HUMAN CAPITAL AND THE MIDDLE INCOME TRAP: HOW MANY OF CHINA'S YOUTH ARE GOING TO HIGH SCHOOL?

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The objective of this paper is to assess the nature of China's human capital. To achieve our objective, we both measure the share of the labor force that has attained upper secondary schooling levels (high school) as well as examine recent trends of 15–17 year olds who are attending high school. Using two sets of national representative data, we are able to show that, while the human capital of China's labor force is still low (30%), between 2005 and 2015 the share of rural youth who attended high school rose sharply. According to Ministry of Education–reported statistics, in 2015 87% of 15–17 year olds were attending high school, up from around 50% in 2005. Given the recent pronouncements of the government to make high school universal by 2020, the challenges for the education system are to increase the attendance of rural as well as vocational education and training students.

I. INTRODUCTION

A wealth of recent research has identified the crucial role that human capital plays in spurring economic growth (Gillies 2017; Madsen and Murtin 2017; Whalley and Zhao 2013). A highly skilled workforce is especially necessary during a nation's transition from a middle-income to a high-income nation (Heckman and Yi 2012; Liu et al. 2009; Autor, Levy, and Murnane 2003; Glewwe 2002). Education, the major way to increase human capital, allows people to acquire the skills and knowledge necessary to succeed during transformations from labor-intensive manufacturing economies to high-wage, higher value-added economies (Gillies 2017; Kruss et al. 2015; Machlup 2014). Numerous studies have stressed the importance of upper secondary (as well as tertiary)

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educational attainment, in particular (Bresnahan, Brynjolfsson, and Hitt 2002; Bresnahan 1999; Autor, Katz, and Krueger 1998). Indeed, Madsen and Murtin (2017) found that while primary (unskilled) education was the most productive form of human capital before the Industrial Revolution in Great Britain, thereafter, secondary/tertiary (or skilled) education was more important.

The consequences for economies that have labor forces with insufficient stocks of secondary educational attainment (or, in the rest of the paper called *economies that are deficient in human capital*) have also been well documented in the existing literature. One way to characterize such countries is to say that they have fallen into the so-called middle income trap, referring to a state in which a nation that reaches the middle-income level stagnates (or collapses) and fails to reach high-income status (Kharas and Kohli 2011; Aiyar et al. 2013). While there are different possible sources of the trap, Khor et al. (2016) argue that economies that are deficient in human capital historically have a high propensity of being stuck in the middle income trap. According to Khor, middle-income countries with labor forces characterized by rising wages, but where a large share of workers are deficient in human capital, become outcompeted by low-wage countries (which can manufacture goods more cheaply) and advanced economies (which can produce high-skill innovations—Zhang et al. 2013).

Is China, a nation defined by the World Bank as an upper middle-income economy, prepared to make the transition to a developed, high-income country? Or is it in imminent danger of falling into the abovementioned trap? Recent research on the educational attainment of China's workforce has pointed to the latter (Khor et al. 2016; Wang et al. 2015; Zeng and Xie 2014). For example, in a study based on 2010 census data, Khor et al. (2016) found that only 24% of China's entire workforce ever attended upper secondary education. This rate was less than one-third of the OECD average (74%). One of the reasons for this low rate of upper secondary attendance in the overall labor force is that even as late as the 1990s and early 2000s, the share of 15–17 year old youth (henceforth, youth) attending upper secondary school was low. Specifically, as late as 2005, the share of youth in China with at least a secondary education was only 53% (NBSC 2013) (Table 1).

The Khor et al. (2016) study also sought to identify the source of the deficiencies of human capital in China's labor force. According to the 2010 census, one of the main sources of China's poor showing in human capital is embodied in the gap between China's urban and rural population in regard to educational attainment. Lower rates of high school attendance by rural individuals in the labor force was certainly a large part of the problem.

What is China's level of high school attainment today? Does China's government recognize the challenge and are officials taking action to overcome the deficiencies of human capital in the overall labor force? When looking at the level of human capital in an entire labor force, the results are in no small part due to

TABLE 1

Share of 15–17 Year Olds with Some Upper Secondary Attainment According to MOE-Reported
Statistics and 2015 Micro-Census Data from 2005 to 2015

	Upper Secondary Attainment Rate	
Year	MOE-Reported Statistics [1]	Micro-Census Data [2]
2005	53	53
2006	60	54
2007	66	56
2008	74	59
2009	79	64
2010	83	70
2011	84	73
2012	85	74
2013	86	75
2014	87	78[†]
2015	87	80[†]

Sources: MOE reports, 2005–15; 2015 One-Percent National Sample Census (2015 Micro-Census).

Notes: 1. In the MOE-reported statistics, the figures in column [1] are taken directly from MOE reports (2005–14).

2. To calculate the figures in column [2], we used data from the year cohorts who would have been 15–17 years old in the respective years. For example, when using the 2015 Micro-Census data for calculating the share of 15–17 year olds who had attained at least some upper secondary school in 2005 (53%), we used data from the 2015 Micro-Census from the 25, 26, and 27 years old cohorts (since individuals who were 25–27 years old in 2015 were 15–17 years old in 2005).

[†] The Upper secondary attainment rate in 2014 based on the 2015 Micro-Census is obtained by taking the average annual change in upper secondary attainment from 2009 to 2013 and adding the average annual change to the 2013 upper secondary attainment rate. The upper secondary attainment rate in 2015 is calculated the same way by using years 2010–14. We estimate the 2014 and 2015 numbers because it is possible that in these years there were still individuals who were 15–17 in 2014–15 who were still in junior high school and would not enter upper secondary school until 2016.

education decisions made decades before (when in the case of China, the nation was still a poor country characterized by most of its population living and working in farming—NBSC 2000). To examine the commitment of policymakers toward improving human capital in recent years, the main metric would be to examine the share of youth (henceforth, ages 15–17) who are attending high school. Such an analysis would also have to look closely at the attendance of rural youth since in the past it was this part of the labor force that was most deficient.

