China's Looming Human Capital Crisis: Upper Secondary Educational Attainment Rates and the Middle-income Trap

Niny Khor[*], Lihua Pang[†], Chengfang Liu[‡], Fang Chang[§], Di Mo[**], Prashant Loyalka[††] and Scott Rozelle[‡‡]

Abstract
Accumulation of human capital is indispensable to spur economic growth. If students fail to acquire needed skills, not only will they have a hard time finding high-wage employment in the future but the development of the economies in which they work may also stagnate owing to a shortage of human capital. The overall goal of this study is to try to understand if China is ready in terms of the education of its labour force to progress from middle-income to high-income country status. To achieve this goal, we seek to understand the share of the labour force that has attained at least some upper secondary schooling (*upper secondary attainment*) and to benchmark these educational attainment rates against the rates of the labour forces in other countries (e.g. high-income/OECD countries; a subset of G20 middle-income/BRICS countries). Using the sixth population census data, we are able to show that China's human capital is shockingly poor. In 2010, only 24 per cent of China's entire labour force (individuals aged 25–64) had ever attended upper secondary school. This rate is less than one-third of the average upper secondary attainment rate in OECD countries. China's overall upper secondary attainment rate and the attainment rate of its youngest workers (aged 25–34) is also the lowest of all the BRICS countries (with the exception of India for which data were not available). Our analysis also demonstrates that the statistics on upper secondary education reported by the Ministry of Education (MoE) are overestimated. In the paper, we document when MoE and census-based statistics diverge, and raise three possible policy-based reasons why officials may have begun to have an incentive to misreport in the mid-2000s.

Keywords: human capital; labour force; upper secondary education; China

---

* Asia Development Bank.
† Institute of Population Research, Peking University.
‡ School of Advanced Agricultural Sciences, Peking University.
§ Center for Experimental Economics of Education, Shaanxi Normal University. Email: changfang4421@163.com (corresponding author).
** Rural Education Action Program, Freeman Spogli Institute, Stanford University, and LICOS Centre for Institutions and Economic Performance, University of Leuven, Belgium.
†† Rural Education Action Program, Freeman Spogli Institute, Stanford University.
‡‡ Rural Education Action Program, Freeman Spogli Institute, Stanford University.

Accumulation of human capital is indispensable to spur economic growth. Exactly how much human capital that entails is the subject of debate as a number of developing countries are making the transition from economies based on low-wage, labour-intensive manufacturing to economies based on high-wage, higher value-added industries. In the course of this transition, the demand for skilled labour is increasing.[1] Students caught in the transition need to acquire skills taught at the level of upper secondary school or above – skills that will enable them to compete more effectively in the future labour market.[2] If students fail to acquire such skills, not only will they have a hard time finding high-wage employment in the future, but the development of the economies in which they work may also stagnate owing to a shortage of human capital.[3]

If developing countries fail to accumulate adequate levels of human capital during their economic transitions, they can fall into the so-called "middle-income trap." This refers to the condition in which countries that have reached middle-income levels of GDP (as defined by the World Bank) stagnate and fail to achieve high-income status.[4] Homi Kharas and Harinder Kohli argue that countries become caught in the middle-income trap when they are unable to compete with developed countries in producing skill-, knowledge- and capital-intensive products and services.[5] Economic advancement for middle-income countries is therefore believed to be in large part dependent on human capital accumulation, which is generally approximated by measuring the average level of educational attainment of a country's labour force.[6]

Interpreting the relationship between growth and education requires deliberation. Precisely how education augments the productivity of individuals is open to debate. There is a large literature base demonstrating with empirical regularity that no country with levels of education even twice as high as those of China has ever progressed from middle-income to high-income status.[7] However, historical evidence suggests that the diffusion of skill and knowledge is one of the main forces driving the convergence of economic development across countries. For example, Japan underwent rapid economic growth following the Second World War owing to its extensive investment in education.[8] Nevertheless, the literature also shows that it is necessary for a country to continue to make the investments when it reaches middle-income status; if a country ceases to invest in education, it may pay a price. For example, in the case of Japan, leaders failed to make sufficient investments in higher education that would have allowed it to maintain its competitiveness as wages and incomes rose and the nation began to compete

---

1 Heckman and Yi 2012; Liu et al. 2009; Autor, Levy and Murnane 2003; Glewwe 2002.
2 Bresnahan, Brynjolfsson and Hitt 2002; Bresnahan 1999; Katz and Krueger 1998.
3 Heckman and Yi 2012; Hanushek and Woessman 2008, 2012; Mincer 1984.
4 Kharas and Kohli 2011; Aiyar et al. 2013.
5 Kharas and Kohli 2011.
6 Barro 1991; Kharas and Kohli 2011.
7 Barro and Lee 1993; 1996; 2001; 2013.
8 Godo 2010.

with the world's other developed countries. In fact, according to Yoshihisa Godo, under-investment in education in Japan can be shown to be one of the major factors that led to its poor economic performance after the 1980s.[9]

So, how is China doing in terms of this important, internationally recognized metric of human capital accumulation? And, in particular, what share of the labour force has attained some upper secondary schooling? What seems like an easy question is actually the cause of much confusion in China today. There are at least two sources for this confusion.

First, there seem to be large discrepancies between the official statistics on education in China and data from in-the-field academic studies. Formal publications of the Ministry of Education (MOE) and the National Bureau of Statistics report that 86 per cent of 15- to 17-year-olds are enrolled in upper secondary school.[10] This is up from 82.5 per cent in 2010 and 66 per cent in 2007. These rosy projections are reflected in many studies that assume the adequacy of upper secondary levels; the literature often focuses on the inequality of access to tertiary education.[11] At the same time, however, large-scale studies based on data collected during carefully planned and executed primary survey efforts suggest that only 37 per cent of rural students graduate from upper secondary school.[12] Since rural youth (aged 15–17 years old) account for 72 per cent of all youth in China in 2010, even if we optimistically assume that most urban students graduate from upper secondary school, this would mean that the share of China's 15- to 17-year-olds that graduate from upper secondary school falls short of the officially reported statistics.[13]

The second source of confusion arises when attempting to interpret the discussions in the China education literature and then draw comparisons with the international literature on the importance of education and growth.[14] Researchers internationally have determined that the relevant measure for human capital development is the *average level of educational attainment for the entire labour force*. In nearly all analyses of growth, researchers use data on the share of all individuals in an economy aged between 25 and 64 years old who have achieved a

