

Rural education across China's 40 years of reform: past successes and future challenges

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Abstract

Purpose – The purpose of this paper is to describe the policy and trends in rural education in China over the past 40 years; and also discuss a number of challenges that are faced by China's rural school system.

Design/methodology/approach – The authors use secondary data on policies and trends over the past 40 years for preschool, primary/junior high school, and high school.

Findings – The trends over the past 40 years in all areas of rural schooling have been continually upward and strong. While only a low share of rural children attended preschool in the 1980s, by 2014 more than 90 percent of rural children were attending. The biggest achievement in compulsory education is that the rise in the number of primary students that finish grade 6 and matriculate to junior high school. There also was a steep rise of those going to and completing high school. While the successes in upscaling rural education are absolutely unprecedented, there are still challenges.

Research limitations/implications – This is descriptive analysis and there is not causal link established between policies and rural schooling outcomes.

Practical implications – The authors illustrate one of the most rapid rises of rural education in history and match the achievements up with the policy efforts of the government. The authors also explore policy priorities that will be needed in the coming years to raise the quality of schooling.

Originality/value – This is the first paper that documents both the policies and the empirical trends of the success that China has created in building rural education from preschool to high school during the first 40 years of reform (1978-2018). The paper also documents – drawing on the literature and the own research – the achievements and challenges that China still face in the coming years, including issues of gender, urbanization, early childhood education and health and nutrition of students.

Keywords Trends, China, Achievements, Policies, Rural education, Shortcomings

Paper type General review

1. Introduction

Rural education is known to play a key role in economic development. This was perhaps most clearly documented by Schultz (1960), who showed the role that rural education plays in the promotion of agriculture, a key growth sector. Rural education is also important for enhancing the productivity of manufacturing and other important growth sectors (Brown and Park, 2002). High human capital is a key feature separating countries that successfully transition from middle-income to high-income (Khor *et al.*, 2016). In countries with a large rural population, this means that rural education is important for sustaining growth.

JEL Classification — O15, O20, O53

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Rural education is especially important in countries like China, where birth rates have historically been much higher in rural areas relative to urban areas (Muyeed, 1982; World Bank, 2005). As nearly two-thirds of China's population still has a rural residency permit (hukou) and nearly half still lives in rural areas, a large share of China's population continues to be educated in rural areas (Chinese National Statistical Bureau, 2005). If one is to understand China's development path over the past 40 years, it is crucial that the policies, trends, and successes of rural education are documented and understood.

In this paper, we do two things. In the first part, we describe China's past successes in rural education, focusing on all three of the pre-college rural schooling systems: preschool, compulsory education (primary and junior high school), and high school. In examining each of these sub-systems, we both review the main policy efforts during the different decades of reform, and examine trends. To the extent possible, we examine both inputs (number of schools and teachers) and accomplishments (student enrollment and graduation rates). We end with a short discussion of fiscal expenditure over time, since this is an important policy tool favored by the central government. This section draws both upon the literature, for a discussion of policy efforts, and upon secondary data, for the analysis of educational trends.

In the second part of our paper, we highlight some of the challenges that still remain in the push to improve rural education. The discussion in this second section is admittedly incomplete. We focus on two main challenges: first, rural primary schools' nagging health, crisis; and second, sub-optimal nutrition and parenting stimulation before preschool. This section is best thought of as a brief review of major findings, we also point interested readers to the full research papers with full results and study methodologies.

2. 40 years of education reform and schooling successes

In this section, we look at 40 years of educational reform in the areas of preschool, primary and lower secondary school, and high school. Throughout this paper, we use the Chinese government's definition of "preschool" as including both types of pre-primary education in China: *youeryuan* – which cover children from ages three to seven; and *xueqianban* – which cover children ages five to seven and are often attached to primary schools (National Bureau of Statistics, 2009; Nirmala *et al.*, 2012; Wu *et al.*, 2012). In each subsection, we examine the major policy actions over the last four decades, and look at trends. The final subsection examines trends in government investment in education.

2.1 Preschool

In the 1980s, policymakers and educators began to lay out rules, regulations, and standards on which its nascent preschool program could be built (Figure 1). The first policy

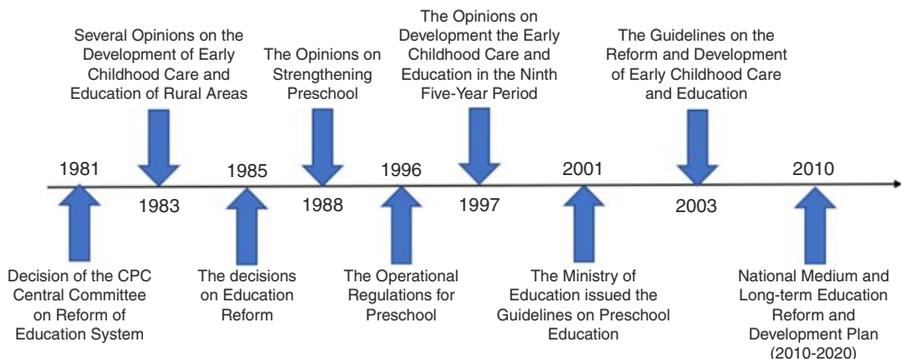


Figure 1. National policies that have shaped the expansion of preschool over the reform period

pronouncement in 1981 focused on defining what constituted an effective preschool program. Four years later (1985) a national edict encouraged local governments at all levels to support the emergence of preschools. Public work units and private firms would be the main operators, but families would be expected to pay for the cost of preschool. Over the next several years, policies in 1986 and 1987 laid out details of how preschool teachers should teach and be assessed, as well as class sizes for both day care and boarding schools. Finally, in 1988 national policymakers made it clear that since it was local governments and citizens that would be funding and managing preschools, the main policy effort during those years should be in cities and wealthier rural areas.

During the 1990s, policymakers continued to make refinements to policies, especially in terms of management standards. Building standards were redefined in the mid-1990s, and there was an effort to better define admissions requirements (e.g. age, health). As private firms emerged, they were encouraged to fund and operate high-quality preschools. As in the 1980s, only areas that were fiscally stable and had sufficient economic activity would be able to afford large-scale preschool systems.

Preschools continued to rely on local government funding until the advent of fiscal decentralization in 1994. This policy made local governments directly responsible for a significantly larger share of expenses, and in doing so, fundamentally eroded the welfare base of the existing preschool system, paving the way for a system-wide restructuring. Under the new policy, local fiscal systems saw a major drop in national-level funding for local initiatives. Many localities had insufficient funds to cover their expenses. With newly tightened fiscal belts, local government had fewer incentives (and lowered ability) to invest in preschool education. By 1995, both the number of preschools and the number of preschool teachers dropped sharply. Enrollment rates stagnated (Zhang *et al.*, 2011).

Throughout the 2000s, a series of policies were developed and promoted that aimed to prepare students for primary and junior high school, which would soon become compulsory. This drew renewed policy attention to the issue of preschool education. Many areas saw an effort to merge free standing preschools with existing primary schools (Song, 2014). Local governments were pushed to increase funding significantly in 2010. In the same year, the central government began to provide preschool subsidies to local governments in more remote rural areas (The State Council, 2010). Starting from this time, huge efforts were made to promote preschool (Han, 2011; Wei, 2011), including discussion about whether it should be made mandatory (Liu, 2007; Wu and Li, 2011).

Preschool trends. Figure 2 contains information on preschool inputs (number of schools and teachers) and outputs (student enrollment) over the reform era. From the 1980s until the mid-2000s, the number of schools was mostly stable (Panel A). There is a slight drop around 2000, but this is thought to be a combination of more careful record keeping (Zhang *et al.*, 2011) and an effort to promote high-quality preschools and shut down poorly performing ones (Li, 2010). While the number of schools stays steady during this period, the literature shows that the quality of preschools improved considerably (Hou, 2016; Zhang and Wang, 2013).

The number of preschool teachers mirrors the number of schools (Panel B). The one important difference is that after 2000, the number of teacher rises somewhat faster than the number of schools. Between 2000 and 2015, the number of preschool teachers rose by around 400 percent.

While the data for the number of students (or share of individuals in the age cohort that are in preschool) only go back to the early 1990s, the literature makes it clear that preschool in the 1980s was confined to large cities and relatively well-off rural areas (Yu and Chen, 2007; Cui and Hong, 2010). In fact, there were almost no private preschools and, as such, enrollment among families in the informal and private sectors was almost non-existent.

In the 1990s, preschools were primarily operated by local governments and firms in relatively well-off areas with access to unallocated fiscal funds (Panel C). Without any

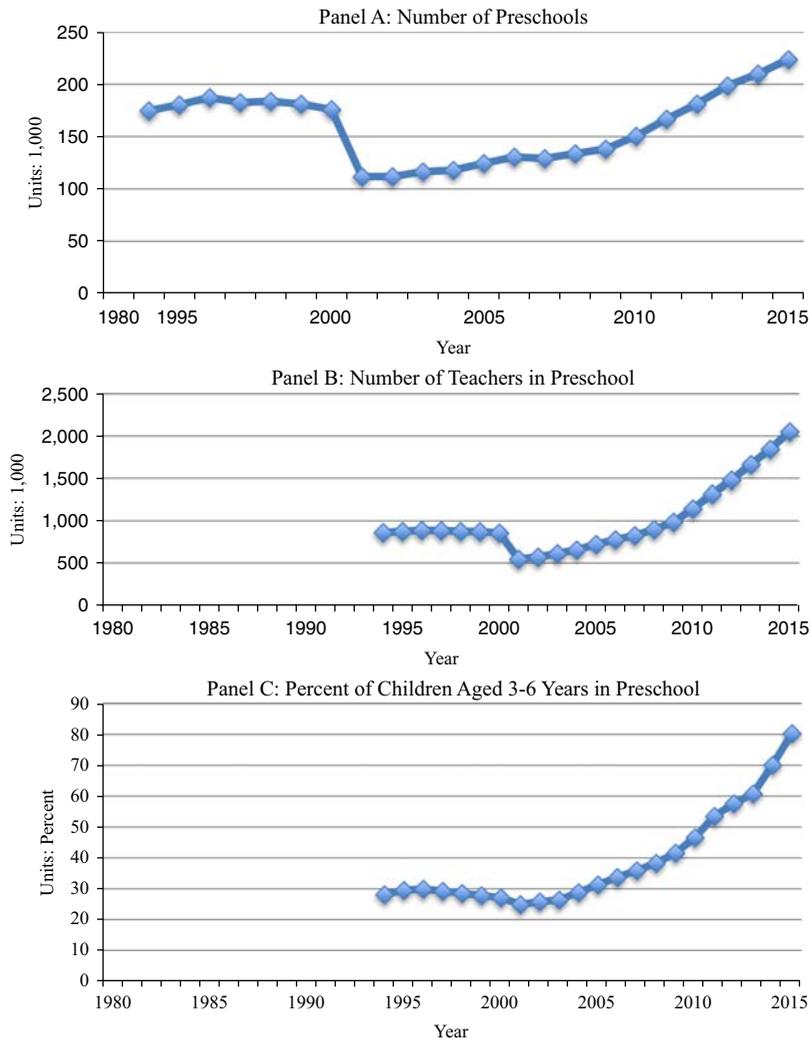


Figure 2. Preschool inputs and outputs over the reform period

Source: National Bureau of Statistics of China

outside support during this period, preschool enrollment rates (as a share of the total eligible age cohort) flattened.

