# Free Entry Ticket to the Labour Market: The Long-Run Effects of Free Compulsory Education on Labour Supply

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# Free Entry Ticket to the Labour Market: The Long-Run Effects of Free Compulsory Education on Labour Supply

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ABSTRACT *The 2006 free compulsory education reform in rural China represents a pioneering initiative that paved the way for China's rural development. However, there is a notable lack of evaluations assessing its long-term impacts. This paper examines the long-run effects of free compulsory education on labour supply, exploiting cross-province variations in the implementation of this reform using nationally representative data in China. Using a cohort Difference-in-Differences (DID) specification, we find that exposure to free compulsory education significantly increases the probability of employment and reduces the probability of unemployment. For the employed population, they shift from the agricultural sector to the tertiary sector, engage more in formal employment and less in farming, informal employment, and entrepreneurship. These results are attributed to improvements in educational outcomes (evidenced by higher high school graduation probabilities), cognitive abilities (evidenced by higher vocabulary and mathematics test scores), and health outcomes (evidenced by better physical and mental health). This reform narrows the gender gap in employment, particularly formal employment with signed labour contracts, as evidence shows that this reform has improved women's human capital more than men's. We examine how free compulsory educational reforms shape long-term labour supply and human capital, offering actionable insights for policymakers across developing countries.*

**KEYWORDS:** Free compulsory education; labour supply; human capital; rural China

**JEL:** I20; I21; J21; J24; O15

## 1. Introduction

A large number of developing countries have implemented programs to reduce the cost of schooling via educational subsidies. These programs have been widely acknowledged as

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effective in improving children's school enrolment (Xie et al., 2025; Liu et al., 2025; Baird et al., 2011; Shi, 2016; Dubois et al., 2012; Ryu, 2020). However, most existing research has focused on short-term evaluations of these programs, which may not provide sufficient time for the effects to materialise (Gazeaud & Ricard, 2024). The main objective of policymakers implementing these educational subsidy programs is to enhance human capital and break the intergenerational transmission of poverty. If educational subsidy programs can improve labour market outcomes in adulthood by enhancing human capital, then the long-term objectives of the programs are achieved. Grounded in Human Capital Theory (Becker, 1964) and the Life Course Perspective (Elder, 1998), investments in education, particularly during formative years, are expected to yield long-term economic benefits by improving skills, productivity, and employability. This paper extends upon existing evaluations by examining the long-term effects of the free compulsory education reform on labour supply in rural China.

China represents an especially suitable context for investigating the long-term impacts of educational subsidy programs, which can offer important insights for other developing countries. First, it offers one of the largest and most systematically implemented school subsidy reforms globally. China has gradually rolled out a nationwide policy of free nine-year compulsory education in three phases: March 2006, September 2006, and September 2007, starting in rural areas. In rural China, where financial barriers had previously hindered actual school attendance despite compulsory education laws, the removal of tuition fees through this reform effectively reduced direct costs and potentially promoted higher school attendance. This reform affected hundreds of millions of students, making it the largest-scale school subsidy initiative in the world.[1] Its size, clarity in policy design, and widespread coverage provide a unique opportunity to evaluate the sustained effects of educational subsidies on adult outcomes.

Second, China's experience holds significant relevance for other developing countries. China has followed an unprecedented development path (Yue et al., 2018). Its relatively high labour force participation and substantial share of non-agricultural employment, even in rural areas, stand in sharp contrast to the patterns observed in most other developing countries. These outcomes may, in part, be attributed to its relatively well-educated labour force (Fang et al., 2012). In contrast, many Low-and Middle-income Countries (LMICs) continue to struggle with low retention beyond primary education and limited labour market engagement, particularly among women and rural populations (Duflo, 2012). China's experience thus provides valuable empirical insights into whether and how educational subsidies can foster human capital and break the cycle of intergenerational poverty, lessons that are applicable to other developing countries.

Third, the staggered rollout of the reform, both across provinces and time, provides a favourable empirical setting for causal identification. Supplementary Materials Section I provides a historical background on the compulsory education reform in China. Unlike in many countries where school subsidy programs were implemented uniformly nationwide, China's policy design allows researchers to exploit both temporal and geographical variation to construct credible counterfactuals. This quasi-experimental feature makes China not only a policy-relevant but also a methodologically advantageous case for studying the long-run consequences of educational subsidies.

Rural education plays a crucial role for economic development as it not only boosts the agricultural productivity (Schultz, 1960) but also enhances the productivity of manufacturing and other growth sectors (Brown & Park, 2002). In rural China, education costs were a major burden for poor families before basic schooling was made free (Liu et al., 2025; Hannum, 2003). To reduce these burdens and promote enrolment, China introduced free compulsory education in rural areas in 2006. The reform exempted rural primary and junior high students from tuition and miscellaneous fees. Like other subsidies, the reform increased rural girls' enrolment and reduced child labour among boys (Chyi & Zhou, 2014; Tang et al., 2020). Whilst these studies have primarily focused on the short-run impacts of the free compulsory education reform, there is limited knowledge about the long-run impacts of the program on labour market outcomes. From a Life Course Perspective (Elder, 1998), early-life interventions can have enduring effects