---

9 Ibid.
10 MOE 2013.
11 Heckman and Yi 2012.
12 Shi et al. 2015.
13 This number (72%) is calculated from the 2010 census data as follows. We first sum all individuals among the 15- to 17-year-old cohorts who are described as living in villages or townships. We then divide this number by the total number of all 15- to 17-year-olds. We believe this is a close approximation of the share of all youth who live in rural China. We know that the number is slightly overestimated since a small percentage of individuals who live in towns/townships have urban *hukou*. However, this slight overestimate is almost certainly offset by the number of rural 15- to 17-year-olds without urban *hukou* who are living in urban areas with their migrant families. If we take an alternative approach (by looking at the proportion of the whole population, aged 1 to 85, who have rural *hukou*, also based on the census), we come up with 70%. Note that this number (i.e. the share of those with rural *hukou*) will likely be slightly higher for 15- to 17-year-olds since family planning was implemented more strictly in urban areas (since the 1980s), meaning the younger cohort will likely be "more rural" than older cohorts. Hence, our estimate of 72% is confirmed from two different sources as being close to accurate.
14 Barro 1991; Kharas and Kohli 2011.

certain level of attainment.[15] Yet, much of the recent discussion on the nature of the human capital in China's economy is in terms of flows, or *the share of a certain age cohort that is currently attending a certain level of education*, for example, as discussed in the previous paragraph, the share of 15- to 17-year-old youth that is currently enrolled in (or was recently enrolled in) upper secondary school.[16]

The overall goal of this paper is to understand if China is ready in terms of the education of its labour force to progress from middle-income to high-income country status. To achieve this goal, we have four specific objectives. First, we seek to understand the share of the labour force that has attained at least some upper secondary schooling (*upper secondary attainment*). Second, in order to gain a better understanding of the forces that are driving China's educational attainment rates, we examine these attainment rates separately by urban versus rural residence and younger versus older age cohorts (using the census definitions and not *hukou*-based definitions). Third, we benchmark the educational attainment rates of China's labour force against the rates of the labour forces in other countries (for example, high-income/OECD countries; a subset of G20 middle-income/BRICS countries). Fourth and finally, we seek to explain why there seem to be such large discrepancies between official statistics on educational attainment in China and data from in-the-field academic studies. Overall, we hope this paper can help us to understand whether China is on a healthy and sustainable path (at least in terms of human capital development) as it continues its ongoing drive towards becoming a high-income, developed economy.

Data

Our main source of data is China's sixth national population census. The census was carried out with midnight (12 am), 1 November 2010, as the reference time. It covers all natural persons residing within the territory of the People's Republic of China at the reference time, excluding residents of Hong Kong, Macau and Taiwan, and foreigners temporarily staying in China.[17] The total population of China at the time of the 2010 census was 1.34 billion.

Persons covered by the census were classified as either *urban* or *rural*. The urban and rural classification used in this paper is *not* based on formal household residency (or *hukou* 户口) status but instead refers to the actual geographic residence of the surveyed individuals at the reference time of the census.[18] Specifically, a person was counted as an *urban resident* if he or she had lived in an urban area *and* outside of his/her own township for at least six months at the time of the census even if he or she had a rural *hukou*. The definitions of

---

15 Barro and Lee 1993; 1996; 2001; 2013.

16 Wu 2010; Wu and Zhang 2010; World Bank 2000.

17 National Bureau of Statistics of China. 2011. "Communique of the National Bureau of Statistics of People's Republic of China on major figures of the 2010 population census," http://www.stats.gov.cn/english/NewsEvents/201104/t20110428_26449.html. Accessed 9 September 2016.

18 National Bureau of Statistics of China 2010.

Figure 1: **Educational Attainment: Share of All Individuals (Urban and Rural) Who Have Attained Each Level of Education, Aged 6–85**
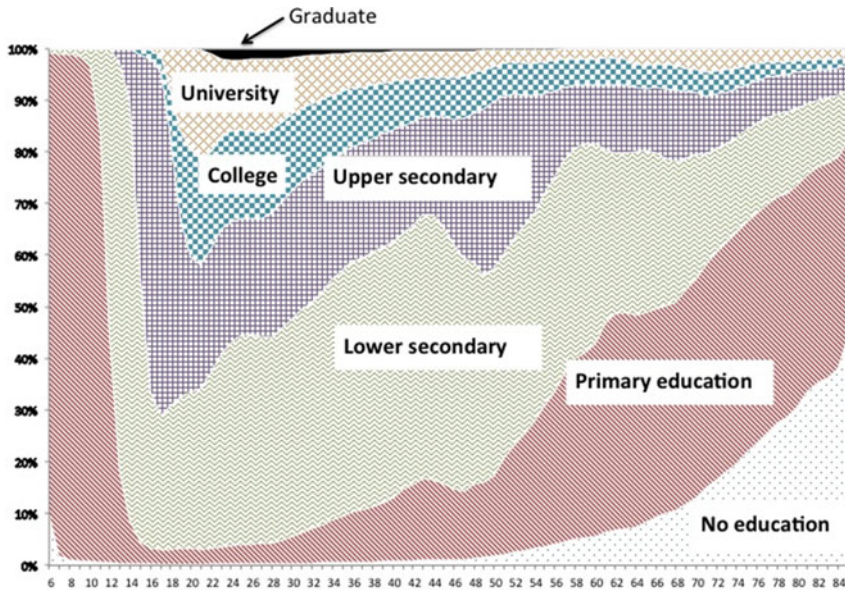
Source:
  2010 census.   (colour online)

"urban" and "rural" are defined in a document entitled "Regulation on statistical classification of urban and rural areas."[19] According to the 2010 census, 50.3 per cent of the population (or 670 million people) was classified as urban and 49.7 per cent (or 663 million people) was classified as rural.

The census also enumerates the basic characteristics of the population census. During this part of the census, all individuals aged 6 years old and above (112 million people) were asked a question about their educational history. Specifically, they were asked about the highest level of education that they had attained: no education; some primary school; some lower secondary school; some upper secondary school; some tertiary school (broken down into three-year college, four-year college, and post-graduate education).

Upper Secondary Educational Attainment in China

The data for constructing our measure of upper secondary attainment are displayed in Figure 1. The data are presented for each year in graphical form for all age cohorts in the 2010 census. Reading vertically (from bottom to top) above each cohort's age, one can see the share of all individuals (both urban and rural) of each age cohort that had: no education; some primary education;

19 Ibid.

Figure 2: **Upper Secondary Educational Attainment in China: Share of the Population with Some Upper Secondary Education, Aged 6–85**
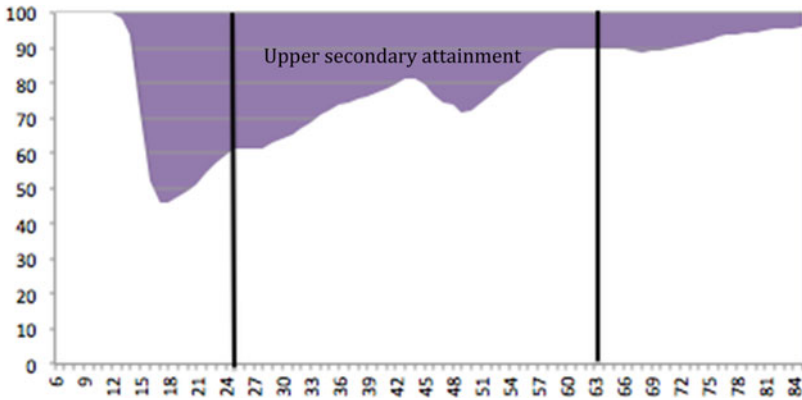
Source:
2010 census. (colour online)

some lower secondary education; some upper secondary education; and some tertiary education (college, university or graduate education). For example, among all 42-year-olds in China in 2010, 2 per cent had no education at all; 24 per cent had some primary education (but no secondary or tertiary education); 54 per cent had some lower secondary education (but no upper secondary or tertiary education); 13 per cent had some upper secondary education (but no tertiary education); and 7 per cent had at least some tertiary education.

