Development Challenges and Preschool Education in China

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Abstract

With its rising dependency ratio and aging population, many argued that China should pay more attention to preschool quality in order to lay a solid human capital foundation for its future development. Preschool access and preschool quality play crucial role in preschool education, which were the most concerned aspects of devlopment of preschool education. The overall purpose of this paper is to examine the trends of preschool education access and quality in China. We draw on a panel dataset of 31 provinces in China from 1974-2018, we depict the spatial-temporal variation of the preschool quality in China. The results show that China has experienced a great improvement in preschool education measured by preschool access and preschool quality, with huge urban-rural disparities. Surprisingly, compared with cities, township areas have better preschool teacher quality. Although the gross enrollment rate of preschool children in China is relatively high, the disparity showed between urban and rural areas. The critical problem of the improvement of preschool in China was the quality of preschool in rural China. The access and teacher quality in rural China still need to improve and the high burden of tuition and fees led to the low access to preschool for kids in rural China. The results imply that China still needs to improve the quality of preschool teachers, especially to optimize the allocation of teacher resources in preschool education among different regions.

Keywords: preschool education; preschool access; preschool teacher quality; tuition barriers

JEL Code: H75, I21, O15

Introduction

Many countries have started to improve the affordability, accessibility, and quality of preschool education. The 4.2 United Nations (UN) 2030 Agenda states that "by 2030 all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education" (UNESCO, 2019). The OECD countries have invested in preschool education to achieve this goal (OECD, 2020). However, despite tremendous efforts, problems of affordability, accessibility, and quality of preschool education persist (Li et al., 2017), which undermine the early stages of human capital accumulation.

The Chinese government has been improving quality of preschool education during the past four decades. Since 1949, almost all workplaces provide kindergartens and childcare for staffs (Wu et al., 2012). The 'reform and opening up' period also marked an new era of preschool education (Hong & Chen, 2017). From the 1980s to 2000s, there were increasing number of rules and regualtions aimed to develop and reform preschool education in China (Hong & Chen, 2017; Yue et al., 2018). More than nineteen rules, regulations, and guidelines were issued for children's development since 1985 (Wu et al., 2012). In the 2010s, the State Council of China issued the "Outline of the National Medium and Long-term Education Reform and Development Plan (2010-2020)", which aims to increase the accessibility, affordability, equity, and quality of preschool education. In particular, it emphasizes the development of rural preschool education (State Council of the People's Republic of China, 2010). Correspondingly, the provincial governments issued three-year action plans for preschool education. In addition, 50 billion yuan was allocated to make preschool education more affordable, particularly in the rural and western areas, during the 12th Five-Year Plan period. As a result, some western regions had achieved free preschool education in China (Wu et al., 2012).

Despite these achievements, varies challenges of preschool education persist until the current era of 'high-quality development' and 'rural revitalization', during which preschool education became increasingly demanded by early human capital accumulation. Studies of preschool education have started to illustrate and find challenges of preschool education in the current era, but there are no current studies analyze the pattern and challenges of the preschool education across all provinces and between urban and rural regions during the past 40 decades combine with fieldwork in China. There is also no studies compare the situation of China's preschool education with other countries in the current era of 'high-quality development' and

‘rural revitalization’. While some of the previous studies are ground-breaking in terms of measurement, they merely focus on macro data of one or two specific regions in China.

To fill this gap, we aim to contribute to our understanding of China’s preschool education. In this paper, we provide valuable experience to the field of study by analyzing both macro data from governmental and international statistics in the past four decades, and micro data from a fieldwork in rural Xiangxi, China. The analysis of macro data can help us understand the pattern of China’s preschool education in the past 4 decades across and within regions. Understanding past development and reform of preschool education is of great significance for China to improve pre-school education and consolidate the accumulation of human capital for high-quality development and rural revitalization. Moreover, studying the experience of China’s preschool education can also provide valuable experience to other countries.

To meet this goal, we organize the paper as follows. First, we review how previous research measure accessibility, affordability, and quality of preschool education in different countries. Then, we will discuss both international and Chinese macro data related to preschool education. In addition, we will show our data from our fieldwork survey 26 kindergartens in Xiangxi Tujia and Miao Autonomous Prefecture, Hunan Province, China to increase our understanding of current rural preschool education in China. Finally, we discuss the challenges and significance of increase the affordability, accessibility, and quality of preschool education in both China and worldwide. With these steps, we aim to provide suggestion for next stage of preschool education reform and development in ‘high-quality development’ and ‘rural revitalization’. More broadly, our work also connects with the same goal of other field of studies, such as neuroscience and cognitive science, which all emphasize the importance of increasing quality, accessibility, and affordability early childhood education and care.

Literature review

This section aims to reiterate the importance of accessibility, affordability, and quality of preschool education worldwide including China. To do so, this section first reviews how previous studies measure accessibility, affordability, sustainability, and quality of preschool education. Second, this section reviews development and reform policies of preschool education in China in the past four decades and the national context of them. Third, this section reviews the

development and challenges of preschool education in the past few decades in China and other countries, particularly Asian countries.

Measurement of accessibility

Accessibility refers to whether preschool education is accessible to all children at preschool age (Li et al., 2017). The data that measure accessibility usually comes from surveys conducted by Bureau of Statistics and MoE in each country. To measure accessibility of preschool education, previous studies have measured preschool attendance, enrollment rate, number of kindergartens per 1000-kilometer square, public and private kindergartens, and total number of kindergartens (Hong & Chen, 2017; Park et al., 2017). For example, within these surveys, respondents need to choose "usually attend", "did not attend", and "preschool enrollment" (Raban & Kilderry, 2017; Su et al., 2020).The number of kindergartens can be further measured by local and non-local schools including childcare centres, the occupancy rate that reflects the sufficiency of kindergarten places in the districts, and distribution of students by district (Izumi-Taylor & Ito, 2017; Lau, 2017; Yang et al., 2017). Geographic distance, commuting time, and transport to school are also important indexes to accessibility (Su et al., 2020; Zhou et al., 2020). Importantly, number of teachers can also represent accessibility of preschool education in terms of child-teacher ratio and classroom size (Hong & Chen, 2017; Khanal et al., 2017; Yang et al., 2017).

Measurement of school quality

This section reviews indexes that measure preschool education quality in previous studies in order to increase our understanding. The conceptual supply-and-demand framework by Liu et al. clarifies students' decision making processes of whether they enroll in high school (Liu et al., 2009). This framework was developed to specify different factors that contribute to the quality of education inputs, tuition or fees, and output in terms of enrolment rate, school completion rate, and test scores. The quality of education is influenced by school facilities, teachers and staffs, curriculum, peers, and tuition and other costs such as the opportunity cost (Liu et al., 2009). Importantly, they developed the framework in the context of high school education in China. So, the dimension that measure high school education quality of Liu et al.'s study can shed light on our current study of preschool education

$$\text{Educational output}_{\text{high school}} = f(\text{school quality}_{\text{high school}}; \text{teacher quality}_{\text{high school}}; \text{curriculum quality}_{\text{high school}}; \text{quality of the students who enter high school}_{\text{pre-high school}}; \text{tuition/fees}) \quad (1)$$

Assorting emphasizes both quality and quantity of hardware and software in preschools, such as teaching materials and tuition. Administration highlights teachers' qualification and certification. It is measured by teacher qualification and compensation and so on. All-inclusive requires fairness in admission without discriminations. So, inclusiveness is measured by educational compensation to disadvantaged groups.

Curriculum can also reflect the quality of preschool education. First, planned curriculum is learning objectives in terms of knowledge, skill, and grades, which set in curriculum plans and rubrics. Second, implemented curriculum is classroom teaching that aims to achieve planned curriculum. Classroom teaching is measured by interactions between children and teachers, including low frequency behaviors. For example, preschool children are observed by children's listening and verbal behaviors, interaction with other studentsfocus time, and involvement. Also, teachers are observed by listening and verbal behaviors, teacher tasks, level of instruction, and teachers' tone. Third, curriculum ideology is categorized by micro-level curricular orientation and pedagogical orientations, meso-level psychological foundation such as behaviorism and constructivism, and political, ethical, and cultural foundations, as well as macro-level philosophical foundations including perennialism and essentialism (Yang & Li, 2018).