So, according to measures based on high school attendance of youth, is China making progress in eliminating the economy's past deficiencies in human capital? Drawing on two sets of national representative data—data reported up

through the schooling system's hierarchy to the Ministry of Education (henceforth, referred to as the MOE data) and the 2015 One-Percent National Sample Census (henceforth, referred to as the 2015 Micro-Census), the main goal of this paper is to understand changes to the state of China's human capital over the past decade (focusing on 2005–15). To meet this broad goal, the paper has two specific objectives. First, drawing on these two sources of data, we will show the different levels/trends of human capital that are embodied in each set of data. Second, we will decompose the trends into urban and rural; and into academic high school and vocational education and training (henceforth, VET). Given the recent policy pronouncements that China will try to achieve universal high school by 2020, we hope this paper will provide suggestions regarding what the Chinese Government should do to ensure the increased accumulation of human capital in order for it to successfully transition to a high-income economy (MOE 2017).

Anticipating the results, the paper overall finds that while the human capital of the China's overall labor force is still low (30%), it has risen by 25% (or 6 percentage points) since 2010 (and even more since 2005). To achieve this rapid rise in the overall human capital level of the labor force, the data are clear that there has been a very sharp increase in the share of youth that have attended high school between 2005 and 2015. According to MOE-reported statistics, in 2015 87% of 15–17 year olds were attending high school, up from around 53% in 2005. The Micro-Census shows similar (though somewhat lower) rises. In decomposing the trends, it is clear that urban rates of attendance are nearly universal and academic high school trends have risen steadily. The challenges to meet the government's recent pronouncements to make high school universal by 2020 will be to improve attendance by rural students and raise the slowing trends of attendance of VET students.

The remainder of the paper is structured as follows. In the next section we introduce the data that we will analyze. After that, we present our results. Finally, the paper ends with a discussion and conclusion.

II. DATA

In this study we will compare and contrast two data sets from different sources in order to come closer to ascertaining educational attainment rates in China. First, we use the data provided annually by China's Ministry of Education. The acquisition of these data depends on reporting by local government and school officials (from school to school district to county to prefecture to province to the national level) as opposed to on-the-ground surveying of individuals and families. Each year it provides detailed information regarding the number of students across mainland China who attain each level of education. Although the data set

does not distinguish whether students have a rural or urban *hukou*,[1] the survey does distinguish between students who attend an academic high school or a VET.

The second data set is the 2015 Micro-Census. This survey—which collected demographic information from a sample population of about 21 million individuals in mainland China (not including Hong Kong, Macao, Taiwan, or foreigners residing in China)—was carried out by China's Bureau of Statistics with midnight on November 1, 2015 as the reference time. The 2015 Micro-Census was the fourth of its kind. The objective of collecting the Micro-Census data is to supplement China's once-a-decade full national censuses. Besides demographic data that are used to produce variables such as age and ethnicity, the 2015 Micro-Census also collected data on educational attainment, recording the total number of individuals who had reached each level of education or *attainment* (no education; some primary school; some lower secondary school; some upper secondary school; some tertiary school including three-year college, four-year college, and post-graduate education). Note, the Micro-Census data (like the MOE data used in our study) are not measuring completion or graduation. Hence, if an individual attended one year of high school and did not finish, he/she would still be counted as attaining junior high school.

Because neither the MOE data nor the 2015 Micro-Census report high school attendance by urban/rural status, we rely on another source of the data—the China Family Panel Survey (or CFPS)—to get estimates of the share of urban and rural students in overall attendance numbers.[2] The CFPS is a widely used, nationally representative study that has been carried out biennially by the Institute of Social Science Survey (ISSS) at Peking University since 2010. In the third wave, conducted in 2014, the ISSS research team surveyed nearly 14,000 families, 37,141 adults, and 8,617 children in 25 of 31 administrative divisions of mainland China (excluding Xinjiang, Tibet, Qinghai, Inner Mongolia,

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[1] *Hukou* in China is a household registration system. It divides the population into two classifications: agricultural and non-agricultural residents. This division puts many constraints on the behaviors of rural individuals, which leads to rural–urban inequalities in social and economic development. For example, rural children are not allowed to attend urban schools.

[2] The CFPS data we used cover 25 provinces in China, representing 95% of the total population in mainland China. In order to evaluate the representativeness of the sample to the population, Xie and Hu (2014) compared the age–sex structure using the CFPS 2010 data and the 2010 Census data. They found that the two population pyramids are almost identical. Xu and Xie (2015) also compared the CFPS 2010 with the 2010 Census. The Xu and Xie paper found that distributions of age, sex, rural–urban stratification, educational attainment, and marital status in the CFPS resemble those from the census closely. Finally, we compared the gender structure of children aged 10 to 15 using the CFPS 2014 data and the *China Statistical Yearbook* (2015 data). We found that structure of sex in the CFPS 2014 is almost the same as the data in the *China Statistical Yearbook 2015*.

Ningxia, and Hainan). The sampling frame represents 95% of China's total population, which makes it close to being nationally representative. The CFPS collects longitudinal information on the individual, family, and community levels, interviewing all household members over age nine and reporting on topics such as educational attainment, migration, and health. One of its strengths is that unlike the Micro-Census it differentiates between urban and rural status by basing this distinction on the *hukou* system. Specifically, it identifies a person holding rural *hukou* as rural no matter where his/her current residency is. While the relatively small size of the data set make it less useful for producing overall trends, we use the data in this paper to produce estimates of the share of the overall number of students that are attending high school (which are available from both the MOE data and the 2015 Micro-Census) that are urban and rural.

