Journal of Asian Economics 91 (2024) 101710

Contents lists available at ScienceDirect

Journal of Asian Economics

journal homepage: www.elsevier.com/locate/asieco

The long-term influence of education resources allocation on the migration: Evidence from the China's rural school consolidation policy

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ARTICLE INFO

JEL Classification:
O15
R23
J24

Keywords:
Rural school consolidation
Migration decision
Human capital

ABSTRACT

The experiences of student life can have lasting impacts on an individual's future outcomes. We take the policy of the Rural Primary School Consolidation Program (RPSCP) in 2001 as a quasi-natural experiment, and comprehensively examine the long-term impact of this policy on students' migration decisions in the future. We find that the RPSCP policy has a persisting negative impact on rural students' future migration, with a more pronounced effect among girls and younger students. Mechanism analysis suggests that the RPSCP can hinder the process of human capital accumulation, thereby reducing the likelihood of migration. Further investigation highlights that school consolidation not only affects students' career choices, but also has a profound impact on household registration conversion and settlement intentions in other regions.

1. Introduction

During the process of urbanization, the allocation of education resources is essential to balance the high-quality and cost-efficiency of education. School consolidation is a significant step in the government's reallocation of public goods in education. It has been a long-standing policy in response to the outmigration and declination of students in rural areas, on the grounds that economies of scale will increase the quality of education and enable it to be delivered in an efficient manner. However, due to the complexity of school consolidation program, its effects on students' performance still remain ambiguous. Most of the existing literatures focused on developed countries, which have proved that smaller schools and an increase in the number of these schools being more beneficial to student learning, especially in ethnic minority areas (Duflo, 2001; Hannum & Wang, 2022; Walberg, 1992) and emphasized the negative effects of school consolidation and size expansion on student achievement (Beuchert et al., 2018; Brummet, 2014; Engberg et al., 2012). However, some scholars holding different views. For example, a Danish research conducted by De Haan et al. (2016) argue that expanding size due to school consolidation can improve students' academic performance significantly, and scholars such as Long et al. (2020), Berry and West (2010) have similar conclusions. In addition, some scholars argue that there is heterogeneity in this effect. Another study in Denmark finds the achievement of students in closing schools is adversely affected in the short run, but the

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https://doi.org/10.1016/j.asieco.2024.101710
Received 30 July 2023; Received in revised form 3 January 2024; Accepted 10 January 2024
Available online 13 January 2024

effects appear to weaken over time (Beuchert et al., 2018). Socioeconomically disadvantaged students and students with learning disabilities are significantly harmed by school size increasing (Gershenson & Langbein, 2015). With population aging and birth rate declining, many low- and middle-income developing countries are facing pressure to school consolidation (Cai et al., 2017; Liu, Zhang, Luo et al., 2010; Liu, Zhang, Luo, Rozelle et al., 2010; Liu & Xing, 2016). However, there is still a lack of exploring on the impact of school consolidation on student's achievements and welfare in developing countries, especially on migration decisions.

Rural-urban migration has been a key focus of economic historians and development economists for a long time. The impact of migration can not only raise the income of migrants, but also bring strong positive effects in the areas where they relocate. The two most important theories regarding the factors that influence human migration are "push-pull theory" and "urban-rural dual economic structure theory" (Bogue, 1959; Lewis, 1954; Ravenstein, 1885). These two theories emphasize that the differences in the economic development and actual income between regions are vital factors that influence migration. Based on these theories, researchers have explored the impact of individual and household characteristics (Kinnan et al., 2018; Long et al., 2017), institutional barriers (Dang et al., 2020; Sun, 2019), and climate shocks on rural-urban migration (Kubik & Maurel, 2016; Minale, 2018; Peri & Sasahara, 2019). In fact, human capital of migrants represented by the level of education is one of the main factors influencing rural-urban migration (Wang & Zhang, 2008; Xie, 2011). Childhood experiences affect individual's ability to develop human capital throughout their lifespan (Heckman, 2008). If they can not master necessary knowledge and learning methods in primary school, their lifelong educational and career development will be limited, which will impede migration behavior.

Oncely, China was the vanguard of school consolidation. In the late 1990s and early 2000s, China faced significant reduction of rural students due to the one-child policy and the fast development of urbanization. The State Council announced the Rural Primary School Consolidation Program(RPSCP) in 2001,[1] essentially involved shutting down remote village schools and merging students into centralized town or country schools. School consolidation was implemented rapidly in China. Official data indicates that nearly 312,400 primary schools were closed due to the consolidation program between 2001 and 2011, an extreme decrease of 56.42%.[2] The drastic reduction of primary schools in rural area caused many children to attend boarding schools far away from their families at young ages. As a result, this will have a lasting impact on students' academic performance and subsequent development.

Scholars agree that RPSCP can bring a series of impacts on academic performance, but there is no consensus reached. In terms of short-term impact, there has been a heated debate. For example, Liu, Zhang, Luo et al. (2010) and Liu, Zhang, Luo, Rozelle et al. (2010) showed that academic performance of fourth-grade students was improved significantly after the school merger. Mo et al. (2012) found that although rural students' achievement increased after attending school in the town, there was a negative effect on achievement after students moved to boarding schools. Pan (2017) demonstrated that school consolidations did not reduce students' chances of enrolling in compulsory education in rural areas and family background played an vital role in this. Also, Xing et al. (2016) found that reducing the number of schools in rural areas increased the probability of residents moving out of villages markedly. Those rural residents with children in the appropriate age group were more sensitive to the reduction in the number of schools. But Hou et al. (2012) and Hou et al. (2018) found that school consolidation further damages rural primary school students in terms of physical and mental development and academic progress, hindering the process of human capital accumulation. In recent years, researchers have investigated the long-term effects of school consolidation in China, but they did not reach a consistent conclusion. Liang and Wang (2020) focused on the positive effects of the policy on the long-term human capital accumulation of rural students. Cheng and Kong (2022) showed that school merger facilitates long-term cognitive development. However, a study by Hou et al. (2018) found that school closure increased the likelihood of low-age boarding and hindered the process of human capital accumulation among rural primary school students. Mcgee et al. (2022), Sorensen et al. (2021), Taghizadeh (2020), Wang et al. (2016), Grongberg et al. (2015) also have the similar opinions. In addition, Guo et al. (2022) analyzed students' income in adulthood and concluded that school consolidation prevent the long-term development of rural students.

Following the implementation of the school consolidation, effected students have had more migration and accommodation experiences than their predecessors, which can, in turn, have a significant impact on their academic performance, physical health and psychological well-being. Therefore, does the implementation of the policy affect the future migration behavior of rural students? This issue is still lacking in China and the long-term effect of school consolidation has not been sufficiently discussed. We applied data of 2012, 2014, 2016, and 2018 from China Labor Force Dynamics Survey (CLDS), and using difference-in-differences method to explore the above question, we find that the RPSCP policy has a persisting negative impact on rural students' future migration. Further investigation indicates that school consolidation affect migration primarily through the process of human capital accumulation.