Preschool participation changed dramatically after the 2005 push by policymakers to get young children into school as well as the advent of central government financial support. In the early 2000s, less than 30 percent of children across China were in preschool. These mostly were children with urban hukou and children of families in the wealthy coastal areas and suburbs. By 2015, an astounding 95 percent of children were going to preschool. Even in the poorest mountainous areas, data collected by our research team in southern Shaanxi shows that more than 85 percent of families have their children in preschool. While no comparable data are available from other countries, it is safe to say that the world has never experienced such a huge rise in preschool participation over such a short period.

2.2 Compulsory education: primary and junior high school

Figure 3 plots the progression of policies that promote schooling for grades 1 to 9. The first reforms in 1978 were announced at a time when the leaders of the Cultural Revolution were ceding decision-making authority to reformers. During the 1950s and 1960s, leaders – mostly funded by central government planners – had been trying to put a school in every village (Hannum, 1999). The curriculum was focused more on political thought than general knowledge (math, Chinese, English). Two of the first reform policies were to shutter small, low quality schools and to update the curriculum of those that remained in operation.

Soon after these initial reforms were launched, in the early 1980s, policymakers also initiated fiscal reforms, which decentralized education management and funding to the county level (Tsang, 1996; Wong, 1997). At the same time, regardless of fiscal capabilities, local governments were required to provide schooling for children. Due to severe funding constraints, nearly all governments – but especially those in poor areas – were obligated to charge tuition for the schooling they provided. In order to save money, many local governments during this time began merging schools or strategically locating them in ways such that they could educate children more efficiently, in fewer schools (Hannum, 1999; Mok and Wat, 1998; Du and Sun, 2016).

In 1986, reformers took the bold step of launching China's first Law on 9-Year Compulsory Education. Even families that were too poor to pay tuition were expected to send their children to school. At this time, teacher recruitment was taken over by local governments, who were now also responsible for paying teacher salaries (Ministry of Education, 1986a, b; Xiao *et al.*, 2017). Because of both a shortage of teachers and a shortage of funds, many localities hired temporary (*daike*) contract teachers, who were typically less well trained and paid substantially less than regular civil service teachers (Fang and Ge, 2010).

After the launch of fiscal reforms in the mid-1990s, pressure continued to mount on the system. In order to provide a higher quality education, many localities steadily raised tuition and fees (Tsang and Ding, 2005). This pressure continued to mount until 2001 when Zhu Rongji's government announced a policy to control tuition and fees. This policy paved the way for the Wen Jiabao government to eliminate tuition and fees entirely (using the Two Exemptions and One Subsidy policy) in 2003. In 2006, leaders launched the Free Compulsory Education Law. For the first time since the Cultural Revolution, the national government began to take responsibility for funding rural education.

As funding from the central government increased, so did the pressure to improve educational quality. The first formal sign of this was an effort by the central government in the early 2000s to merge smaller schools into larger town- and large village-based schools (Ding and Zheng, 2015). This led to a concentrated effort to build new physical infrastructure for schools (Fan, 2006). Classrooms, teacher offices, teacher, and student dormitories were rebuilt and renovated. By the mid-2010s, a large share of China's rural primary schools and junior high schools had been physically renewed.

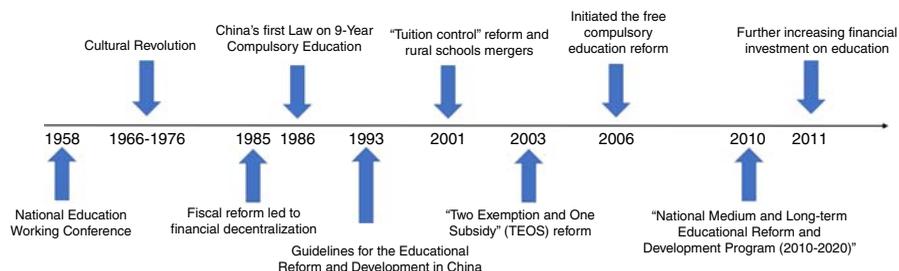


Figure 3. National policies that have shaped the expansion of compulsory education over the reform period

The 2000s also saw sharp changes in teacher funding and recruitment. Policies in the late 1990s discouraged the hiring of contract teachers, but they lacked teeth until 2006. In that year, the central government took over the payment of salaries to all public school teachers in poor rural areas. In 2009, salaries were raised to levels equal to that of regular civil servants. After 2010, the main effort of the national government was to increase funding and push local school districts to improve the quality of education.

Primary school trends. The graph of the number of schools before (1960 to 1978) and during (1978 to 2015) the reform era shows two dramatically different trends (Figure 4, Panel A). For at least two decades during the 1960s and 1970s, the central government was successful in putting schools into almost every village (reaching around 1 million schools in 1970). Since 1978, however, there has been a nearly linear decline. As described above, when local governments were faced with both limited funds and a mandate to provide quality education, one of their main policy tools for reducing costs was school mergers. From 1978 to 2015, the number of schools declines drastically and consistently. (The slight downward spike in the early 2000s is due to the institution of a centrally directed school merger policy – Pang, 2006; Guo, 2007). By 2015, there are fewer than 200,000 primary schools in China.

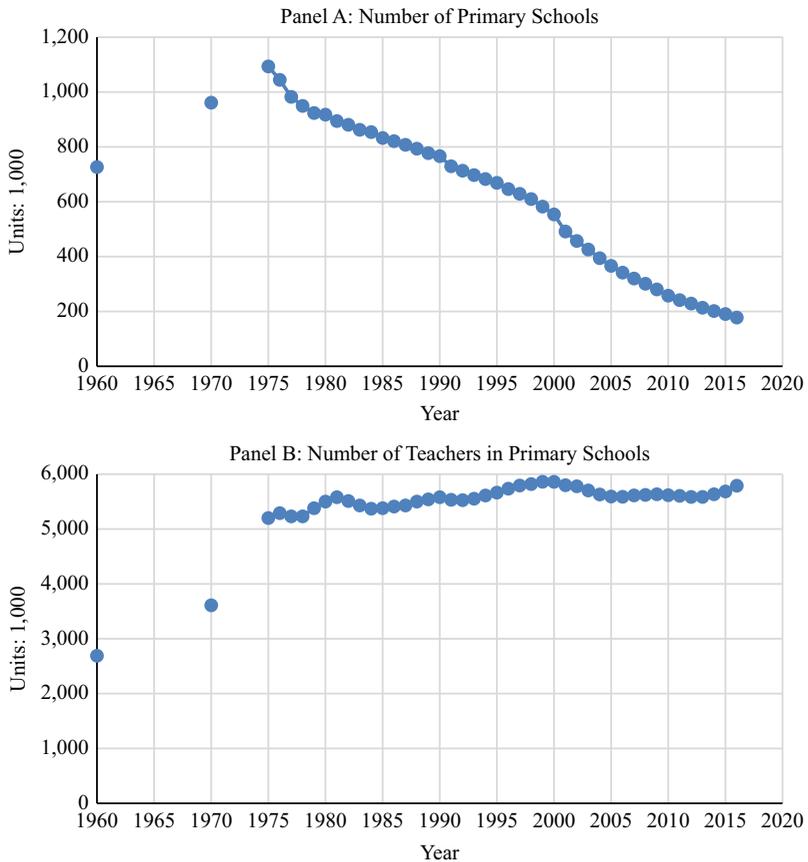


Figure 4. Inputs in primary school over the reform period

Source: National Bureau of Statistics of China

Over the same time period, the number of teachers is nearly flat (Figure 4, Panel B). The number of teachers in the 1980s is almost the same as the number of teachers in 2015. The mix of contract teachers and regular civil service teachers, however, does change. The share of contract teachers in rural China is less than 4.5 percent in 2010 (Wang *et al.*, 2017), much lower than the share in the 1980s and 1990s. Moreover, salaries and fringe benefits for all teachers are dramatically higher (Jiang and Du, 2014).

The number of primary school students falls over time (Figure 5, Panel A). Unsurprisingly, given what we know about the unchanging number of teachers during the reform period, the student-teacher ratio falls steadily during the reform era (Figure 5, Panel B). This has undoubtedly increased the quality of teaching in rural China.

Enrollment rates in primary schools stay high across the reform period (Figure 5, Panel C). In fact, even at the end of the socialist era, most children were enrolled in primary school. In 1990, the data show that more than 97 percent of children ages 6 to 12 are attending primary school. According to a survey of 181 schools in nine counties, more than 99 percent of Han children finished primary school as of the early 2010s (Lu *et al.*, 2016).

Even more impressive than net enrollment rates is the illustration of the share of primary school graduates that progress onto junior high school (Figure 5, Panel C). In the early 1980s, between 60 and 70 percent of children in China finished primary school and continued onto junior high school. This aggregate rate almost certainly masks an urban-rural split; this rate was likely much lower in rural areas. After the passing of the Compulsory Education Law in the mid-1980s, the share of children that finished primary school and went onto junior high gradually rose. By the late 1990s, nearly all children were continuing onto junior high school.

Junior high school trends. Junior high school trends are remarkably similar to those of primary schools, with some variation in the levels and the precise years of policy implementation (Figure 6). For example, like primary schools, the number of junior high schools falls consistently over the 40 year reform period (Figure 6, Panel A).

The trends in the number of teachers and student-teacher ratios are also nearly the same for junior high schools as for primary schools. The number of teachers is nearly constant (Figure 6, Panel B)[1]. The falling student to teacher ratio (Figure 6, Panel C) implies the number of junior high school students is also falling, due to the same demographic trends that cause a fall in the number of primary school students.

Finally, a combination of rising instruction quality (to the extent that the quality of instruction rose as student-teacher ratios fell) and other policy efforts has had a dramatic effect on junior high school enrollment. Figure 7 shows a steady rise of junior high school enrollment rates over the reform era. In 1990, only 60 percent of 13 to 15 year olds attended junior high school. Most of those not attending were children from rural areas. By 2010, according to MOE data, almost all 13 to 15 year olds were attending junior high school (Ministry of Education, 2010b).

The share of junior high school graduates that continue onto high school is equally (or perhaps even more) impressive. Under Chinese law, high school is not compulsory. However, between 1980 and 2010, the rate of children progressing on to high school increases dramatically, from one in three to nearly nine out of ten. This rise shows the intense interest of all Chinese youth, including rural youth, in continuing their schooling even after the law allows them to drop out.

2.3 High School

Four important reform-era policies account for nearly all of the trends we observe in high school expansion over this period. As China exited the Cultural Revolution, on average there were more than ten high schools in each county (National Bureau of Statistics, 1980).

