and years of education. However, the concept of reporting the educational category is different. It is based on the last grade of school a person has attended. Hence, we create a consistent category matching the definition of the Indian educational category using years of education. For 1988, the educational categories are based on the highest level of education achieved.

We impute years of education in 1988 by the average of harmonized educational categories, sector (rural/urban), and decadal birth cohort from the 1995 round. For some individuals, when years of education remain missing (due to non-overlap of the cohort in 1988 and 1995), we impute by dropping the cohort condition. As before, if the imputed year of education is less than 0.2 years, we make it zero.

The surveys in both countries and in each round capture the current working status of individuals. A person is classified as non-working if neither employed (including self-employed) nor studying. In CHIP and EUS surveys, the non-working population is an aggregation of retired, unable to work, full-time homemakers, and others.

Table B.XI. Survey Educational Categories Harmonization

		Illiterate	Below Primary	Primary Graduate	Secondary Graduate	University or Above	Vocational
China	1988 (Rural)	Illiterate	(<3 years AND >=3) of Primary School Years	Primary School Graduate	Upper/Lower Middle School Graduate	College or Above	Professional School Graduate
	1988 (Urban)	Illiterate (no category)	(<3 years AND >=3) of Primary School Years	Primary School Graduate	Upper/Lower Middle School Graduate	University	Professional School Graduate AND College
	1995 (Rural/Urban)	(Eduyr=0) OR "Illiterate or Semi-illiterate"	(Eduyr<6) OR "1-3 years of elementary school"	(Eduyr<9) OR "4 or more years of Elementary School"	(Eduyr<16) OR "Upper/Lower Middle School"	(Eduyr>=16) OR "College or Above"	Middle Level Professional, Technical or Vocational School/ Professional School
	2002 (Rural)	””	””	””	””	””	””
	2002 (Migrant)	(Eduyr=0)	Entered Elementary School or Below OR (Eduyr<6)	Finished Elementary School/Entered Lower Middle school but not finished OR (Eduyr<9)	Entered in college but not finished/Finished or Entered Upper middle school/Finished Lower Middle School OR (Eduyr<16)	Finished College and Above	Finished/Entered Professional or Middle-level Professional School
	2002 (Urban)	(Eduyr=0)	(Eduyr<6)	(Eduyr<9)	(Eduyr<16)	(Eduyr>=16)	Technical Secondary School/Junior College
	2013 (Rural/Urban/Migrant)	(Eduyr=0) OR Never Schooled	(Eduyr<6)	(Eduyr<9) OR "Elementary School"	(Eduyr<16) OR "Junior/Senior Middle School"	(Eduyr>=16) OR "Bachelor's, Master's or Higher Degree"	Polytechnic College, Specialized Secondary School, Vocational Senior/Technical School
	2018 (Rural/Urban/Migrant)	””	””	””	””	””	””
India	1983	Illiterate AND Literate w/o formal schooling	Below Primary	Primary Graduate	Middle Level Graduate AND Secondary	Bachelors and above	
	1987	””	””	””	””	””	Diploma
	1993	””	””	””	””	””	””
	2004	””	””	””	””	””	””
	2011	””	””	””	””	””	””
	2018	””	””	””	””	””	””

Notes: The table presents the educational categories harmonized in all rounds of CHIP (China) and EUS (India) surveys.

C.2. **Different Components of Human Capital Framework.** In this subsection, we illustrate different measures we build to conceptualize different components of the human capital framework. These measures are built from core variables captured in reports - enrollments, graduates, teachers, and expenditures. In all formulas, $j \in P, S, T$ stands for primary, secondary, and tertiary stages, respectively; Y stands for the year. The school starting (finishing) age and duration by different educational stages are provided in Appendix Table B.I.

(1) Gross enrollment rate: is the total enrollment divided by school-aged population at a given level for a given year.

$$GER_Y^j = \frac{\text{Total Enrollment}_Y^j}{\text{School-aged population}_Y^j}$$

There are two things to note about this measure, especially in the context of developing countries. There are often over-aged students at each educational level; hence, the rates can be more than 100%. Second, a high non-attendance rate (enrolled students not attending or teachers not attending school) reduces its efficacy while considering education imparting human capital.

(2) Net Enrollment Rate: is the enrollment (in the official school-going age) divided school-aged population at a given level for a given year. Essentially, compared to GER, it removes over- and under-aged enrolled students from the numerator.

$$NER_Y^j = \frac{\text{Age-specific Enrollment}_Y^j}{\text{School-aged population}_Y^j}$$

It cannot be more than 100%, though it doesn't solve the issue of non-attendance rates (enrolled students not attending or teachers not attending school).

(3) Gross graduation ratio: is the total graduation divided by the usual finishing age population at a given level for a given year. Total graduation is the number of students clearing the level and are eligible to move to the next. The finishing age is the highest age to finish a level under normal circumstances, where normal circumstances imply that someone starts at the right age and does not repeat or skip any grade.

$$GGR_Y^j = \frac{\text{Total Graduation}_Y^j}{\text{Official finishing age population}_Y^j}$$

We also compute GGR within tertiary education for Bachelor, Master, and Doctorates (see **Data Appendix SheetA3a and A3b** for full series).

The other way to compute the gross graduation ratio is with respect to a fixed birth cohort.

$$GGR_Y^j = \frac{\text{Total Graduation}_{Y+d}^j}{\text{Cohort population}_Y^j}$$

where d is the duration of finishing primary, secondary, and tertiary levels (see **Data Appendix SheetA3c** for full series).