The main contributions of this study are as follows. Firstly, this paper is the first to analyse the long-term effects of the policy on the future migration decision of rural students in developing countries, which can provide deeper understanding of the long-term effects of the school consolidation policy on individuals. On the one hand, previous studies have primarily focused on the short-term effects of this policy, including decreased investment in education, increased commuting costs, and reduced accessibility to education, which might negatively affect the education and mental health of students. However, due to the persistence of these policy effects and the lack of suitable data, it is difficult to assess the full impact on students' development as adults. Therefore, this analysis is concerned with longer-term economic decisions and social welfare, which can provide a basis for deeper understanding of the long-term effects of the school consolidation policy on individuals. On the other hand, although existing studies on labor migration are relatively well developed, they have mainly focused on analyzing the effects of factors such as relative income disparity and public goods supply. Among the factors that influence individual migration behavior, few studies have explored the impact of students' experiences while in

[1] resources: https://www.gov.cn/gongbao/content/2001/content_60920.htm
[2] resources: China Statistical Yearbook

school. In the context of school abolition, there is a need to further explore the long-term effects of school consolidation on future migration behavior, based on the study of its effects on individual academic performance. In this respect, this would be a useful addition to the existing literature related to rural-urban migration.

Second, from the perspective of human capital, we develop a logical analytical framework of "school consolidation-human capital accumulation-migration decision". China is undergoing rapid urbanization and there is still a significant gap between urban and rural areas. For many people living in villages, moving to the city and getting higher education and jobs can be a way to improve their economic situation and rise in social class. If the school consolidation policy result in a decrease in the quality of education available, it could hinder the accumulation of human capital and make it less likely for rural residents to migrate to the cities. Therefore, this study aims to use the implementation of school consolidation in 2001 as a quasi-natural experiment to thoroughly evaluate the impact of school consolidation on the future migration of rural students.

The rest of the paper is proceeded as follows. Section 2 provides the theoretical analysis and research hypothesis. Section 3 describes the data sources, empirical strategy for identifying the causal impact of school consolidation, and some statistical description of the sample data. Section 4 presents the main results on school consolidation on individual's future migration and settlement in the city. In Section 5, we present the results on potential mechanism and heterogeneous analysis. Section 6 provides the further discussion and Section 7 concludes.

2. Theoretical analysis and research hypothesis

2.1. Background of RPSCP

In 2001, the State Council issued the "Decision on the Reform and Development of Basic Education" (hereinafter referred to as the "Decision"). It clearly required that "the layout of rural compulsory education schools should be adjusted according to local conditions, and rural primary schools and teaching points should be properly merged under the premise of facilitating students to enroll nearby", which marked the beginning of the RPSCP. The decision is mainly based on the following two considerations: First, after the reform of rural taxes and fees, the county and township fiscal revenue decreased, and the county and above governments hope to reduce the financial pressure through the adjustment of the distribution of rural primary and secondary schools. Second, due to the implementation of the family planning policy and the development of urbanization, the number of rural students has been greatly reduced, resulting in a serious waste of educational resources. Therefore, for the purpose of scientifically and reasonably adjusting the layout of primary and secondary schools, realizing the optimal allocation of resources (Ding & Zheng, 2015), the state promulgated the RPSCP.

Statistics show that the number of primary school students was 130,132,500 in 2000 and 96,959,000 in 2012, while the number of elementary school nationwide during the same period was 553,600 and 228,600, respectively. From 2000 to 2012, the number of primary school students decreased by 25.49%, much less than the 58.71% decrease in the number of primary schools. Fig. 1 shows the changes in the number of elementary school and the number of elementary school students in rural China from 2001 to 2012. It can be seen that the reduction in the number of schools far exceeds the reduction in the number of students. However, RPSCP has produced a series of negative effects. For example, the adjustment of school layout leads to further polarization and greater inequality in educational opportunities and resources, which increases the cost of schooling for rural students. Therefore, in 2012, the General Office of the State Council issued the Opinions on Regulating the Adjustment of the Distribution of Rural Compulsory Education Schools, proposing to "resolutely stop blind withdrawal and consolidation of rural compulsory education schools" and "schools or teaching points that have already been withdrawn and merged shall be restored by the local government according to the procedures if they are really necessary". A decade-long policy of closing schools and merging was halted.

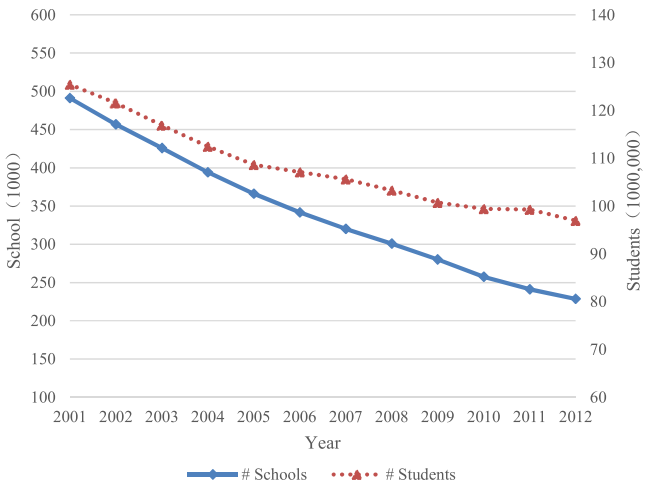

Fig. 1. Trend of the number of rural primary schools and students in China.

2.2. Theoretical analysis and research hypothesis

The policy of school consolidation reduces the accumulation of human capital. The original intention of the RPSCP is to improve the education level of rural students by integrating and optimizing educational resources, improving the quality and efficiency of education (Ding & Zheng, 2015). However, the impact of the policy on rural students has not been satisfactory. The RPSCP leads to a longer distance for rural students to go to school, while the inconvenient transportation in rural areas and the poor economic conditions of families increase the cost of schooling for students (Guo, 2013; Killeen & Sipple, 2000; Zhao & Barakat, 2015). Boarding schools are generally poor, and living conditions and learning environment are relatively hard, which further affects the quality of learning and mental health of younger boarders (Luo et al., 2012; Lu et al., 2022). Younger students are affected by school consolidation policies for a longer period, so disruptions caused by school consolidation may have a greater impact on their academic progress, which in turn affects their future development and career prospects. For example, Liu, Zhang, Luo et al. (2010) and Liu, Zhang, Luo, Rozelle et al. (2010) found that RPSCP led to a significant decline in the achievement of students in the lower grades, while the achievement of fourth graders increased significantly after the school merge. Similarly, Zhao and Barakat (2015) found that young students were more likely to experience increased stress and decreased social connectedness after school consolidation. Besides, Mo et al. (2012) found that there are slight positive social benefits for students attending more concentrated and larger schools, but these may be offset by boarding costs. However, Berry and West (2010) analyzed the adult wages of 994,000 white men in the United States over 40 years and found no positive impact of larger schools on student life outcomes. In addition, the dramatic increase in money and time costs associated with the school consolidation is a key factor contributing to the rise in dropout rates (Ding and Zheng, 2013).