Accountability is another important index of preschool quality, which means whether policies were accountable for the fiscal resources that aims to improve preschool education (Li et al., 2017). Accountability can be measured by staff-to-child ratios of different provinces and staff qualifications (including teacher) such as certificate and degree (Izumi-Taylor & Ito, 2017; Lau, 2017; Raban & Kilderry, 2017; Yang et al., 2017). Accountability can also be measuerd by governemt duties such as monitoring mechanisms, investment mechanism and financial budget and safeguard system, expansion of qualified and affordable facilities and kindergardens, teacher development and compensation, managaement system in terms of license, pricing, safety and healthcare, and quality intervention (Hong & Chen, 2017).

Measurement of teachers' quality

Teacher quality is one of the most important indexes of preschool education quality. Studies have observed pedagogical experiences such as teachers' efficacy, mental health, and the techniques they use. Teachers' self-efficacy is measured by instructional strategies and classroom management skills, which shows positive correlation with students' positive development (Hu et al., 2021). Su et al. (2021) observed classroom arrangement, space, equipment, furniture and learning materials such as books, writing utensils, and blocks. Education facilitates also reflect teachers' ability to engage student and fit preschool education with the goal of children and social development. For example, Bautista et al. (2018) studied arts-related pedagogical practices in Singapore kindergarten, which aims to examine how the preschool environment and pedagogical practices affects children's developmental outcomes such as readiness for primary school. They drew on the dataset of classroom observations by coding "Visual Arts 2D, Visual Arts 3D, Singing, Music Performance, Drama/Theatre, and Dance" in binary form and analyzing the descriptive statistics.

Teachers' mental health also contributes to the high quality of preschool education. For example, more frequent daily spiritual experiences were associated with a lower risk of depression, which could strengthen teachers' relationship with children and families and improve children's outcomes (Whitaker et al., 2021). By contrast, high anxiety and depression is detrimental to the quality of education in terms of lower job motivation and satisfaction (Peele & Wolf, 2021). Studies also assess the outcome of teacher mental health training program. For example, the program called *Roots of Resilience* that aims to improve mental health for teachers and improve outcomes of education shown that the mental health training can help to reduce children's negative engagement and achieve better academic achievements (Lipscomb et al., 2021).

Language as medium of instruction (MOI) is a pedagogical technique that is demanded by multi-language regions, such as the Spanish-English dual language speaking kids in the US (Luo et al., 2021; Zucker et al., 2021), Pakistani-speaking immigrants in Hong Kong (Chan & Li, 2020), Portuguese and Chinese and English as the MOI in Macau (Lau, 2017, pp. 114-115). Access to language can be measured by survey such as asking parents to tell their home language, migration status, as well as observe teachers' linguistic recasting of children's home language, adapting language to children's level, and frequency of emphasising, rephrasing, and repeating language (Janssen et al., 2021; Mathers, 2021). Language is important for kids at early

ages as it can contribute to kids' cognitive and socio-economic development when they grow up (Mathers, 2021; Rao et al., 2019). So, language abilities is an important part of evaluating teachers, especially in multi-cultural regions.

Measurement of sustainability

Sustainability examining whether policies can facilitate preschool education development in varies aspects in a long run. Sustanabiliy is measured by whether preschool education is child-oriented in recent studies (Raban & Kilderry, 2017; Yang et al., 2017); whether policies support women and promote them to work (Izumi-Taylor & Ito, 2017; Raban & Kilderry, 2017); whether the fiscal funding is sustanable in a long run (Hong & Chen, 2017; Jing, 2017; Lau, 2017; Leung & Chen, 2017; Raban & Kilderry, 2017; Yang et al., 2017); how much effort policies and government practices support disabled children (Everiss et al., 2017); teacher training (Li et al., 2017); curriculum innovation (Hong & Chen, 2017; Park et al., 2017; Yang et al., 2017); school management and whether opportunities to access is expanding (Park et al., 2017). In addition, it is reasonable to consider social justice contribute to preschool sustainability. As a moral standard, social justice in the context of preschool quality means that whether the resources are distributed fairly to individuals based on their needs. Social justice looks at whether polices consider equity, diversity, and biases in terms of gender, language, religion, and socioeconomic status (Li et al., 2017). Recently, scholars used inclusiveness to measure fairness in admission without discriminations. So, inclusiveness is measured by educational compensation to disadvantaged groups (Zhou et al., 2020).

Measurement of affordability

Affordability refers to parents' ability to pay the tuition and spend time with children on the one hand, and government subsidies to difficult families on the other hand. Affordability can be measured by both monetary form and symbolic form. Most studies collect data of tuition fees, government financial subsidies and family income and try to find their correlations and make comparasions (Hong & Chen, 2017; Izumi-Taylor & Ito, 2017; Jing, 2017; Lau, 2017; Leung & Chen, 2017; Raban & Kilderry, 2017; Yang et al., 2017). For example, a study measured preschool attendance and its correlations among family social economic status by China Family Panel Studies nationwide survey (Su et al., 2020). The allocation of financial resources that make

preschool education more affordable is measured by basic funding and focused founding for kindergartens and teachers' salaries (Zhou et al., 2020). The symbolic form of payment such as parents' will of spending time is also important (Roose & Bie, 2003).

Policies to develop and reform preschool education in China, the past four decades

Although there were preschool rules and regulations issued in around six decades since 1900, they were very few and were not fully implemented. Since New Culture Movement in 1915, Xingzhi Tao and some scholars came up with preschool curriculum movement to develop curriculum based on both Chinese and Western experience. Then after a decade, Ministry of Education of the Republic of China issued '*Kindergarten Curriculum Standards*' in 1932 and revised in 1936. However, the curriculum movement was ceased between 1966 and 1976 during Chinese Culture Revolution (Qi & Melhuish, 2017).

We collect the data from the late 1980s onwards because it was a new era of government oriented preschool practices began in the 'reform and opening up' policy period. It was also the first time that the quality and rural preschool education development were pointed out (Yue et al., 2018). During this period, China started to learn from Western preschool practices and announced policies more frequently and implemented them more thoroughly (Hong & Chen, 2017). Starting from the 1980s, the Chinese government issued rules and regulation on the role of preschool education. For example, there were decisions and opinions aimed to reform and strengthening preschool education, such as the 'Decision of the CPC Central Committee on Reform of Education System (1981)', 'The decisions on Education Reform (1985)', and 'The Opinions on Strengthening Preschool (1988)' (Yue et al., 2018). Also, the 'Kindergarten Work Regulations (Trial)'and the 'Regulations on the Management of Kindergartens' both set the role of preschool education to care for and educate children's redness for primary school (MOE 1989a, 1989b) emphasized the quality of preschool education. Importantly, for the first time, 'Several Opinions on the Development of Early Childhood Care and Education of Rural Areas (1983)' mentioned rural preschool education and care (Yue et al., 2018).

In the 1900s, the market economy system in China led to more private kindergartens but less public ones due to lack of operating funds (Yue et al., 2018). So, the Chinese government issued a series of policies to reform preschool education in the late 1990s and 2000s. In 1996, 'The Operational Regulations for Preschool' was issued and in 1997 the 'Opinions on

Development the Early Childhood Care and Education in the Ninth Five-Year Period' was issued. In 2001, MOE of China issued the 'Guidelines on Kindergarten Education (Trial basis)' to assist preschool progresses, and soon in 2003, 'The Guidelines on the Reform and Development of Early Childhood Care and Education' was announced. Importantly, with the emergence of media in the beginning of the 21st century, scholars and public opinion both pointed out the increasing demand of high-quality and affordable preschool centers despite all previous policies (Hong & Chen, 2017).