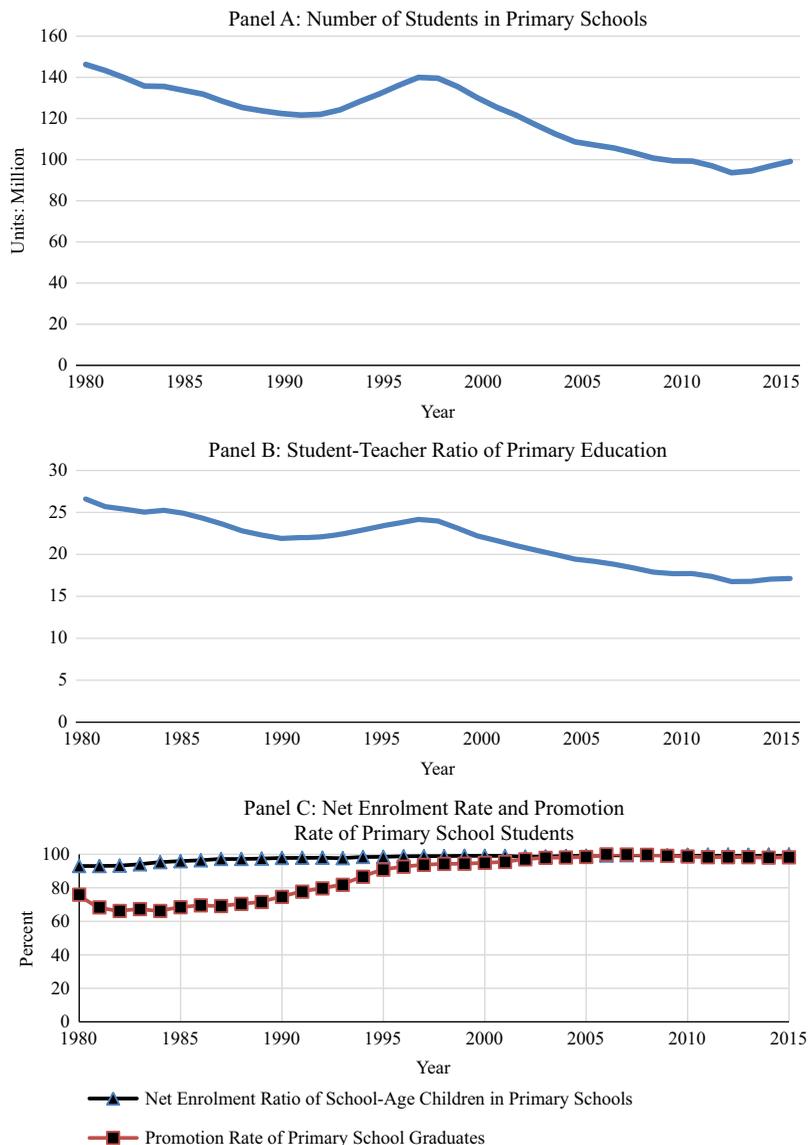
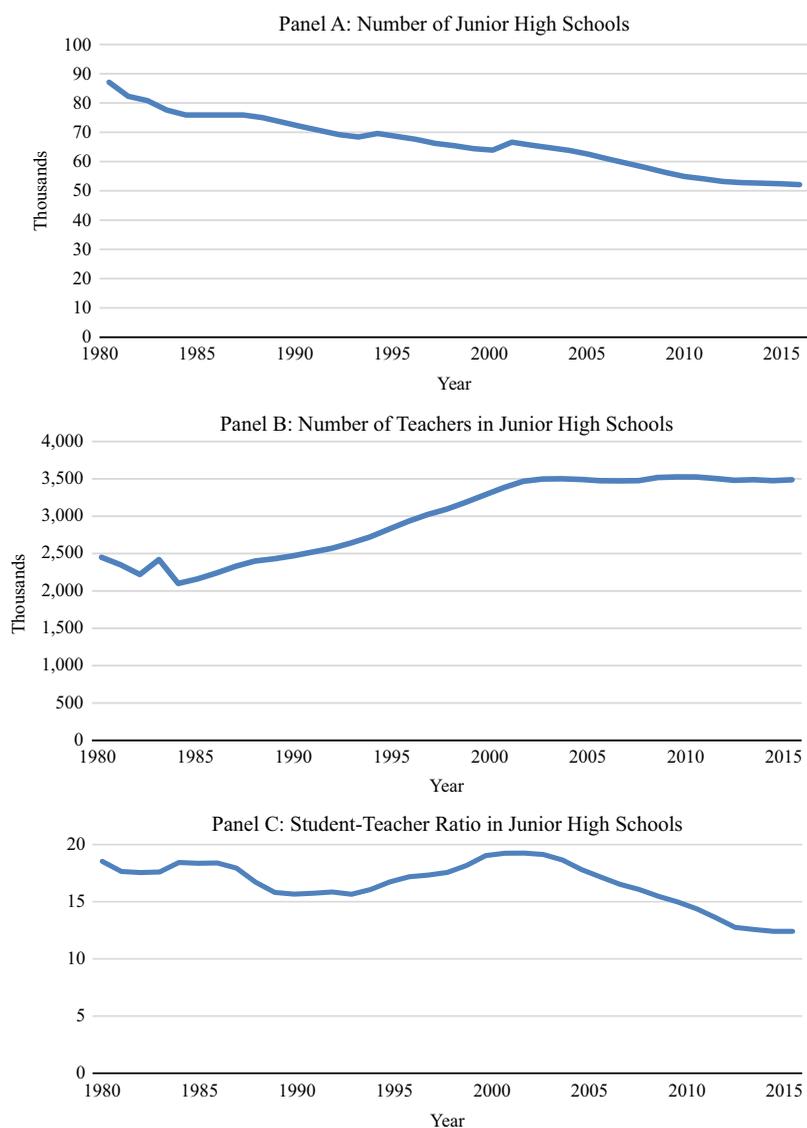


Figure 5.
Primary school
outputs over the
reform period

Source: National Bureau of Statistics of China

The high school curriculum in the pre-reform era was built around political ideology and work-study activities (Giles *et al.*, 2008; Meng and Gregory, 2002). It was not a curriculum focused on math, science, Chinese language, and English.

Therefore, in the late 1970s and early 1980s when China reinstated the more traditional curriculum in academic high school, the first – and primary – new policy was to close a large number of poor quality Cultural Revolution high schools (Lin and Zhang, 2006). Reformers also instituted a policy that created a new three year curriculum instead of the two year



Source: National Bureau of Statistics of China

Figure 6.
Inputs in junior high
school over the
reform period

curriculum that had prevailed during the Cultural Revolution (Liao, 2004). The number of available slots for high school – set by the national government – was reduced (Lin and Zhang, 2006).

The next big policy push came in the 1980s, and focused on creating a new system of vocational education and training (VET). To do so, local governments were encouraged to open a series of VET schools and recruit students for them (Zhang, 2011). The main goal of these schools was to produce the skilled workers that China would need to staff the industry and service sectors in the decades to come (Hansen and Woronov, 2013; Tsang, 2000).

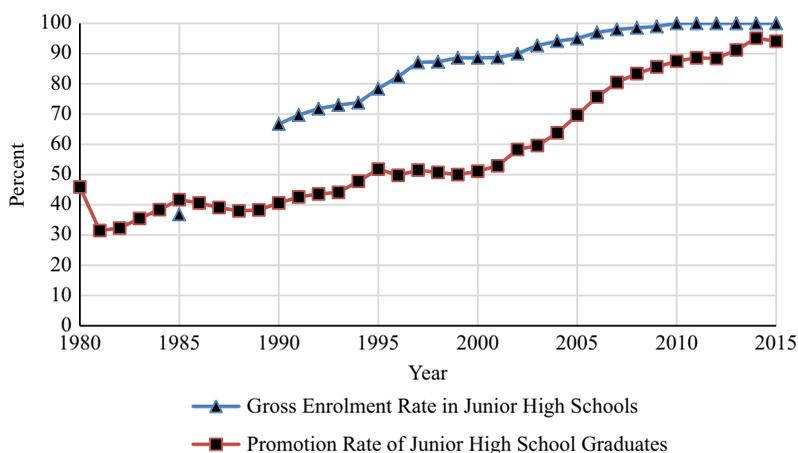


Figure 7.
Junior high school
outputs over the
reform period

Source: Statistical bulletin for the development of education

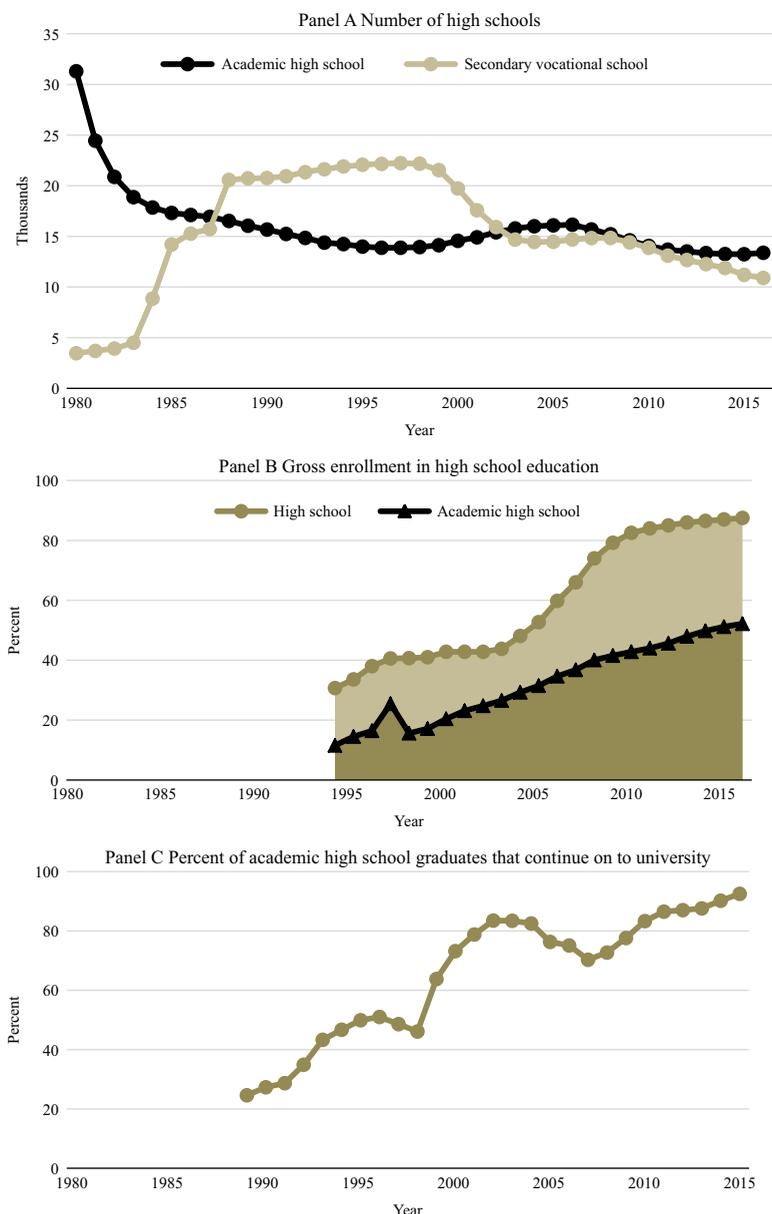
During the late 1980s and almost the entirety of the 1990s, little changed in the high school system. There was gradual expansion, but since the central government limited the number of students who were allowed to attend college, there was limited demand for academic high school. (In fact, Li, Wang and Nie (2017), Li, Loyalka, Rozelle and Wu (2017), and Li, Huang, Shi, Luo, Yang and Rozelle (2017) show that the return to a high school education in the 1990s was zero if one did not continue on to college). The third major policy change to affect high school education, therefore, was in fact a policy that greatly expanded tertiary education (Ministry of Education, 1998). In the late 1990s and early 2000s, the central government expanded the size of the university system (in terms of number of students), causing it to nearly quadruple in size (Li *et al.*, 2014; Yeung, 2013). Such a dramatic expansion necessitated a rapid expansion of high school. Policymakers complied with a new pro-growth high school policy (Yang and Yang, 2010).