Education is an important factor in promoting the migration of agricultural registered population (Wang & Zhang, 2008; Xie, 2011). First, people with higher levels of education are more likely to find jobs or earn higher levels of wages in migrant destinations and thus have stronger incentives to migrate. Ham et al. (2011) have shown the significance of education attainment in estimating the real wage gains from primary migration. Second, people with higher education have stronger ability to collect and process information, so the possibility of migration is higher. Greenwood (1990) stating that less-educated individuals may be less likely to plan their moves and less likely to avoid risky situations. Maier (1986) argued that information costs should be lower for well-educated individuals, who are presumed to know how to acquire and interpret information. Therefore, the propensity to migrate is stronger for high-skilled individuals than for the low-skilled (Eggert et al., 2010; Sjaastad, 1962), and well-educated migrants are expected to move more frequently, longer distances and a wider migration range (Thomas et al., 2012; Xing & Zhang, 2023). A further analysis of the skill structure of migrants reveals that only an increase in the proportion of high-skilled immigrants will lead to an increase in the net income of local population (Isaac & Kim, 2015). At the same time, some studies have found that the proportion of high-skilled labor flowing into developed areas in the total migrant population has increased significantly (Hu et al., 2022). Based on the data from OECD, Kahanec and Zimmermann (2008) and Zhou and Lian (2021) found that the migration of highly skilled talents plays an important role in promoting regional economic development.

In view of the above analysis, we propose the Hypotheses 1 and 2:

Hypothesis 1. *The RPSCP reduces the probability of future migration of rural students.*

Hypothesis 2:. *The implementation of the RPSCP will reduce the probability of future migration of rural students by reducing the long-term human capital accumulation of rural students.*

3. Data and empirical strategy

3.1. Data source

Our empirical analysis uses data from China Labor Force Dynamics Survey (CLDS) launched by Sun Yat-Sen University. Using a multistage, cluster, stratified, Probability-Proportional-to-Size (PPS) sampling technique, the CLDS covers 29 provinces and cities in mainland China (excluding Tibet and Hainan) with solid representation and credibility. The survey tracked the families and individuals in Chinese urban and rural areas every two years. Until now, a total of four waves of surveys have finished in 2012, 2014, 2016, and 2018.

We use all four waves of the CLDS because of its two advantages. To begin with, the CLDS is the first nationally representative datasets targeted at the labor force in China, and it distinguishes itself from other datasets by only considering people aged from 15 to 64. Secondly, this survey contains a wide range of subjects, such as migration, education, employment, economic activities, and other individual characteristics, which provides precise and comprehensive information for us to analyze the long-run impacts of the RPSCP.

In order to further analyze the impact on specific migrant behaviors, we use China Migrants Dynamic Survey (CMDS) in the subsequent discussion to analyze the influence of RPSCP on migration time, distance and number of cities to which students migrated in their later life. CMDS is organized by the China National Health Care Commission, which has been carried out annually with a stratified, multistage, large-scale PPS sampling method. Covering 31 provinces in China mainland, this survey targets those working-age population who have left the locale of their household registration to live in another place. CMDS provides useful information about migrants on their basic employment status, social security, family status, and other individual characteristics, and we use the

data of 2018 for our research.[3]

Finally, the city-level control variables used in our study are obtained from the Chinese City Statistics Database (CCSD), which is provided by the Chinese Research Data Services Platform. CCSD covers vital statistics on the socio-economic development of over 600 cities in China. According to Duflo (2001), Liang and Wang (2020), we similarly control for the characteristics of cities in 2001, which is the year just before the RPSCP.

3.2. Empirical strategy

The study of the long-time impacts of RPSCP policy on migration faces the challenge of reverse causality between the policy and its effects. Following the approaches of Duflo (2001), Liang and Wang (2020), we make use of the exogenous variation in the exposure to the SC policy, which creates a quasi-natural experiment to solve the problem of causality.

3.2.1. Difference in policy intensity among regions

The first variation comes from the difference in the intensity of RPSCP policy between regions. Actually, almost every rural village was affected by the RPSCP, exposure to the RPSCP varied across regions because of the differences in population density, the proportion of rural students, and the number of primary schools. According to the settings of Duflo (2001), Liang and Wang (2020), this paper conducts the intensity of policy by the change in the number of schools per student between 2000 and 2006 (Eq. (1)).

$$Intensity_j = \frac{\text{Number of elementary school in 2000}}{\text{Number of elementary school students in 2000}} - \frac{\text{Number of elementary school in 2006}}{\text{Number of elementary school students in 2006}} \tag{1}$$

We choose this equation to characterize the intensity of the RPSCP policy for two main reasons. The first point comes from the perspective of time selection. Since the year of 2006, a series of problems brought about by the adjustment of rural school layouts have attracted government's attention. The Ministry of Education of China began to issue relevant documents, such as the Notice on Realistic and Proper Adjustment of Rural Primary and Secondary School Layouts, consciously correcting and adjusting the RPSCP policy. Another consideration that we choose the 2006 as research time is that if the period is too short, it is not conducive to capturing the difference in policy intensity; however, if the period is too long, it will mix with the impact of many other policies. In the subsequent analysis, the change in the number of schools per student counterpart from 2000 to 2007 is used to re-measure the RPSCP policy for robustness test. Furthermore, in terms of the scientific nature of the indicator. Distinguished from Xing (2016), who only use the changes in the number of elementary schools to measure the RPSCP policy, the indicator we use allows us to characterize the intensity of the policy more scientifically. Eq. (1) considers the number of schools and students in this area, which effectively eliminates the natural variation in the number of schools due to changes in students, thus capturing the more exogenous impact of the RPSCP policy (Liang & Wang, 2020).

3.2.2. Difference in birth cohorts

In addition to the location of school, another variance comes from students' date of birth. The two crucial sources of variation jointly determine individual's exposure to the policy. We define whether respondents were affected by the school consolidation policy based on whether they attended elementary school in 2001. Given the fact that China's usual age requirement for school entry is seven years old, and the elementary school system is six years, we restrict the sample to rural students aged 7–20 years in 2001. Eq. (2) shows the settings of birth cohort. The cohort that aged 7–13 years old in 2001 was affected by the RPSCP policy, we define Cohort = 1; otherwise, Cohort = 0.

$$Cohort_i = \begin{cases} 0, \ if 14 \le Age2001_i \le 20 \\ 1, \ if 7 \le Age2001_i \le 13 \end{cases} \tag{2}$$

We calculate the age of individuals in 2001 based on the age of respondents in the survey year. For example, in the CLDS 2018 survey, adults aged 24 to 30 belong to the young (or treated) cohort, as they were 7–13 years old in 2001. Table 1 shows the age and cohort settings of investigators in all survey years.

3.2.3. Model specification

In terms of estimation method, consistent with Duflo (2001), Liang and Wang (2020), we construct the baseline regression model for cross-sectional data based on DID (Difference-in-Differences) model. The model can be written as follows:

$$\begin{aligned} Y_{ijt} &= \beta_0 + \beta_1 Cohort_i + \beta_2 Intensity_j + \beta_3 Cohort_i * Intensity_j \\ &+ \beta_4 Z_{ij} + \beta_4 C_{ij} + \rho_j + \sigma_i + \xi_t + \varepsilon_{ij} \end{aligned} \tag{3}$$

where the dependent variable Y_{ijt} is a dummy variable for whether an individual has ever moved, which equals to 1 if the rural student has moved across counties, cities or provinces since the age of 14 and has lived continuously for six months or more, otherwise 0. Among the independent variables, $Cohort_i$ is a dummy variable indicating whether individuals belong to the cohort young or the cohort

[3] The reason why we use CMDS data of 2018 is that it is the latest data available to us, and there are variables needed for research in the questionnaire.