In the 2010s, Chinese government focus on increasing the affordability, accessibility, quality, and equity problems of preschool education across and within regions. Chinese State Council announced the 'National Medium and Long-term Education Reform and Development Plan (2010-2020)', which emphasized rural preschool improvement. correspondingly, 'The State Council's Several Opinions on the Current Development of ECE' was announced in 2010 (Hong & Chen, 2017). Following the call of the central government, the provincial government also responded by issuing the 'Three-Year Action Plan (2011-2013)' to implement national plan in provincial, regional, and local levels. Also, the Ministry of Finance (2011) published 'Issues on increasing financial investment and support in early childhood education development' to allocate more financial resources in preschool education. Then, in 2014, a second round of "Three-year Action Plans (2014–2016)" was announced to increase both quality and quantity of preschool centers, such as improving the management mechanism (MOE of China, 2014). As a result, although there was no nationwide free preschool education, Tibet and some prefectures in Sichuan and Yunnan provinces have achieved 15 years of free education. There are also classification and grading evaluation mechanisms and regulatory systems for the programs and teachers that increase accountability of preschool education (The Central People's Government of the People's Republic of China Xinhua News Agency, 2020). With all these policies, China aims to construct a harmonious society from preschool perspective.

Why we measure the accessibility, affordability, and quality of preschool education in China

Now, just like the previous periods, preschool education had tried to respond to China's national development such as the 'reform and opening' period. It is important to set a goal for China to continue improving preschool education in the current national goal of 'high-quality development' and 'rural revitalization'. In 2017, the 19th National Congress of China proposed

high-quality development, indicating that China's economy has shifted from a stage of rapid growth to a stage of high-quality development (The Central People's Government of the People's Republic of China, 2017). Recently in 2021, the Central Committee of the Communist Party of China and the State Council issued the 'Opinions on Comprehensively Promoting Rural Revitalization and Accelerating Agricultural and Rural Modernization'. It emphasizes that rural revitalization also needs to promote high-quality development, including increasing the supply of rural talents. Rural construction is one of the important parts of socialist modernization (The Central People's Government of the People's Republic of China, 2021).

Importantly, both national goals require human capital accumulation, and it is widely proved that the earlier investment in human capital, the more return individual and society and gain. The benefit of early accumulation in life-cycle has been shown by various fields of studies. Accumulation of human capital is a cumulative process, and preschool education is of great significance to human capital accumulation (World Bank, 2021). Investing in early childhood education can bring socio-economic benefit to individuals and the society. As Heckman Curve shows, the return of earlier investment is higher (Doyle et al., 2009; Heckman, 2000). At a macro level, earlier investment in preschool education can increase tax payers, reduce social problems such as crime, and reduce welfare spending for the government (Karoly et al., 2005). At a micro level, investing in preschool education can reduce intergenerational inequalities of social-economic status (Doyle et al., 2009). Neuroscience research also shows the importance of early education as human brain has higher plasticity to development at earlier ages in terms of neuro and synapses, phonology, language, and expression of genes. Cognitive science studies also show that preschool-age (0-5) is vital for cognitive development which contributes to education outcome in school ages (Doyle et al., 2009). A research by Heckman further shows that not only cognitive but also non-cognitive skills cultivated at earlier ages contribute to better academic and economic outcomes (Heckman & Raut, 2015). Therefore, it is important to solve the accessibility, affordability, and quality problems of preschool education to increase these benefits.

Thus, it is important to improve the quality of preschool education in China and solve the problems of accessibility and affordability within and across regions in the new era. In this study, we analyze the development of China's preschool education in the past four decades across provinces and urban and rural regions during each period of preschool policies. We collect data

to measure China's current situation of accessibility, affordability, and teachers' quality because these are the most common problems of preschool education that previous studies have found in the past few decades. Importantly, teachers' mental health, skills of manage classes are also important to quality of preschool education. Also, teachers' quality contributes to the social justice, inclusivity, academic and mental outcome, and sustainability of preschool education (2021; Li & Deng, 2016; Lipscomb et al., 2021; Mathers, 2021; Peele & Wolf, 2021; Whitaker et al., 2021). It is also worth to note that although kindergarten evaluation mechanism varies across countries, teachers' quality is measured by all accessibility, affordability, school quality and sustainability factors of preschool education (Jing, 2017; Park et al., 2017; Yang et al., 2017). So, noticing the importance of teacher quality, we measure quality of preschool teacher in China by titles and education attainment of teachers across provinces and urban and rural regions nationwide.

With these analyses, we aim to provide suggestion for next stage of preschool education reform and development in 'high-quality development' and 'rural revitalization'. More broadly, we also want to contribute to the discussion of preschool education worldwide. Preschool quality, affordability, and accessibility has been a challenge worldwide. Although there were tremendous fiscal investment, enforcement of policies, and implementation of quality rating systems, the problem of sustainable access, financial assistances, and teachers' quality persist (Bautista et al., 2018; Hu & Li, 2012; Li et al., 2017; Lipscomb et al., 2021; Mathers, 2021; Peele & Wolf, 2021; Su et al., 2021; Tang et al., 2021; Whitaker et al., 2021; Yang & Li, 2018; Yang et al., 2017; Zhou et al., 2020; Zucker et al., 2021). Finally, our study aims to advocate for improving teacher quality, affordability, and accessibility on both supply and demand sides of preschool education.

Data and measurement

The goal of this section is to increase our understanding of the situation of China's preschool education across provinces and urban and rural regions of preschool education in China in the past four decades and compare China's preschool education with other countries around that world. We mainly use two types of data sources, including macro data from institutional official statistics and micro data from our fieldwork in rural Xiangxi, China.

First, from the “China Population and Employment Statistics Yearbook” (1991-2018) published by the National Bureau of Statistics of China, we obtained the composition of children aged from 3 to 5 in China from 1991 to 2018 divided by urban and rural areas and all provinces. Second, from the “China Education Statistics Yearbook” (1991-2018) published by the MOE of China, we obtained data across provinces and urban and rural China in terms of the number of children in kindergartens in China, the number of kindergartens, the number of kindergarten teachers, the educational attainment of kindergarten teachers, and kindergarten teachers’ professional title structure (2003-2018). Above data sources also helps us calculated the the number of kindergartens per thousand school-age children in China from 2003 to 2018. In addition, through the “Statistical Yearbook of Educational Expenditure in China” (1995-2018) issued by the MOE of China, we have obtained China's national education expenditures (1995-2018), China’s pre-school education expenditures, and education expenditures per Chinese student per education stage. To do international comparasion in terms of gross enrollment rate, child-teacher ratio, and education expenditure per child as a percentage of national GDP, we compared China’s data with other countries in Organization for Economic Co-operation and Development (OECD), G20 from previous studies and database such as the UNESCO database (1974-1999) and OECD education indicators.

In addition to these official statistics, we aim to illustrate the challenges of affordability, accessibility, and quality of preschool education in rural area by a fieldwork in Xiangxi Tujia and Miao Autonomous Prefecture, Hunan Province, China in 2018. We conducted fieldwork in 26 kindergartens in Xiangxi Tujia and Miao Autonomous Prefecture, Hunan Province, China in 2018. We got first-hand data from a questionnaire survey of 1,334 caregivers of children aged 3-5 years, 26 principals, and 142 teachers. These first-hand data provide information of the preschool education expenditure required of students and their families, disposable income of these families, and the structure of kindergarten teachers’ academic attainment and teachers’ professional titles in rural Xiangxi, China in 2018.

Accessibility of preschool education in China

To measure the need of access to preschool education, we investigated the composition of children aged 3 to 5 years old, gross enrollment rate (1974-2018) and number of preschools per thousand population of age three to five (1991-2018) across urban, rural, and provinces.

Our data of the national, urban, county, and rural composition of preschool children aged 3-5 from 1991 to 2018 shows that the size of rural 3-5 years old children in China was shrinking. While the total number of rural children and the total number of children nationwide was decreasing, the number of children in urban and county area has increased. However, the size of rural children aged 3-5 remains bigger than children in urban and county areas. Overall, the composition of the 3-5-year-old children in rural areas decreased from 79.77% in 1991 but remains high at 42.25% in 2018, while children live in urban area was increased from 13.54% in 1991 to 30.9% in 2018, and children in county increased from 6.7% to 26.85% between 1991 and 2018. Thus, it is reasonable to say that children in rural and county areas still needs more preschool resources.