At the same time as the demand for college-educated students was rising (and therefore attracting more students to attend academic high school), the structure of industry and the growth of wages was changing fast. There was a high perceived demand that the economy needed more skilled workers (Hansen and Woronov, 2013). In response, the national government launched a newer, high-profile VET initiative on top of the existing VET system. The new initiative provided generous national subsidies to support VET education, and also encouraged local governments to fund their own VET programs. In addition, in the mid-2000s, a tuition subsidy was offered to VET students to encourage more students to attend. There was a plan to encourage half of all students of high school age (16 to 18) to attend academic high school and the other half to attend VET schools (Dong and Du, 2014; Li, 2014; Ministry of Education, 2010a, b; Wang, 2011).

While the final edict has not yet been announced, it is clear that the national government will be aiming to make high school universal in the coming years. Recently (2017), the government made an official policy statement that the target is to encourage all 16 to 18 year olds to attend high school by 2020 (Ministry of Education, 2017).

High school trends. The way in which inputs (number of schools) and outputs (number of students enrolled) react to policy is perhaps clearest in the case of high school. As soon as the central government stopped funding Cultural Revolution high schools and handed responsibility for high schools back to local governments, the number of schools

fell dramatically (Figure 8, Panel A). Indeed, between 1980 and 1990, the number of academic high schools fell by more than half, from over 30,000 to less than 15,000. At the same time the new VET system emerged, leaving China's upper secondary landscape radically different in the late 1980s than in the 1970s.



Source: Panel A and C data from National Bureau of Statistics of China; Panel B data from Education Statistical Yearbook in China and authors' calculation

Figure 8.
High school inputs
and outputs over the
reform period

From the mid-1980s to the late 1990s, however, there was little movement in the total number of high schools. In fact, even after the expansion of college, the number of high schools has remained unchanged. This is likely because most funding for high schools is still provided at the local levels, so the building of new schools is not a priority.

In stark contrast to the number of schools, the number of high school students rose dramatically between 1995 and 2015 (Figure 8, Panel B). While the number of VET students rose in the mid-2000s as they garnered more investment from the central government, the greatest, most steady rise in high school students occurred after 1998. Between 1998 and 2015, the number of students enrolled in academic high school rose from about 15 percent of the 16 to 18 year old cohort to nearly 50 percent. This undoubtedly is a response to the expansion of tertiary education.

The real demand for high school is illustrated in Figure 8, Panel C. In 1998, when the volume of students in colleges and universities was low, only about 50 percent of academic high school graduates continued on to university. The rest entered the labor force directly. By 2015, however, more than 90 percent of high school graduates continued on to university. This improved university matriculation rate may be behind the slowdown in VET enrollment rates after 2010.

2.4 Summary of policies and trends, 1978 to 2018

The policy environment in China is never perfectly clear. Policies and edicts are promulgated by different levels of government at different times using language with different depths of intensity. In the area of education, however, we see that education policy is almost always implemented when the central government pushes hard and funds its stated policies. This is especially true for rural areas. The data show that preschool does not truly take off until the central government begins to provide funding. Then, within ten years, it is nearly universal. The same is true for primary and junior high school. When the government reduces tuition and makes universal participation a priority, school completion rates become universal. The rise of VET is also very much driven by central government funding. The biggest policy lever for expanding high school education was the decision to expand the university system. Here, the mechanism is a bit different, as local governments were and still are in control. The mere prospect of getting into university is enough to elicit a behavioral response from local governments and families.

Due to China's sheer size – and its rapid pace of growth – we are confident that there has never been as large an expansion of education, in terms of sheer numbers, as China has experienced over the past 40 years. Nearly 50 million additional students completed primary school and matriculated to junior high school. Approximately 25 million junior high students were added during the 1990s; and nearly 25 million high school students were added during the 2000s and beyond. Most of this increase was from students in rural areas.

These numbers are nearly unfathomable. But China did it. This rise in enrollment undoubtedly contributed immensely to the economic growth that China experienced during the reform era. It also increased incomes for hundreds of millions of rural families; there are positive rates of return to education for rural workers (De Brauw and Rozelle, 2008; Zhang *et al.*, 2002).

2.5 Financing education during the reforms

We have suggested that support from the central government is an important factor in expanding and improving education. To explore this further, here we take a closer look at education expenditure during the reform era. First, we examine total spending on education over the reform period. Second, we look at the share of spending across different parts of the educational system.

One of the most dramatic signs of the government's commitment to education can be seen through the data on funding (Figure 9). While the national government spent only 167 billion RMB on education in 1996, by 2013, national expenditures rose to 2.4 trillion. This is the equivalent of 17 percentage point increase each year for 17 years in a row.

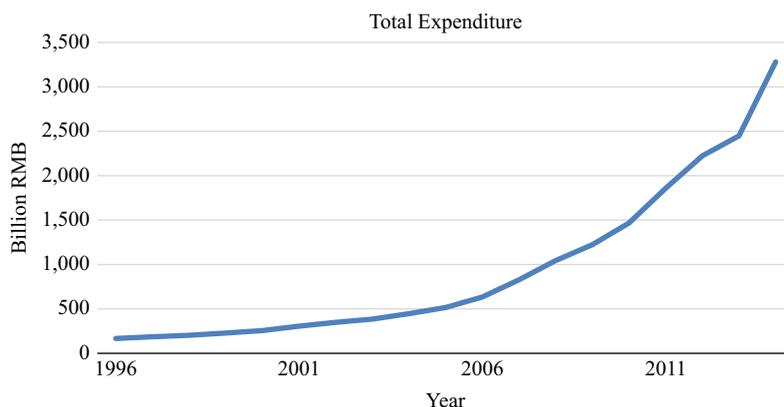
Expenditure growth as a share of GDP is even higher. In 1996, the national government only invested 2.3 percent of GDP into education. By 2013, this rose to 4.11 percent. The government has met its target rate of investing at least 4 percent of GDP into education each year (Ministry of Education, 1993).

In the rest of this subsection, we divide the total expenditures from Figure 9 into the shares spent on preschool, primary school, junior high school, VET, academic high school and university, respectively. Before embarking on this set of analyses, however, we make a set of assumptions. First: we assume that the participation rates of university are dominated by urban students (Wu, 2013). Two: the same is true for academic high school, since this is the same population that attends university (Figure 8). Three: since all students, both urban and rural, attend primary school, and the share of rural students is around 70 percent (NSBS), this means that most primary school students in China are rural. The same is true of both junior high school and preschool (in recent years). Of the rise in VET students, most of the newly enrolling students are rural (He, 2013; Du and Sun, 2016). Based on these assumptions, we can say that universities and academic high schools are predominantly urban, and preschools, primary schools, junior high schools, and VETs are predominantly rural.

The two branches of the schooling system that have seen the largest increases in funding share over the past 20 years are universities and academic high schools – both predominantly urban. These are the only two branches of the schooling system that have experienced share gains over the reform era. The other branches have all seen their shares of total education funding fall.

The breakdown of national funding also shows that universities receive the largest share of the funding pie. Universities receive more funding than primary schools, in spite of the fact that there are more years in primary school and, while 100 percent of each age cohort (ages 6 to 12) attends primary school, less than 30 percent of young adults aged 19 to 22 attend tertiary education. The bulk of the urban bias in the educational system seems to be due to this huge expenditure on universities.

A comparison of academic high school to VET funding also shows an urban bias, especially since the mid-2000s. A higher share of the overall education budget is spent on academic high school (10 percent) compared to VET (7 percent).



Source: China Educational Finance Statistical Yearbook

Figure 9.
Total national
expenditure on
education over the
reform period

With respect to education financing over the past 40 years, there is some good news and some bad news. The total rise both in absolute amounts and in the share of GDP is healthy and shows the commitment of the government to raising the level of human capital. Unfortunately, although our earlier analysis shows that rural students and schools are the ones lagging furthest behind, China's spending patterns favor urban students and schools, especially due to the focus on universities. Preschools, where the largest gaps remain between urban and rural children (Zhang, 2011; Luo, Zhang, Liu, Zhao, Shi, Rozelle and Sharbono, 2012; Luo, Shi, Zhang, Zhang, Miller, Medina and Rozelle, 2012), receive the least funding.

3. Conclusion and discussion: setting the stage for the next 40 years

The progress that China has made in rural education over the past 40 years – and especially over the last decade – is incomparable. In the 1980s, only urban children went to preschool; 70 percent of China's children sat at home until age 7. Even as late as the mid-2000s, preschool attendance was still low in the rural areas of central and western China. Today, however, preschool attendance is over 90 percent. The same trends can be seen in the attendance rates for primary, lower secondary, and high school. Over the past 40 years, China has educated nearly one billion students. It is an incredible accomplishment.

The analyses above, however, do not come close to describing the full extent of China's educational achievements. For example, although almost all children attended primary school in the 2000s, the quality of the education that they received was much lower than it is today. When our research team first turned our focus to rural education in 2005, school buildings were still made of crumbling adobe. The insides of classrooms were dark, illuminated by a single light bulb dangling on the end of an exposed wire. In the winter, broken glass windowpanes offered no protection from winds and cold. Children were often packed three to a desk. Textbooks were not a guarantee, but then again, neither were teachers. In many school districts, most of the teachers were on short-term contracts, informally hired simply as an adult on school grounds, with no effort to ensure good pedagogy. It was not uncommon for these contract teachers to be owed many months back wages.

Today, however, the situation is entirely different. The central government embarked on an ambitious infrastructure program that has financed and overseen the rebuilding of nearly every primary and secondary school in rural China (Hannum, 2003; Lai *et al.*, 2014). Crumbling adobe has been replaced with solid cement, whitewashed or painted in vivid, welcoming colors. Classrooms are brightly lit, and sport tidy rows of modern desks and chairs – one student in each. Proper chalkboards line the walls, matched with a seemingly endless supply of white and colored chalk. The contract teachers of just ten years ago have been all but replaced by civil servants, highly trained career educators who receive consistent pay from the central government (Wang *et al.*, 2017; Sargent and Hannum, 2005). Tuition is free (Marcucci and Johnstone, 2007; Chyi and Zhou, 2014). Books are free. In poor areas, students even get a free lunch (Zhang *et al.*, 2014).

Similar achievements have been made in junior high and high school. Even as early as 2004, 88 percent of rural 13-17 year olds living in a less developed province (Gansu) were enrolled in school (Zhao and Glewwe, 2010). Freshmen majoring in engineering in China score two to three years above their counterparts from the USA and Russia on a series of math, physics and critical thinking tests (Lu *et al.*, 2017). It may not be easy to be a high school student in China, but China's academic high schools seem to be teaching as much, indeed more, than anywhere else in the world.

The Chinese government's policies for the coming years demonstrate that the current leadership will not allow stagnation; they are pushing for even higher levels of human capital growth (Ministry of Education, 2010a, b). A number of policy efforts, if realized, will be beneficial for China's future growth and stability. For example, there is a push to make high school universal by 2020 (Ministry of Education, 2010a, b; Gu, 2010).