Table 1
The settings of birth cohort.

Survey year	Age in survey year	Age in 2001	Cohort
2012	[18,24]	[7,13]	1
2012	[25,31]	[14,20]	0
2014	[20,26]	[7,13]	1
2014	[27,33]	[14,20]	0
2016	[22,28]	[7,13]	1
2016	[29,35]	[14,20]	0
2018	[24,30]	[7,13]	1
2018	[31,37]	[14,20]	0

old, and $Intensity_j$ measures the extent of district elementary school consolidation. In contrast to the traditional DID model, the baseline model we used in this study does not measure the difference between the pre-post, within-subject differences of the treatment and control group. We estimate the average difference in the probability of migration of affected children compared to unaffected children between areas with different policy intensities. The interaction term coefficient β_3 is the parameter that we most interested in. It measures the change in the probability of subsequent migration of children attending elementary school in 2001, when they experience different levels of elementary school consolidation in the district.

Z_{ij}denotes the other control variables that affect the individual migration decision, including gender, father's educational level, GDP, population density, the number of primary teachers, etc. The variable of ρ_i, σ_i and ξ_t represents age fixed effects, province fixed effects, and time fixed effects, respectively; ε_{ij} is the residual term on city level. In addition, we report the cluster robust standard error.

3.3. Descriptive statistics

In the part of baseline analysis, we pool four waves of the CLDS and keep the variables consistently measured across the data sets. The data of sample analysis came from the following procedures. Firstly, because the RPSCP policy targeted the primary schools in rural areas, we keep the sample of those born in rural areas according to Hukou (the residence registration system). Secondly, on account of the settings of the birth cohort, we restrict the sample to adolescents aged 7–20 years old in 2001. Thirdly, based on the birthplace of the individuals in the selection, we calculate the intensity of elementary school consolidation from 2001 to 2006, then connected them into the individual data from CLDS. This study successfully compiled 241 prefecture-level administrative regions, covering 30 provinces, municipalities, and autonomous territories in mainland China.

Finally, the data set of this study contained 9950 observations from CLDS between 2012 and 2018. To be more specific, 4604 individuals are divided into the treatment group and 5346 individuals were divided into the control group. Table 2 shows the definition of the variables used in our paper and their statistical characteristics.

4. Empirical results

4.1. Parallel trend

As described above, we use the difference-in-difference model to assess the impact of policies on the future migration of rural students. An important assumption of this approach is that there is no significant difference between the treatment group and the control group before the policy is implemented. In order to test the assumption, we adopt the Event Study method and consider the dynamic effect of the school consolidation on students' future migration. This paper takes the year of 2001 as the baseline year, takes 13 years old as the benchmark group, and assesses the impact of policy on rural students aged 7–20 years. With reference to the

Table 2
Descriptive statistics for the study population.

Variable	Obs	Definition	Mean	S.D.
Migrate	9950	Moved across county after 14 years old= 1, otherwise= 0	0.254	0.435
Migrate to city	9950	Living in an urban area now= 1, otherwise 0	0.117	0.321
Cohort	9950	Defined in Eq. (1)	0.463	0.499
Intensity	9950	Defined in Eq. (2)	0.012	0.043
Education	9779	Years of schooling	10.905	3.408
Gender	9950	male= 1, otherwise 0	0.455	0.498
Education of Father	9803	Interviewee's father's years of schooling	7.047	3.426
Natural Increase	9950	Rate of natural increase	0.76	0.545
Population	9950	Registered population (unit:10)	0.551	0.399
Population Density	9743	Number of people/km^2/10 thousand	0.513	0.286
Middle Teacher	9950	Number of middle school teachers (unit:10)	17.709	12.066
Primary Teacher	9950	Number of primary school teachers (unit:10)	24.938	16.173
GDP	9950	Log of regional GDP	15.092	0.808
Capital city	9950	Provincial capital city= 1, otherwise 0	0.176	0.381

research of Duflo (2001) and Liang and Wang (2020), the regression model is set as follows:

$$Y_{ijt} = \sum_{l\geq -7, l\neq 0}^{7} \left(d_l{*}Intensity_j\right)\beta_l + \beta + Z_{ij} + C_{ij} + \rho_j + \xi_t + \varepsilon_{ijt} \tag{4}$$

Where, l indicates the distance between the age of the individual in 2001 and 13 years in the baseline group; For example, 13 year olds in 2001 were the baseline group, l= 0; For students aged 20, l= -7, for students aged 7, l= 6. $d_l$is an indicator function, which representing when the difference between the age of the individual in 2001 and 13 years old is $l$equals to 1, otherwise 0. The interaction coefficient β_l reflects the impact of the RPSCP on the future migration of rural students aged 7–20 years at the time of the policy. If students who had already finished primary school in 2001 were not affected by the policy, a parallel trend before the policy was established. The regression results based on above formula are shown in Fig. 2. The horizontal coordinate represents the age gap between the baseline group at 13 years old in 2001 and other individuals in the sample. On the left side is the future migration behavior of those who have graduated from primary school in 2001 and are not affected by the RPSCP, and on the right side is the group affected by the policy. It can be found that rural students aged 14 years and above in 2001 were not significantly affected by the RPSCP, which proves the existence of a parallel trend before the policy. From the perspective of dynamic effect, the probability of future migration of rural children aged 13 and below in 2001 was significantly reduced because of the RPSCP, and the longer the students were affected by the policy, the higher the probability of reduction.

4.2. Baseline results

Table 3 shows the DID estimates of the long-run impacts of school consolidation (RPSCP) reform on migration behavior. As migration behavior is a binary variable, we take the Probit model to conduct the estimation and Table 3 reports the marginal effects of the Probit model. The first two columns report the impact of migration in adulthood. Column 1 includes the important variables of the cohort, intensity, and their interaction terms. Meanwhile, we also control the age, province, and year dummy variables. The parameter of *Cohort* Intensity* indicates that school consolidation has a significantly negative impact on migration, which means that RPSCP did hinder interviewee's possibility of migration behavior. Column 2 adds control variables of individual and regional characteristics on the bases of column 1. The result shows that the closure of one primary school per ten students would result in a 32.2% reduction in the probability of future migration.

Another DID estimated effects of school consolidation on migration are presented in column 3 and column 4 of Table 3. The independent variable is whether the rural student currently settled in the city or not, with column 3 controlling for age, province and time fixed effects and column 4 further controlling for individual characteristics and initial characteristics of the locality. The result of column 4 indicates that closing one school for per ten primary school students makes them 8.7% less likely to settle in the city in the future.

A comparison of the results in columns 1–4 shows that the regression coefficient for *Cohort* Intensity* is significantly negative regardless of the model setting, suggesting that the implementation of the school closure policy has a significant negative impact on the probability of future migration and urban residence of rural students. There are two possible reasons for this result. Firstly, following the large-scale school merge movement, rural students have been forced to choose boarding schools because of the long distance to school. Due to the poor conditions of rural boarding schools and the negative impacts on mental health, it is difficult for young children to enter and complete high school (Luo et al., 2012), which further deprive rural students of the possibility of future migration through educational opportunities. Secondly, the impact of school consolidation on rural students will last a long time, and the disruption of the process of human capital accumulation will further negatively affect the income level of rural students in adulthood (Guo et al., 2022).