Based on the data in Figure 2 (which displays the same data included in Figure 1, except aggregated into a form that allows the reader to focus on upper secondary attainment), we find low rates of upper secondary attainment overall (across all ages of the labour force) in China today. For example, Figure 2 shows that in 2010, the share of 20-year-old individuals that had attained some upper secondary education and beyond was 51 per cent.

We next look at the weighted averages of upper secondary attainment for the entire labour force, aged 25 to 64 (as a whole). To calculate the weighted averages, we first calculate a "population weight" for each cohort year. Specifically, we divide the population for a single cohort year by the total population aged between 25 and 64. This gives a total of 40 population weights, one for each cohort year (and the sum of the population weights equals 100 per cent). We then estimate upper secondary educational attainment by: a) first multiplying the upper secondary educational attainment rate of each cohort year by the population weight for that cohort year; and b) then taking the sum of these amounts across the 40 cohort years.

According to our data, in 2010 the share of China's labour force that had attained at least some upper secondary schooling was 24 per cent (or 187 million

Table 1: **Share of the Labour Force with Some Upper Secondary School Education by Age Cohort and by Urban/Rural Status in China**

Panel A	By age cohort				
	Total (25–64)	25–34	35–44	45–54	55–64
Share of labour force that has attained some upper secondary school education (by age cohort)	24	36	23	24	12
Panel B	**Urban vs rural**				
Share of labour force that has attained some upper secondary school education					
Urban	37	52	37	38	21
Rural	8	14	7	10	4

Source:
   2010 census.
Note:
   The total share of the labour force that has attained at least some upper secondary schooling is the same in the first column of Panel A and Panel B. This table is created using the share of the labour force that has attained some upper secondary education.

people). By contrast, 76 per cent of the labour force in 2010 (578 million people) had never attended any upper secondary school.

   Since China's official retirement age (and therefore definition of "the labour force") may differ from that of other countries, we check to see whether our results differ materially when we use alternative age cut-offs for the labour force. We find that changing the cut-offs for the labour force makes little difference in upper secondary educational attainment rates in 2010. For example, if we defined the labour force as being between 25 and 60 years of age, the share of the labour force with upper secondary educational attainment would be 25 per cent. If the cut-offs were 22 and 64 years of age, the share would also be 25 per cent. If the cut-offs were 22 and 60 years of age, the share would be 26 per cent.

Decomposing Upper Secondary Educational Attainment Rates

Dividing the share of the labour force that attained at least some upper secondary schooling into sub-cohorts by age demonstrates that the relatively low levels of upper secondary attainment in China are, in part, driven by the low levels of educational attainment among the older age cohorts (Table 1). According to our data, the share of individuals in the youngest cohort (aged between 25 and 34 in 2010) is 36 per cent. The rate of upper secondary attainment falls for each successive ten-year cohort from 23 per cent for 35- to 44-year-olds, to 12 per cent for 55- to 64-year-olds.

Figure 3: **Shares of the Rural Labour Force and Urban Labour Force that Have Attained Upper Secondary Education, Aged 25–64**
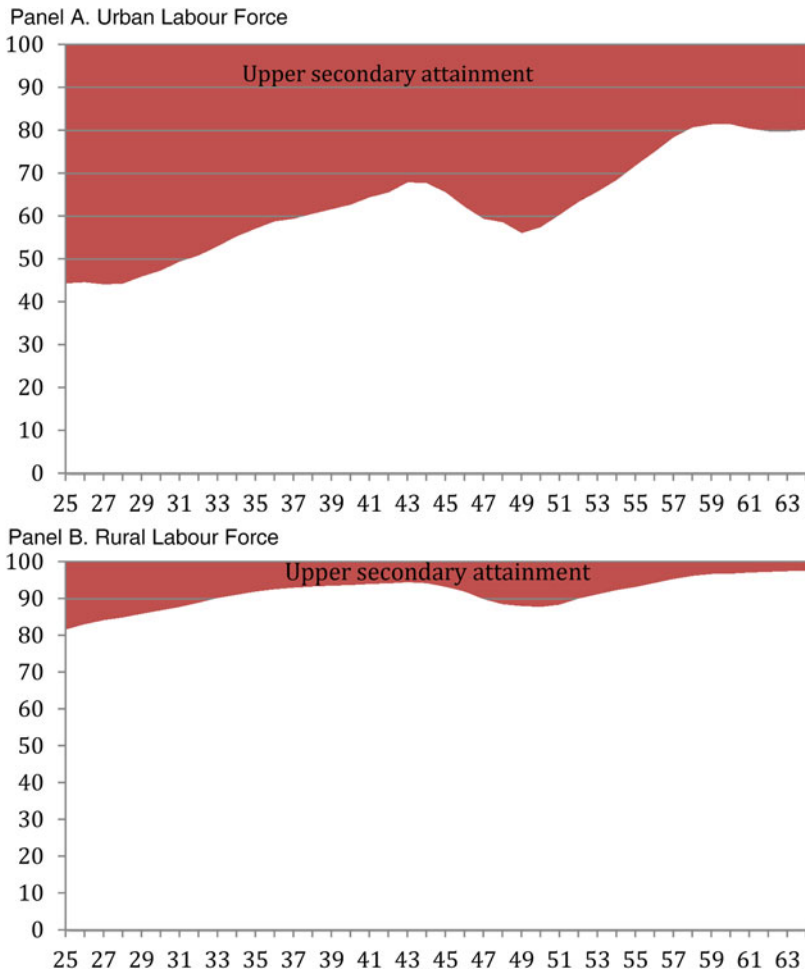
Source:
   2010 census.
Note:
   The weighted average of Panel A and Panel B (shares of the rural and urban labour forces that have attained upper secondary education) equals the share of population that has attained upper secondary education presented in Figure 2.　　(colour online)

Examining the differences in upper secondary attainment between the urban labour force and rural labour force reveals an even greater source of disparity. The share of the urban labour force that had attained upper secondary schooling in 2010 was 37 per cent (Table 1). The upper secondary attainment rate of the rural labour force was only 8 per cent (Table 1). This disparity can be seen even more dramatically in Figure 3. The much larger highlighted area of the graph in Panel A (the share of the urban labour force that had attained at least some upper secondary education) relative to the highlighted area in Panel B

(the share of the rural labour force that had attained at least some upper secondary education) suggests that the low rate of upper secondary attainment in China is largely driven by low rates of educational attainment among the rural labour force. According to the census definition of urban/rural status (see the Data Section above for the definition), 48 per cent of China's labour force (or 366 million people) was living and working in rural China in 2010. Because roughly half of China's labour force is in rural areas, the low rate of upper secondary attainment among the rural working force is of critical importance to overall national human capital formation and, hence, economic development.