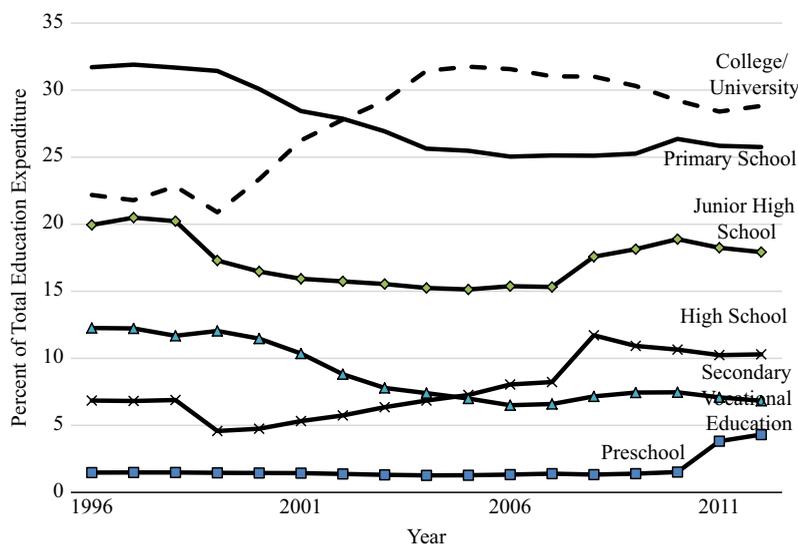
Considerable efforts are being put into building school libraries (Gao *et al.*, 2017), computer rooms (Bai *et al.*, 2016), and other school facilities. Standards for preschool are being constantly revised and upgraded (Li, Wang and Nie, 2017; Li, Loyalka, Rozelle and Wu, 2017; Li, Huang, Shi, Luo, Yang and Rozelle, 2017). China is creating a schooling system that can prepare its students for China's drive to become a fully developed, high-wage, high-income economy.

3.1 Other social forces

The systematic changes to China's educational system that we have described, thus, far have not occurred in a vacuum. They have been indelibly shaped by countless other social changes that have been simultaneously occurring in China over the past 40 years. In this section, we discuss some of these changes, and how they have contributed to the expansion in education that we have observed.

Returns to education. Returns to education in China have increased considerably over the last 40 years. Knight and Song (2003) show that the returns to a university education rose from 15.1 percent in 1988 to 40.1 percent in 1995. For other levels of education, the economic returns to one additional year of education has risen from 3.7 percent in 1986 (Byron and Manaloto, 1990) to 17.3 percent in 2014 (Awaworyi and Mishra, 2014). Other researchers are slightly more modest in their analyses of trends: Liu and Zhang (2013) find that the returns to education have increased at an average rate of 0.2 percentage points each year since 1978. Still, the existing literature overwhelmingly shows an increase in returns to education over the reform period; it is likely that this increase is at least partially responsible for the increase in enrollment and attainment rates that we observe (Figure 10).

Returns to education accrue differently to different sub-populations. Returns to education are slightly higher for girls than for boys (Awaworyi and Mishra, 2014), and for urban residents compared with migrant workers (Liu and Zhang, 2013). This latter finding in particular may be a product of some of the existing inequities in the educational system that we have described above.



Source: China Educational Finance Statistical Yearbook

Figure 10.
Share of national education expenditure on different levels of education, 1996-2012

Gender. China has achieved substantial gains for girls' education over the reform period, though some gender disparities still exist. At the start of the reform period, school-aged girls had significantly lower rates of school enrollment than did their male peers (Coale and Banister, 1994; Gu and Roy, 1995; Arnold and Zhaoxiang, 1986; Ren, 1995). Gender was a significant predictor of school dropout during this early period, particularly in rural areas (Connelly and Zheng, 2003), and continued to be a significant predictor even as recently as 2004 (Zhao and Glewwe, 2010). That said, while gender inequality in educational attainment still exists, it has been narrowing over time (Zeng *et al.*, 2014). As with many indicators, the gender gap varies by area (rural vs urban) and by grade level. There is nearly no significant gender inequality in urban areas or in the nine years of compulsory education (Zeng *et al.*, 2014).

In terms of academic performance, the evidence on the existence of a gender gap is more mixed. On the one hand, some research has found that girls outperform boys on a series of cognitive and educational performance indicators (Zhou *et al.*, 2016). At the same time, several studies have found that girls underperform in STEM subjects compared with their male classmates (Li, Wang and Nie, 2017; Li, Loyalka, Rozelle and Wu, 2017; Li, Huang, Shi, Luo, Yang and Rozelle, 2017; Hill *et al.*, 2010). These findings suggest that gender inequality in Chinese education still merits concern and call for further work to better understand the gender gap in academic performance.

Parental migration and left-behind children (LBC). China's rapid development and urbanization over the reform period has induced large numbers of rural residents to migrate from their homes in search of off-farm employment opportunities (Hu *et al.*, 2008; Wen and Lin, 2012). Because China's strict household registration prohibits (or limits) rural children from attending school in urban areas (Wu, 2011; Cheng and Selden, 1994; Chen and Feng, 2013), it is common for migrant parents to leave their children behind with a caregiver – typically the child's paternal grandparents (Ye *et al.*, 2006). As a direct result of this mass urbanization, a new subpopulation – called LBC – has emerged in China (Duan and Zhou, 2005). There were more than 61 million LBCs in China in 2010 (National Bureau of Statistics of China, 2011).

The evidence on how this pattern of migration has affected educational outcomes is mixed. Zhao *et al.* (2014) find that having migrant parents can reduce a child's math score ranking by 15.6 percent on average. Similarly, Li, Wang and Nie (2017), Li, Loyalka, Rozelle and Wu (2017), and Li, Huang, Shi, Luo, Yang and Rozelle (2017) find that parental migration has a significant negative impact on the school performance of junior high school students. On the other hand, Zhou *et al.* (2015) find that LBCs performed as well as or better than children living with both parents on nine health and educational outcomes, while Bai *et al.* (2014), and Bai *et al.* (2017) find that parental migration has a significant and positive impact on the English language test scores of rural primary school students.

3.2 Challenges for the coming years

Assuming that China achieves its goal of universal high school by 2020, what are the challenges that China faces in preparing its primary and junior high school children for the rigors of high school? Looking at where the first 40 years of reform have led us, and thinking ahead to the next 40 years, we identify three main policy goals that, if realized, could strengthen the foundation of schooling for all children, and enable them to absorb even more knowledge from their three years in high school.

Health in primary school. Studies across China have shown that students in primary schools in poor rural areas are beset with a series of health conditions that diminish their energy levels and interfere with their ability to learn. Indeed, poor health may be one of the first – and largest – obstacles that students encounter in their educational path.

Recent research has revealed that, on average, between 25 and 34 percent of rural primary school students in China suffer from iron-deficiency anemia (Luo *et al.*, 2011; Li, Wang and Nie, 2017; Li, Loyalka, Rozelle and Wu, 2017; Li, Huang, Shi, Luo, Yang and Rozelle, 2017). Anemia is a nutritional problem that inhibits learning: studies have shown that anemic children around the world have worse grades, lower school attendance, and higher rates of school dropout (Halterman *et al.*, 2001; Stoltzfus, 2001; Stoltzfus *et al.*, 2001; Bobonis *et al.*, 2006). Chinese primary students are therefore being expected to learn and thrive without even basic nutrition. While the government has taken actions to solve this problem (MOE, 2012), problems still exist (Kleiman-Weiner *et al.*, 2013).

A second major health crisis is uncorrected vision. In an average primary school populations, around 10 percent of students will have some kind of problem with their eyesight (Bai *et al.*, 2014, 2017). This rate is even higher among upper primary school grades (grades 4 to 6) in rural northwest China (Yi *et al.*, 2015).

For most of these children, the solution is simple and effective: fit them with a pair of glasses. And yet in rural China, it is very rare to see a child wearing glasses (Bai *et al.*, 2014, 2017). In a study in rural Gansu, researchers found that only 2 percent of students with poor vision owned a pair of glasses (Glewwe *et al.*, 2016). Since that time, large-scale quantitative studies across China have shown that of all children in rural schools, more than 20 percent need glasses but do not have them (Bai *et al.*, 2014, 2017). This means that more than millions of students are being asked to navigate a competitive school system without the ability to see what is written on the blackboard.

A final major health crisis can be found among primary school children in Southern China. In 2013, a study in Guizhou Province revealed that more than 40 percent of students in rural primary schools were infected with intestinal worms (Liu *et al.*, 2015). Invisible to the naked eye, intestinal worms steal valuable nutrients from their human host. This leads to a plethora of physical symptoms, and can also be devastating for educational outcomes. Intestinal worm infection is associated with worse academic performance, lower scores on memory and intelligence tests, and lower school attendance rates. Other multi-province studies have documented rates of infection even higher than 40 percent (Steinmann *et al.*, 2008; Zhou *et al.*, 2007). Childhood intestinal worm infection appears to be endemic across all of southern China.

Based on these findings, we conclude that one reason for China's persistent rural-urban education gap is that rural students are sick. They are anemic; they cannot see the blackboard; and they have worms in their bellies. Research has shown that when nutrition is improved (Luo, Zhang, Liu, Zhao, Shi, Rozelle and Sharbono, 2012; Luo, Shi, Zhang, Zhang, Miller, Medina and Rozelle, 2012); when glasses are prescribed and worn (Ma *et al.*, 2014); and when deworming occurs (Liu *et al.*, 2017), educational outcomes improve. Better health, nutrition and vision care should be a priority in schools in the coming years.

Poor early child development. China's rural babies and toddlers are experiencing alarming rates of developmental delay (Luo *et al.*, 2015; Luo, Jia, Yue, Zhang, Lyu, Shi *et al.*, 2017; Luo, Yue, Zhou, Shi, Zhang, Martorell, Medina, Rozelle and Sylvia, 2017; Yue, Shi, Luo, Chen, Garth, Zhang... and Rozelle, 2017; Yue, Wang, Yang, Shi, Luo, Zhang, Kenny and Rozell, 2017). Nearly half (48 percent) of young children living in poor communities are cognitively delayed. Development experts agree that delays that are uncorrected that age two are irreversible. Assuming this to be true, large shares of children from China's poor rural areas will be at a life-long developmental disadvantage. These results are consistent across multiple regions of China (Wei *et al.*, 2015; Luo, Jia, Yue, Zhang, Lyu, Shi *et al.*, 2017; Luo, Yue, Zhou, Shi, Zhang, Martorell, Medina, Rozelle and Sylvia, 2017).

Despite the considerable advances in rural preschool expansion that we have shown in the first part of this paper, two important challenges remain. First, Wu *et al.* (2012) show that rural children who attend preschool typically only attend for one year, rather than the three years that is standard among urban children. This puts rural children at a disadvantage compared to their urban peers. Second, preschool in China begins only at age 3; no public preschool programs are available for children aged 0-3 years. But by age 3, the crucial 1,000-day window has already closed forever.

In reality, then, the problem of developmental delay among toddlers begins even before children begin preschool. We identify two possible causes for this problem: poor nutrition and poor parenting practices. Research internationally (Grantham-McGregor and Ani, 2001; Black *et al.*, 2017) and in China (Yue *et al.*, 2016) shows that poor nutrition and the absence of stimulation is significantly associated with delays in cognitive development, even after controlling for individual and household characteristics. Overall, the literature is clear that when nutrition is better (Akman *et al.*, 2004; Hasanbegović and Sabanović, 2004; Luo *et al.*, 2015; Yue, Shi, Luo, Chen, Garth, Zhang... and Rozelle, 2017; Yue, Wang, Yang, Shi, Luo, Zhang, Kenny and Rozell, 2017) and when a caregiver engages with their child in a stimulating way (e.g. singing, reading, playing – Gertler *et al.*, 2014; Heckman *et al.*, 2013; Bus, 2001; Evans *et al.*, 2000; Ritchie *et al.*, 2015), the child is less likely to be delayed.