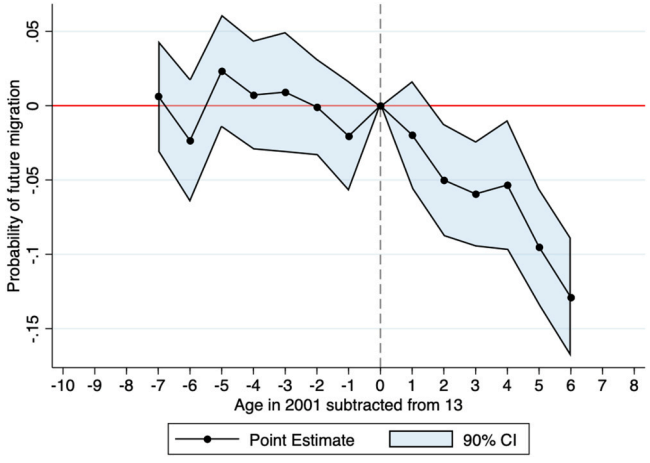

Fig. 2. Parallel trend.

Table 3
DID results on the effects of RPSCP on migration.

	(1)	(2)	(3)	(4)
Variables	Migrate	Migrate	Settle in city	Settle in city
Cohort* Intensity	-0.338***	-0.322***	-0.095***	-0.087***
	(0.000)	(0.000)	(0.006)	(0.008)
Intensity	0.301**	0.216	0.230***	0.196**
	(0.015)	(0.121)	(0.002)	(0.020)
Cohort	-0.006	-0.001	-0.002	-0.000
	(0.750)	(0.961)	(0.888)	(0.999)
Gender		-0.003		0.015**
		(0.741)		(0.011)
Father Education		0.011***		0.010***
		(0.000)		(0.000)
Natural Increase		0.036**		0.057***
		(0.048)		(0.000)
Population		0.242		0.179
		(0.272)		(0.235)
Population Density		-0.084		-0.043
		(0.217)		(0.388)
Middle Teacher		-0.002		-0.002
		(0.618)		(0.415)
Primary Teacher		0.003		0.002
		(0.424)		(0.595)
GDP		-0.116***		-0.046**
		(0.000)		(0.027)
Capital city		-0.010		0.003
		(0.779)		(0.885)
Age dummy	✓	✓	✓	✓
Province fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
N	9899	9489	9899	9489

Note: Standard errors in parentheses are clustered on cities; ***p < 0.01, **p < 0.05, *p < 0.1

As a result, rural students affected by the RPSCP policy will not have a sufficient income base to support their decision to migrate and settle in the city as adults.

In terms of regression results for the control variables, boys are more likely to settle in cities in adulthood. This may result from the males participate more and earlier in non farm employment than females (Bernard, 2017; Lyu & Zhao, 2022), thus they tend to leave their hometowns to pursue a career compared to females. The education level of father increases the higher likelihood of cross-county migration and urban settlement for laborers. One possible explanation is that parents with higher levels of human capital place more emphasis on investing in their children's education, and their children are more likely to migrate as they gain more educational opportunities. Regarding to the control variables at the regional level, the natural growth rate of population has a positive impact on migration while the regional GDP has a negative impact on migration. This is because higher natural growth rate indicates a younger age structure and a greater probability of migration compared to an ageing city (Zhang & Fu, 2014). Furthermore, the distribution of the sample shows that cities with higher natural growth rates are concentrated in the central and western regions, where rural students born in the region have a greater incentive to migrate and settle in the city in the future. Additionally, the higher the regional GDP, the more services the industrial structure can absorb, thus the labor force can get more money. As a result, it is easy for the labor force to find non-agricultural jobs in their hometown, so rural students born in this region are not as motivated to migrate in the future, this is also consistent with Wen (2019) research results.

Table 4
Robustness check – change the calculation of intensity.

	(1)	(2)	(3)	(4)
Variables	Migrate	Settle in city	Migrate	Settle in city
Cohort* Intensity_2007	-0.314***	-0.085**		
	(0.000)	(0.013)		
Cohort* Intensity_2012			-0.280***	-0.077*
			(0.000)	(0.055)
Control variables	✓	✓	✓	✓
Age dummy	✓	✓	✓	✓
Province dummy	✓	✓	✓	✓
Year dummy	✓	✓	✓	✓
N	9544	9544	9529	9529

Note: Standard errors in parentheses are clustered on cities; ***p < 0.01, **p < 0.05, *p < 0.1

4.3. Robustness tests

4.3.1. Change the period of Intensity

Due to the reduction of elementary schools in rural areas, which has led to some students traveling long distances to school, increased traffic safety hazards, and financial burdens on families, the government began to adjust the RPSCP policy in 2006. In 2012, the General Office of the State Council issued the Opinions on Regulating the Layout Adjustment of Compulsory Education Schools in Rural Areas to call a halt to the blind removal and merging of schools. Therefore, in order to make our regression results more robust, we recalculate the intensity of the RPSCP policy in this section using 2007 and 2012 as the time points, respectively.

Table 4 shows the robustness check of changing the period of intensity. We first calculate the change in elementary school in 2007, and then calculate the change in elementary school in 2012. The DID estimations are all significantly negative, demonstrating that the RPSCP policy still negatively affects students' migration and settlement in city. Therefore, the results of Table 4 is still consistent with Table 3, indicating that the above analysis are robust.

4.3.2. Add residence fixed effects

Since the data of 2018 do not provide the information of current place of residence, we only control for birthplace fixed effects. Here we use data from 2012, 2014, and 2016, controlling for both birthplace and current residence fixed effects. Table 5 shows this result. As can be seen, even with the inclusion of the fixed effect of place of residence, the RPSCP policy still has a negative impact on rural children's migration and settlement in urban areas when they reach adulthood, which further validates the robustness of the results of the baseline regression.

4.3.3. Placebo test

To further verify that unobservant factors do not drive the estimates in this paper such as household, province, and year, a placebo test is conducted by randomly generating pseudo-treatment groups. Specifically, we randomly generate treatment groups and conduct 500 times bootstrap after controlling for individual characteristics, regional characteristics, time fixed effects, age fixed effects, and province fixed effects. Afterward, we tally the coefficients of the DID estimators from the 500 regressions to make the distribution of the 500 estimated coefficients.

In Fig. 3, under the placebo test, the coefficients of the RPSCP policy are mainly concentrated around 0. Only very few coefficients have absolute values smaller than the estimated coefficient (−0.322) obtained using the actual data. This result suggests that the effect of the implementation of the RPSCP policy on migration behavior is relatively robust and that the baseline regression results are not due to other levels of chance such as household, province, or year.