(4) Students per Teacher: is the total enrolled students divided by the total teachers at a given level for a given year.

$$PTR_Y^j = \frac{\text{Total Enrollment}_Y^j}{\text{Total Teachers}_Y^j}$$

(5) Teachers per School-Aged Population: is number of teachers per school-aged population (irrespective of their enrollment status).

$$\text{Teacher per Population}_Y^j = \frac{\text{Total Teacher}_Y^j}{\text{School-aged Population}_Y^j}$$

(6) Female Enrollment Share: is total female enrollment divided by total enrollment at a given level for a given year.

$$\text{Female Enrollment share}_Y^j = \frac{\text{Total Female}_Y^j}{\text{School-aged Population}_Y^j}$$

(7) Female/Male Enrollment Ratio: is total female/male enrollment divided by school-aged female/male population at a given level for a year.

$$\text{Female GER}_Y^j = \frac{\text{Total Female Enrollment}_Y^j}{\text{Female School-aged population}_Y^j}$$

$$\text{Male GER}_Y^j = \frac{\text{Total Male Enrollment}_Y^j}{\text{Male School-aged population}_Y^j}$$

(8) Vocational Enrollment Share

$$\text{Vocational Share}_Y^j = \frac{\text{Total Vocational Enrollment}_Y^j}{\text{Total Enrollment}_Y^j}$$

Vocational share is at secondary and tertiary levels only.

(9) Discipline-wise share at Tertiary Level

$$\text{Discipline-wise Share}_Y^k = \frac{\text{Total Graduates from a Discipline}_Y^k}{\text{Total Graduates}_Y^k}$$

$k \in B, M, D$ stands for Bachelor, Master, and Doctorate within the tertiary non-vocational level, respectively. We create 7 comparable disciplines - social science (including law and business/economics), education, science, engineering, medicine, agriculture, and others.

(10) Total Expenditure: is provided in local currency and real USD PPP (2020) at a given level for a given year.

$$\text{Total Exp (2020 \$ PPP)}_Y^j = \frac{\text{Total Expenditure}_Y^j}{\text{USD GDP deflator}_Y}$$

(11) Expenditure as a share of GNI: is total expenditure in local currency divided by gross national income in local currency at a given level for a given year.

$$\text{Exp share GNI}_Y^j = \frac{\text{Total Expenditure}_Y^j}{\text{GNI}_Y}$$

(12) Share of Expenditure by Education Level: is total expenditure at a given level divided by total expenditure for a given year.

$$\text{Share of Exp by Level}_Y^j = \frac{\text{Total Expenditure}_Y^j}{\text{GNI}_Y}$$

(13) Expenditure per Student: is total expenditure divided by total enrollment at a given level for a given year. It is computed in both local currency and 2020 USD PPP.

$$\text{Expenditure per Student}_Y^j = \frac{\text{Total Expenditure}_Y^j}{\text{Total Enrollment}_Y^j}$$

(14) Education Investment Ratio (EIR)

$$EIR^j = \frac{\text{Education Expenditure}^j/\text{School-aged population}^j}{\text{GNI per capita}}$$

The step-wise multiplicative decomposition of EIR^j is below

$$\begin{aligned} EIR^P =& \frac{\text{Expenditure}^P/\text{Population}_{6-11/12}}{\text{GNI/Total Population}} \\ =& \underbrace{\frac{\text{Enrollment}^P}{\text{Population}_{6-11/12}}}_{GER^P} * \underbrace{\frac{\text{Expenditure}^P/\text{Enrollment}^P}{\text{GNI/Total Population}}}_{Quality^P} \end{aligned}$$

$$\begin{aligned} EIR^M =& \frac{\text{Expenditure}^M/\text{Population}_{11/12-17}}{\text{GNI/Total Population}} \\ =& \underbrace{\frac{\text{Enrollment}^M}{\text{Population}_{11/12-17}}}_{GER^M} * \underbrace{\frac{\text{Expenditure}^M/\text{Enrollment}^M}{\text{GNI/Total Population}}}_{Quality^M} \end{aligned} \tag{B.1}$$

$$\begin{aligned} EIR^T =& \frac{\text{Expenditure}^T/\text{Population}_{18-27}}{\text{GNI/Total Population}} \\ =& \underbrace{\frac{\text{Enrollment}^T}{\text{Population}_{18-27}}}_{GER^T} * \underbrace{\frac{\text{Expenditure}^T/\text{Enrollment}^T}{\text{GNI/Total Population}}}_{Quality^T} \end{aligned}$$

The first component is GER, capturing the *quantitative* part of education expansion. The second term- $Quality$, captures how much a country spends per enrolled student relative to its per capita economic development. It is an input-based *quality* measure - comparable across time and space without an exchange rate and price index (often difficult to find in the long run). It could be further decomposed into two multiplicative components.

$$
\begin{aligned}
Quality^j =& Quality1^j * Quality2^j \\
=& \frac{\text{Teachers}^j}{\text{Enrollment}^j} * \frac{\text{Expenditure}^j/\text{Teachers}^j}{\text{GNI/Total Population}} \\
=& \underbrace{TPR^j}_{Quality1^j} * \underbrace{\frac{\text{Expenditure}^j/\text{Teacher}^j}{\text{GNI/Total Population}}}_{Quality2^j}
\end{aligned}
\tag{B.2}
$$

The final decomposition has three multiplicative parts:

$$
\begin{aligned}
EIR^j =& Quantity^j * Quality1^j * Quality2^j \\
=& \underbrace{GER^j}_{Quantity^j} * \underbrace{(\underbrace{TPR^j}_{Quality1^j} * \underbrace{\frac{\text{Expenditure}^j/\text{Teacher}^j}{\text{GNI/Total Population}}}_{Quality2^j}}_{Quality^j}
\end{aligned}
\tag{B.3}
$$

$Quality1$ is the Teacher-Pupil ratio (which is the inverse of the Pupil-Teacher ratio). $Quality2$ is a proxy for teachers' relative salary, as part of the total expenditure goes into developing and maintaining infrastructure, which could be thought of as creating better working conditions for teachers. Hence, it is a broader measure than teachers' salaries. It also signals the attractiveness of the education sector relative to the overall economy. A higher value implies a better qualitative measure for both components.