The educational gap is currently widening between the urban and rural labour forces. The younger cohort (aged 25 to 34) of urban residents has an upper secondary educational attainment rate of 52 per cent. The same-aged cohort of rural residents has an upper secondary educational attainment rate of only 14 per cent. This 38 percentage point difference is larger than the differences between the urban and rural residents of the older cohorts. For example, the difference in the attainment rates between the urban and rural residents aged 35 to 44 years old is 30 percentage points (37 per cent for urban; 7 per cent for rural); 28 percentage points for those aged 45–54 (38 per cent for urban; 10 per cent for rural); and 17 percentage points for those aged 55–64 (21 per cent for urban; 4 per cent for rural). As shown by the statistics above, although the overall rate of upper secondary educational attainment is increasing in China, this increase is mainly driven by the urban population. Moreover, owing to the fact that the improvement in educational levels among the rural population is comparatively small, there is a widening gap between the levels of educational attainment of the urban and rural populations.

Comparison across Countries

To put China's level of educational attainment into international perspective, we compare our findings with levels of upper secondary educational attainment in other countries, the data for which were obtained from a report published in 2012 by the Organization for Economic Cooperation and Development (OECD) entitled "Education at a glance."[20] In this report, the OECD documents the educational attainment of all 34 OECD country members, the G20 countries (on average), BRICS countries (Brazil, Russia, India, China and South Africa), and Argentina, Indonesia and Saudi Arabia (a subset of G20 countries that are neither OECD nor BRICS countries). The data on upper secondary attainment rates used in the 2012 OECD report are comparable with our findings because they were calculated from similar data sources (population censuses) using similar methods (assumptions, cut-offs and definitions). Since the data on China in the OECD report are derived from the fifth population census in 2000, we use the more recent educational attainment statistics presented in this paper

20 OECD 2012.

(from the sixth population census in 2010). The China attainment numbers in this section are exactly the same as those used above.

By comparing China with countries that have experienced both fast economic growth and subsequent slowdowns after reaching middle-income level, we want to demonstrate that if China does not improve its human capital now, it is possible it may lack the capability to sustain its growth once it reaches middle-income status. There is a well-established literature that uses international comparisons of educational attainment levels to explain past growth patterns and to predict future development across different countries.[21] Countries such as Mexico, Brazil and Argentina all experienced fast growth before they developed into middle-income countries – for example, Brazil had a growth rate of around 6 per cent between 1970 and 1980.[22] However, these countries experienced a noticeable slowdown of growth once they reached an income level of US$3,000–US$4,000. If stagnated growth once countries hit middle-income levels is caused in part by an insufficient investment in education, this is an alarming message for China. China has already met the World Bank's definition of middle income (that is, GDP per capita greater than US$4,000). However, owing to the fact that China has one of the lowest educational attainment rates in the world, there is reason to believe that China does not have the human capital stock to transition successfully from an economy based on low-wage, labour-intensive manufacturing to an economy based on high-wage, higher value-added industries.

Our cross-country analysis shows that the share of China's labour force that has attained at least some upper secondary schooling is extremely low relative to the OECD average in 2010 (Table 2). In particular, China's upper secondary attainment rate (24 per cent) is less than one-third of the OECD average (74 per cent). The gap between China (24 per cent) and the EU21 (75 per cent) is similarly wide. China's upper secondary attainment rate is, in fact, substantially lower than the lowest OECD countries – Mexico (36 per cent) and Turkey (31 per cent). This relationship holds for every age cohort (25–34; 35–44; 45–54; and 55–64) examined in the OECD report.

China's upper secondary attainment rate is also low when compared to the G20 countries (Table 2). The average share of the labour force that has attained at least some upper secondary education in all G20 countries is 56 per cent. This rate is more than twice that of China's (24 per cent). When compared to selected middle-income G20 countries (for example, Argentina, 42 per cent), China's upper secondary attainment rate remains low.

With the exception of India (for which there are no data), China also has the lowest upper secondary attainment rate of all the BRICS countries (Table 2). The shares of the labour force with some upper secondary education in Brazil (41 per

21 Barro and Lee 1993; 1996; 2001; 2013.
22 Aiyar et al. 2013.

Table 2: **Share of the Labour Force with Some Upper Secondary School Education in China and Benchmark Countries in 2010 (percentage, by age cohort)**

Country/country group	25–64	25–34	35–44	45–54	55–64
China[a]	24	36	23	24	12
OECD[c]					
Average	74	82	78	72	65
Other OECD					
EU21[d]	75	83	80	73	64
Mexico	36	44	37	33	23
Turkey	31	42	28	24	19
G20 average[e]	56	72	68	61	25
Argentina	42	m[b]	m	m	m
Indonesia	24	m	m	m	m
BRICS					
Brazil	41	53	42	34	34
Russia	88	91	94	89	79
India	m	m	m	m	m
S. Africa	28	m	m	m	m

Source:
   All figures, except for China, are from OECD 2012; see note[a] below, for the source of data used for China.
Notes:
   [a]Upper secondary school educational attainment in China is calculated based on the data presented in this paper from the 2010 census, rather than from the OECD report (which was based on the 2000 census data); [b]m = missing data; [c]OECD countries include Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States; [d]EU21 countries include Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom; [e]G20 members include Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States and the European Union.

cent), Russia (88 per cent) and South Africa (28 per cent) are all higher than the share in China.

   Overall, we can conclude that China is a relatively extreme negative outlier when it comes to upper secondary attainment among developed and large middle-income/developing countries. This is true even for the youngest cohort, suggesting that this relationship is unlikely to change in the near future. Tellingly, China's overall upper secondary attainment rate of 24 per cent is the same as that of a much less developed and much poorer nation, Indonesia.

Explaining the Discrepancies in China's Educational Statistics

How can one explain the large discrepancy in educational attainment statistics in China that appears to exist between researchers and policymakers who rely on different sources of data? Specifically, China's Ministry of Education reported in 2013 that the rate of (at least) upper secondary attainment among 15- to 17-year-olds in 2010 was 82.5 per cent. However, according to the 2010 census (the data source used for this paper), the rate of upper secondary attainment for this age group was only 53 per cent.