4.3.4. PSM-DID

The DID research method adopted in this paper is similar to the difference-difference method based on processing intensity construction adopted by Duflo (2001). In this paper, the regions were divided into "treatment group" and "control group" according to the intensity of RPSCP. The regions with greater policy intensity were treated as the treatment group, while the regions with less policy intensity were treated as the control group. The DID method in this paper aims to capture the differences in the changes in the high school enrollment rates of affected children among regions with different policy intensity. It is important to note that although individuals have no control over their birth year, the degree of consolidation in different regions is not random. Factors such as population density, economic development and urbanization, education expenditure and school stock may affect the implementation of consolidation. The systematic differences between different regions may lead to significant differences in the probability of future migration of rural students between regions even if the RPSCP is not implemented. This "non-randomness" and "heterogeneity" in the selection of "treatment" and "control" groups may lead to bias in the results of DID estimates.

In order to alleviate this endogenous problem, referring to the practice of Liang and Wang (2020), this paper further adopted Propensity Score Matching model to screen local and municipal samples for robustness test, and enhanced the comparability of samples from the "treatment group" and "control group" according to observable characteristics. The specific steps are as follows: First, according to the intensity of school consolidation, the cities are divided into treatment group and control group. The treatment group is the area with more schools closed, and the control group is the area with less schools closed. Secondly, based on the propensity score matching, the treatment group and the control group were matched to find out the areas with similar economic and social development

Table 5
Robustness check – add residence fixed effects.

	(1)	(2)
Variables	Migrate	Settle in city
Cohort* Intensity	-0.351***	-0.204***
	(0.000)	(0.000)
Control variables	✓	✓
Age dummy	✓	✓
Province dummy	✓	✓
Year dummy	✓	✓
N	7383	7383

Note: Standard errors in parentheses are clustered on cities; ***p < 0.01, **p < 0.05, *p < 0.1

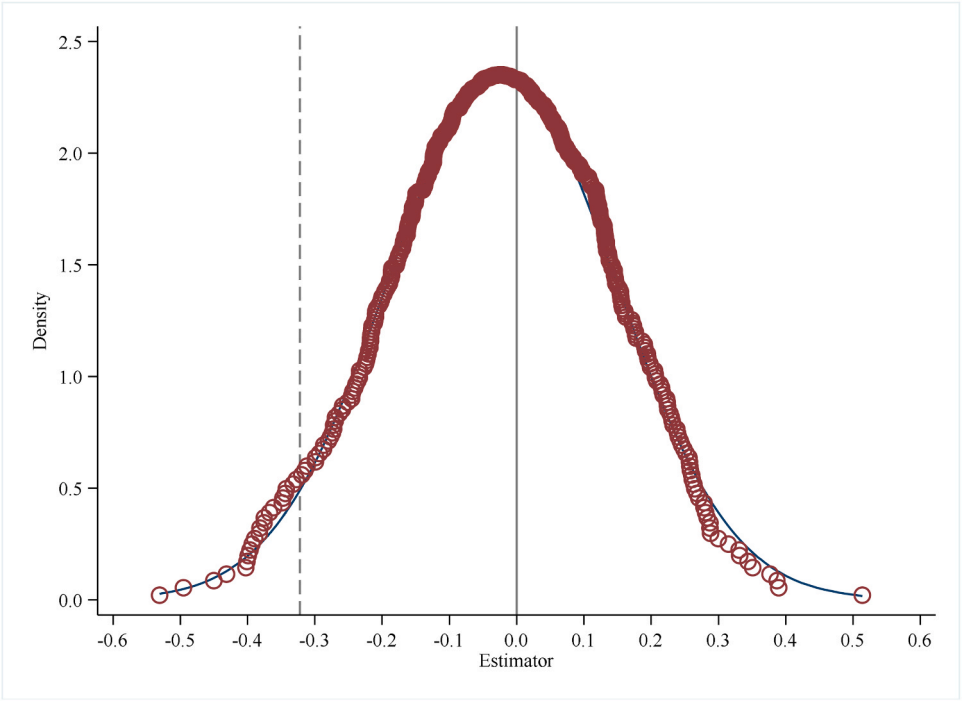

Fig. 3. Randomly generated pseudo-treatment group. Note: The x-axis indicates the estimated coefficient values from the 500 randomly assigned treatment groups, the curves are the estimated coefficient distributions for the random samples. The vertical dashed line is the actual estimate in column 2 of Table 3.

but with large differences in the intensity of RPSCP. This paper mainly adopts the kernel matching method, and also uses the least nearest neighbor matching and radius matching to verify it. Finally, based on the samples selected by matching, we estimate the results again.

In order to ensure the estimation quality of Propensity Score Matching, a balance test is carried out in this paper. As shown in Table 6, all statistics decreased after matching. After three matching methods, namely kernel matching, nearest neighbor matching and radius matching, the quasi-R^2 decreased from 0.064 to 0.002, 0.009 and 0.005 respectively. LR statistics decreased from 19.47 to 0.6–2.76, the value of mean and median were both reduced to less than 2.9%, and value of B also decreased significantly after matching, which were no longer significant. The above matching results show that there is no systematic significant difference between the samples after matching, basically achieving the effect of randomized trial.

In order to ensure the quality of matching, in addition to the balance test, the probability distribution of propensity score before and after matching is drawn according to the results of kernel matching. As shown in Fig. 4, there is a significant difference in the probability distribution of the propensity score values of the pre-matching and control group samples for RPSCP intensity (left figure). However, after sample matching by propensity score matching method, the probability distribution of propensity scores of the control group and the treatment group became very close (figure on the right), indicating that the matching effect was good, and the sample characteristics of the treatment group and the control group were very similar. After controlling for variables, the results are showed in Table 7. From the perspective of economic significance, the RPSCP significantly reduces the probability of future migration of students, indicating that the reliability of the results. The results of nearest neighbor matching and radius matching are also similar to the results of baseline regression, so we will not go into details here.

Table 6
Results of balance test.

	Pseudo R^2	LR test	$P > \chi 2$	Mean Bias	Med Bias	B	R	%Var
before matching	0.064	19.47	0.035	17.3	16.6	55.7*	0.42*	100
kernel matching	0.002	0.6	1	1.4	1.5	10.3	0.87	18
nearest neighbor matching	0.009	2.76	0.987	2	1.9	22.1	1.27	45
radius matching	0.005	1.41	0.999	2.7	2.9	15.7	1.28	27