Also, table 2 shows that the gross enrollment rate in China has been growing from 1974 to 2019, rising from 2.3% in 1974 to 83.4% in 2019, but the gap between urban and rural areas has widened. The gross enrollment rate of preschool education in China is calculated as follows:

$$\text{Gross enrollment rate} = \frac{\text{number of children in the kindergarten}}{\text{number of preschool age children aged } 3-5} \qquad (2)$$

The gross enrollment rate in urban areas increased from 32.9% in 2003 to 112.3% in 2018. However, the gross enrollment rate in rural areas has only increased from 15.26% in 2003 to 49.15% in 2018. As table 2 shows, the enrollment rate is higher in urban areas than the rural areas. Importantly, comparing the composition of children aged 3 to 5 with growth enrollment rate, we find that although the children aged three to five is higher in rural than in urban areas, the gross enrolment rate is much higher in urban area than in rural area. For example, in 2018, there are 30.9% children has urban hukou and 42.2% children has rural hukou. However, the gross enrollment rate is 112.3% in urban area but only 49.1% in rural area. Interestingly, due to Hukou and some children outside of 3-5 age group enrolled in kindergartens, the gross enrollment rate can exceed a hundred percent as Figure 1 shows.

The number of kindergartens per thousand population of children aged 3-5 from 2000 to 2019 can help us understand the trend of accessibility of preschool education in China:

$$\text{Number of kindergartens per 1000 people} = \frac{\text{number of children aged } 3-5}{\text{number of kindergartens}} * 1000 \qquad (3)$$

The compound annual growth rate (CAGR) measures the mean annual growth rate of an investment over a given period of time. The CAGR of kindergartens per thousand population of age 3-5 is measured by:

$$\text{CAGR} = [\left(\frac{\text{Ending year}}{\text{Beginning year}}\right)^{\frac{1}{\text{Number of years}}} - 1] \times 100\% \quad (4)$$

As table 5 shows, the number of kindergartens per thousand people of the population (3-5 years old) in China has grown from 1987 to 2018, with the CAGR 2.0%. The most rapid growth was during 2016-2018 (5.1%). Meanwhile, the CAGR in rural areas was 8.9% compared to 3.7% in urban area. According to Table 1 (15), this progress reflects a success of implementation of policies that targeted at rural area have worked, particularly 'Three Year Action Plan for Preschool Education'.

Finally, the progress at international level reinforced our conclusion that the policies in 2010s (Table1 (11)-(15)) have contributed in improving accessibility of preschool education. We compared the kindergarten gross enrollment rate in China with other OECD and G20 countries in 2005, 2010, and 2018. These countries all joined in OECD institution to improve education by better policies, and China joined OECD in 2015. As Table 3 shows, the gap of gross enrollment rate between China and OECD average and EU23 average was decreasing. By 2018, China's gross enrollment rate at kindergarten level (81.7%) was only 5.9% less than OECD average and 9.3% less than EU23 average, compared to 24.1% less than OECD average and 27.1% less than EU23 average in 2010. Thus, the progress at international level reinforced our conclusion that the policies in 2010s, such as the 'National Medium and Long-term Education Reform and Development Plan (2010-2020)' have contributed to improving accessibility of preschool education. Some polices prior to 2010s might also contributed to this progress because they took a longer period to show effects.

Preschool quality

Research shows that greater teacher-students interaction benefit preschool quality (Hu et al., 2021; Pentimonti et al., 2021). Smaller student-to-teacher ratio means that every teacher can focus on less children and increase classroom quality (OECD, 2020). The student-to-teacher ratio is calculated by:

$$\text{Student-to-teacher ratio} = \frac{\text{number of students in kndergartens}}{\text{umber of teachers in kndergartens}} \quad (5)$$

The student-to-teacher ratio from 1990 to 2018 across urban and rural areas and the change of the student-to-teacher ratio from 2003 to 2018 by provinces shows the increasing supply of the quantity of teachers nationwide. As table 6 and 7 shows, the overall student-teacher ratio of China decreased from 18.7 in 1990 to 10.3 in 2018, and the CAGR of student-to-teacher ratio of China is -2.1%. The CAGR of urban China is -0.7% from 1990 to 2018, compared to the CAGR of rural China -2.2%. This change means that more teachers are available to students in kindergartens nationwide and especially in rural areas. Importantly, from 2011 to 2018, China has seen a great increase of teacher quantity. Since the 'National Plans for Medium- and Long-Term Education Reform and Development (2010–2020)' and the 'Three-year action plans' from 2011 to 2016 emphasized urban-rural disparity, we see the great decrease of student-to-teacher ratio in rural area. It is important to notice that the CAGR shows the biggest decrease was in 1996-1997, which partly attributed to the policy 'The Operational Regulations for Preschool' that solve the problem of unregulated private kindergarten market from 1990s. However, since the 1996 statistical yearbook did not disclose how many children in county and there was a change in statistics measurement, we still consider the great progress of quantity of kindergarten teachers in 2010s.

Despite the progress of decreased student-to teacher ratio between urban and rural areas and provinces, the gap persists, and the sustainability of more teachers became a problem. As Figure 5 shows, across regions, the student-to-teacher ratio across urban-rural areas and provinces shows that teachers are more concentrated in urban areas and east coast regions. By 2018, the student-to-full time teacher ratio was 14.41 in urban areas, but it was 26.07 in rural areas. Also, Figure 5 shows that the east coast regions have lower student-to-teacher ratio compared to northwestern regions from 2003 to 2018. Within each province, we can see that almost all provinces had gained a better preschool quality. However, the student-to-teacher ratio fluctuated decreasing in Fujian, Xinjiang, and Tibet. Also, the ratio is fluctuated in Liaoning, Neimenggu, Heilongjiang, Shanxi, and Hubei. Thus, we can say that the 'Three-year action plan' and preschool related policies helped to increase the supply of teacher in rural and western areas of China, but further policy are required to continue the progress.

Teachers' Quality

The Our study measures the spatial differences of teachers' quality by both macro data from China's official statistics and micro data from our fieldwork in Xiangxi, China. The macro data include teachers' academic attainment and teachers' title structures across provinces, urban and rural regions from 2003 to 2018. In addition, we got the micro data in terms of composition of teachers' title and academic attainment of preschool education from Rural Xiangxi, China.

Preschool teacher across rural, urban, and different provinces in China tended to gain higher degree and professional titles. With the enforcement of 'National Plans for Medium- and Long-Term Education Reform and Development (2010–2020)' and the 'Three-year action plans' from 2011 to 2016, preschool teachers with high school and below degree decreased from 68.8% in 2001 to 18.1% in 2018. By contrast, preschool teachers with a polytechnic and bachelor and above degree both increased more than 20% from 2001 to 2018. However, while all teachers have higher level of education, the disparity across provinces and regions persist. As table 10 shows, the academic attainment of kindergarten teachers is mainly associate college and high school below nationwide, and teachers in rural kindergartens have even lower degree, teachers with master and above is ten times more in urban than in rural areas.

Teachers with university and above degree are mainly located in the economically developed areas of the Yangtze River Delta, Pearl River Delta and Beijing-Tianjin-Hebei. By contrast, the academic attainment of teachers in the central and northwest areas are below average. We use the Index $_{\text{teachers attained bachelor and above}}$ to show the disparity across provinces. It is calculated by:

$$\text{Index}_{\text{teachers with bachelor and above degree}} = \text{proportion of teachers achieved bachelor and above degree in the region / proportion of teachers with the first and senior titles in the country} \quad (6)$$

The result shows that teachers' academic achievement is higher than the national average in Tibet, Xinjiang, Qinghai, Gansu, Mongolia, Jilin, and Liaoning in 2018. Thus, it is reasonable to believe that this phenomenon was result from the enforcement of the 'Three Year Action Plans'.

Similar to teachers' education attainment, we also use teachers' professional title across national, urban, and rural area measure teachers' quality in China. There are four types of titles for kindergarten teachers: senior titles, first-level titles, second-level titles, and senior titles for

elementary and middle schools. Primary titles include first- second- and third- level preschool teachers. Teachers who graduated from vocational secondary school can be second-level preschool teachers, and undergraduates can be first-level preschool teachers. Mid-level titled teachers include senior preschool teachers. Senior titles include elementary and middle school senior. Cross-level assessment requires a certain number of years of work.