Which is correct? The census-based data, in fact, appear to be consistent with the findings of field-based studies that use primary data. For example, Yaojiang Shi et al. demonstrate that in the schools in their field sites (which span a large number of provinces and are based on randomly selected samples), which they visited between 2007 and 2012, less than 40 per cent of rural students graduate from upper secondary school.[23] As discussed above, since rural youth (aged 15–17) account for more than 70 per cent of all youth in China in 2010, even if we optimistically assume that most urban students graduate from upper secondary school, this would mean that the share of China's 15- to 17-year olds who graduate from upper secondary school falls short of the officially reported statistics. In contrast, the numbers from Yaojiang Shi et al. are fully consistent with the numbers from the census.[24]

To examine the consistency of the results from the 2010 census, we also compared our results with two other field-based datasets: the China Health and Nutrition Survey (CHNS) and the China Public Goods and Public Service Survey (CPGPSS) conducted by the Chinese Academy of Sciences.[25]

According to an analysis of the CHNS data, the statistics that are based on the 2011 CHNS data and the 2010 census data are similar (Table 3). The 2011 CHNS data show that the upper secondary educational attainment rate of the labour force (aged 25–64) is 24 per cent, which is exactly the same as the attainment rate based on the 2010 census. The attainment rates decomposed by age cohorts and regions (urban/rural) are similar as well. The CHNS data show an educational attainment divide of 25 percentage points between urban and rural areas, which is close to the 31 percentage difference that is shown by the 2010 census data.

The CPGPSS data also show that the educational level of the rural labour force is extremely low (Table 4). The dataset shows that the upper secondary completion rate of the rural labour force is only 13 per cent, which is close to the attainment rate of 12 per cent found using the 2010 census data.

Using the same CNHS data, we can extend our analysis by examining whether the gap we observe in educational attainment rates is owing in part to rural–urban differences or the inequality between east and west China. The CHNS dataset provides evidence that there is a large and widening gap between the more developed and less developed provinces. For example, Beijing's labour force has an upper secondary educational attainment rate of 71 per cent and Shanghai's labour force has an attainment rate of 58 per cent. The youngest cohort in the labour force (25–64 years old) of these two cities has an attainment rate of around 90 per cent. However, a vastly different scenario persists in the less developed provinces. For example, the labour forces in Guizhou and

---

23 Shi et al. 2015.
24 Ibid.
25 See http://www.cpc.unc.edu/projects/china for CHNS. For more on the CPGPSS dataset, see Luo et al. 2007; Zhang et al. 2006.

Table 3: **Share of the Labour Force with Some Upper Secondary School Education by Age Cohort and by Urban/Rural Status in China**

Panel A		By age cohort				
		Total (25–64)	**25–34**	**35–44**	**45–54**	**55–64**
Share of the labour force that has attained upper secondary school education		24	32	26	23	14
Panel B		**By region**				
Urban		37	58	50	46	28
Rural		12	21	15	14	6
Panel C		**By province**				
Beijing	Total	71	90	74	72	40
	Urban	78	97	88	79	44
	Rural	45	70	26	48	20
Shanghai	Total	58	88	70	62	33
	Urban	65	94	80	72	39
	Rural	28	72	35	20	2
Heilongjiang		29	25	31	32	24
Henan		22	29	25	21	10
Hunan		29	39	30	28	18
Guangxi		19	26	22	18	6
Guizhou		15	21	17	14	10
Chongqing		25	48	31	33	9

Source:
  China Health and Nutrition Survey 2011.

Guangxi provinces have overall high school educational attainment rates of 15 and 19 per cent, respectively. Even the youngest cohorts lag far behind those in Beijing and Shanghai. Among 25- to 34-year-olds in Guangxi, only 26 per cent have some upper secondary education; in Guizhou the rate is even lower, at 21 per cent. In short, China's "east–west" divide strongly presents itself in the current levels of educational attainment.

Additionally, a fundamental aspect of educational equality in China can be attributed to the country's rural–urban divide. Even in Beijing and Shanghai, we see sharp and statistically significant differences between urban and rural upper secondary educational attainment rates (Table 3).

So, what explains the differences between the MOE figures for upper secondary educational attainment and those from the census? To begin to formulate an explanation for the discrepancy, we produced Table 5, which shows the discrepancies between MOE-reported statistics and the census data for upper secondary

Table 4: **Share of the Labour Force that Has Completed Upper Secondary School by Age Cohort and by Urban/Rural Status in China**

Panel A		By age cohort			
	Total (25–64)	**25–34**	**35–44**	**45–54**	**55–64**
Share of the labour force that has completed upper secondary school	13	29	9	16	5
Panel B		**By province**			
Share of the labour force that has completed upper secondary school					
Jiangsu	17	36	8	21	7
Sichuan	9	27	9	9	2
Shaanxi	13	31	7	13	3
Jilin	13	24	11	15	5
Hebei	12	21	7	20	7

Source:
   China Public Goods and Public Service Survey 2012.

attainment rates of 15- to 17-year-olds for a ten-year period (2001–2010). The attainment rates in columns 1 to 3 are taken directly from MOE statistical yearbooks.[26] Column 2 shows MOE-reported numbers on the share of upper secondary VET (vocational education and training) students. Column 3 shows MOE-reported numbers on the share of upper secondary academic high school students. Column 1 is the sum of columns 2 and 3.[27] The figures in column 4 are calculated using the 2010 census data. To calculate the figures for each year in column 4, we used data from cohorts aged between 15 and 17 in the respective years. For example, when using the census data for calculating the share of individuals who had attained at least some upper secondary school in 2001 (39.4 per cent), we used data from the 2010 census for the 24-, 25- and 26-year-old cohorts since individuals aged 24–26 years old in 2010 were aged 15–17 in 2001.[28]

26 By attainment rate, we mean the "gross enrolment ratio" (*mao ruxue lü*) used by the Ministry of Education.
27 The attainment rates in columns [2] and [3] are calculated by dividing the respective number of students attending VET and academic high schools by the number of students in the 15- to 17-year-old cohort (MOE 2013).
28 In fact, our method yields an estimation of the upper bound of educational attainment of upper secondary levels and beyond, since the data in 2010 also captured schooling that these cohorts may have acquired between 2010 and the year in which they were 15 to 17 years old. Thus, if we were to measure the actual attainment of 15- to 17-year-olds at those years (should the data exist, which they do not), the gap between the census data and the MOE data is likely to be even larger. In other words, the differences that we report between the census data and MOE data are likely to be the lower bounds of the actual differences.

Table 5: **Discrepancies in Upper Secondary Educational Attainment Rates of 15- to 17-year-olds between MOE-reported Statistics and the Census Data in 2001 to 2010**

Year	MOE-reported statistics		Census data		
	Upper secondary	Vocational education and training	Academic high	Upper secondary	Discrepancy [1] − [4]
	[1]	[2]	[3]	[4]	[5]
2001	42.8	18.7	24.1	39.4	3.4
2002	42.8	17.4	25.4	40.8	2.0
2003	43.8	17.3	26.5	43.1	0.7
2004	48.1	18.4	29.7	45.9	2.2
2005	52.7	20.2	32.5	48.6	4.1
2006	59.8	23.8	36.0	50.8	9.0
2007	66	28.3	37.7	52.4	13.6
2008	74	33.1	40.9	53.6	20.4
2009	79.2	36.4	42.8	52.1	27.1
2010	82.5	38.9	43.6	52.9	29.6

Source:
See Fn. 29.