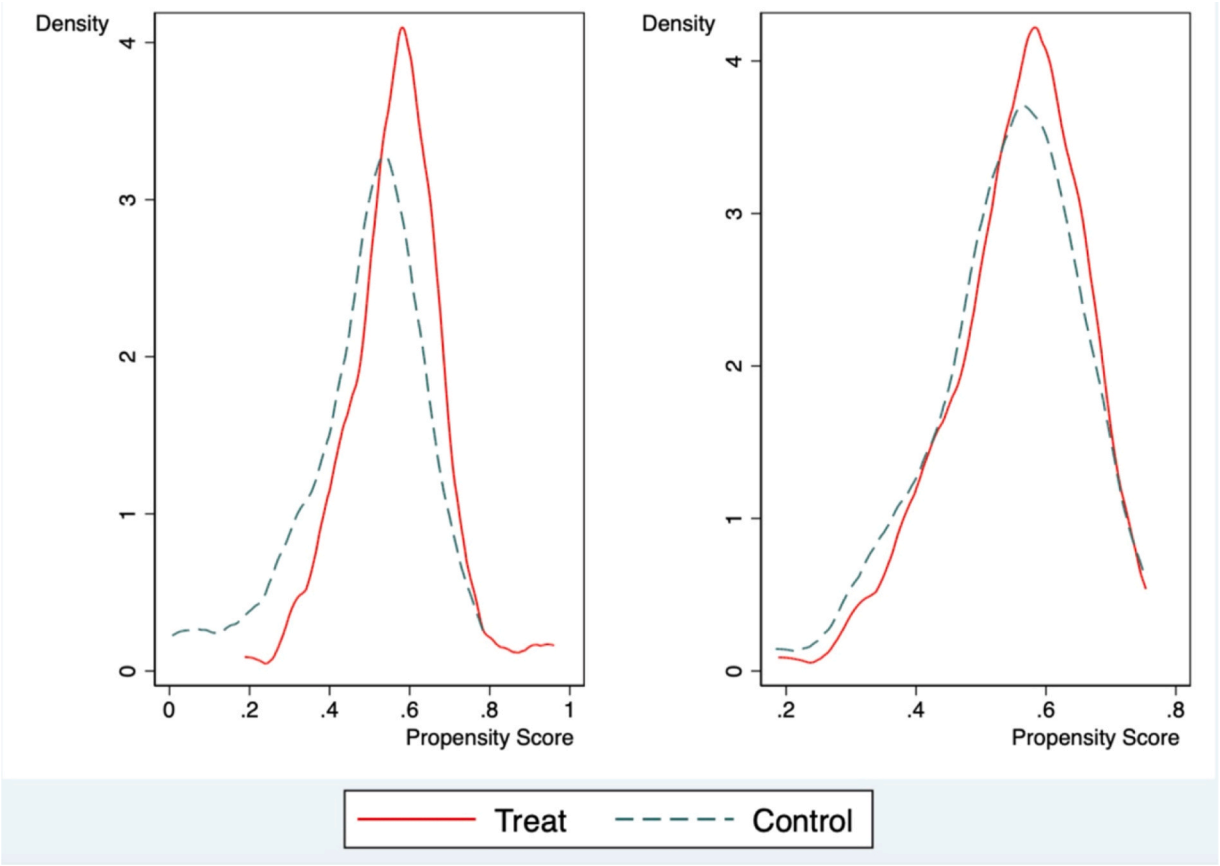

Fig. 4. Propensity score plot of RPSCP.

Table 7
Robustness—kernel matching.

	(1)	(2)	(3)	(4)
variables	Migrate	Migrate	Settle in city	Settle in city
Cohort* Intensity	-0.349***	-0.331**	-0.104***	-0.093***
	(0.000)	(0.000)	(0.004)	(0.005)
Control variables		✓		✓
Age dummy	✓	✓	✓	✓
Province dummy	✓	✓	✓	✓
Year dummy	✓	✓	✓	✓
N	8391	8149	8391	8149

5. Mechanism and heterogeneity analysis

5.1. Mechanism analysis

The direct impact of school consolidations is increasing commuting distance to schools, which not only raises the financial and time costs of attending school, but also affects students' lives and psychological well-being (Guo et al., 2022). Although boarding schools can alleviate some of the negative effects of increased commuting distance, problems such as under-age boarding and poor accommodation extremely expose students to greater psychological and life stress. These problems can have a significant negative impact on students' learning, which further hinder the process of long-term human capital accumulation (Hou et al., 20). Therefore, we will explore the mechanisms that influence the future migration of rural students from the perspective of one of the most significant aspects of school consolidation, long-term human capital accumulation.

Table 8 presents the mechanism analysis of the RPSCP policy on migration. Panel A shows the impact of school consolidation on rural students attend junior high school and senior high school, and their educational attainment in the future. The DID estimates show that the implementation of the policy increases the probability of attending middle school, but significantly decreases the probability

Table 8
Mechanism analysis.

	(1)	(2)	(3)
Variables	Middle School	High school	Schooling years
Panel A			
Cohort* Intensity	0.107**	-0.237*	-1.444
	(0.044)	(0.097)	(0.189)
N	9348	9431	9436
Panel B		Dependent Variable: Migration	
	(4)	(5)	(6)
Education	0.046***	0.049***	0.040***
	(0.015)	(0.013)	(0.007)
N	9385	9385	9385
Control variables	✓	✓	✓
Age dummy	✓	✓	✓
Province dummy	✓	✓	✓
Year dummy	✓	✓	✓

Note: Standard errors in parentheses are clustered on cities; ***p < 0.01, **p < 0.05, *p < 0.1

of attending high school in the future. Besides, Table 8 also shows that RPSCP policy has a negative but non-significant effect on educational attainment. This suggests that the policy does not have a negative impact on rural students' access to education at the compulsory level in the short term, but in the long run, it reduces their probability of receiving education after secondary school and prevents the process of long-term human capital accumulation.

Education is an important influencing factor in promoting migration of the agricultural household population (Wang & Zhang, 2008; Xie, 2011). On the one hand, those who are better educated are better able to gather and process information, and can find relatively better job opportunities. On the other hand, their affordability of relocation costs is also relatively high. Panel B of Table 8 demonstrates the effect of whether rural students attend middle school and high school, and the level of education on their future migration. It is clear that education has a significant positive effect on migration, and that the experience of attending high school has a greater effect on future migration than attending middle school. This leads us to conclude that the policy of school abolition reduces the probability of future migration by hindering the long-term human capital accumulation of rural students.

5.2. Heterogeneity analysis

In rural areas of China, there is a disparity between family support for the education of children of different genders, with higher support for male offspring than for female offspring (Liu et al., 2021). Therefore, in order to explore the variability of this effect, we divided all samples into two categories by gender, and Table 9 presents the regression results for this grouping. The results show that the long-term effect of the RPSCP policy on migration is highly significant in the female group. In contrast, this effect is not significant in the male group.

Besides, with the rationale that different age groups respond differently to school consolidation, then we conduct a heterogeneity analysis by dividing the whole sample into three subgroups by individual's age in 2001. Age_1 indicates children aged from 7 to 8 in 2001, Age_2 represents children between the age of 9 and 10 at that time, and we assign the rest treatment group to Age_3. In Table 9, it can be seen that the RPSCP policy has a more negative effect on migration for children at a relatively young age in 2001.

Also, we quartered all the samples according to the number of primary schools in each region in 2000 before the implementation of the school consolidation policy, and the impact of school consolidation policy on the future migration of rural students was investigated respectively (Fig. 5). It can be seen that in areas with a large number of primary schools before the implementation of the policy (Q4), the negative effect of the policy is smaller. Conversely, the policy in areas with fewer primary schools (Q2) had the greatest negative impact. The number of primary schools that ranked first (Q1) and third (Q3) also showed negative effects on future migration, but these two have not passed the significance test.

Finally, the result of above analysis may be attributed to that the women, young children and children with fewer educational

Table 9
Heterogeneity impacts of the RPSCP policy on migration for different groups.