Despite this strong correlation between parental involvement and development, we find that the fraction of caregivers who engage their children using cognitively stimulating practices is low (Yue, Shi, Luo, Chen, Garth, Zhang... and Rozelle, 2017; Yue, Wang, Yang, Shi, Luo, Zhang, Kenny and Rozell, 2017; Luo, Jia, Yue, Zhang, Lyu, Shi *et al.*, 2017; Luo, Yue, Zhou, Shi, Zhang, Martorell, Medina, Rozelle and Sylvia, 2017). Less than 40 percent of rural caregivers play with their child on a typical day. Even fewer read (12.6 percent) or sing to their child (37.5 percent). In other words, a large majority of China's youngest children receive nearly zero modern parenting investments as they grow up in their rural villages.

Recent efforts to improve nutrition and train caregivers in modern parenting approaches have been successful in improving developmental outcomes. One study in the Qingba mountains found improved nutrition both reduced anemia rates and raised cognitive outcomes (Luo, Jia, Yue, Zhang, Lyu, Shi *et al.*, 2017; Luo, Yue, Zhou, Shi, Zhang, Martorell, Medina, Rozelle and Sylvia, 2017). Another study demonstrates in-home parental training to have even larger impacts on cognition of 18 to 30 month olds (Sylvia *et al.*, 2017). Preparing children with the cognitive and language skills they will need to do well in school involves intervening even before preschool.

3.3 Final thoughts

The successes of China's reform are manifold. In this Special Issue, other papers have documented improvements in agriculture, fiscal policy, and banking, among other areas. Many have been impressive. However, the rise of rural schooling from a nation that was focused on political education for a small share of children, to today's rural schooling system where almost all children attend preschool, primary school, junior high school and high school may be the greatest accomplishment of all. As China moves toward becoming a high income country, continuing to strive for high levels of human capital for all, including rural residents, will be essential for maintaining growth and stability.

Note

1. The number of teachers rose gradually between 1980 and 2000 and then was constant after 2000.

References

- Akman, M., Cebeci, D., Okur, V., Angin, H., Abali, O. and Akman, A.C. (2004), "The effects of iron deficiency on infants' developmental test performance", *Acta Paediatrica*, Vol. 93 No. 10, pp. 1391-1396.
- Arnold, F. and Zhaoxiang, L. (1986), "Sex preference, fertility, and family planning in China", *Population and Development Review*, Vol. 12 No. 2, pp. 221-246.
- Awaworyi, S. and Mishra, V. (2014), "Returns to education in China: a meta-analysis", discussion paper, Nos 41-14, Department of Economics, Monash University, Melbourne, available at: <https://ideas.repec.org/p/mos/moswps/2014-41.html> (accessed November 17, 2017).
- Bai, Y., Mo, D., Zhang, L., Boswell, M. and Rozelle, S. (2016), "The impact of integrating ICT with teaching: evidence from a randomized controlled trial in rural schools in China", *Computers & Education*, Vol. 96, pp. 1-14.
- Bai, Y., Zhang, L., Liu, C., Shi, Y., Mo, D. and Rozelle, S. (2017), "Effect of parental migration on the academic performance of left behind children in North Western China", *The Journal of Development Studies*, pp. 1-17.
- Bai, Y., Yi, H., Zhang, L., Shi, Y., Ma, X., Congdon, N. and Rozelle, S. (2014), "An investigation of vision problems and the vision care system in rural China", *Southeast Asian Journal of Tropical Medicine and Public Health*, Vol. 45 No. 6, p. 1464.
- Black, M.M., Walker, S.P., Fernald, L.C.H., Andersen, C.T., DiGirolamo, A.M., Lu, C., McCoy, D.C., Fink, G., Shawar, Y.R., Shiffman, J., Devercelli, A.E., Wodon, Q.T., Vargas-Baron, E. and Grantham-McGregor, S. (2017), "Early childhood development coming of age: science through the life course", *The Lancet*, Vol. 389 No. 10064, pp. 77-90, available at: [https://doi.org/10.1016/S0140-6736\(16\)31389-7](https://doi.org/10.1016/S0140-6736(16)31389-7)
- Bobonis, G., Miguel, E. and Puri-Sharma, C. (2006), "Anemia and school participation", *Journal of Human Resources*, Vol. 41 No. 4, pp. 692-721.
- Brown, P.H. and Park, A. (2002), "Education and poverty in rural China", *Economics of Education Review*, Vol. 21 No. 6, pp. 523-541.
- Bus, A.G. (2001), "Joint caregiver-child storybook reading: a route to literacy development", in Neuman, S.B. and Dickinson, D.K. (Eds), *Handbook of Early Literacy Research*, Guilford Press, New York, NY, pp. 179-191.
- Byron, R.P. and Manaloto, E.Q. (1990), "Returns to education in China", *Economic Development and Cultural Change*, Vol. 38 No. 4, pp. 783-796.
- Chen, Y. and Feng, S. (2013), "Access to public schools and the education of migrant children in China", *China Economic Review*, Vol. 26, pp. 75-88.
- Cheng, T. and Selden, M. (1994), "The origins and social consequences of China's hukou system", *The China Quarterly*, Vol. 139, pp. 644-668.
- Chinese National Statistical Bureau (2005), *Chinese Agricultural Statistical Yearbook*, Chinese National Statistical Bureau, Beijing.
- Chyi, H. and Zhou, B. (2014), "The effects of tuition reforms on school enrollment in rural China", *Economics of Education Review*, Vol. 38, pp. 104-123.
- Coale, A.J. and Banister, J. (1994), "Five decades of missing females in China", *Demography*, Vol. 31 No. 3, pp. 459-479.
- Connelly, R. and Zheng, Z. (2003), "Determinants of school enrollment and completion of 10 to 18 year olds in China", *Economics of Education Review*, Vol. 22 No. 4, pp. 379-388.
- Cui, F.F. and Hong, X.M. (2010), "The unbalanced regional development of preschool education in China: status, causes and suggestions", *Educational Development Research*, Vol. 2010 No. 24, pp. 20-24.
- De Brauw, A. and Rozelle, S. (2008), "Reconciling the returns to education in off-farm wage employment in rural China", *Review of Development Economics*, Vol. 12 No. 1, pp. 57-71.

- Ding, D. and Zheng, F.T. (2015), "Dismantling teaching points: integrate education resources or reduce investment in education? – Based on the analysis of 1996-2009 provincial panel data", *China Economic Quarterly*, Vol. 14 No. 2, pp. 603-622.
- Dong, J.Y. and Du, L.L. (2014), "Popularization trend of high school education – an empirical analysis based on provincial panel data", *Educational Science Research*, Vol. 8 No. 1, pp. 48-52.
- Du, Y. and Sun, Z. (2016), *Research on Compulsory Education Financing in China*, Springer, Berlin.
- Duan, C.R. and Zhou, F.L. (2005), "The current situation of China's left-behind children", *Renkou Yanjiu (Population Research)*, Vol. 29 No. 1, pp. 29-36.
- Evans, M.A., Shaw, D. and Bell, M. (2000), "Home literacy activities and their influence on early literacy skills", *Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale*, Vol. 54 No. 2, p. 65.
- Fan, X.Z. (2006), "Studies on the reason, motivity and pattern selection of adjusting primary and secondary school distribution in rural areas", *Education & Economy*, Vol. 1 No. 1, pp. 26-29.
- Fang, Z. and Ge, X.B. (2010), "The issue of irregular teachers in China and its policy implications", *Theory and Practice of Education*, Vol. 30 No. 22, pp. 32-36.
- Gao, Q., Mo, D., Shi, Y., Wang, H., Kenny, K. and Rozelle, S. (2017), "Can reading programs improve reading skills and academic performance in Rural China?", REAP working paper, Stanford.
- Gertler, P., Heckman, J., Pinto, R., Zanolini, A., Vermeersch, C., Walker, S., Chang, S.M. and Grantham-McGregor, S. (2014), "Labor market returns to an early childhood stimulation intervention in Jamaica", *Science*, Vol. 344 No. 6187, pp. 998-1001.
- Giles, J., Park, A. and Wang, M. (2008), "The great proletarian cultural revolution, disruptions to education, and returns to schooling in Urban China", working paper, World Bank.
- Glewwe, P., Park, A. and Zhao, M. (2016), "A better vision for development: eyeglasses and academic performance in rural primary schools in China", *Journal of Development Economics*, Vol. 122, pp. 170-182.
- Grantham-McGregor, S. and Ani, C. (2001), "A review of studies on the effect of iron deficiency on cognitive development in children", *The Journal of Nutrition*, Vol. 131 No. 2, pp. 649S-668S.
- Gu, B. and Roy, K. (1995), "Sex ratio at birth in China with reference to other areas in East Asia: what we know", *Asia-Pacific Population Journal*, Vol. 10 No. 3, pp. 17-42.
- Gu, M. (2010), "A blueprint for educational development in China: a review of 'the national guidelines for medium-and long-term educational reform and development (2010-2020)'", *Frontiers of Education in China*, Vol. 5 No. 3, pp. 291-309.
- Guo, Q. (2007), "On the concrete effects of the rural primary secondary school mapping restructure: positive research on the basis of six provinces and regions in the Midwest", *Education and Economy*, Vol. 2 No. 1, pp. 45-49.
- Halterman, J., Kaczorowski, J., Aligne, C., Auinger, P. and Szilagyi, P. (2001), "Iron deficiency and cognitive achievement among school-aged children and adolescents in the United States", *Pediatrics*, Vol. 107 No. 6, pp. 1381-1386.
- Han, Q.L. (2011), "'Popularization and fairness' is the inevitable choice for the development strategy and basic policy of preschool education in China", *Contemporary Education Sciences*, Vol. 3 No. 1, pp. 31-35.
- Hannum, E. (1999), "Political change and the urban-rural gap in basic education in China, 1949-1990", *Comparative Education Review*, Vol. 43 No. 2, pp. 193-211.
- Hannum, E. (2003), "Poverty and basic education in rural China: villages, households, and girls' and boys' enrollment", *Comparative Education Review*, Vol. 47 No. 2, pp. 141-159.
- Hansen, M.H. and Woronov, T.E. (2013), "Demanding and resisting vocational education: a comparative study of schools in rural and urban China", *Comparative Education*, Vol. 49 No. 2, pp. 242-259, available at: <https://doi.org/10.1080/03050068.2012.733848>
- Hasanbegović, E. and Sabanović, S. (2004), "Effects of iron therapy on motor and mental development of infants and small children suffering from iron deficiency anaemia", *Medicinski arhiv*, Vol. 58 No. 4, pp. 227-229.