C.3. **Comparison with Other Datasets.** *Mitchell 1998* : We compare the enrollment figures from 1900-1970 for primary, secondary, and higher education with Mitchell 1998. The difference is less than 0.5% for China for the entire duration. The difference between Mitchell 1998 and Indian data is as expected since we have emphasized carefully allocating students to their respective stages of education. Our numbers are higher at the primary level by 5-8% for different years, as the students at the primary stage but studying in secondary schools are allocated

at Primary. On the other hand, our higher education numbers are lower because we take out the Intermediate level (Class XI-XII) students from Higher education and put them at the secondary level.

UNESCO World Education Surveys: UNESCO 1958 provides Primary level enrollment from 1930-58. The difference is close to zero for China. For India, our numbers are 11% higher in 1930 and decrease to 1-2% after 1950. UNESCO 1961b and UNESCO 1961a provides Secondary and Higher level enrollment. Since the UNESCO method also allocates intermediate students to secondary, the higher-level enrollment figures for India are close.

Contemporary 1970:
UNESCO : UNESCO provides information on the variables from 1970 onwards. We compare our figures with those of UNESCO and highlight the contribution of our data. First, UNESCO does not provide information on the following:

(1) enrollment by stage: enrollment figures are provided consistently post-1970. The Primary level enrollment figures differ by +/- 3% in comparison with UNESCO data, with more difference in the recent years for India. This is due to the Government of India's frequent updates of past years on the estimated numbers.

(2) Discipline-wise share: It is completely missing for China, and for India, the information is present only from 2013. We provide the discipline-wise share of enrollment and graduates from the early 1900s.

(3) Expenditure split by Education: Once again, the information is missing for China and for India; sparse data is present from 1999.

C.4. **Educational Policies in Detail.** This section provides a detailed overview of the adopted educational policies for China and India, separately in chronological order.

C.4.1. *China.* Before the abolishment of the imperial examination system in 1905, Classic Confusion education was predominant, with its foremost goal of supporting the Imperial civil service examination.[81] Having operated for over a thousand years, the Imperial examination-centred education system had increasingly proven inadequate, especially when China confronted Western and modern forces. Indeed, two fundamental weaknesses of the traditional education system are often cited – first, a narrow focus on Confucian study disincentivizing young talent from pursuing broad academic subjects, resulting in a retarded development of technology and a modern mentality and second, the absence of public provision for basic schooling, thus keeping education inaccessible to many (Gao 2015).

The 19th century saw the diffusion of the European university model throughout much of the world under conditions of imperialism and colonialism. After the Opium War (circa 1839–1842), China was forced to open up. Since then, western education started emerging in China together with the expansion of missionary activities. Protestant and Catholic Churches began establishing schools with western-based curricula, and they gradually spread to all levels of education.[82] The reach of missionary activities remained limited till 1900, given the large geographical expanse and population. Nevertheless, these missionary schools were the nucleus from which the idea of modern education grew in China. Inspired by the western schools, in the second half of the 19th century, a handful of specialized schools were established under the support of the Qing government to meet the urgent need for talents in the areas of foreign language and military in the empire.[83] With the same goal, the Imperial University of Peking, the first modern university, was established in 1898, which marked the official starting point of modern universities in China.

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[81] The Imperial Civil exam was implemented as early as the Tang Dynasty (618-896) and had existed for more than 1000 years before its abolition in 1905.

[82] For example, St. John's University (Shanghai), one of the oldest and most prestigious universities in China, was established in 1879.

[83] I.e., Imperial Tongwen Guan (京师同文馆) (1862); Guangdong Fangyan Guan (广东方言馆) (1863); Fujian Shipping and Polity Schoo(福建船政学堂) (1866); Tientsin Navy Academy (天津水师学堂) (1867); Tientsin Military Academy (天津武备学堂) (1885) Guangdong Military Academy (广东陆师学堂) (1886); Guangdong Navy Academy (广东水师学堂) (1887); Hubei Ziqiang College (湖北自强学堂) (1893)；Tientsin Zhongxi College (天津中西学堂) (1895); Shandong Jingshe(东山精舍) (1895)；Hubei Military Academy (湖北武备学堂) (1895) Nanjing Military Academy (南京陆军学堂) (1895) Nanyang Mission College (南洋公学) (1896).

Education reform took a quantum leap after the turn of the century to meet the rising challenges of the western powers. The Qing government promulgated several official decrees on education reforms, which could be seen as seminal events in modern education in China. In 1904, Education Act laid down the general foundation of China's first modern educational system. In 1905, to incentivize modern education, the imperial civil service examination was abruptly ended, after more than 1300 years of its existence, marking the start of a transition to the modern education system officially.