As can be seen from Table 5, a review of the ten-year statistic series from MOE-reported sources and the census shows that the discrepancies between the sources only appeared in recent years.[29] Between 2001 and 2004, the gap between MOE-reported and census-based upper secondary attainment rates averaged only 2 percentage points. After 2005, however, the gap rises steadily. The gap increased from 4.1 percentage points in 2005 to 27.1 percentage points in 2009, and to 29.6 percentage points in 2010. Given the level of the census-based figure in 2010 (52.9 per cent), this means that the MOE-reported numbers are overstated by 56 per cent.

Given the greater reliability of the census data and the fact that they are consistent with high-quality in-the-field data, the question must be asked why MOE-reported figures begin to diverge from those obtained from the census and start to be over-reported in the mid-2000s? While we do not know for sure, there is reason to believe that the over-reporting of overall upper secondary educational attainment is likely owing to the over-reporting of upper secondary

---

29 Columns [1] to [3] are taken directly from MOE 2013; the figures in column [4] are calculated from the 2010 census data. To calculate the figures for each year in column [4], we used data from the year cohorts that would have been 15–17 years old in the respective years. For example, when using the census data for calculating the share of 15- to 17-year-olds who had attained at least some upper secondary schooling in 2001 (39.4%), we used data from the 2010 census for the 25-, 26- and 27-year-old cohorts (since individuals who were 24–26 years old in 2010 were 15–17 years old in 2001). The upper secondary educational attainment rate in 2010 based on the census data is obtained by taking the average annual change in upper secondary educational attainment from 2005 to 2009, and adding the average annual change to the 2009 upper secondary educational attainment rate. We estimate the 2010 numbers because it is possible that in 2010 there were still individuals who were 15–17 years old and who were still in junior high school and therefore would not enter upper secondary school until 2011.

VET attainment. First, the rise in upper secondary VET attainment between 2005 and 2010 (19 percentage points, see Table 5) is higher than that of academic high school (11 percentage points). Second, the demands on the MOE to expand upper secondary school, which were initially announced as national targets in the mid-2000s, were almost fully placed on the VET sector.[30] The MOE was asked to increase enrolment in upper secondary VET (which was only 20 per cent in 2005) to 50 per cent by 2020. This means that after 2005, VET sector officials would be under great pressure to meet leader-set goals. Moreover, as discussed above, this goal was set at a time when wages were rising and the opportunity cost of attending VET schools was thus also rising. Third and finally (and probably most importantly), perhaps in part because of the reluctance of students to enrol in VET, the central government began to pay per-student-enrolled subsidies to local education bureaus.[31] The announcement of the subsidy would, of course, have given local officials a clear incentive to over-report VET enrolment. Curiously, in 2007, the year when the initial central–local VET subsidy transfers were made, over-reporting increased the most (6.8 percentage points). The next year, the jump was nearly as large (6.7 percentage points).

Discussion and Conclusions

This paper makes several new and important contributions to the literature. First, the data that are used in the paper, China's sixth population census data, have never before been used to study China's human capital in this dimension. In other words, this dataset has never before been used in any published paper on the theme of the educational attainment of China's labour force. For the most part, census data are considered to be high quality and representative of the labour force of the entire country. The use of this dataset allows this paper to make an important contribution to the literature on the human capital in China's labour force.

Second, because we use census data, our findings are more comparable to similar studies in other national contexts. The labour force educational attainment data from other countries all use census data and the same approach for analysis.

Third, this paper reports a finding that is both important and alarming for China's future economic growth prospects. China's human capital is shockingly poor and the statistics reported by the Ministry of Education have overestimated the educational level of its labour force. The census data show that China has one of the most under-educated labour forces in the world when compared to middle-income countries. Only 24 per cent of more than 600 million people in the labour force have attended upper secondary school. The labour force estimates include all individuals between the ages of 25 and 64 in both urban and

30 China State Council 2010.
31 MOF and MOE 2007.

rural areas on the day of the census. Regardless of recent improvements in the educational attainment of China's students, the current level of educational attainment of the entire labour force matters for growth both now and for several decades to come. For example, those individuals who are 30 years old now will likely still be working in 2050. The poor levels of human capital of all cohorts will impact on China's future prosperity.[32]

Providing an explanation for the low rates of high school enrolment is a very complicated issue, with many different dimensions: it is related to the *hukou* system; to fiscal policy (and the fact that local governments are responsible for education); to the poor levels of investment in rural health in the past; to the rural population's poor understanding of the importance of education; to high and rising wages (and opportunity cost); to the overwhelming focus on the college entrance exam; and to the fact that China's rural public high schools are the most expensive in the world.[33]

Can China rectify this problem? Clearly, the younger cohorts are better educated than older members of the population. In addition, the steady upward trend in upper secondary attainment in our data suggests access to upper secondary school is continuing to expand. This is good news for China.

Although the human capital is increasing, the "stock" of human capital in China is still very low, especially compared to OECD or other BRICS countries. In fact, we show that even among the youngest cohort of adults (25- to 34-year-olds), the level of educational attainment is relatively low – only 36 per cent. Moreover, with the current rate of growth, China will not be able to reach OECD levels of upper secondary educational attainment in the coming decades.

In order to provide evidence of a trend, we present a series of simulations that seek to project the future human capital levels of China's labour force under a

---

32 Indeed, various news outlets have reported on the expansion of universities in China and the difficulties that college students face in finding a job after graduation. See, e.g., bbc.co.uk. 2014 "What do you do with millions of extra graduates?," 1 July, http://www.bbc.co.uk/news/business-28062071. Accessed 22 September 2016; Bloomberg.com. 2015. "Dreams collide with China slowdown for job-seeking graduates," 2 July, http://www.bloomberg.com/news/articles/2015-07-02/dreams-collide-with-china-slowdown-for-job-seeking-graduates. Accessed 22 September 2016.
      Studies have shown that the younger cohorts have a harder time finding work as they enter the job market. See Park, Cai and Du 2010. They struggle to match their skills to jobs and they often need to adjust their unrealistically high expectations about their first jobs. However, Giles, Park and Zhang (2005) estimate that, for five large cities surveyed using a specially designed instrument and based on an internationally standard definition, the census overestimated the unemployment rate by about 30%. Different sources of data show that the employment rate of college graduates is high, and has been estimated as high as 93%. See http://www.statista.com/statistics/280947/employment-rate-of-university-graduates-in-china/. Accessed 22 September 2016. Moreover, evidence suggests that there is an increase in returns to college education in the past 25 years and that the demand for college-educated workers far exceeds increases in supply. See Carnoy et al. 2012. Although the starting salaries of young college graduates may be modest, their wages subsequently rise more steeply than those of other segments of the workforce (Park, Cai and Du 2010).
33 Our research group, the Rural Education Action Project (REAP), has been engaged in research that could illuminate the reasons why high school enrolment is so low. For further information on our research, see: http://reap.stanford.edu.

number of alternative scenarios. We make these projections using a set of alternative assumptions about the rate of growth of each new cohort (after 2010) that attends upper secondary school. We then examine the share of the labour force that has attended upper secondary school in a series of future dates (as new cohorts replace older ones that retire).