III. RESULTS

The controversy over educational attainment rates began in the mid- to late 2000s, when MOE data began to diverge from 2010 Census data (Khor et al. 2016). According to Khor et al. (2016), it is shown that in 2005, there is a 4 percentage point difference between the MOE data and census data. By 2007, the gap is 14 percentage points. Because there is potentially incomplete data for 2008–10, the authors use trends from 2004 to 2009 (rising at only between 2% and 3% per year over the years prior to 2010) and then estimate on-trend predication for 2010. Calculated in this way, the Khor et al. (2016) paper demonstrated that there was a gap between the MOE data and the census data that reached 30 percentage points in 2010.

A. *Assessing the Aggregate Trends in Upper Secondary School Attainment Rates*

In order to update these data until more recently and to overcome the problem of using predicted data for 2010 (instead of actual data), in our analysis we have included actual data from the MOE data for 2005–15 and actual data from the 2015 Micro-Census from 2005 until 2013 (and then use predicted data from the Micro-Census for 2014 and 2015).[3] These new data series will let us then not only revisit the gap that appeared between 2007 and 2010, but it will also allow us to track trends between 2010 and 2015 (with two different data sets).

So what do the new data show? In part, one could argue that the same story appears in these series (as did in the paper by Khor et al. 2016). Specifically, in

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[3] The reason for using predicted data for 2014 and 2015 in the series that come from the Micro-Census data is that in 2014 and 2015 it is likely that there are still 15, 16, and 17 year olds that have not begun high school yet (due to any number of reasons, such as delayed matriculation to school or grade retention).

Table 1, the two data sources (including the original MOE data and the new 2015 Micro-Census) show that the upper secondary attainment rates of 15–17 year olds are similar in 2005 (no difference between the MOE and Micro-Census data). After 2005, however, discrepancies appear and continue to grow through the next five years. The MOE data show that attendance in secondary school rises to 83% in 2010, a rise of 30 percentage points. During the same years, however, the 2015 Micro-Census data show the rate climbing to 70% by 2010. In other words, between 2005 and 2010 a gap of 13 percentage points had appeared—from 0 in 2005 to 13 percentage points in 2010. In this way, the appearance of a gap over the last half of the 2000s between the MOE data and the 2015 Micro-Census is similar to that found when using the 2010 Census data (and comparing them with the MOE data in the Khor et al. 2016 paper).

However, there are also fundamental differences in this paper's new analysis and the findings reported in Khor et al. (2016). First, the gap that appears by 2010 using the new 2015 Micro-Census data series is less than that reported in the Khor et al. paper. Clearly, we can see that even when we use the Micro-Census data, the overall educational attainment rate of 15–17 year olds in China has increased significantly more over the 2005–10 period than the trend that was plotted (for 2005–9) and predicted (2010) by the 2010 Census data (see Figure 1). While the Khor paper reported a gap in 2010 of 29.6 (or in rounded terms 30) percentage points (between figures calculated using the 2010 Census and the MOE data), this was clearly wider than the highest gap in 2010 calculated using the 2015 Micro-Census data (only 13 percentage points, as reported above). In other words, while there still are differences between the estimated upper secondary attendance rates in 2010 using MOE and the 2015 Micro-Census, it appears that the Khor paper overestimated the discrepancy (when they compared the predicted upper secondary school attainment rate based on 2010 Census Data and the MOE data).

The second difference, in fact, embodies the answer to the question of why the gap varies between the Khor paper and this paper. Looking at the trend lines in Figure 1, it is clear that the trends using the 2010 Census and the 2015 Micro-Census are all more or less the same between 2005 and 2007. However, between 2007 and 2010, according to the 2015 Micro-Census, the rise in the share of children attending upper secondary school accelerates, which is markedly different from the more gradual rise between 2007 and 2010 using the 2010 Census–based data (which were based in part on predictions). While the trends do not rise as steeply as the MOE data (hence the increasing gap), the pace of the trend is definitely faster between 2008 and 2010 than was predicted in the Khor paper.

Beyond differences with the Khor paper (that focused on upper secondary school attainment up to 2010), there are other lessons to be drawn from comparing the full 10 years of data (2005–15) from the two data series used in this

Fig. 1. The Trend Lines of Upper Secondary Attainment Rates from MOE Reports, 2015 Micro-Census, and the 2010 Census
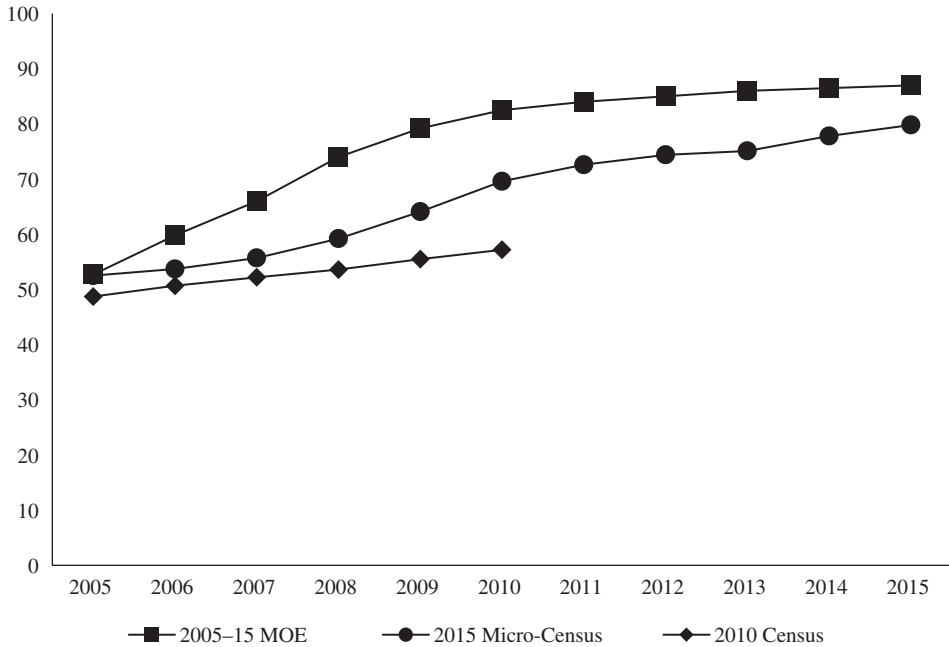
Sources: MOE reports, 2005–15; 2015 One-Percent National Sample Census (2015 Micro-Census); 2010 Census.