Learning lessons from the limitation of China's traditional education, the pivot of the education development plan for both the Qing and China Republic have always been the universal compulsory education for all school-aged kids. To achieve the ambitious goal of universal coverage of compulsory education, the Qing empire and the China Republic made multiple trials in the following several decades. In 1906 the first Compulsory Education Law was issued stipulating that "Children must go to school at the age of 7" (Guilin, Mingxiu, and Manqian 1995, Page 37). In the following year, the first piece of legislation on female primary schools was issued, which provided legal support for the education right of girls (Guilin, Mingxiu, and Manqian 1995, Page 43).

Despite the fall of the Qing Empire in 1911, the new China Republic government was determined to popularize compulsory education. In 1912, the Ministry of education was established, followed by the enactment of the "Primary School Law", setting the four-year elementary and primary school as the compulsory education stage (Sun 1957, Ch 3, P115). However, the power of central authority waned during the warlordism (1915–28) in China, which consequentially impeded the expansion of coverage of compulsory education. With the warlord fiefdoms and rival governments reunifying in 1928 by the Nationalist government, the third wave of universal coverage for compulsory education started. In 1935, the Executive Yuan of the Nationalist government promulgated the "Outline of Interim Measures for the Implementation of Compulsory Education", aiming to implement four years of compulsory education in 3 phases: in the first phase (1935-1940),

providing at 1-year compulsory education for more than 80% school-aged children; in the second phase (1940-1944), providing 2-years compulsory education for more than 80% school-aged children; in the final phase (after 1944), providing 4-years compulsory education national wide (Sun 1991, P423). Furthermore, in 1939 the Nationalist government implemented a new local administrative system - the "New County System (新县制)", to strengthen its control over the grassroots political power. Expanding compulsory education is a core component of the new system. According to the provisions [84], local governments have to install one national primary school in each village or town and one national primary school in each Bao[85] to provide basic education for school-aged kids and illiterate adults (Sun 1957, Ch 3, P115). Unfortunately, the implementation of the above policies was again interrupted by the outbreak of the Sino-Japanese War (1937-1945).

From the end of the Qing to the creation of the People's Republic of China (PRC), the development of primary education waxed and waned in response to warlordism (1915–28), J apanese invasion (1937–45), and the Chinese Civil War (1927–49). In this turbulent half-century, the ambitious goal of universal coverage of compulsory education was never fully achieved. Nevertheless, China made great progress in the expansion of primary education. At the beginning of the century, the enrollment in primary school was less than half a million, which by 1945 increased to 22 million (GER reaching 34% for 6 to 12 years) in about 270 thousand primary schools.. In 1947 for the first time, the six-year compulsory education was written into the Constitution. It is clear that in this period, the priority for the authorities was to increase the enrollment rate in primary education in all manners (establishing short-term primary schools and half-day schools), and the quality of compulsory education remained a second-order issue. Such a strategy has also adopted during Mao's period of PRC.

Another main criticism of Chinese traditional education was the discouragement of the distribution and creation of knowledge of natural sciences and practical expertise. Driven by the aspirations towards a strong industrialized nation and

[84] See "The outline of the organization at all levels of the county(县各级政府组织纲要)" issued by the Nationalist government in 1939.

[85] An administrative unit consisting of 100 households.

modern military prowess, exceptional attention was given to applied disciplines as well as normal and vocational education in secondary and tertiary education, ever since the advent of a modern education system in China.

For example, the 1922 education system reform divided secondary education into lower secondary education (3 years) and higher secondary education (3 years), which provided the division of different tracks, such as general education, normal education and vocational education (agriculture, industry, commerce). [86] In 1932, a package of momentous educational laws was further promulgated for the first time to promote the establishment of normal and vocational schools.[87] Furthermore, to encourage the development of normal and vocational education, in 1938, the Ministry of Education specified the ratio of the number of classes in different types of secondary schools.[88] Similar corrections were also adopted in higher education. In 1929 shifting the focus of higher education towards science and technology was written in the national education development guideline[89] (Wang 1934, Ch3, P11). Three years later, the "Vocational Education Law" was promulgated, which marked the formation of an independent vocational education system for higher education in China.

The policies for primary and secondary education carried out during the Communism period resembled in many ways its predecessors. Popularizing compulsory education continued to be the priority of education [90]. The significant addition

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[86] See School System Reform Law (学校系统改革案), 1922

[87] Therefore, students are no longer divided into different tracks in higher secondary education (Sun 1991, P425).

[88] The ratio among ordinary secondary schools, normal schools and vocational schools in lower secondary education was set to 6:3:2; the corresponding ratio for higher secondary education was set to 2:1:1 (Sun 1957, Ch 3, P182).

[89] Republic of China's Educational Aims and Implementation Guidelines

[90] The first national primary education and demonstration education conference of the Ministry of Education (1951) proposed to enroll 80% of school-age children in primary school in 1952-1957 and provide universal basic education coverage within ten years. In 1956, the State Council passed the "1956-1967 National Agricultural Development Outline", proposing that from 1956 onwards, according to local conditions, compulsory primary education should be popularized within 7 to 12 years. In 1961, the Central Committee of the Communist Party of China approved the "Report on the Arrangement of Cultural and Educational Work in 1961 and the Future Period" by the Central Culture and Education Group, insisting that according to the different conditions of urban and rural areas, popularize primary education for school-age children. (See Zhang 1984, P123)

was that the expansion of secondary education was also to be accelerated.[91] Particularly in light of the Cultural Revolution's objective to eradicate educational disparities in the existing system, enrollments experienced a significant surge at both primary and secondary levels during this tumultuous period, despite the disruption in the initial two years of the Cultural Revolution. Such surge was largely fueled by the widespread proliferation of locally managed or minban schools in rural areas (Zhu and Sicular 2022; Deng and Treiman 1997; Shirk 1979; Suzanne 1990; Robinson 1986). With the conclusion of the Cultural Revolution in 1976, corresponding revisions were made to the education policy. These new policies aimed to reverse the equalization of both quantity and quality that had occurred between 1966 and 1976. Consequently, the education system at the secondary level underwent a significant reduction in size, uniformly impacting both urban and rural areas, from 1978 to 1983. (See Suzanne 1990, P95)