	(1)	(2)	(3)	(4)	(5)
Variables	Female	Male	Age_1	Age_2	Age_3
Cohort* Intensity	-0.680***	-0.074	-0.414***	-0.624***	-0.125*
	(0.000)	(0.314)	(0.000)	(0.003)	(0.067)
Control variables	✓	✓	✓	✓	✓
Age dummy	✓	✓	✓	✓	✓
Province dummy	✓	✓	✓	✓	✓
Year dummy	✓	✓	✓	✓	✓
N	4318	5201	7438	6069	6289

Note: Standard errors in parentheses are clustered on cities; ***p < 0.01, **p < 0.05, *p < 0.1

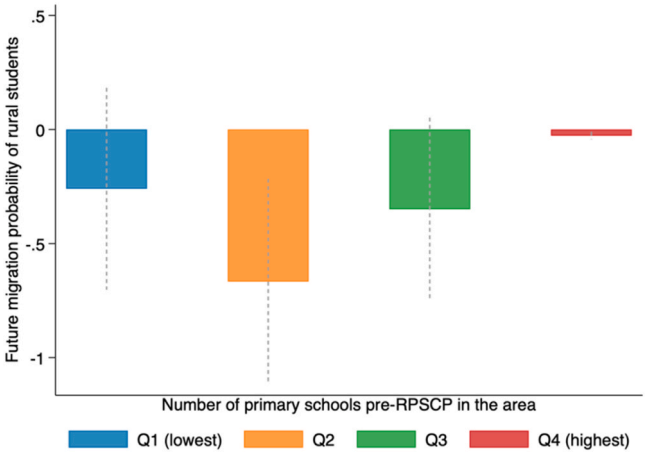

Fig. 5. Heterogeneity of school stock before the withdrawal of the consolidation policy. Notes: The length of the dotted line denotes the size of the value in Y-axis, which is the confidence interval.

resources are more vulnerable groups, and are more sensitive to policy. After the school consolidation, due to the distance increase and cost of schooling, the policy is more likely to have a negative impact on these groups, which is not conducive to their long-term development.

6. Further discussion

6.1. The impact of RPSCP on future employment

Given that the RPSCP policy reduces the probability of migration, it is reasonable to consider whether these children in their hometowns choose to work in agriculture or other occupations. Therefore, we reserve the sample of rural students who did not migrate in order to further analyze the impact of RPSCP on career choices, and Table 10 shows the results. Columns 1 and 2 demonstrates that school consolidation increase the probability of being entrepreneurs and employers respectively. Column 5 presents that the RPSCP policy reduces the probability of future farming for rural children. In addition, column 3 and 4 shows that the RPSCP policy has no significant effect on individuals becoming employee and self-employment.

6.2. Analysis based on CMDS

Here, we explored the impact of school consolidation on migration timing, distance and number of cities rural students migrated, using the data of CMDS2018 to analyze. We performed the same data processing and sample selection for the CMDS. Unlike the data used in the baseline regression, now the sample is all individuals who have experienced migration. Table 11 presents the results based on CMDS. Columns 1 and 2 show that the RPSCP policy delays the first cross-country migration of rural children and reduces the number of cities migrated through. Distance1 and Distance2 refer to cross-city and cross-province migration experiences, which demonstrate that the RPSCP policy increases the former's probability but decreases the latter's probability.

7. Conclusion

In this paper, we implement an DID design to estimate the future migration decisions response to school consolidation experiences in student life. Specifically, in 2001, the Chinese government proposed a series of documents to allocate education resources in rural areas, which is called the Rural Primary School Consolidation Program.

Our results suggest a significant reduction in future migration in response to school consolidation. Specifically, a decrease of 1 school per 100 elementary school students would result in a 3.22% and 0.87% decrease in the probability of future migration and urban settlement respectively. More importantly, education plays an important role in the process. We also find heterogeneous effects across age groups and gender capacity. Young individuals are more sensitive to the changes in school consolidation than elderly's. Female student is more responsive to changes in school consolidation than male student, suggesting that a new type of inequality has also arisen. Further investigation indicates that school consolidation can not only further affect students' career choices, but also has impacts on Hukou migration and settlement intention in other places.

Our findings have important implications for policy makers. Firstly, the policy of school consolidation does bring about the unequal distribution of educational resources, thus affecting the accumulation of human capital of rural children. Therefore, we need to be cautious in adopting a one-size-fits-all approach policy of school consolidation, and should comprehensively assess the effectiveness of the policy before its implementation. Secondly, the school consolidation has long lasting effects, which extends to important family

Table 10
The impact of RPSCP on future employment.

	(1)	(2)	(3)	(4)	(5)
Variables	Entrepreneur	Employer	Self-employ	Employee	Farmer
Cohort*Intensity	0.106*	0.048***	0.013	0.044	-1.744***
	(0.076)	(0.000)	(0.829)	(0.784)	(0.007)
Control variables	✓	✓	✓	✓	✓
Age dummy	✓	✓	✓	✓	✓
Province dummy	✓	✓	✓	✓	✓
Year dummy	✓	✓	✓	✓	✓
N	6719	6611	6673	6719	6612

Note: Standard errors in parentheses are clustered on cities; ***p < 0.01, **p < 0.05, *p < 0.1

Table 11
Analysis based on CMDS.

Variables	(1) Age	(2) Number	(3) Distance1	(4) Distance2
Cohort*Intensity	2.684***	-1.280***	0.045*	-0.089***
	(0.000)	(0.000)	(0.086)	(0.008)
Control variables	✓	✓	✓	✓
Age dummy	✓	✓	✓	✓
Province dummy	✓	✓	✓	✓
N	44978	44978	43227	44936

Note: Standard errors in parentheses are clustered on cities; ***p < 0.01, **p < 0.05, *p < 0.1

economic decisions, migration, then affects the mobility of social stratum. Therefore, the government can take some measures to mitigate the negative impact of the policy of abolishing schools on the accumulation of human capital in rural areas and the long-term development of cities, for example, by allowing the children of migrant workers to enroll in schools in the places where their parents work, or by providing vocational education and training for rural residents whose human capital has been damaged. Thirdly, the impact on disadvantaged groups will be greater, which may widen the gap between the distribution of educational resources and economic resources, leading to the deterioration of inequality, it is not conducive to the realization of the goals of preventing the return of poverty and common prosperity. Therefore，the adjustment of the distribution of rural educational resources should focus on the children in remote areas and vulnerable families, so as to prevent the RPSCP from causing the widening of the education gap between urban and rural areas, and then affecting the intergenerational mobility and equality of opportunities.

One limitation of this study is that it only examines the effects of the policy on migration patterns, it doesn't consider other potential effects such as changes in earnings, health outcomes or other socio-economic outcomes that may have been influenced by the policy. Future research could explore the policy's generalization to other contexts, as well as the study the broader effects of the policy on different socio-economic outcomes.

CRediT authorship contribution statement

Yu Zhao: Data curation, Methodology, Software, Writing – original draft. **Hui Du:** Formal analysis, Software, Writing – original draft. **Rui Li:** Data curation, Formal analysis, Methodology, Writing – original draft. **Guangsu Zhou:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing.

Declaration of Competing Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

Data will be made available on request.

Acknowledgments

The authors gratefully acknowledge financial supports from National Social Science Fund of China (Grant No. 22CJY072) and Special Funds of the National Natural Science Foundation of China (Grant No. 72342033).

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