paper. First, like when looking at the trends between 2005 and 2010, the MOE data also show markedly steeper trends for the entire decade (2005–15) than the trends based on the 2015 Micro-Census data (Figure 1). As a result, during the entire 2005–15 decade there is a gap that exists between the MOE data and the 2015 Micro-Census data. The MOE data set shows a rise of 35 percentage points from 53% to 87% between 2005 and 2015. During the same years, the 2015 Micro-Census also rises, but by a somewhat slower rate. Specifically, according to the Micro-Census-based data, the share of youth attending high school rose by 28 percentage points, starting at the same level in 2005 (53%) and rising to 80% in 2015. In short, there is a 7 percentage gap between the MOE data and the 2015 Micro-Census data, but the gap is smaller than the 2010 gap (13 percentage points) using the same two sources of data.

The differences in trends over time, however, should not disguise one of the underlying similarities among the two trends. Regardless of the source of data, there clearly were sharp increases in the share of students in China that were attending high school between 2005 and 2015. On a percent basis, the attainment rate shown in the MOE was 64% higher in 2015 than in 2005 (87%/53%). While

smaller, the rise in high school attainment between 2005 and 2015 according to the Micro-Census was also large (51% = 80%/53%) and should be considered extremely rapid increases for any economy, especially for a school system as large as China's, which already started off the period (in 2005) with about half of the students already attending this critical phase of human capital development. Given that there were about 20 million individuals in each youth cohort year (or around 60 million 15–17 year olds), a rise of attendance from between 51% to 64% from a base that already had about 30 million students in high school means that between 2005 and 2015 China's education system added annually between 15 and 19 million new students into the high school system.

The other thing to notice, however, is that according to the MOE and the Micro-Census data, one of the periods in which there is an extremely sharp rise during our study period is between 2007 and 2010. In the MOE data, of the overall rise in upper secondary school attendance (34 percentage points), almost exactly half (17 percentage points) occurs during that three-year period. In the Micro-Census, of the overall rise of attendance in upper secondary school (27 percentage points), 52% of the rise (14 percentage points) occurs between 2007 and 2010. So, the rise in attendance in upper secondary education, according to the MOE and Micro-Census data sets, is concentrated in the last three years of the first decade of the 21st century.

The other common finding of the two data sets is that—even though they have different ending points—both sets of data suggest that there is still going to be a lot of effort needed by China's schooling system in the last part of the 2010s (between 2015 and 2020) if the nation is to reach its goal of having full attendance in upper secondary school by 2020. Even according to the MOE data, there are still 13% (100 minus 87) of 15–17 year olds who are not attending upper secondary school. That number is 20% according to the Micro-Census data. Assuming (again) that there are about 20 million individuals who were born each year (in the early 2000s), this means China's school system still needs to produce schooling opportunities for between nearly 8 million more students (13% times 3 years times 20 million children per year), according to the MOE numbers, to 12 million (20% times 3 times 20 million children per year), according to the Micro-Census numbers.

B. *The Proximate Source of the Challenge: An Urban–Rural Divide*

Our data also can help us identify where the education system needs to focus its efforts to get the remaining 8–12 million students into high school. To do this (at least in one dimension), we examine the difference in attainment rates for urban and rural students.

From Table 2, which is based on trends from the two main data sources (Table 1 and Figure 1) and estimates of the shares of the overall numbers of

TABLE 2

Share of 15–17 Year Olds with Some Upper Secondary Attainment by Urban–Rural Residency (or *Hukou*) Status According to MOE-Reported Statistics and 2015 Micro-Census Data from 2005 to 2015

Year	MOE-Reported Statistics			Micro-Census Data		
	All [1]	Urban [2]	Rural [3]	All [4]	Urban [5]	Rural [6]
2005	53	91	43	53	90	43
2006	60	98	51	54	88	46
2007	66	100	57	56	87	48
2008	74	100	64	59	89	51
2009	79	100	69	64	98	56
2010	83	100	73	70	100	62
2011	84	100	76	73	100	66
2012	85	100	78	74	100	69
2013	86	100	80	75	98	70
2014	87	100	82	78[†]	98	74
2015	87	100	83	80[†]	97	77

Sources: MOE reports, 2005–15; 2015 One-Percent National Sample Census (2015 Micro-Census).

Notes: 1. The figures in column [2] ([5]) are calculated by multiplying the figures in column [1] ([4]) by the ratio of urban upper secondary attainment rate to total (which can be calculated by numbers in Appendix Table 1) that is calculated using the CFPS data (since rural/urban breakdowns are not available either in MOE or 2015 Micro-Census data).

2. The figures in column [3] ([6]) are calculated by multiplying the figures in column [1] ([4]) by the ratio of rural upper secondary attainment rate to total (column [4] of Appendix Table 1) that is calculated using the CFPS data (since rural/urban breakdowns are not available either in MOE OR 2015 Micro-Census data).

3. We defined rural based on the *hukou* system. A person who holds rural *hukou* is counted as rural. It is for this reason that we do not use the rural/urban breakdown from the Micro-Census, which is based on where a person was living/working at the time of the census, without regard to *hukou* status.