Regarding higher education, the universities and colleges underwent a nationwide, large-scale adjustment of faculties and departments after the 1950s. This restructuring aimed to align with the objectives of the First Five-Year Plan (1953–1957), which prioritized the development of heavy industry, drawing inspiration from Russian expertise and guidance. The Soviet-style higher education system was set to replace the British and American-style higher education systems adopted earlier. As a result, all private universities (including universities run by foreign churches) were abolished; engineering, teacher training, agriculture and forestry were emphasised more to promote industrialization; humanities and social sciences were overkilled.[92] Vocational education was also strongly emphasized through "two education systems, two labor systems". [93] During the Cultural Revolution period, higher and vocational education development was abruptly

[91] The first national secondary education conference (1951) concluded with urgency for medium technical talents for national defence, economic, and cultural and educational construction. In 1963, the Central Committee of the Communist Party of China issued the "Regulations on Discussing the Work of Full-time Secondary Schools (Draft) and Instructions on Several Issues in the Current Education of Secondary Schools", proposing that primary and secondary education should conscientiously implement the policy of walking on two legs and establish different types schools. The national organization of full-time primary and secondary schools is the major component of primary and secondary education. The government should strengthen leadership management for collective and individual schools and provide appropriate teaching materials. (See Zhang 1984, P148-150)

[92] In May 1952, following the guideline of "focusing on cultivating industrial construction talents and teachers, develop specialized colleges, rectify and strengthen comprehensive universities", the Central Ministry of Education put forward plans for the adjustment of colleges and universities nationwide (Zhang 1984, P251)

[93] In 1964, Liu Shaoqi proposed "two education systems, two labor systems", a parttime-work-parttime-study education system. (Zhang 1984, P149, P180)

interrupted. A radical affirmation action was taken to achieve equality for the poor and the uneducated. The adopted strategy was to cut off the top of the educational pyramid by lowering the quality and quantity of urban and tertiary-level education. Enrollment at Bachelor's level was stopped for the next six years; enrollment at the Master/PhD level was halted for the next 12 years. The impact was catastrophic, especially for vocational and higher education.

Since the introduction of modern education in 1906, in the following 80 years, China's modern education experienced multiple alterations for good and bad and has made tremendous progress, especially in popularizing compulsory education and developing secondary and vocational education. The following decades witnessed a gradual transition of the development strategy from popularizing compulsory education to popularizing higher education, from focusing on quantity to focusing on quality.

In 1982, compulsory education was written into the Constitution of the PRC for the first time. In 1985, a series of laws regarding compulsory education was promulgated, transitioning compulsory education from 6 to 9 years.[94] The goal was to universalize nine-years compulsory education (primary+lower secondary) nationwide by 2000. Meanwhile, due to the accelerating economic development (post-economic reform) and demographic change (birth control campaign in the 1970s and the implementation of the one-child policy in 1980), primary and secondary education quality has improved significantly since 1980.

Aligned with China's economic reform, higher education reform started in the 1980s. [95] The essence of the reform was to expand school autonomy by decentralizing, streamlining administration, and shifting the fund source from the public sector to the private sector [96] In particular, in higher education, universities and colleges were given more rights to make admission plans and adjust faculties;

[94]The Compulsory Education Law of the People's Republic of China (1986), Rules for the Implementation of the Compulsory Education Law of the People's Republic of China (1992), Education Law of the People's Republic of China (1995)

[95]The market-oriented reform was initiated by "The Decision on the Reform of the Educational Structure", issued by the CCP Central Committee in 1985, followed by a detailed reform programme issued in 1993. The Higher Education Law, which provides the legal foundation for the reform, was published in 1998.

[96]Through the channel of raising tuition fees, allowing school-affiliated industrial revenue, and encouraging private investment and social donations.

accelerating the development of disciplines in law, management, and economics and expanding higher vocational education were strongly emphasized. The market-oriented reform prepared the ground for a rapid expansion of higher education. In 1999, the State Council set a goal of having a GER of 15% in higher education by 2010.[97] Having achieved this target, the State Council raised the target in 2010 to become a nation with strong human capital by 2020.[98] With the GER of high education passing 50% in 2020, in the Fourteenth Five-Year Plan (2021-2025), the target was further updated to popularize higher education by 2035.

Higher vocational education played a significant role in the expansion of higher education. On the verge of China's economic reform, developing vocational education regained its critical position in the government's agenda after a temporary setback during the Cultural revelation. [99] In particular, developing higher vocational education has gradually become the centre topic at the turn of the century, intending to cultivate a large number of specialized talents with both necessary theoretical knowledge and strong practical capabilities for economic development urgent needs in various fields. [100] In 2014, the State Council proposed establishing the "Modern Vocation Education System", which features strong interconnections between secondary and higher vocational education and between vocational and general education. In 2018, vocational education was officially endorsed to have equal importance as general education. [101] From 1999 to 2016, enrollment in higher vocational education more than quadrupled.