According to our simulations/projections, which assume that the rate of enrolment from 2015 to 2030 will rise at the same rate that enrolment has been rising over the past 15 years, the share of the labour force with at least an upper secondary education would only be 44 per cent in 2030.[34] Even if 100 per cent of students aged 16 to 18 years old attended upper secondary school starting in 2020 (which is consistent with China's official target), our predictions show that it would take 24 years (from 2010) to reach a point where 50 per cent of the individuals in the labour force would have attained an upper secondary education.[35] Of course, this is not a very realistic assumption given that in recent years the rate of increase in high school enrolment has been slowing down. Employing a more realistic scenario, where 80 per cent of 16- to 18-year-old students attend high school by 2020, it would still take over 44 years (from 2010) for China to reach OECD levels of educational attainment. The key for China to improve its human capital is to put a massive effort into boosting rural educational attainment rates now.

The bottom line is that, assuming our census-based measures of educational attainments are correct, China could be facing enormous challenges in the coming years. Wages are rising and low-wage manufacturing is moving out. China is already making plans to become an economy that will be based on higher value-added, high-wage industries. This will mean, of course, that there will be a high demand for skilled labour. International experience demonstrates that individuals will need to have acquired skills taught at the level of high school or above if they hope to be competitive in these higher value-added industries.[36] If China fails to endow its labour force with such skills, not only will many individuals have a difficult time finding employment but the newly emerging industries may also falter owing to the lack of skilled workers. The whole economy may experience slower development. This path could lead China towards the "middle-income" trap. The

34 The prediction for the upper secondary education attainment rate in 2030 is calculated by dividing the estimated size of the labour force (aged 25–64) that would attain some upper secondary education by the total population of the labour force in 2030. In order to obtain an estimate of the upper secondary education attainment rate of each of the age cohorts of the labour force in 2030, we used 17- to 26-year-olds in the 2010 census and fitted a linear line to their upper secondary education attainment rates. Using the linear prediction, we calculated the predicted attainment rates for the younger cohorts (5–16 years old) in the 2010 census (who would be 25–36 years old in 2030). We then aggregated the upper secondary education attainment rates of those aged 5–44 years old in the 2010 census and weight by the cohort sizes to show the upper secondary education attainment rate of the labour force in 2030.

35 In order to calculate how much time is needed to reach a certain level of upper secondary education attainment rate, we predicted both the future attainment rate of the labour force and the future cohort size of each age cohort. The predicted future attainment rate of the labour force is calculated in the same way as described in Fn. 13. The predicted future cohort size of the labour force is calculated by fitting (backwards) a linear line to the cohort size of 1- to 10-year-olds in the 2010 census data (in order to predict the cohort size of those that were not yet born in 2010).

36 Bresnahan, Brynjolfsson and Hitt 2002; Bresnahan 1999; Katz and Krueger 1998.

path away from this trap must be paved with much greater investment in a well-educated rural labour force. China is already far behind. It is going to need a massive campaign, starting immediately, if it is going to minimize the damage that low-quality human capital can inflict on an economy.

So, why is China not making a more concerted effort to improve enrolments in upper secondary school? One reason may be that China's top leaders are simply not aware of the urgency. We have shown that MOE-reported upper secondary educational attainment rates are dramatically over-reported. Even as late as 2010, compared to census-based figures, the MOE was over-reporting enrolment rates in upper secondary schools by 56 per cent (29 percentage points). Since the census data are surely much more reliable, the MOE needs to revise its official figures and use more reliable statistics. The nature of the current over-reporting raises the possibility that national leaders are being lulled into a false sense of complacency about the state and direction of education in China today.

Acknowledgement

Biographical notes

Niny Khor is currently an economist at the Asian Development Bank Resident Mission in the People's Republic of China. She holds an MA and PhD in economics from Stanford University. Her current research focuses on Chinese economic growth and the structural transformation of Chinese factor markets. She was recently selected to be an adjunct research fellow at the Asian Development Bank Institute.

Lihua Pang is an associate professor at the Institute of Population Research, Peking University. Her research focuses on rural–urban migration, migrant labour and human capital in rural China. She also works on globalization and international migration.

Chengfang Liu is an associate professor at the China Center for Agricultural Policy, School of Advanced Agricultural Science, Peking University. For more than 15 years her research has been in the field of agricultural and rural development, with a focus on the provision of rural infrastructure, human capital and migration. She is currently working on how to carry out rigorous impact assessments in agricultural and rural development policies.

Fang Chang is an assistant professor at the Center for Experimental Economics in Education, Shaanxi Normal University. Her research focuses on rural development as well as rural education. Recently, she has been working on teaching methods and teacher performance pay at the compulsory education level in rural China.

Di Mo is a research associate at the Freeman Spogli Institute at Stanford University. Her field of research is development economics, experimental economics and programme evaluation, with a specific focus on China's rural education and health.

Prashant Loyalka is a faculty member of the Rural Education Action Program, a center research fellow at the Freeman Spogli Institute for International Studies and an assistant professor (research) at the Graduate School of Education, Stanford University. His research focuses on examining and addressing inequalities in the education of youth and on understanding and improving the quality of education received by youth in a range of countries, including China, Russia and India. He is currently leading a large-scale international, comparative study to assess and improve student learning in higher education. He also frequently conducts large-scale evaluations of educational programmes and policies.

Scott Rozelle holds the Helen Farnsworth endowed professorship at Stanford University and is senior fellow in the Food Security and Environment Program and the Shorenstein Asia-Pacific Research Center, Freeman Spogli Institute for International Studies. Rozelle spends most of his time co-directing the Rural Education Action Project (REAP). Currently, his work on poverty has its full focus on human capital, including issues of rural health, nutrition and education.

摘要: 人力资本积累是促进经济发展至关重要的因素。如果劳动力的人力资本不足, 不仅难以找到高收入的工作, 国家经济发展也会因此停滞。本研究的主要目的是通过衡量和比较中国和其他国家 (经合组织成员国等高收入国家以及二十国集团和金砖四国等中等收入国家) 劳动力的中等教育水平 (包含高中和职高), 来了解中国目前的劳动力教育水平是否能够支持中国经济从中等收入向高等收入迈进。我们利用第六次人口普查数据分析显示中国的人力资本水平极低。 2010 年中国只有24%的劳动力 (25 到 64 岁人口) 上过高中或职高, 不足经合组织成员国的三分之一。中国总体劳动力中上过高中或职高的比例和相对年轻的劳动力 (25 到 34 岁人口) 中上过高中或职高的比例也是在金砖四国当中最低的 (因数据缺失该比较不含印度)。我们的分析也指明中国教育部过高估计了劳动力中等教育的普及程度。本文也探索了人口普查数据和教育部统计数据之间出现差异的时间截点以及出现这种对劳动力教育程度过高估计的原因。

关键词: 人力资本; 劳动力; 中等教育; 中国

References

Aiyar, Shekhar, Romain A. Duval, Damien Puy, Yiqun Wu and Longmei Zhang. 2013. "Growth slowdowns and the middle-income trap." International Monetary Fund Working Paper No. 13/71.