[†] The Upper secondary attainment rate in 2014 based on the 2015 Micro-Census is obtained by taking the average annual change in upper secondary attainment from 2009 to 2013 and adding the average annual change to the 2013 upper secondary attainment rate. The upper secondary attainment rate in 2015 is calculated the same way by using years 2010 to 2014. We estimate the 2014 and 2015 numbers because it is possible that in these years there were still individuals who were 15–17 in 2014–15 who were still in junior high school and would not enter upper secondary school until 2016.

students that are urban and rural from the CFPS data, we can see both positive and negative trends regarding China's urban–rural disparity. The good news is that a much greater part of the overall increase in upper secondary attainment among 15–17 year olds has been thanks to improvements in the rural attainment rate, thereby narrowing the gap between rural and urban students (Table 2). Using the MOE data during the 10-year period, urban rates increased by only 9 percentage points (from 91% to 100%), while at the same time rural rates

Fig. 2.   The Trend Lines of Upper Secondary Attainment Rates among MOE Reports and
2015 Micro-Census by Urban/Rural Cohort

Panel A: Urban
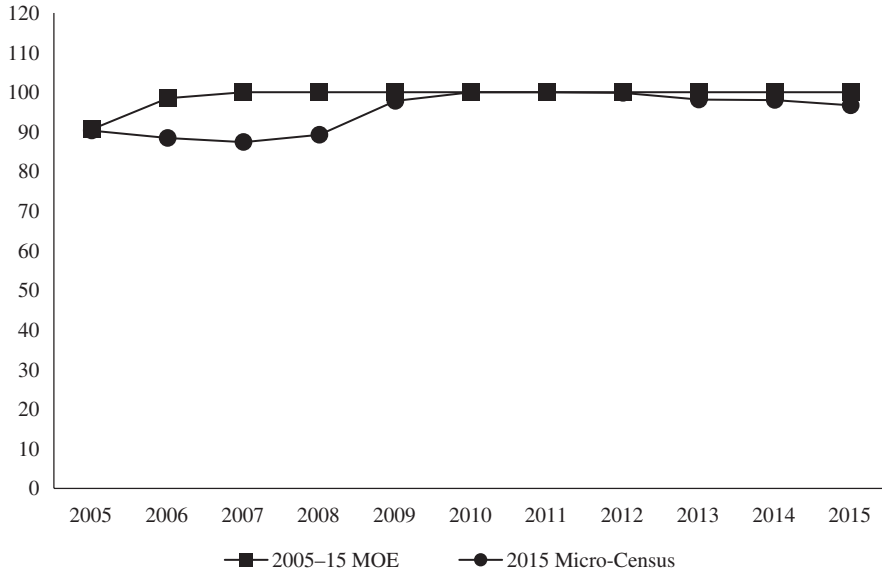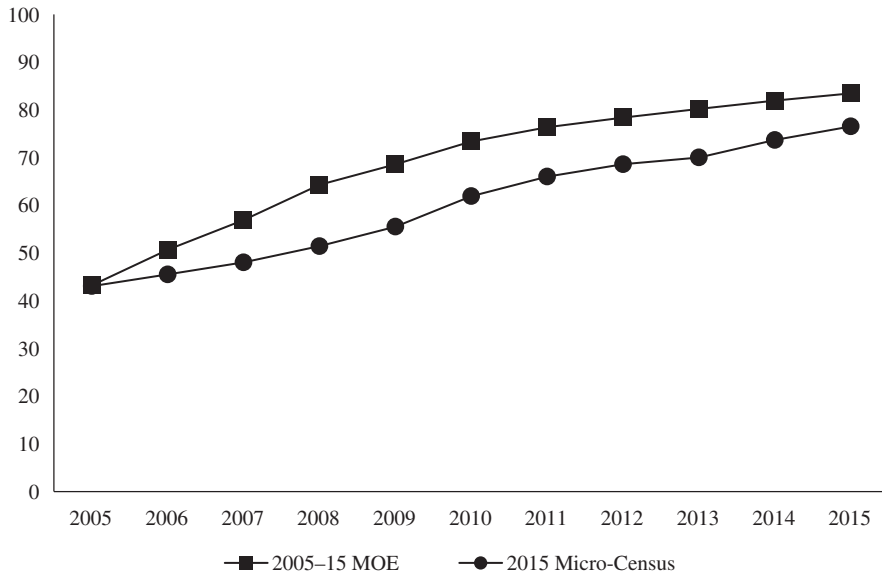
—■— 2005–15 MOE   —●— 2015 Micro-Census

Panel B: Rural

—■— 2005–15 MOE   —●— 2015 Micro-Census

Sources: MOE reports, 2005–15; 2015 One-Percent National Sample Census (2015 Micro-Census).
Note: Micro-Census and MOE lines are calculated by multiplying the total attainment rate of Micro-Census (MOE) by the ratio of urban (rural) students in upper secondary school that is calculated using the 2014 CFPS data.

jumped 40 percentage points (from 43% to 83%). Using the Micro-Census data for the same period, urban rates also increased much less (from 90% to 97%) than rural rates (from 43% to 77%). Figure 2 Panel A (using MOE data with the CFPS urban/rural ratio estimates) and Panel B (using Micro-Census data supplemented by the CFPS urban/rural ratio estimates) reflects the difference in urban and rural trends, showing a steep slope for the rural attainment rates and a gradual slope for the urban rates.

The bad news, however, is that despite these dramatic increases in the rural attainment rates, a significant urban–rural divide still exists. This can be seen by not only comparing the 2015 urban and rural rates themselves (100% vs. 83%, respectively—using the MOE data; 97% vs. 77%, respectively—using the 2015 Micro-Census data) but also by looking at the ratio between urban/rural rates and the overall attainment rate. According to the MOE data, while the urban attainment rate in 2015 is about 14.94% higher than the overall attainment rate (a ratio of 1.15 between the urban and overall rates), the rural rate is 5.74% lower (a ratio of 0.95 between the rural and overall rates). According to the Micro-Census data, while the urban attainment rate in 2015 is about 21.25% higher than the overall attainment rate (a ratio of 1.21 between the urban and overall rates), the rural rate is 3.75% lower (a ratio of 0.96 between the rural and overall rates). Since children with rural *hukou* account for over 70% of the nation's youth, the rural rates are bringing down the overall attainment rates of 15–17 year olds to a significant degree. The overall lesson, of course, is that if China wants to meet its goal of universal upper secondary schooling by 2020 and avoid becoming an economy deficient in human capital, the real challenge will be to figure out how to get rural children into upper secondary school.