Expanding higher education has been an ongoing process, and with that comes the need to improve the quality of education available. Several key universities

[97] In 1999, the State Council approved "The Action Plan for Educational Revitalization in the 21st Century", formulated by the Ministry of Education, in which the strategic target was set to achieve 15% GER in higher education by 2010.

[98] See "National Medium and Long-term Educational Reform and Development Plan Outline (2020)" by the State Council

[99] Decision of the Central Committee of the Communist Party of China on Education System Reform (1985); Decision on Vigorously Developing Vocational Education (1991); In 1996, "The Vocational Education Law of the People's Republic of China" was promogulated; "Decision on Vigorously Promoting the Reform and Development of Vocational Education (2002)".

[100] In 1999, vigorously developing higher vocational education was announced for the first time by the Central Committee of the Communist Party of China and the State Council in its decision on "Deepening Educational Reform and Comprehensively Promoting of Quality Education".

[101] The Decision on Accelerating the Development of Modern Vocational Education (2018); National Vocational Education Reform Implementation Plan (2018) by the State Council

have been developed through various schemes to meet this need, such as the 211 Project in 1996, Project 985 in 1998, and the C9 in 2009. [102] These initiatives have seen the establishment of leading universities in some of the most important cities in the country and have become important focal points for higher education reform. The quality of higher education has improved significantly since these schemes started.

C.4.2. *India.* Two important documents guided the education system in the second half of the 19th century- Wood's Despatch, 1854 and the Indian Education Commission (IEC), 1882. One of the important objectives of the education policies was to impart western knowledge (and culture) to the Indians, thereby creating a class of public servants. Though it was not the only aim[103], the low level of social and political awareness about formal education combined with the lack of other employment opportunities, made educational degrees a tool to enter into the public sector. The progress of education had to be carried out mainly through privately managed bodies, with the government playing the role of financier (through grants-in-aid), manager (through the creation of the Education department) and supervisor(through regular inspections and publishing reports). The religious neutrality and emphasis on the western form of modern education led to a gradual decline of indigenous forms of schooling (and other missionary-led education). There was much more attention towards the planning of secondary and higher education, and the responsibility of primary education was relegated to the local level bodies. The expansion of education was a significant feature on account of *laissez faire* policy of the government. The material benefits associated with gaining degrees[104] led to a rush towards passing the Matriculation examination and eventually getting University degrees. The growth of vocational education could not pick up, even though the policies enunciated the

[102] By the year 2010, there were 112 universities selected in Project 211 and 39 top universities selected in Project 985. In 2009, The C9 League was founded, which has been compared to other elite university groupings around the world, such as the Ivy League (US), Russell Group (UK), U15 (Canada), and Group of Eight (Australia).

[103] Wood's Despatch other objectives talk about promoting intellectual development, raising the moral character of the young generation, developing, spreading education among masses etc.

[104] The resolutions of Governor-general in Council of the 10th October 1844 gave a general preference to well-educated over uneducated men in the admissions to the public service.

development of this type of education from higher classes of the secondary stage.[105]

The beginning of the century started with a big shift in education policy. First, the government policy now changed to take an active role in providing education. It was partly due to Lord Curzon's self-initiative and partly because educated Indians were becoming a nuisance by fuelling freedom movements. Second, in the wake of the rapid pace of education expansion in the late 19th century, the government now wanted to keep a check on the quality of educational institutions. The period was of an intense quantity-quality debate, where the Indian intelligentsia argued for continuing expansion.[106]. As a result, the government decided to open and maintain a limited number of "model" institutions at the primary and secondary levels and begin providing grants-in-aid to collegiate education.[107] The quality control came through several means- stricter conditions for getting college affiliations, prescription for "recognition" of the secondary schools (by the Department of Education for receiving grants-in-aid and by a university for presenting its pupil at the Matriculation examination), prohibition of the transfer of students from unrecognized to recognized schools, increase in the inspecting staffs to enforce conditions of recognition, reducing PTR at primary level, increasing the salary of teachers, training of primary teachers, revision of curricula etc[108].

The slow growth of primary schools was first highlighted in the government resolution of 1904.[109] Even after the government took an active role, the neglect of

[105] Wood's Despatch in 1854 contemplated the provision of vocational instruction from the secondary stage, IEC 1882 recommended bifurcation of upper classes of high school, one leading to the University and the other to a more practical character, intended to fit youths for commercial and non-literary pursuits.

[106] Gopal Krishna Gokhale introduced a private bill on compulsory education in 1911 in the Imperial Legislative Council, which was not passed.

[107] The model institutions were supposed to serve as examples for the private agencies to follow in maintaining educational institutions.

[108] Government Resolution of 1913 mentions that no teachers should be called on to instruct more than 50 pupils, preferably the number should be 30 or 40, trained teachers should receive not less than Rs 12/month and they should either be eligible for a pension or admitted to a provident fund. Hartog Committee 1929 also emphasized the increasing inspecting staff and improving teachers' standards, remuneration and service conditions at both primary and secondary.