- He, W.M. (2013), "82% students of secondary vocational schools from rural areas means what?", *Education and Vocation*, Vol. 34 No. 1, pp. 16-17.
- Heckman, J., Pinto, R. and Savelyev, P. (2013), "Understanding the mechanisms through which an influential early childhood program boosted adult outcomes", *The American Economic Review*, Vol. 103 No. 6, pp. 2052-2086.
- Hill, C., Corbett, C. and St Rose, A. (2010), *Why so Few? Women in Science, Technology, Engineering, and Mathematics*, American Association of University Women, Washington, DC.
- Hou, M.L. (2016), "Challenges and opportunities: review on the development of government-dominating preschool education", *Journal of Guangxi Normal University (Philosophy and Social Sciences Edition)*, Vol. 52 No. 6, pp. 106-110.
- Hu, X., Cook, S. and Salazar, M.A. (2008), "Internal migration and health in China", *The Lancet*, Vol. 372 No. 9651, pp. 1717-1719.
- Jiang, J.Q. and Du, Y.H. (2014), "On the project design of enhancing financial input of primary and secondary school teachers' salary and its feasibility analysis", *Education & Research*, Vol. 35 No. 12, pp. 54-60.
- Khor, N., Pang, L., Liu, C., Chang, F., Mo, D., Loyalka, P. and Rozelle, S. (2016), "China's looming human capital crisis: upper secondary educational attainment rates and the middle-income trap", *The China Quarterly*, Vol. 228, pp. 905-926.
- Kleiman-Weiner, M., Luo, R., Zhang, L., Shi, Y., Medina, A. and Rozelle, S. (2013), "Eggs versus chewable vitamins: which intervention can increase nutrition and test scores in rural China?", *China Economic Review*, Vol. 24 No. Supplement C, pp. 165-176, available at: <https://doi.org/10.1016/j.chieco.2012.12.005>
- Knight, J. and Song, L. (2003), "Increasing urban wage inequality in China", *Economics of Transition*, Vol. 11 No. 4, pp. 597-619.
- Lai, F., Liu, C., Luo, R., Zhang, L., Ma, X., Bai, Y., Sharbono, B. and Rozelle, S. (2014), "The education of China's migrant children: the missing link in China's education system", *International Journal of Educational Development*, Vol. 37, pp. 68-77.
- Li, H., Loyalka, P., Rozelle, S. and Wu, B. (2017), "Human capital and China's future growth", *The Journal of Economic Perspectives*, Vol. 31 No. 1, pp. 25-47.
- Li, L., Wang, L. and Nie, J. (2017), "Effect of parental migration on the academic performance of left-behind middle school students in Rural China", *China & World Economy*, Vol. 25 No. 2, pp. 45-59.
- Li, L., Huang, L., Shi, Y., Luo, R., Yang, M. and Rozelle, S. (2017), "Anemia and student's educational performance in rural Central China: prevalence, correlates and impacts", *China Economic Review*, available at: <https://doi.org/10.1016/j.chieco.2017.07.006> (accessed November 17, 2017).
- Li, S., Whalley, J. and Xing, C. (2014), "China's higher education expansion and unemployment of college graduates", *China Economic Review*, Vol. 37, Supplement C, pp. 567-582.
- Li, X.F. (2010), "Management of running period of rural merged preschool", *Preschool Education (Early Education Version)* Vol. 12 No. 1, pp. 42-44.
- Li, Y.J. (2014), "The promotion of secondary vocational education: construction of security system", *Vocational and Technical Education*, Vol. 19 No. 1, pp. 1-1.
- Liao, Q.F. (2004), "Experiences in and lessons from the development of contemporary China's school system reform", *Journal of Nanjing Xiaozhuang College*, Vol. 20 No. 2, pp. 9-35, available at: www.cnki.com.cn/Article/CJFD2004-SFZK200402002.htm
- Lin, J. and Zhang, Y. (2006), "Educational expansion and shortages in secondary schools in China: the bottle neck syndrome", *Journal of Contemporary China*, Vol. 15 No. 47, pp. 255-274, available at: <https://doi.org/10.1080/10670560500534889>
- Liu, C., Lu, L., Zhang, L., Luo, R., Sylvia, S., Medina, A., Rozelle, S., Smith, D., Chen, Y. and Zhu, T. (2017), "Effect of deworming on indices of health, cognition, and education among schoolchildren in rural China: a cluster-randomized controlled trial", *The American Journal of Tropical Medicine and Hygiene*, Vol. 96 No. 6, pp. 1478-1489.

- Liu, C., Luo, R., Yi, H., Zhang, L., Li, S., Bai, Y., Medina, A., Rozelle, S., Smith, S., Wang, G. and Wang, J. (2015), "Soil-transmitted helminths in Southwestern China: a cross-sectional study of links to cognitive ability, nutrition, and school performance among children", *PLoS Neglected Tropical Diseases*, Vol. 9 No. 6, pp. 1-16.
- Liu, E. and Zhang, S. (2013), "A meta-analysis of the estimates of returns to schooling in China", Working Paper No. 201309855, Department of Economics, University of Houston, Houston.
- Liu, L. (2007), "On the responsibilities and functions of government on the suburban left-behind young children problem", *Studies in Preschool Education*, Vol. 6 No. 1, pp. 12-15.
- Lu, M., Shi, Y., Chang, F., Kenny, K. and Rozelle, S. (2017), "The gender gap in math performance, self-concept, and anxiety: rural and urban China in an international context", REAP working paper, Stanford.
- Lu, M., Cui, M., Shi, Y., Chang, F., Mo, D., Rozelle, S. and Johnson, N. (2016), "Who drops out from primary schools in China? Evidence from minority-concentrated rural areas", *Asia Pacific Education Review*, Vol. 17 No. 2, pp. 235-252.
- Luo, R., Jia, F., Yue, A., Zhang, L., Lyu, Q., Shi, Y. and Rozelle, S. (2017), "Passive parenting and its association with early child development", *Early Child Development and Care*, pp. 1-15.
- Luo, R., Shi, Y., Zhang, L., Zhang, H., Miller, G., Medina, A. and Rozelle, S. (2012), "The limits of health and nutrition education: evidence from three randomized-controlled trials in Rural China", *CESifo Economic Studies*, Vol. 58 No. 2, pp. 385-404, available at: <https://doi.org/10.1093/cesifo/ifs023>
- Luo, R., Shi, Y., Zhou, H., Yue, A., Zhang, L., Sylvia, S., Medina, A. and Rozelle, S. (2015), "Micronutrient deficiencies and developmental delays among infants: evidence from a cross-sectional survey in rural China", *BMJ Open*, Vol. 5 No. 10, pp. 1-8.
- Luo, R., Wang, X., Zhang, L., Liu, C., Shi, Y., Miller, G., Rozelle, S., Yu, E. and Martorell, R. (2011), "High anemia prevalence in western China", *Southeast Asian Journal of Tropical Medicine and Public Health*, Vol. 42 No. 5, p. 1204.
- Luo, R., Yue, A., Zhou, H., Shi, Y., Zhang, L., Martorell, R., Medina, A., Rozelle, S. and Sylvia, S. (2017), "The effect of a micronutrient powder home fortification program on anemia and cognitive outcomes among young children in rural China: a cluster randomized trial", *BMC Public Health*, No. 17, pp. 738-753.
- Luo, R., Zhang, L., Liu, C., Zhao, Q., Shi, Y., Rozelle, S. and Sharbono, B. (2012), "Behind before they begin: the challenge of early childhood education in rural China", *Australasian Journal of Early Childhood*, Vol. 37 No. 1, pp. 55-64.
- Ma, X., Zhou, Z., Yi, H., Pang, X., Shi, Y., Chen, Q., Meltzer, M., Cessie, S., He, M., Rozelle, S., Liu, Y. and Congdon, N. (2014), "Effect of providing free glasses on children's educational outcomes in China: cluster randomized controlled trial", *BMJ*, Vol. 349 No. g5740, pp. 1-12, available at: www.bmj.com/content/349/bmj.g5740 (accessed November 17, 2017).
- Marcucci, P.N. and Johnstone, D.B. (2007), "Tuition fee policies in a comparative perspective: theoretical and political rationales", *Journal of Higher Education Policy and Management*, Vol. 29 No. 1, pp. 25-40.
- Meng, X. and Gregory, R.G. (2002), "The impact of interrupted education on subsequent educational attainment: a cost of the Chinese cultural revolution", *Economic Development and Cultural Change*, Vol. 50 No. 4, pp. 935-959, available at: <https://doi.org/10.1086/342761>
- Ministry of Education (1986a), "Compulsory education law of the people's Republic of China", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_619/200606/15687.html (accessed November 10, 2017).
- Ministry of Education (1986b), "Regulations on trial implementation of primary school teachers' duties", available at: <http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/s7077/201412/180695.html> (accessed November 10, 2017).
- Ministry of Education (1993), "Guidelines for the educational reform and development in China", available at: www.moe.edu.cn/jyb_sjzl/moe_177/tnull_2484.html (accessed November 10, 2017).

- Ministry of Education (1998), "21st century education revitalization action plan", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_177/200407/2487.html (accessed November 10, 2017).
- Ministry of Education (2010a), "National medium and long-term educational reform and development program 2010-2020", available at: www.moe.edu.cn/srcsite/A01/s7048/201007/t20100729_171904.html (accessed November 10, 2017).
- Ministry of Education (2010b), "2010 National educational development statistics bulletin", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_633/201203/xxgk_132634.html (accessed November 10, 2017).
- Ministry of Education (2012), "The guideline of implementing the nutrition improvement program for compulsory education students in rural China", available at: www.edu.cn/zong_he_778/20120615/t20120615_791948.shtml (accessed November 10, 2017).
- Ministry of Education (2017), "Popularize high school education plan (2017-2020)", available at: www.gov.cn/xinwen/2017-04/06/content_5183767.htm (accessed November 17, 2017).
- Mok, K.H. and Wat, K.Y. (1998), "Merging of the public and private boundary: education and the market place in China", *International Journal of Educational Development*, Vol. 18 No. 3, pp. 255-267.
- Muyeed, A. (1982), "Some reflections on education for rural development", *International Review of Education*, Vol. 28 No. 2, pp. 227-238.
- National Bureau of Statistics (1980), *The 1980 Population Census of the People's Republic of China*, China Statistics Press, Beijing.
- National Bureau of Statistics (2009), *The 2009 Population Census of the People's Republic of China*, China Statistics Press, Beijing.
- National Bureau of Statistics of China (2011), *The 2010 Population Census of the People's Republic of China*, China Statistics Press, Beijing.
- Nirmala, R., Sun, J., Zhou, J. and Zhang, L. (2012), "Early achievement in rural China: the role of preschool experience", *Early Childhood Research Quarterly*, Vol. 27 No. 1, pp. 66-76.
- Pang, L. (2006), "Primary and high school consolidation in rural China: issues. Reasons, and solutions", *Education Development Research*, Vol. 2 No. 1, pp. 1-6.
- Ren, X.S. (1995), "Sex differences in infant and child mortality in three provinces in China", *Social Science & Medicine*, Vol. 40 No. 9, pp. 1259-1269, available at: www.stats.gov.cn/ztjc/ztsj/hstjnj/sh2009/201209/t20120905_73025.html
- Ritchie, S.J., Bates, T.C. and Plomin, R. (2015), "Does learning to read improve intelligence? A longitudinal multivariate analysis in identical twins from age 7 to 16", *Child Development*, Vol. 86 No. 1, pp. 23-36.
- Sargent, T. and Hannum, E. (2005), "Keeping teachers happy: Job satisfaction among primary school teachers in rural Northwest China", *Comparative Education Review*, Vol. 49 No. 2, pp. 173-204.
- Schultz, T.W. (1960), "Capital formation by education", *Journal of Political Economy*, Vol. 68 No. 6, pp. 571-583.
- Song, Y.M. (2014), "Current rural preschool integration, ban the status of the process and methods", *China Extracurricular Education*, Vol. 2014 No. 21, pp. 161-162.
- Steinmann, P., Du, Z.W., Wang, L.B., Wang, X.Z., Jiang, J.Y., Li, L.H., Marti, H., Zhou, X.N. and Utzinger, J. (2008), "Extensive multiparasitism in a village of Yunnan province, people's Republic of China, revealed by a suite of diagnostic methods", *The American Journal of Tropical Medicine and Hygiene*, Vol. 78 No. 5, pp. 760-769.
- Stoltzfus, R. (2001), "Defining iron-deficiency anemia in public health terms: a time for reflection", *The Journal of Nutrition*, Vol. 131 No. 2, pp. 565S-567S.
- Stoltzfus, R., Kvalsvig, J., Chwaya, H., Montresor, A., Albonico, M., Tielsch, J., Savioli, L. and Pollitt, E. (2001), "Effects of iron supplementation and anthelmintic treatment on motor and language development of preschool children in Zanzibar: double blind, placebo controlled study", *British Medical Journal*, Vol. 323 No. 7326, pp. 1389-1397.