From table 11, we can see that preschool teacher with all titles have increased, however, teachers with no title increased the most, from 302.2 thousand in 2001 to 2143.6 thousand in 2018, which increased around 7 times. In comparison, the total number of primary-level titled teachers only increased two times more. Although the number of mid-level titled preschool teachers increased ten times and there is only a small gap between urban and rural areas, only 1% proportion of preschool teachers are mid-level preschool teachers nationwide by 2018. The small gap between urban and rural areas can be attributed to the enforcement of government policies since 2011. Importantly, from 2001 to 2018, most preschool teachers do not have title. Although the total number of teachers has been increased dramatically, the composition of teachers without any title also increased almost a quarter.

In addition, we also use the index of the ratio of first-level and senior preschool teachers in one province to all first-level and senior preschool teachers across provinces investigate the progress across provinces. It is important to note that there is no requirement that higher title teachers are better. Since the amount of mid-level titled preschool teachers only has a small amount, to show regional difference, we combine first-level and senior preschool teachers. When the index>1, it means that teachers' title is higher than the national average. Similar to teachers' academic qualifications, we measure the teachers's title structure nationwide by:

$$\text{Index}_{\text{first-level and senior teachers}} = \frac{\text{composition of first-level and senior preschool teachers in the province}}{\text{composition of teachers with the first and senior titles in China}} \quad (7)$$

Although the difference across provinces in teachers' title is reduced in time (from 2003 to 2018) and space (inter-regional, intra-regional), differences across regions and provinces still exist. Areas with more first-level teachers and senior teachers are also concentrated in more developed areas such as Beijing, Tianjin, Hebei, and the Yangtze River Delta. By contrast, the index that teachers with a first-level or senior title is lower than the national average in the central, southwest, and southern coastal areas. Importantly, in remote areas such as Tibet, Gansu,

Mongolia, Heilongjiang, Jilin, and Liaoning, the amount of first-level and senior teachers is higher than the national average due to due to the enforcement of the Action Plan for Three-Year Preschool Education policies. So, similar to the condition of teachers' academic attainment structure nationwide, the teachers' title also shows disparity across urban and rural area and across provinces, although there are more first level and senior teachers nationwide.

Preschool education expenditure

The fiscal expenditure for preschool education per children from 1977 to 2018 and the increased percentage of preschool education expenditure in the total education expenditure both show the financial support from the Chinese government in the past 2 decades. The education expenditure per kid is measured by the following formula:

Education expenditure per kid = expenditure for preschool education / number of children age 3-5 (8)

As table 12 shows, the financial investment in pre-school education had been increasing since 1997, from 663.5 yuan in 1997 to 10648.6 yuan in 2018, an increase of 23 times; meanwhile, preschool education expenditure in rural areas increased from 2439.7 yuan in 2011 to 7468.4 yuan in 2018, which increased 2.1 times. The proportion of pre-school education fiscal expenditures in total education expenditures has also increased from 1.4% in 1997 to 8.1% in 2018. However, in 2018, the financial input of education expenditure per student at each education stage still shows that the education expenditure per student for preschool education is the lowest at all stages (10,649 yuan), which is only 31.8% of all education stages.

Teachers' quality and challenge of affordability in rural Xiangxi families

Our fieldwork in rural Xiangxi shows that the affordability of preschool education is still a challenge because the cost for the caregivers still account for higher than China's average percentage of per capita annual disposable income. As table 14 shows, the tuition is 3368 yuan, which is 36.6% of the per capita disposable income of rural areas in western Hunan and 23% of the national rural per capita disposable income. In addition, other costs involved in kindergarten education include transportation expenses (1200 yuan, accounting for 13.1%), renting expenses (1989 yuan, accounting for 21.7%) and the cost of attending a caregiver (2600 yuan, accounting for 283.1%). Thus, the cost of going to kindergartens in China is still a challenge for rural Xiangxi family.

We also investigated teachers' quality in terms of teachers' professional title and teachers' academic attainment composition. As the table 15 and 16 shows, 95.77% teachers have no title. Two of 142 preschool teachers in rural Xiangxi, China has a mid-level title. In addition, 6% of teachers have an undergraduate degree and no teachers hold a graduate degree. 94% preschool teachers in rural Xiangxi hold a degree below polytechnic.

Conclusion

In this paper, we have discussed the current affordability, accessibility, and teachers' quality in China in the past four decades. The three different stages of preschool education are divided by policies. The foundation period from 1980 to 2000 set the role of preschool education in China. The legislations and policies show the importance of having preschool education. Then, the consolidation period from 2000 to 2010 had more policies to set a foundation for future development. Until now, the third stage from 2011 to 2018 aims to reduce inequality and reduce the affordability and accessibility burden for preschool education for families in China, it also aims to improve the quality of preschool education. However, after four decades of effort, although preschool education has made great progress in the past four decades, the gap and sustainability of quality preschool education across regions and urban and rural areas persist.

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Table 1: Composition of children aged 3 to 5 years old in China, 1991-2018

Year	China (million)	of which (%):		
		Urban	County	Rural
1991	72.0	13.5	6.7	79.8
1992	75.1	17.8	4.9	77.4
1993	72.5	17.7	6.5	75.8
1994	71.8	13.3	5.0	81.7
1995	66.5	15.2	5.6	79.2
1996	56.2	23.0	N/A	77.0
1997	52.0	17.5	7.5	75.0
1998	49.3	17.8	9.2	73.0
1999	47.1	17.3	9.5	73.3
2000	46.6	18.0	12.9	69.1
2001	46.1	19.4	13.0	67.6
2002	43.3	21.0	12.3	66.7
2003	42.5	21.1	15.4	63.6
2004	40.9	20.8	15.7	63.5
2005	43.3	22.1	17.1	60.8
2006	41.0	18.3	18.9	62.8
2007	41.0	18.1	19.7	62.3
2008	41.0	17.9	20.8	61.3
2009	43.2	18.4	21.6	60.0
2010	45.2	22.0	19.9	58.1
2011	47.8	21.8	22.3	55.9
2012	49.2	23.3	22.8	53.9
2013	50.0	24.3	23.0	52.7
2014	49.0	25.1	23.4	51.5
2015	49.9	26.4	25.0	48.6
2016	50.4	29.2	24.2	46.5
2017	51.5	29.4	25.7	44.9
2018	48.3	30.9	26.9	42.2

Source: National Bureau of Statistics of China (1991-2018)

Note: table 1 does not distinguish the urban and county children aged 3-5 in 1996 because 1996 statistical yearbook did not disclose how many children there were in urban areas and county. The number of children aged three to five in 1996 includes both urban and county children.

Table 2: Gross enrollment rate at the preschool level in China (%), 1974-2019

Year	China	Urban China	Rural China
1974	2.3	N/A	N/A
1975	2.4	N/A	N/A
1976	5.7	N/A	N/A
1977	13.0	N/A	N/A
1978	8.6	N/A	N/A
1979	7.9	N/A	N/A
1980	9.1	N/A	N/A
1981	12.4	N/A	N/A
1982	12.0	N/A	N/A
1983	13.4	N/A	N/A
1984	14.5	N/A	N/A
1985	16.9	N/A	N/A
1986	19.5	N/A	N/A
1987	21.0	N/A	N/A
1988	22.4	N/A	N/A
1989	21.9	N/A	N/A
1990	20.9	N/A	N/A
1991	21.5	N/A	N/A
1992	22.7	N/A	N/A
1993	23.5	N/A	N/A
1994	23.6	N/A	N/A
1995	24.6	N/A	N/A
1996	26.0	N/A	N/A
1997	27.5	N/A	N/A
1998	40.8	N/A	N/A
1999	44.9	N/A	N/A
2000	35.0	N/A	N/A
2001	35.4	N/A	N/A
2002	36.8	N/A	N/A
2003	37.4	32.9	15.3
2004	40.8	37.9	18.5
2005	41.4	35.5	20.4
2006	42.5	43.4	22.6
2007	44.6	48.7	23.4
2008	47.3	54.0	25.7
2009	50.9	53.9	26.9
2010	56.6	49.6	29.1
2011	62.3	97.8	31.4
2012	64.5	98.2	33.6
2013	67.5	98.8	35.6

2014	70.5	105.1	38.1
2015	75.0	104.8	40.8
2016	77.4	101.0	42.6
2017	79.6	106.0	44.3
2018	81.7	112.3	49.1
2019	83.4	N/A	N/A
2020	85.2	N/A	N/A

Source: The gross enrollment rate (1974-1999) is collected from UNESCO database. The gross enrollment rate of China (2000-2019) comes from MOE of China. The urban and rural gross enrollment rate (2003-2018) is calculated by the number of children in kindergartens from the MOE of China (2003-2018) and the number of children aged 3-5 from the National Bureau of Statistics of China (2003-2018).