C. *The Challenge of Quality Education: Academic High School versus Vocational Education*

The two sets of data also can demonstrate another challenge that education officials face in producing the levels of human capital that are needed in the coming decades. Even if China is able to meet its target of getting all youth into high school (as described above), there needs to be an almost equal amount of effort to ensure that those who are in school are actually learning. In other words, as Hanushek et al. (2008) wrote, it is not enough to just get children into school. A successful education system is one in which there is quality education and students learn the skills they will need in the future.

To examine the nature of the changing quality of China's upper secondary education system, we examine what the data sets tell us about the mix of academic high school (AH) and vocational education and training (VET). In carrying out this analysis, we are going to make two assumptions. First, we are going to assume that AH training in China is rigorous, focused, and teaches students

the skills needed in the future: math, critical thinking/language skills, science, computers, and foreign languages. Although there are some who raise concerns about the absence of creativity and the extreme focus on memorization in China's education system (Zhao 2007; Kirkpatrick and Zang 2011), there is a lot of evidence that students in China's AHs from Shanghai (Sellar and Lingard 2013) to poor rural areas are making great strides in learning (Loyalka et al. 2016). The second assumption is that while many VET schools are good and providing VET students with substantial value added (Yi et al. 2013), there is a significant share of China's upper secondary VET school system that is not producing high-quality learning (Loyalka et al. 2016). In addition, because of the absence of the provision of quality education in many VET schools, some VET students are dropping out (Yi et al. 2015). Notably, and related to the challenge raised above about China's officials needing to focus on getting rural students into high school, the literature shows that the VET schools that are poor quality (reflected by high student dropout rates) are those that are in inland and predominantly rural communities (Yi et al. 2015).

From Table 3 we can see that trends in attainment rates in both kinds of schools have contributed to the overall rise in upper secondary school attainment rates. In examining the MOE data, it can be seen that between 2005 and 2015 there has been a rise in both AH and VET attainment. In 2005, 32% of individuals in the age cohort attended AH. During the same year, 21% of individuals attended VET. In other words, of the slightly more than half (53%) of the individuals who were in upper secondary school in 2005, 60% (32 divided by 53) were in AH. The MOE data then show that between 2005 and 2015 somewhat more than half of the rise in upper secondary attainment (19 percentage points of the 34 percentage points) came from rising AH attainment rates. In other words, by 2015, 51% of all 15–17-year-old individuals in China were attending AH. While the rise in VET was marginally less (15 percentage points), because the starting percentage was lower, the share of the rise that was from VET was still large and the share nearly doubled (from 21% to 36%).

To the extent that our two assumptions about the relative (and absolute) quality of AH and VET hold true, the rise in quality of China's upper secondary level education is both strong and weak at the same time. On the one hand, to the extent that AH is delivering quality education, there are a lot more youth (literally millions more) learning higher levels of math and science, computers, critical thinking, and foreign languages (skills that will be useful in the labor force in the coming decades) than ever before. However, a large share of the rise is from VET also. Perhaps because in relative terms VET expanded even faster than AH, there is concern that learning may not be as effective as it could be (if the VET system were delivering a higher quality education in many of the schools) and that many students, while starting upper secondary schooling, are not finishing (in no small part because they do not believe they are learning—Yi et al. 2015, 2017).

TABLE 3

Share of 15–17 Year Olds Who Have Attended Academic High School or Vocational Education and Training in MOE-Reported Data, 2005–15

Year	All [1]	AH [2]	VET [3]	Ratio of VET to Total [4]
2005	53	32	21	0.4
2006	60	35	25	0.4
2007	66	37	29	0.4
2008	74	40	34	0.5
2009	79	42	38	0.5
2010	83	43	40	0.5
2011	84	44	40	0.5
2012	85	46	39	0.5
2013	86	48	38	0.4
2014	87	50	37	0.4
2015	87	51	36	0.4

Source: MOE reports, 2005–15.
Notes: 1. AH = academic high school; VET = vocational education and training.
  2. The figures in column [1] are taken directly from MOE reports, 2005–15. The figures in columns [2] and [3] are also calculated by MOE reports, 2005–15.
  3. The figures in column [4] are calculated by dividing the figures in column [3] by the figures in column [1].

Figure 3 (and Table 3, column 3), in fact, suggests that this lower quality of VET may be behind the slowdown in upper secondary attainment (when comparing 2007–10 to 2010–15). According to the MOE data, we can see that the size of the share (or proportion) of 15–17 year olds attending VET high schools approached the size of the share attending AHs in 2010. However, after 2010 (perhaps as parents began to realize that VET was lacking in quality), the gap between AH and VET widened.[4,5]

## D. *Changing the Human Capital in the Entire Labor Force*

While the rapid rise of upper secondary schooling attainment—regardless of the data set that is used—is certainly a positive part of this paper's findings (even given the caveats that rural students need extra attention and parts of the nation's VET are in need of quality upgrading), it should be cautioned that China's

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[4] The Micro-Census also shows increases in VET attainment rates, though to a less significant degree (Figure 3).

[5] We obtained the VET attainment rates for the Micro-Census in Figure 3 by taking the share of students with upper secondary attainment who attended a VET high school (column 4 of Table 3) and multiplying this by the overall upper secondary attainment rates reported by the Micro-Census. We did this because the Micro-Census does not provide VET/AH breakdowns for all survey respondents.