Autor, David H., Frank Levy and Richard J. Murnane. 2003. "The skill content of recent technological change: an empirical exploration." *The Quarterly Journal of Economics* 118(4), 1279–1333.

Barro, Robert J. 1991. "Economic growth in a cross section of countries." *The Quarterly Journal of Economics* 106(2), 407–443.

Barro, Robert J., and Jong Wha Lee. 1993. "International comparisons of educational attainment." *Journal of Monetary Economics* 32, 363–394.

Barro, Robert J., and Jong Wha Lee. 1996. "International measures of schooling years and schooling quality." *American Economic Review* 86, 218–223.

Barro, Robert J., and Jong Wha Lee. 2001. "International data on educational attainment: updates and implications." *Oxford Economic Papers* 53(3), 541–563.

Barro, Robert J., and Jong Wha Lee. 2013. "A new data set of educational attainment in the world, 1950–2010." *Journal of Development Economics* 104, 184–198.

Bresnahan, Timothy F. 1999. "Computerisation and wage dispersion: an analytical reinterpretation." *The Economic Journal* 109(456), 390–415.

Bresnahan, Timothy F., Erik Brynjolfsson and Lorin M. Hitt. 2002. "Information technology, workplace organization, and the demand for skilled labor: firm-level evidence." *The Quarterly Journal of Economics* 117(1), 339–376.

Carnoy, Martin, Prashant Kumar Loyalka, Greg V. Androushchak and Anna Proudnikova. 2012. "The economic returns to higher education in the BRIC countries and their implications for higher education expansion." Higher School of Economics Research Paper No. WP BRP 2, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2005696. Accessed 13 September 2016.

China State Council. 2010. "Guojia zhongchangqi jiaoyu gaige he fazhan guihua gangyao (2010–2020 nian)" (National education reform and development outline (2010-2020)), http://www.gov.cn/jrzg/2010-07/29/content_1667143.htm. Accessed 7 September 2016.

Giles, John, Albert Park and Juwei Zhang. 2005. "What is China's true unemployment rate?" *China Economic Review* 16(2), 149–170.

Glewwe, Paul. 2002. "Schools and skills in developing countries: education policies and socioeconomic outcomes." *Journal of Economic Literature* 40(2), 436–482.

Godo, Yoshihisa. 2010. "The human capital basis of the Japanese miracle: a historical perspective." In Keijiro Otsuka and Kaliappa Kalirajan (eds.), *Community, Market and State in Development*. Houndmills, Basingstoke: Palgrave Macmillan.

Hanushek, Eric A., and Ludger Woessmann. 2008. "The role of cognitive skills in economic development." *Journal of Economic Literature* 46(3), 607–668.

Hanushek, Eric A., and Ludger Woessmann. 2012. "Schooling, educational achievement, and the Latin American growth puzzle." *Journal of Development Economics* 99(2), 497–512.

Heckman, James J., and Junjian Yi. 2012. "Human capital, economic growth, and inequality in China." NBER Working Paper No. 18100.

Katz, Lawrence F., and Alan B. Krueger. 1998. "Computing inequality: have computers changed the labor market?" *The Quarterly Journal of Economics* 113(4), 1169–1213.

Kharas, Homi, and Harinder Kohli. 2011. "What is the middle income trap, why do countries fall into it, and how can it be avoided?" *Global Journal of Emerging Market Economies* 3(3), 281–289.

Liu, Chengfang, Linxiu Zhang, Renfu Luo, Scott Rozelle, Brian Sharbon and Yaojiang Shi. 2009. "Development challenges, tuition barriers, and high school education in China." *Asia Pacific Journal of Education* 29(4), 503–520.

Luo, Renfu, Linxiu Zhang, Jikun Huang and Scott Rozelle. 2007. "Elections, fiscal reform and public goods provision in rural China." *Journal of Comparative Economics* 35(3), 583–611.

Mincer, Jacob. 1984. "Human capital and economic growth." *Economics of Education Review* 3(3), 195–205.

Mo, Di, Linxiu Zhang, Hongmei Yi, Renfu Luo, Scott Rozelle and Carl Brinton. 2013. "School dropouts and conditional cash transfers: evidence from a randomised controlled trial in rural China's junior high schools." *The Journal of Development Studies* 49(2), 190–207.

MOE (Ministry of Education). 2013. *China Statistical Yearbook*. Beijing: China Statistics Press.

MOF (Ministry of Finance) and MOE. 2007. "Zhongdeng zhiye xuexiao guojia zu xuejin guanli zanying banfa" (Temporary order on managing needs-based financial aid for vocational high schools), http://www.mof.gov.cn/zhengwuxinxi/caizhengwengao/caizhengbuwengao2007/caizhengbuwengao 20079/200805/t20080519_27591.html. Accessed 9 September 2016.

National Bureau of Statistics of China. 2010. *China Population and Employment Statistics Yearbook*. Beijing: China Statistics Press.

OECD. 2012. *Education at a Glance 2012: OECD Indicator*. OECD Publishing, http://dx.doi.org/10.1787/eag-2012-en.

Park, Albert, Fang Cai and Yang Du. 2010. "Can China meet its employment challenges?" In Jean Oi, Scott Rozelle and Xuegang Zhou (eds.), *Growing Pains: Tensions and Opportunity in China's Transformation*. Stanford, CA: Asia-Pacific Research Center, Stanford University, 27–55.

Shi, Yaojiang, Linxiu Zhang, Yue Ma, Hongmei Yi, Chengfang Liu, Natalie Johnson, James Chu, Prashant Loyalka and Scott Rozelle. 2015. "Dropping out of rural China's secondary schools: a mixed-methods analysis." *The China Quarterly* 224, 1048–69.

World Bank. 2000. *China: Overcoming Rural Poverty*. Washington, DC: World Bank Publications.

Wu, Xiaogang. 2010. "Economic transition, school expansion and educational inequality in China, 1990–2000." *Research in Social Stratification and Mobility* 28(1), 91–108.

Wu, Xiaogang, and Zhuoni Zhang. 2010. "Changes in educational inequality in China, 1990–2005: evidence from the population census data." In Emily Hannum, Hyunjoon Park and Yuko Goto Butler (eds.), *Globalization, Changing Demographics and Educational Challenges in East Asia (Research in Sociology of Education Vol. 17)*. Bingley: Emerald Publishing, 123–152.

Zhang, Linxiu, Renfu Luo, Chengfang Liu and Scott Rozelle. 2006. "Investing in rural China: tracking China's commitment to modernization." *Chinese Economy* 39(4), 57–84.