Table 3: Gross enrollment rate in OECD countries and China, 2005, 2010, 2018

Countries	2005	2010	2018
France	100.0	100.0	100.0
Ireland	N/A	N/A	100.0
Israel	N/A	N/A	100.0
United Kingdom	N/A	N/A	100.0
Denmark	N/A	96.9	99.5
Belgium	N/A	N/A	98.5
Spain	97.6	97.1	97.5
Iceland	95.3	95.6	97.1
Norway	87.7	96.2	97.0
Korea	N/A	84.6	94.5
Germany	87.6	94.2	94.2
Sweden	N/A	N/A	93.8
Italy	100.0	97.6	93.6
New Zealand	95.7	97.5	93.0
Latvia	77.4	82.1	93.0
Hungary	86.8	86.7	92.2
Japan	87.5	90.3	91.8
Estonia	83.8	88.9	91.2
Slovenia	75.5	85.8	91.1
Portugal	77.5	86.8	91.0
Austria	75.8	84.0	89.7
Netherlands	N/A	94.3	89.4
Luxembourg	84.1	87.3	87.2
Czech Republic	84.7	79.0	86.7
Lithuania	58.7	72.3	86.2
Poland	38.3	59.6	84.6
Brazil	N/A	N/A	84.6
Australia	N/A	N/A	84.2
Russian Federation	37.1	73.0	83.0
Mexico	63.6	77.7	82.5
Finland	68.1	72.6	82.3
Chile	N/A	72.5	79.0
Slovak Republic	73.3	71.2	77.6
Argentina	N/A	N/A	76.5
Colombia	N/A	N/A	70.3
Indonesia	N/A	N/A	69.3
United States	66.3	65.8	66.0
Costa Rica	N/A	N/A	59.8

Switzerland	46.8	46.8	49.6
Turkey	13.4	27.0	42.8
Saudi Arabia	N/A	N/A	21.0
EU23 average	**N/A**	**83.7**	**91.0**
OECD average	**74.8**	**80.7**	**87.6**
China	**41.4**	**56.6**	**81.7**

Source: Education at a Glance 2020: OECD Indicators, Table B2.2. The gross enrollment rate of China (2000-2019) comes from MOE of China.

Table 4: Number of kindergartens per 1000 children aged 3-5 years old, 1987-2018

Year	China	Urban	County	Rural
1987	3.0	3.0	1.8	3.3
1989	2.7	4.2	5.6	2.3
1991	2.3	3.0	5.0	1.9
1992	2.3	2.3	7.3	2.0
1993	2.3	2.5	6.1	1.9
1994	2.4	3.7	9.9	1.8
1995	2.7	3.7	9.8	2.0
1996	3.3	2.8	N/A	2.6
1997	3.5	3.9	10.1	2.8
1998	3.7	4.1	9.1	2.9
1999	3.8	4.6	9.4	2.9
2000	3.8	4.4	7.5	2.9
2001	2.4	3.1	5.1	1.7
2002	2.6	3.2	6.3	1.7
2003	2.7	3.5	5.2	1.9
2004	2.9	3.9	4.8	2.1
2005	2.9	3.5	4.2	2.3
2006	3.2	4.2	4.4	2.5
2007	3.2	4.5	4.3	2.4
2008	3.3	4.5	4.3	2.6
2009	3.2	4.2	4.1	2.6
2010	3.3	3.6	4.8	2.7
2011	3.5	5.1	5.1	2.2
2012	3.7	5.0	5.4	2.4
2013	4.0	5.0	5.9	2.7
2014	4.3	5.4	6.2	2.9
2015	4.5	5.2	6.2	3.2
2016	4.8	5.0	6.7	3.6
2017	5.0	5.2	6.5	3.9
2018	5.5	5.6	6.9	4.6

Source: Educational Statistics Yearbook of China (1991-2018).

Note: there was adjustment of the statistical caliber which led to the cliff fall from 2000 to 2011, especially at county level. Table 3 does not distinguish the urban and county children aged 3-5 in 1996 because 1996 statistical yearbook did not disclose how many children in county.

Table 5: CAGR (%) of the number of kindergartens per 1000 children aged 3-5, 1987-2018

CAGR	China	Urban	County	Rural
1987-2018	2.0	2.0	4.3	1.1
1989-1996	2.8	-5.1	N/A	1.5
1996-1997	2.6	18.9	N/A	16.4
1997-2001	-7.2	-4.6	-12.5	-9.2
2001-2003	3.9	3.8	1.0	3.5
2003-2010	2.5	0.2	-1.1	4.8
2010-2013	4.5	8.8	5.2	-0.7
2013-2016	4.6	0.0	3.3	7.8
2016-2018	5.1	3.7	0.9	8.9

Source: Educational Statistics Yearbook of China (1991-2018).

Table 6: Student-to-teacher Ratio in China, 1990-2018

Year	China	Urban	County	Rural
1990	18.7	9.7	17.5	29.4
1991	20.8	10.5	19.4	32.7
1992	23.1	10.6	20.1	34.7
1993	23.3	11.4	21.4	35.3
1994	22.9	11.3	21.7	35.7
1995	23.4	11.7	21.7	36.3
1996	22.7	11.3	21.5	35.3
1997	21.5	11.1	20.3	32.9
1998	20.8	11.3	19.7	31.3
1999	20.1	11.2	19.2	30.3
2000	19.6	11.3	18.8	29.8
2001	23.5	11.0	19.1	61.3
2002	22.5	11.0	18.8	59.8
2003	20.6	10.8	17.6	52.1
2004	19.9	10.5	17.5	46.7
2005	20.8	10.8	19.2	47.6
2006	18.3	9.6	17.1	37.1
2007	17.8	9.7	17.2	36.5
2008	17.3	9.5	16.9	33.8
2009	16.9	9.5	16.7	31.8
2010	16.1	9.5	16.3	28.1
2011	15.5	9.8	18.0	30.5
2012	14.8	9.6	17.1	27.8
2013	13.8	9.3	15.6	24.3
2014	12.9	8.9	14.6	22.0
2015	12.2	8.7	13.6	19.8
2016	11.6	8.5	12.8	18.2
2017	11.0	8.2	12.2	16.7
2018	10.3	7.9	11.4	15.3

Source: number of children and teachers comes from the Educational Statistics Yearbook of China (1990-2018)

Note: In 2001, due to changes in the statistical standards, there was a dramatic increase of rural student-to-teacher ratio in 2000-2001. The number of full-time teachers in the country was 300 thousand, which was less than the number in 2000 (220,000+ in rural areas and 70,000+ in towns), and the number of children in kindergartens was 2 million, which was less than that in 2000 (1.1 million + in rural areas, 660,000 + in towns, and 400,000 + in urban areas).