- Sylvia, S., Warrinnier, N., Luo, R., Shi, Y., Attanasio, O. and Rozelle, S. (2017), "From quantity to quality: delivering a home-based parenting intervention through China's family planning workers. working paper, Stanford.
- The State Council (2010), "Several opinions on the current development of preschool education", available at: www.gov.cn/zwggk/2010-11/24/content_1752377.htm (accessed November 17, 2017).
- Tsang, M.C. (1996), "Financial reform of basic education in China", *Economics of Education Review*, Vol. 15 No. 4, pp. 423-444.
- Tsang, M.C. (2000), "Education and national development in China since 1949: oscillating policies and enduring dilemmas", *China Review*, pp. 579-618.
- Tsang, M.C. and Ding, Y. (2005), "Resource utilization and disparities in compulsory education in China", *China Review*, Vol. 5 No. 1, pp. 1-31.
- Wang, L., Zhang, S., Li, M., Sun, Y., Sylvia, S., Yang, E., Ma, G., Zhang, L., Mo, D. and Rozelle, S. (2017), "Contract teachers and student achievement in Rural China: evidence from class fixed effects", REAP working paper, Stanford.
- Wang, X.X. (2011), "Unscrambling and thinking of current high school education development policy in China", *Theoretic Observation*, Vol. 69 No. 3, pp. 97-99.
- Wei, M. (2011), "Reflections on preschool education in Rural China", *Intelligence*, Vol. 23 No. 1, pp. 254-254.
- Wei, Q.W., Zhang, J.X., Scherpbier, R.W., Zhao, C.X., Luo, S.S., Wang, X.L. and Guo, S.F. (2015), "High prevalence of developmental delay among children under three years of age in poverty-stricken areas of China", *Public Health*, Vol. 129 No. 12, pp. 1610-1617.
- Wen, M. and Lin, D. (2012), "Child development in rural China: children left behind by their migrant parents and children of nonmigrant families", *Child Development*, Vol. 83 No. 1, pp. 120-136.
- Wong, C.P. (1997), *Financing Local Government in the People's Republic of China*, Oxford University Press, Oxford.
- World Bank (2005), *World Development Report 2006: Equity and Development*, World Bank and Oxford University Press, Washington, DC.
- Wu, K.B., Young, M.E. and Cai, J. (2012), *Early Child Development in China: Breaking the Cycle of Poverty and Improving Future Competitiveness*, World Bank Publications, Washington, DC.
- Wu, X. (2011), "The household registration system and rural-urban educational inequality in contemporary China", *Chinese Sociological Review*, Vol. 44 No. 2, pp. 31-51.
- Wu, Y.X. (2013), "Educational opportunities of Chinese rural and urban residents in 1978-2008: inequality and evolution", *Social Sciences in China*, Vol. 3 No. 1, pp. 4-21, 203.
- Wu, Y.Y. and Li, X.Y. (2011), "Problems and countermeasures of financial support for preschool education in China – based on the experiences of OECD countries", *Early Education (Teacher Edition)*, Vol. 9 No. 1, pp. 10-13.
- Xiao, Y., Li, L. and Zhao, L. (2017), "Education on the cheap: the long-run effects of a free compulsory education reform in rural china", *Journal of Comparative Economics*, Vol. 45 No. 3, pp. 544-562.
- Yang, R.Y. and Yang, Y.F. (2010), "Retrospect and analysis on the policies for the development of academic senior high schools in twenty years", *Theory and Practice of Education*, Vol. 30 No. 7, pp. 23-27.
- Ye, J.Z., Wang, Y.H., Zhang, K.Y. and Lu, J.X. (2006), "The impact of parental labor migration on left behind children", *Zhongguo Nongcun Jingji (Chinese Rural Economy)*, Vol. 1 No. 1, pp. 57-65.
- Yeung, W.-J.J. (2013), "Higher education expansion and social stratification in China", *Chinese Sociological Review*, Vol. 45 No. 4, pp. 54-80, available at: <https://doi.org/10.2753/CSA2162-055450403>
- Yi, H., Zhang, L., Ma, X., Congdon, N., Shi, Y., Pang, X., Zeng, J., Wang, L., Boswell, M. and Rozelle, S. (2015), "Poor vision among China's rural primary school students: prevalence, correlates and consequences", *China Economic Review*, Vol. 33 No. 1, pp. 247-262, available at: <https://doi.org/10.1016/j.chieco.2015.01.004>

- Yu, Y.H. and Chen, S.H. (2007), "Equality of preschool education from the perspective of public resource distribution", *Early Childhood Education*, No. 4 No. 1, pp. 22-24.
- Yue, A., Marsh, L., Zhou, H., Medina, A., Luo, R., Shi, Y. and Rozelle, S. (2016), "Nutritional deficiencies, the absence of information and caregiver shortcomings: a qualitative analysis of infant feeding practices in Rural China", *PloS One*, Vol. 11 No. 4, pp. 1-21.
- Yue, A., Shi, Y., Luo, R., Chen, J., Garth, J., Zhang, J., Medina, A., Kotb, S. and Rozelle, S. (2017), "China's invisible crisis: cognitive delays among rural toddlers and the absence of modern parenting", *The China Journal*, Vol. 78 No. 1.
- Yue, A., Wang, X.H., Yang, S., Shi, Y.J., Luo, R.F., Zhang, Q., Kenny, K. and Rozell, S. (2017), "The relationship between infant peer interactions and cognitive development: evidence from rural China", *Chinese Journal of Sociology*, Vol. 3 No. 2, pp. 193-207.
- Zeng, J., Pang, X., Zhang, L., Medina, A. and Rozelle, S. (2014), "Gender inequality in education in China: a meta-regression analysis", *Contemporary Economic Policy*, Vol. 32 No. 2, pp. 474-491.
- Zhang, F., Zhang, Q., Xu, H., Zhang, Y., Li, L., Pan, H., Hu, X. and Ma, G. (2014), "Student's nutrition improvement plan on national rural compulsory education", *Chinese Journal of School Health*, Vol. 35 No. 3, pp. 418-420.
- Zhang, L., Huang, J. and Rozelle, S. (2002), "Employment, emerging labor markets, and the role of education in rural China", *China Economic Review*, Vol. 13 No. 2, pp. 313-328, available at: [https://doi.org/10.1016/S1043-951X\(02\)00075-5](https://doi.org/10.1016/S1043-951X(02)00075-5)
- Zhang, X. (2011), *China's Education Development and Policy, 1978-2008*, Vol. 9, BRILL, Leiden.
- Zhang, X.F. and Wang, H.Y. (2013), "Analysis of Chinese policies on financial investment in preschool education since 2010", *Early Childhood Education*, Vol. 9 No. 1, pp. 24-29.
- Zhang, Y., Zhou, P.R. and Zhang, Q.J. (2011), "From welfare to socialization: a review of early childhood care and educational policies in China", *China's Education Development and Policy*, 1978-2008, No. 9, pp. 61-110.
- Zhao, M. and Glewwe, P. (2010), "What determines basic school attainment in developing countries? Evidence from rural China", *Economics of Education Review*, Vol. 29 No. 3, pp. 451-460.
- Zhao, Q., Yu, X., Wang, X. and Glauben, T. (2014), "The impact of parental migration on children's school performance in rural China", *China Economic Review*, Vol. 31, pp. 43-54.
- Zhou, C., Sylvia, S., Zhang, L., Luo, R., Yi, H., Liu, C., Shi, Y., Loyalka, P., Chu, J., Medina, A. and Rozelle, S. (2015), "China's left-behind children: impact of parental migration on health, nutrition, and educational outcomes", *Health Affairs*, Vol. 34 No. 11, pp. 1964-1971.
- Zhou, H., Mo, D., Zhou, C., Medina, A., Zhang, L., Rozelle, S. and Shi, Y. (2016), "The gender gap among school children in poor rural areas of western China: evidence from a multi-province dataset", *International Journal for Equity in Health*, Vol. 15 No. 1, pp. 162-173.
- Zhou, H., Watanabe, C. and Ohtsuka, R. (2007), "Impacts of dietary intake and helminth infection on diversity in growth among schoolchildren in rural south China: a four-year longitudinal study", *American Journal of Human Biology*, Vol. 19 No. 1, pp. 96-106.

Further reading

- Ministry of Education (1981), *Kindergarten Education Program (Trial Draft)*, Vol. 12, People's Education Press, Beijing, p. 13.
- Ministry of Education (1995), "The State Planning Commission, The Ministry of Civil Affairs, The Ministry of Construction, The State Economic and Trade Commission, The National Federation of Trade Unions & the ACWF", The Opinions on Enterprises Running Kindergartens, available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/s3327/201001/xxgk_81988.html (accessed November 17, 2017).
- Ministry of Education (1996), "Working rules of kindergarten", available at: www.moe.edu.cn/srcsite/A02/s5911/moe_621/199603/t19960309_81893.html (accessed November 17, 2017).

- Ministry of Education (1997), "The opinions on developing the early childhood care and education in the ninth five-year period", available at: www.moe.edu.cn/srcsite/A06/s3327/199707/t19970717_81983.html (accessed November 17, 2017).
- Ministry of Education (2000a), "Education memorabilia from 1949 to 1959", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_163/200408/3444.html (accessed November 17, 2017).
- Ministry of Education (2000b), "Education memorabilia from 1960 to 1969", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_163/200408/3451.html (accessed November 17, 2017).
- Ministry of Education (2001a), "The guidelines on kindergarten education", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_309/200412/1506.html (accessed November 17, 2017).
- Ministry of Education (2001b), "The state council's decision on basic education reform and development", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_16/200105/132.html (accessed November 17, 2017).
- Ministry of Education (2003), "Education revitalization action plan 2003-2007", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_4/200501/5323.html (accessed November 17, 2017).
- Ministry of Education (2006), "Compulsory education law of the people's Republic of China", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_619/200606/15687.html (accessed November 17, 2017).
- Ministry of Education (2009), "Guidance on the performance appraisal of teachers of compulsory education", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/s7051/201412/xxgk_180682.html (accessed November 17, 2017).
- Ministry of Education. The Central Office (2003), "The State Planning Commission, the Ministry of Civil Affairs, the Ministry of Finance, the Ministry of Labor and Social Security, the Ministry of Construction, the Ministry of Health, the State Council Working Committee & the National Women's Federation", *The Guidelines on the Reform and Development of Early Childhood Care and Education*, available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_35/200303/61.html (accessed November 17, 2017).
- Ministry of Labor and Human Resources & National Education Commission (1987), "Full-time, boarding Kindergarten Preparation Standards (Trial)", available at: <https://wenku.baidu.com/view/554a0d6348d7c1c708a14536.html?from=search> (accessed November 17, 2017).
- National Education Commission (1988), "The opinions on strengthen the work of early childhood care and education", available at: http://development.yangtzeu.edu.cn/jyfg/jcyjgl/law_15_1269.htm (accessed November 17, 2017).
- The State Council (1985), "The decision of the central committee of CPC on reforms of education system", available at: http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_177/200407/2482.html (accessed November 17, 2017).
- The State Council (1989), "The regulations on kindergarten management", available at: www.gov.cn/fwxx/bw/jyb/content_2267003.htm (accessed November 17, 2017).

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