Fig. 3.   The Trend Lines of Upper Secondary Attainment Rate among MOE Reports and 2015
Micro-Census

Panel A: VET
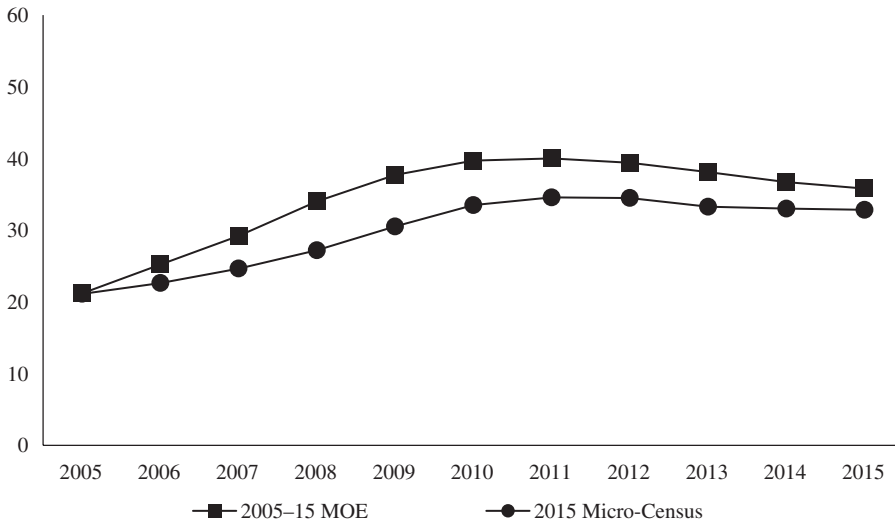
Panel B: AH
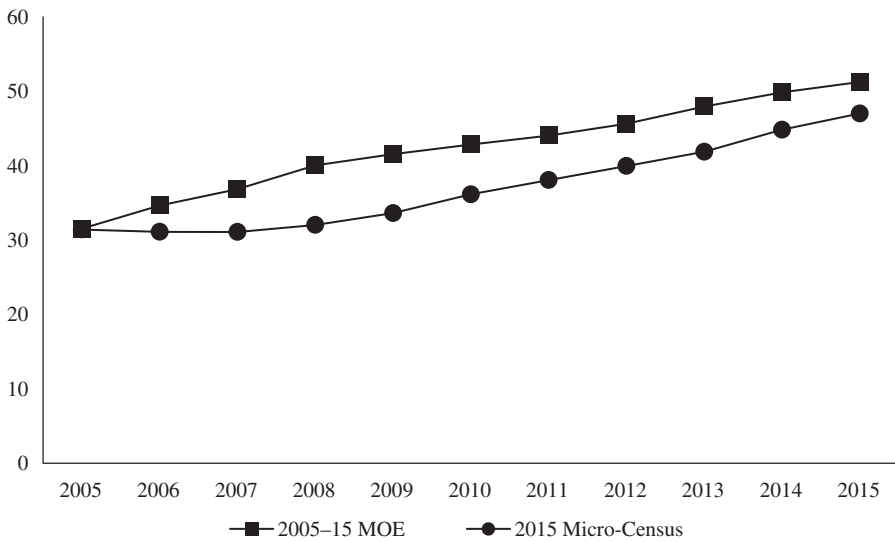
Sources: MOE reports, 2005–15; 2015 One-Percent National Sample Census (2015 Micro-Census).
Notes: 1. VET = vocational education and training; AH = academic high school.
       2. Micro-Census are calculated by multiplying the total attainment rate of Micro-Census by the share of upper secondary school students in VET (AH) school, which is calculated using the MOE reports.

TABLE 4

Share of the Labor Force That Has Attained At Least Some Upper Secondary School in China and Benchmark Countries in 2014 (Percentage, by age cohort)

Country/Country Group	25–64	25–34	35–44	45–54	55–64
China	30	47	31	22	16
OECD average	76	83	80	74	66
Other OECD:					
EU21	78	85	83	77	68
Mexico	34	46	33	28	20
Turkey	36	50	35	25	21
G20 average	64	73	66	60	51
Argentina	m	m	m	m	m
Indonesia	31	40	34	22	15
BRICs:					
Brazil	46	61	48	40	28
Russia	95	95	95	96	92
India	m	m	m	m	m
South Africa	65	77	69	52	38

Sources: All numbers except for China are from OECD (2015); upper secondary attainment in China is calculated based on the data from the 2015 One-Percent National Sample Census (2015 Micro-Census), rather than from the OECD report.

Note: m = missing data.

overall labor force (all individuals between 20 and 65) is still dramatically under-educated. This is best illustrated by comparing the upper secondary education attainment rates of China's workforce with those of other countries. In Table 4, we utilize a report published by the Organisation for Economic Co-operation and Development (OECD) entitled *Education at a Glance* (OECD 2015) to obtain upper secondary attainment rates in other countries. These data are comparable with our findings because they were determined using similar data sources (that is, population censuses) and using similar methodologies (e.g., similar assumptions, cutoffs, and definitions). The China attainment numbers we use in this table are calculated using the 2015 Micro-Census.

The international comparisons in Table 4 show that China is still lagging behind other middle-income economies and is far below high-income economies. The poor comparative outcome was initially reported in Khor et al. (2016) using underestimated 2010 upper secondary attainment rates. It is still true in 2014, despite the fact that rate increased to 30% in 2014 (using the Micro-Census) from 24% in 2010 (see Khor et al. 2016). The share of the labor force in China that has attained upper secondary education is less than 40% of the OECD average (76%) and less than half of the G20 average (64%). Even in 2014, China's labor force human capital (in upper secondary attainment rates) is lower than that of all other BRICs countries (excluding India, which was not included in the study). It is even

below that of Indonesia (31%), a poor country that only recently graduated to become a lower middle-income economy. When comparing countries by each age cohort, as well, China is almost always near the bottom of the pack. This reveals that, despite the dramatic rise in educational attainment of China's youth in recent years, the long lags that appear when trying to change the nature of an entire labor force mean that China still has a long way to go before it can build its human capital to a level comparable with that of a high-income nation.