Table 7: CAGR of student-to-teacher ratio, 1987-2018

Periods	China	Urban	County	Rural
1990-2018	-2.1	-0.7	-1.5	-2.2
1990-1996	2.8	2.2	3.0	2.7
1996-1997	-10.6	-2.4	-11.2	-13.5
1997-2001	1.8	-0.2	-1.2	13.3
2001-2003	-4.3	-0.6	-2.6	-5.3
2003-2010	-3.0	-1.6	-1.0	-7.4
2010-2013	-3.8	-0.5	-1.0	-3.6
2013-2016	-4.3	-2.1	-4.8	-6.9
2016-2018	-3.9	-2.5	-3.8	-5.7

Source: number of children and teachers comes from the Educational Statistics Yearbook of China (1990-2018)

Table 8: Student-to teacher ratio across provinces (2003-2018)

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
China	20.6	19.9	20.8	18.3	17.8	17.3	16.9	16.1	15.5	14.8	13.8	12.9	12.2	11.6	11.0	10.3
Beijing	15.3	14.5	13.7	12.6	12.6	12.5	12.5	12.8	12.9	11.5	12.1	11.5	11.6	11.6	11.8	11.6
Liaoning	27.1	25.0	24.0	24.0	23.3	22.0	21.7	18.4	21.3	17.6	17.5	15.9	15.0	13.8	13.7	12.6
Tianjin	20.5	20.4	20.4	21.2	20.7	20.3	20.5	20.1	21.5	18.6	19.0	18.3	17.0	16.4	15.6	13.4
Shanghai	16.9	17.0	16.8	16.0	15.5	15.2	15.0	15.0	15.2	14.6	15.2	14.4	14.6	14.5	14.3	13.8
Neimenggu	29.9	28.4	26.9	24.0	22.5	21.9	21.7	21.0	20.6	17.2	18.0	16.8	15.9	15.3	14.9	13.9
Jilin	25.6	25.7	21.7	23.6	22.3	21.4	21.9	20.2	20.6	17.4	17.7	16.9	16.3	15.6	15.2	14.7
Heilongjiang	29.3	30.3	26.0	26.0	26.2	25.4	25.3	28.0	24.7	20.1	18.8	17.4	16.5	15.5	15.7	14.9
Zhejiang	21.8	21.8	21.1	20.7	20.2	20.0	19.1	19.2	18.7	17.1	16.9	16.5	16.3	16.0	15.7	14.9
Shaanxi	18.3	33.3	30.3	27.3	25.8	23.7	23.4	22.0	24.5	20.4	22.1	19.5	18.5	17.1	16.1	15.2
Guangdong	25.9	24.8	23.3	22.3	21.3	20.8	20.4	20.3	20.6	17.6	18.8	17.7	16.7	16.4	15.7	15.3
Shandong	25.0	24.4	23.6	23.8	23.4	22.9	22.3	22.2	21.5	19.0	19.8	18.6	17.6	16.8	15.9	16.2
Jiangsu	27.1	27.3	26.9	26.8	28.3	27.0	27.0	25.4	24.3	20.6	21.7	20.2	19.4	18.7	17.7	16.9
Hainan	26.3	26.2	24.8	24.2	23.0	23.8	25.2	24.5	24.7	20.6	22.8	21.0	19.9	19.1	18.2	17.0
Shanxi	34.1	31.5	29.5	26.5	25.3	24.2	24.6	24.9	24.6	22.1	23.0	21.8	20.4	19.4	18.8	17.4
Guizhou	70.9	69.1	69.0	68.4	64.9	61.0	57.0	52.6	48.4	28.7	31.5	27.8	23.4	19.7	18.4	17.7
Jiangxi	35.9	36.1	34.6	33.3	32.5	30.4	28.4	28.5	27.5	24.7	25.4	23.7	22.7	21.1	19.7	18.1
Fujian	25.5	25.9	26.5	27.4	27.5	29.4	29.3	30.0	24.8	21.5	22.0	20.7	20.2	19.7	19.4	18.5
Qinghai	40.6	39.6	37.3	36.9	35.8	35.2	32.3	31.6	33.1	32.8	35.7	33.2	27.7	19.7	19.4	18.7
Hebei	42.7	47.1	43.0	36.7	33.8	32.6	32.3	31.3	31.0	25.8	28.0	25.9	23.6	22.0	20.7	19.0
Hubei	33.6	30.6	29.7	29.9	29.5	29.9	30.3	29.1	30.7	23.5	25.5	24.4	23.6	21.8	20.8	19.3
Ningxia	42.3	38.3	37.6	34.1	34.2	32.7	29.9	29.9	28.2	24.2	25.5	23.4	22.9	21.8	20.2	19.8
Chongqing	47.2	44.1	40.6	39.0	37.5	37.0	38.1	35.5	37.0	29.6	29.6	27.2	24.8	22.7	21.6	20.1
Gansu	38.7	35.3	34.2	31.3	30.2	29.7	29.0	28.3	28.8	23.3	26.7	23.8	23.1	22.6	21.1	20.3
Henan	56.9	48.2	42.2	37.9	35.4	32.0	29.4	27.3	30.2	24.7	26.8	25.9	23.8	22.9	21.5	20.4
Hunan	51.9	47.2	41.7	38.8	35.9	33.8	32.4	29.6	29.0	24.8	26.9	26.1	25.2	23.7	22.2	20.7
Sichuan	49.2	44.9	41.7	41.6	39.7	38.2	37.8	36.4	36.7	28.4	29.9	27.9	25.6	24.6	22.4	21.2
Yunnan	46.2	44.4	43.0	42.0	40.6	38.6	36.4	33.8	33.2	28.0	29.7	27.9	26.4	24.5	23.7	21.8
Xizang	20.2	23.8	25.4	24.5	21.6	19.4	18.9	22.5	37.2	29.4	35.1	30.9	27.6	26.0	25.0	21.8
Anhui	50.5	48.3	43.8	40.5	40.7	42.2	37.5	34.1	32.3	30.9	32.9	29.7	27.9	25.4	24.2	23.0
Xinjiang	27.6	27.3	28.8	20.2	31.5	33.1	39.8	41.7	32.6	24.6	25.5	22.5	21.7	22.0	24.3	23.5
Guangxi	61.5	56.6	53.6	50.8	47.3	44.8	42.8	38.1	38.3	31.8	34.9	32.2	30.2	28.3	26.0	24.6

Source: Educational Statistics Yearbook of China (2003-2018)

Table 9: Student-to teacher ratio, OECD and G20 countries, 2018

Countries	Student-to-teacher ratio
OECD countries	
Iceland	4.2
Ireland	4.2
New Zealand	4.9
Denmark	5.0
Germany	7.5
Slovenia	7.8
Estonia	8.4
Korea	8.5
Latvia	8.9
Lithuania	10.3
Norway	11.0
Slovak Republic	11.8
Luxembourg	12.1
Italy	12.2
Costa Rica	12.4
Hungary	12.4
Spain	12.5
Austria	12.5
Czech Republic	13.1
Japan	14.0
Poland	14.9
Netherlands	16.2
Switzerland	18.2
Chile	22.4
France	23.3
Mexico	23.3
Australia	N/A
Belgium	N/A
Canada	N/A
Colombia	N/A
Finland	N/A
Greece	N/A
Israel	N/A
Portugal	N/A
Sweden	N/A
Turkey	N/A
United Kingdom	N/A

United States	N/A
OECD average	**12.0**
EU23 average	**11.3**
Partners	
Russian Federation	11.1
Saudi Arabia	15.0
Indonesia	16.5
Brazil	16.9
China	**17.4**
Argentina	N/A
India	N/A
South Africa	N/A
G20 average	**15.0**

Source: Education at a Glance 2020: OECD Indicators, Table B2.3.(12)