[109] "Nor has the rate of growth of primary schools kept pace with that of secondary schools, in which the number of scholars has considerably more than doubled during the last twenty years. It highlighted the indifference of the more advanced and ambitious classes to the spread of primary education, lack of funding, etc., as important reasons.

the structural problems of primary education continued, as the Hartog Committee 1929 reported. It categorically condemned the policy of hasty expansion at the primary stage and proposed consolidation on account of enhancing quality. It pointed out the excessive devolution of authorities to local government in the primary stage. It called for taking more control by the government and improving the quality by reducing wastage and stagnation. [110] It highlighted high school and collegiate education overcrowding due to a lack of a reasonable selective system. The report proposed compulsory education (for four years) but without any haste, which led to the passing of compulsory education acts (for 4 or 5 years) in several provinces but covering predominantly urban areas and boys from 1921 to 37. The Sargent Report in 1944 suggested increasing the compulsory education period to 8 years (from age 6-14), which is valid till today in India.

The higher education expansion continued in liberal education rather than professional education. Hartog Committee in 1929, too, recommended diverting pupils towards industrial and commercial careers through a more diversified curriculum in the middle-level vernacular schools and technical education in universities. The spread of vocational education also continued to suffer despite the government's re-iteration several times. The lack of professional education was much more highlighted due to wars requiring more technical persons. Later in 1936-37, the British government had to call two experts from Britain (A. Abott and S.H. Wood) to study and formulate the expansion of vocational education. The fast spread of secondary and higher education based on literary education created the problem of educated unemployment in the 1930s.

In 1950, independent India's Constitution made it a duty of states to provide free and compulsory education for up to 14 years.[111] Five-Year Plans (FYP) were formulated to guide education development. The first National Policy on Education came in 1968, and the second one in 1986. The government became the foremost education provider. The primary-level education continued to suffer, and

[110] Wastage implied students were not finishing the primary stage and dropping out. Stagnation meant a repeat of the classes for more than one year. According to the report, the reasons behind wastage and stagnation were illiterate parents, single-teacher schools, lack of trained teachers, and poor teaching methods.

[111] It was a part of the Directive Principles of State Policy, which does not make it a justiciable right, making the provision weaker. Simply put, the government can not be held accountable in the courts for being unable to implement the provision.

diversification of education happened at the very top of the education ladder. The progress of vocational education never took off, and the rush toward degree programmes continued.

The lack of seriousness toward primary-level education continued till the 1990s. Unlike secondary and higher education, no comprehensive study was undertaken on the development of primary education immediately after independence.[112] The provision for primary/elementary education in the first NPE, 1968, was a mere reiteration of the existing Constitutional provision and reduction of wastage and stagnation. The first 7 FYPs from (1951 to 90) kept re-iterating the goal but shied away from allocating enough resources or outlining a concrete plan to achieve them. [113] The rapidly growing population combined with relatively slow economic growth did not help either. Later, the goal was split into 3 phases- universal provision of schools, universal enrollment and finally, universal retention - always focusing on educationally backward regions and classes, keeping in check the disparity. Secondary education also saw unplanned growth and suffered from lower resource allocation. The thrust was more on the expansion of higher education and research capabilities. It was done through an increased share of plan expenditure, strengthening science and technology, and setting up research centres.[114] The rapid development of higher educational institutions created a situation in which VI FYP changed its stance towards increasing coordination among universities to maximize their utilization instead of opening more.

The period (1950-90) saw a thrust towards quantity- a massive expansion of educational institutions and enrollments at all levels of education, partly due to the increasing social demand for education and partly due to the adopted policies.

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[112] All-India Commission on Secondary Education under Dr A Lakshmanswami Mudaliar's chairmanship was set up in 1952-53 to examine the prevailing secondary education system and suggest measures for its re-organization and improvement. Indian University Education Commission under Dr S. Radhakrishnan was established in 1948-49 for a similar purpose for higher education.

[113] The share of elementary education was 56% in the first FYP, which decreased to 35% in the II FYP and remained at that level up to VII FYP (1985-90). III FYP states that "The progress in establishing new schools during the first two Plans was relatively greater in respect of middle and high schools than in the case of primary schools"

[114] Scientific Policy Resolution in 1958 was adopted, which established National laboratories, the Indian Council of Agricultural Research, the Indian Council of Medical Research, the Indian Council of Social Science Research and the Department of Atomic Energy, to name a few.

Under the quality reforms, teachers' quality was considered the most critical factor (NPE 1968), which led to increased emphasis on the teachers' training and their emoluments at all levels of education. [115] The second component of quality improvement is through establishing "model" schools and autonomous colleges as pace-setting institutions. [116] The third focus was on science education and research as it was considered an essential factor for the growth of the national economy, which led to the inclusion of science and mathematics as an integral part of general education till the end of the school stage.

The academic nature of the secondary schools (from class IX onwards) and the lopsided development of liberal education in higher education were well-known issues by now. Hence, the government announced several measures to diversify education. Multipurpose schools were established on the recommendation of the Mudaliar Commission in 1952.[117] NPE 1968 emphasized education development for teachers training, agriculture, industry (technical education) and other workers through traditional, part-time and correspondence courses. All the FYP documents emphasized the development of basic vocational courses starting from the secondary stage (class IX onwards) to increase vocational course enrollment (after class X), but the enrollment share in vocational remained abysmally low. [118] Nothing seemed to be working as the 6th FYP (1980-85) reiterated that - "There has been an undesirable growth of facilities for general higher education, especially at the undergraduate stage in arts, commerce and humanities, and in the consequent increase in the incidence of unemployment among the educated".

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[115] Mudaliar Commission 1952 also suggested improving the quality of teachers and recommended increasing the share of post-graduates for teaching at higher secondary schools.