IV. DISCUSSION AND CONCLUSION

If there is one message that should be taken away from this paper, it is that regardless of the source of data, China is doing a fantastic job in improving upper secondary attainment. Depending on the data source, there was a rise of between 51% (27 percentage points) and 64% (34 percentage points) in upper secondary school attainment between 2005 and 2015. Literally millions of additional students are now going to upper secondary school compared to the early 2000s. Although we do not have data from other countries, it is almost certain that no country—certainly no large country—has ever accomplished the rate of expansion that China has seen over the past decade or so. Of course, as seen, the goal of universal needs to be achieved and needs to be sustained for decades before China will be able to transform the human capital of its labor force into one that looks like that of a high-income country. The past 10 years, however, has given this transition a huge boost.

Our analysis also demonstrates that there are still challenges to be faced in promoting universal upper secondary education over the next several years. First, although it is clear that the vast majority of urban children in China are now attending high school, attainments rates of rural children are much lower. According to our analysis (that draws on three different data sources) somewhere between 17% and 23% of high school–aged rural children are not attaining any upper secondary education. Considering that the larger share (over two-thirds) of Chinese children have rural *hukou*, the Chinese Government needs to focus its efforts on bringing education to this group of youth if it wants to avoid becoming an economy deficient in human capital.

While the challenge of getting youth, especially rural youth, into school is significant, we believe the paper shows that there is an equally significant challenge to provide quality education for those who are in school. In other words, it is absolutely essential that efforts be placed on not only increasing attainment rates but also providing a high-quality education to rural children, equipping them with life-long skills that would prepare them for China's potential transition to a high-income economy. While there are always ways to improve all schooling systems, the literature would suggest that attention is needed by policymakers to

improve the quality of VET. In fact, many of the most serious problems have been documented in poor rural areas. If the quality of VET could be improved in poor rural areas, it might help solve both challenges: attracting rural students into upper secondary schools and improving quality so they can learn the skills that they will need for the coming years, thereby allowing China to become an economy sufficient in human capital.

Finally, improvements in the quantity and quality of upper secondary education—especially for poor rural subpopulations—will almost have to start with reforms and new investments into human capital long before the rural children are 15 years old. Although not covered in this paper, the literature is beginning to document several serious problems that still plague rural communities. Despite the increased investment into facilities and teachers in poor rural areas at the primary and lower secondary schooling levels (which have been successful in raising school performance—Chu et al. 2015; Loyalka et al. 2015), there are still serious nutrition and health (including poor uncorrected myopia) problems that are negatively affecting learning in rural schools (Yi et al. 2013; Wang et al. 2017; Wang et al. 2015; Ma et al. 2014; Luo et al. 2012; Yue et al. 2017). The same is true with even younger children. The literature shows that a significant proportion of infants and toddlers are developing in a way that their cognitive and non-cognitive skills are underdeveloped (Yue et al. 2017). If China wants to make sure that youth who enter upper secondary school are learning as much as possible and really getting the skills they will need for the future high-wage, high-skills economy, then it is imperative to make sure that children are maximizing their cognitive development as infants and toddlers and are learning in primary schools in an environment characterized by good nutrition and high qualities of health and vision care.

This paper has identified the enormous challenges that China must overcome if it wishes to become a high-income nation and avoid falling into the middle income trap. Although China has made great strides in increasing upper secondary educational attainment since 2005, international comparisons have shown that China still has a long way to go. In order to overcome these challenges, China must continue making efforts to raise the human capital level of its workforce by investing in the future: the youth and their education, including both educational quantity and quality in schools, as well as neglected areas such as the early development and health of rural toddlers. Only then will China's children have the necessary skills to become productive citizens in a developed economy.

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APPENDIX TABLE 1

Share of 15 to 17 Year Olds with Some Upper Secondary Attainment by Urban–Rural Residency (or *Hukou*) Status According to China Family Panel Survey (CFPS) Data, 2014

Year	All [1]	Urban [2]	Rural [3]	Ratio of Rural Share to Total [4]
2005	48	83	39	0.82
2006	50	83	43	0.85
2007	54	85	47	0.86
2008	58	87	50	0.87
2009	60	91	52	0.87
2010	62	91	55	0.89
2011	65	90	59	0.91
2012	66	89	61	0.92
2013	68[†]	89[†]	64[†]	0.93
2014	70[†]	88[†]	66[†]	0.95
2015	72[†]	88[†]	69[†]	0.96

Source: China Family Panel Survey (CFPS), 2014.

Notes: 1. To calculate the numbers in this table, we used data from the year cohorts who would have been 15–17 years old in the respective years. For example, when using the 2014 CFPS data for calculating the share of 15–17 year olds who had attained upper secondary school in 2005 (48%), we used data from the 2014 CFPS from the 24, 25, and 26 years old cohorts (since individuals who were 24–26 years old in 2014 were 15–17 years old in 2005).

2. The ratios in column [4] are calculated by dividing the figures in column [3] by the figures in column [1].

[†] The Upper secondary attainment rate in 2013 based on the 2014 CFPS data is obtained by taking the average annual change in upper secondary attainment from 2008 to 2012 and adding the average annual change to the 2012 upper secondary attainment rate. The upper secondary attainment rate in 2014 is calculated the same way by using years 2009 to 2013. We estimate these numbers because it is possible that in these years there were still individuals who were 15–17 in 2013/14 who were still in junior high school and would not enter upper secondary school until 2015. We estimate numbers in 2015 in the same way because we only have data for up to 2014.