Table 10: Kindergarten teachers' academic attainment in China, 2001-2018

Year	High school and below				Associate college degree				Bachelor				Master and above			
	Total (thousand)	of which (%):			Total (thousand)	of which (%):			Total (thousand)	of which (%):			Total (thousand)	of which (%):		
		China	Urban	Rural		China	Urban	Rural		China	Urban	Rural		China	Urban	Rural
2001	428.7	68.0	24.7	19.5	186.5	29.6	16.9	3.7	14.5	2.3	1.7	0.1	.4	0.06	0.05	0.002
2002	414.6	62.9	22.8	17.1	224.8	34.1	19.2	4.4	19.3	2.9	2.0	0.2	.6	0.08	0.07	0.002
2003	418.2	59.0	21.9	16.3	264.6	37.3	20.6	4.9	25.4	3.6	2.5	0.2	.9	0.12	0.10	0.007
2004	414.0	54.5	20.0	17.1	308.4	40.6	22.1	6.0	36.2	4.8	3.2	0.3	1.0	0.13	0.11	0.007
2005	414.0	54.5	20.0	17.1	308.4	40.6	22.1	6.0	36.2	4.8	3.2	0.3	1.0	0.13	0.11	0.007
2006	428.7	47.7	14.8	17.2	403.4	44.9	21.6	7.8	64.8	7.2	4.4	0.7	1.3	0.15	0.12	0.009
2007	429.1	45.1	14.3	15.5	437.9	46.0	22.6	7.9	83.5	8.8	5.3	0.8	1.5	0.15	0.13	0.007
2008	438.2	42.5	13.0	15.1	487.2	47.2	22.6	8.5	105.0	10.2	5.9	1.0	1.6	0.16	0.13	0.007
2009	454.7	40.3	11.7	14.7	538.5	47.8	22.4	9.0	132.5	11.8	6.6	1.2	2.1	0.18	0.14	0.006
2010	502.9	38.5	10.8	14.3	632.6	48.5	21.7	9.8	167.4	12.8	6.9	1.5	2.5	0.19	0.15	0.008
2011	543.5	36.3	13.7	9.1	742.1	49.6	26.5	6.5	207.5	13.9	8.8	1.0	3.0	0.20	0.17	0.005
2012	564.0	33.6	12.6	8.5	854.0	50.9	26.5	7.0	256.0	15.3	9.5	1.2	3.4	0.20	0.17	0.004
2013	577.2	30.6	10.9	8.0	989.9	52.5	26.1	7.9	313.7	16.6	10.0	1.5	4.3	0.23	0.19	0.008
2014	580.5	27.9	10.0	7.3	1117.2	53.7	26.2	8.4	377.4	18.1	10.6	1.8	5.2	0.25	0.20	0.010
2015	578.0	25.1	8.7	6.7	1270.2	55.2	25.8	8.9	449.0	19.5	11.0	2.0	5.9	0.26	0.20	0.011
2016	560.9	22.4	7.6	6.2	1408.6	56.4	26.6	9.2	522.6	20.9	11.8	2.2	6.7	0.27	0.21	0.011
2017	543.1	20.0	6.5	5.6	1554.0	57.3	27.3	9.4	607.7	22.4	12.6	2.5	7.3	0.27	0.21	0.011
2018	520.8	18.1	5.8	5.1	1658.5	57.7	27.6	9.5	686.3	23.9	13.3	2.8	7.9	0.27	0.22	0.012

Source: Educational Statistics Yearbook of China, 2001-2018

Table 11: Preschool teachers' professional title in China, 2001-2018

Year	Mid-level titled				Primary-level titled				No titled			
	Total (thousand)	of which (%):			Total (thousand)	of which (%):			Total (thousand)	of which (%):		
		China	Urban	Rural		China	Urban	Rural		China	Urban	Rural
2001	2.8	0.4	0.3	0.04	325.0	51.6	26.7	7.1	302.2	48.0	16.4	16.3
2002	3.5	0.5	0.3	0.05	338.2	51.3	26.5	6.9	317.6	48.2	17.2	14.6
2003	3.8	0.5	0.3	0.04	347.7	49.0	25.4	6.7	357.6	50.4	19.3	14.7
2004	4.7	0.6	0.4	0.05	358.8	47.2	24.4	7.1	396.0	52.1	20.6	16.2
2005	4.7	0.6	0.4	0.05	358.8	47.2	24.4	7.1	396.0	52.1	20.6	16.2
2006	6.0	0.7	0.4	0.06	392.3	43.7	20.3	7.5	500.0	55.7	20.1	18.1
2007	5.6	0.6	0.4	0.06	401.8	42.2	20.0	7.2	544.5	57.2	22.0	16.9
2008	6.5	0.6	0.4	0.09	419.9	40.7	18.8	7.1	605.6	58.7	22.4	17.3
2009	7.4	0.7	0.4	0.07	428.8	38.0	17.4	6.6	691.7	61.3	23.0	18.2
2010	9.5	0.7	0.4	0.10	457.1	35.0	15.3	6.3	838.7	64.3	23.8	19.1
2011	11.7	0.8	0.5	0.05	485.9	32.5	16.8	4.1	998.4	66.7	31.9	12.4
2012	12.3	0.7	0.5	0.06	512.5	30.6	15.7	3.9	1152.7	68.7	32.7	12.7
2013	13.6	0.7	0.4	0.07	544.1	28.9	14.3	4.0	1327.4	70.4	32.4	13.3
2014	15.2	0.7	0.4	0.07	584.8	28.1	13.5	4.1	1480.4	71.2	33.0	13.2
2015	16.9	0.7	0.4	0.08	621.8	27.0	12.6	4.2	1664.4	72.3	32.8	13.4
2016	19.2	0.8	0.4	0.09	656.9	26.3	12.2	4.2	1822.7	72.9	33.5	13.3
2017	22.7	0.8	0.4	0.10	681.7	25.1	11.9	4.0	2007.6	74.0	34.1	13.5
2018	28.0	1.0	0.5	0.14	702.0	24.4	11.7	3.8	2143.6	74.6	34.7	13.4

Source: Educational Statistics Yearbook of China, 2001-2018

Table 12: Education expenditure in China, 1997-2018

Year	The proportion of preschool education expenditure to the total education expenditure (%)	Per Capita Financial Allocation in China Kindergarten (yuan)	
		China	Rural China
1997	1.4	663.5	
1998	1.4	846.9	
1999	1.4	1036.8	
2000	1.3	1212.8	
2001	1.3	1526.8	
2002	1.2	1701.8	
2003	1.2	1978.2	
2004	1.2	2312.6	
2005	1.2	2616.2	
2006	1.3	2857.1	
2007	1.3	3121.2	
2008	1.4	3718.3	
2009	1.5	3901.2	
2010	3.7	3622.1	
2011	4.3	4440	2439.7
2012	5.3	6166.8	4019
2013	5.8	6516.9	4225.1
2014	6.2	6601.5	4503.9
2015	6.7	7437.6	5269.4
2016	7.2	8629.7	6072.7
2017	7.7	9775	6898.9
2018	8.1	10648.6	7468.4

Source: China Educational Expenditure Statistical Yearbook, 1997-2018.

Table 13: Education expenditure in OECD countries, 2017

Countries	Expenditure on ECEC services as a percentage of GDP	Annual expenditure per child in USD, converted using PPPs (based on head counts)
Australia	0.6	7862.9
Austria	0.7	11009.0
Belgium		
Canada		
Chile	1.2	6727.3
Colombia	0.5	
Costa Rica		
Czech Republic	0.5	6108.9
Denmark	1.6	18501.8
Estonia	1.2	8136.5
Finland	1.2	13185.7
France	0.8	8893.9
Germany	0.9	12816.7
Greece		
Hungary	0.8	7401.5
Iceland	1.7	17309.6
Ireland	0.2	4567.8
Israel	1.3	5048.6
Italy	0.5	8779.6
Japan	0.2	7609.2
Korea		
Latvia	0.9	6221.6
Lithuania	0.9	6677.0
Luxembourg	0.5	19326.2
Mexico	0.5	2569.8
Netherlands	0.4	6958.6
New Zealand	0.9	9598.8
Norway	2.0	19662.6
Poland	0.8	7164.2
Portugal		
Slovak Republic	0.6	6122.7
Slovenia	1.1	9328.7
Spain	0.7	7759.2
Sweden	1.8	15441.7
Switzerland	0.4	13412.0

Turkey		
United Kingdom	0.4	5971.2
United States		
OECD average	**0.9**	**9661.1**
EU23 average	**0.8**	**9698.1**

Table 14: Preschool education expenditure required of students and their families, rural Xiangxi China, 2018

	Expenditure (yuan)	As a percentage of per capita annual disposable income in Xiangxi	As a percentage of per capita annual disposable income in China
	(1)	(2) = $\frac{(1)}{9183} \times 100\%$	(3) = $\frac{(1)}{14167} \times 100\%$
Tuition and fees	3368	36.6	23
Cost of transportation to preschool centers	1200	13.1	8.2
Rental fee near preschool centers	1989	21.7	13.6
Opportunity cost of the caregiver	26000	283.1	177.9

Source: Authors' survey

Table 15: Teachers' professional title structure, rural Xiangxi China, 2018

Teachers' professional title	Frequency	%
No title	136	95.8
Primary level	4	2.8
Junior level	2	1.4
Total	142	100

Source: Author's survey

Table 16: Teachers' academic attainment structure in rural Xiangxi

Academic attainment	Frequency	%
Primary school	7	5
Junior high school	29	20
Senior high school / vocational education training	54	38
Associate college	44	31
College	8	6
Master and above	0	0

Source: Author's survey