[116] V Five Year Plans (1974-79) recommended establishing one model comprehensive secondary school in each district and one model primary school in each community development bloc. In addition, 10% of the institutions were selected at all levels for intensive development. It was quite similar to the policy in 1900 but argued using an analogy of the "seed-farm" technology with three steps- the first step is to establish a quality number of institutions, in the next step, excellence percolating to a larger group of second-level and finally excellence generated in these two groups to spread in every educational institution.

[117] The purpose of these schools was to provide terminal courses in technology, commerce, agriculture, fine arts and home science, intending to divert students into different walks of life and reduce the pressure on university entrance (Pg 443 of Naik 2000)

[118] The share of enrollment at higher secondary remained less than 10% during the 1970s.

In the 1990s, India went through an economic liberalization process, shifting towards a market-based economy where private sector involvement was encouraged in all sectors, including education. The major shift occurred in terms of turning attention towards primary education and diversifying the education sector. The NPE 1986 (amended in 1992) re-emphasized the universal enrollment and universal retention of children up to 14 years of age. However, this time government was ready to walk the talk. The planned allocation of resources started rising, and the government started several schemes. The major among them was Sarva Shiksha Abhiyan (SSA), and Mid-Day Meal (MDM) - the expansion of elementary education was now in mission mode. Several foreign-funded projects started in the 1990's - District Primary Education Programme (DPEP) in 1994, Mahila Samakhya Programme in 1998, and Janshala in 1998 - were the major ones. [119] Gradually, the government took over these programmes. The Constitution was amended in 2002 to make elementary education a justiciable Fundamental Right, and the Right to Education Act 2008 was passed. The provision of an informal type of education (started gradually in the 1970s in V FYP) also helped expand at all levels, including open universities, distance learning and correspondence courses.

Until the 2010s (end of XI FYP), quantitative expansion remained prominent, outshining any measures undertaken for quality. The gross enrollment rate at the primary level crossed 100% in the early 2000s, and the higher education system entered into the "mass" (i.e. GER >15%) phase by 2011. Several academic research started highlighting the poor learning outcomes among primary kids,[120] which shifted the debate towards quality from XII FYP (2012-17). One significant departure from before is that the quality started to be seen from the learning-outcome-based approach compared to the input-centric and credential-based approach before. The past strategies relied on increasing teachers' salaries (to attract better human capital), establishing training institutions for ample production of teachers, and training of teachers since independence. The introduction of ICT

[119] DPEP was launched in 1994, assisted by WB, European Commission, DFID, the Netherlands and UNICEF. It was the main vehicle for the spread of primary education and was rapidly spread so that by 2000, it covered 50% of children in the primary stage in over 271 districts in 18 states (X FYP, pg 5).

[120] The annual ASER reports and other studies highlighted the issue of learning outcomes at the primary stage of education.

from the middle level onwards was another important feature during this period. Further, after the 2010s, there was an increased focus on consolidating institutions (as rapid expansion resulted in the opening of institutions working at low capacity, creating thinning of resources).

There has been an improvement in diversification in higher education concerning the expansion of professional disciplines. The government policy of opening the door for private players at a higher level increased access to specific disciplines that were lagging before, like engineering, management, medicine, and IT, where students are willing to pay substantial fees. It increased the diversification of disciplines in higher education. There has been impeccable growth in technical education after 2000. The vocationalization of education received a great impetus in policymaking during this period. However, the problem of never achieving the set target remained throughout .[121] This impetus came in the background of the opening up of the economy in 1990, changing nature of jobs, increasing prominence of the service sector, thus making the pre-existing system obsolete, and poor skill development in the country[122], a golden opportunity of the "demographic dividend", and increasing mismatch between supply and demand leading to higher educated unemployment issue. The first national policy - National Skill Development Policy, came in 2009 to guide the skill development strategies covering institution-based skill development.[123] Some other major reforms during this period were the early introduction of vocational courses[124], bringing the service sector into the domain of vocational education[125], standardization of

[121] e.g. the NPE 1986 set a target of 10% of the higher secondary enrollment towards vocational streams by 1990 and 25% by 1995. XI FYP revised the target to 25% by 2011, but at the beginning of 2012, XII FYP highlighted that only about 4.8% of students are enrolled in vocational streams.

[122] XI FYP: According to NSSO data, only 5% of the population of 19-24 age group in India have acquired some sort of skills through vocational education, compared to 96% in Korea.

[123] The formal skill development through vocational educational institutions was one of the aspects of the policy. It also covered non-formal, self-employment, and entrepreneurial development. Later, National Policy for Skill Development and Entrepreneurship 2015 was launched, superseding the 2009 policy.

[124] XII FYP proposed to begin vocational courses after eight years of education, instead of 10 years before.

[125] XI FYP: "Greater emphasis will be placed on the services sector and, therefore, on soft skills, computer literacy and flexi-time." Before that, vocational education through polytechnics year diplomas was related to conventional subjects such as civil, electrical and mechanical engineering.

skill qualifications to facilitate mobility from vocational to general education, and vice-versa. [126]

[126]The expansion of vocational education and training had taken place very decentralized fashion. It has led institutions to have their standards in terms of duration, curriculum, entry requirements, title, certifications etc., which created the problem of establishing equivalence of certificates/diplomas/degrees in different parts of India. The National Skills Qualification Framework comprises ten levels, each representing a different level of complexity, knowledge, and autonomy.

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ZEW – Leibniz-Zentrum für Europäische Wirtschaftsforschung GmbH Mannheim
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L 7,1 · 68161 Mannheim · Germany
Phone +49 621 1235-01
info@zew.de · zew.de