on individuals' life trajectories, particularly through improved access to education, health, and socio-emotional development. Data limitations contributed to this gap – for example, a 12-year-old student affected by the reform in 2007 would only enter the labour market by 2015. Existing studies, such as Xiao et al. (2017), primarily rely on micro-household surveys from 2010, 2012, and 2014, which may not be well-suited to examining the long-term impacts of the program. However, this study addresses this issue by utilising data from the 2014, 2016, 2018, 2020, and 2022 waves of the China Family Panel Studies (CFPS), allowing for a more comprehensive analysis of the long-term effects. Consequently, to our knowledge, this is the first study examining whether the individuals who were exposed to China's free compulsory education reform have experienced improvements in employment outcomes. In the literature, most studies on educational programs focused on their ability to increase human capital through better educational outcomes but fell short to demonstrate the more lasting gains associated with improved labour market outcomes (e.g. Murnane & Ganimian, 2014; Glewwe & Muralidharan, 2016). Although completed grades of schooling can be considered as a short to medium-term outcome, it is poverty alleviation that is the ultimate long-term policy objective which can truly qualify an educational program as successful in any developing nation (Millán et al., 2019).

Our study examines the long-run effects of the free compulsory education reform on labour supply in rural China using nationally representative data of inter-census population surveys and China Family Panel Studies (CFPS). One challenge is that reforms involving the exemption of education fees often coincide with a compulsory education law, making it difficult to establish a clear causal inference. Fortunately, the Compulsory Education Law in China was implemented in 1986,[2] long before the introduction of the free compulsory education reform. This temporal separation allows us to differentiate the influence of the two. Another challenge arises from the non-random timing of the free compulsory education reform implementation across provinces. The first batch of reform provinces is mainly located in the central and western regions of China, which are relatively underdeveloped areas. To address this issue, we control for province-specific linear cohort trends, the interactions of pre-reform (i.e. 2005) provincial-level characteristics and birth cohort dummies in our specification. Following Xiao et al. (2017), we construct the number of semesters that a person is supposed to be exposed to free compulsory education by exploiting the cross-province variation in the phase-in of the reform and birth cohort variation. Using a cohort Difference-in-Differences (DID) approach, we identify the effects of exposure to free compulsory education on labour supply.

We find that exposure to free compulsory education significantly increases employment rates and reduces unemployment rates, but has no significant effect on labour force participation. The point estimates suggest that one additional semester of exposure increases the likelihood of being employed by 1.7 percentage points and reduces the likelihood of being unemployed by 2.2 percentage points. Moreover, exposure to free compulsory education reduces the likelihood of employment in the primary sector and promotes the likelihood of employment in the tertiary sector. It also increases the likelihood of formal employment. These findings support the Life Course Perspective, which highlights the long-term influence of early-life conditions on adult outcomes. The improvement in the labour market outcomes is primarily attributed to human capital accumulation, including improved high school graduation rates, enhanced health, and cognitive abilities. These findings align with the Human Capital Theory, which emphasises the role of education in enhancing productivity and employability. We further investigate the heterogeneous effects of free compulsory education by gender. We find that this reform demonstrates a reduction in inequality as it is more beneficial for women.

Our study contributes to two important strands of the literature. Firstly, we enrich the literature regarding the effects of free compulsory education reforms by analysing the reform's long-term effects on adult labour supply. Free compulsory education reforms have generally led to significant improvements across multiple outcomes – such as increased educational attainment, delayed marriage, improved health, and reduced child labour – yet their effects on labour

market outcomes are mixed (Liu et al., 2025; Dessy et al., 2023; Tang et al., 2020; Adu Boahen & Yamauchi, 2018; Xiao et al., 2017). This study extends this literature by exploring how this type of reforms impacts individuals' labour supply later in life.

Secondly, this study provides new evidence for the impact of the education reform on the gender gap in labour market outcomes. While the effects of the educational programs on gender gaps in education and labour market outcomes are marked by mixed evidence (Xie et al., 2025; Didier, 2021; Patel-Campillo & García, 2022), Du et al. (2021) have discovered that the compulsory schooling reform in China fostered more egalitarian gender role attitudes. Further evidence from China shows that while the implementation of compulsory education reduced gender disparities in educational attainment among rural populations, it did not translate into greater gender equality in labour market outcomes (Xie et al., 2025). However, Xie et al. (2025) focus on the legal mandate requiring all school-age children to complete nine years of compulsory education. In contrast, this paper examines the effects of removing financial barriers to schooling during the compulsory education period – a policy dimension that is closely related but conceptually distinct. This distinction matters, as behavioural responses may differ.

In the context of China's free rural compulsory education reform, which eliminated school fees for rural students, we find that expanded educational access has narrowed the gender gap in employment by boosting overall employment, including formal employment (which implies contractual agreements and social insurance benefits), especially for women. Our findings establish a causal link between free compulsory education and labour market outcomes. This highlights the role of education policies in reducing long-term poverty. The study shows how free education boosts participation among disadvantaged groups, offering a valuable model for other developing countries seeking to narrow employment gaps and break the cycle of poverty. In resource-constrained settings, such educational policies can provide a cost-effective means to raise the employment rate and foster more inclusive economic growth.

The rest of the paper is organised as follows. Section 2 describes the data sources and descriptive statistics. Section 3 introduces the identification strategy. Section 4 presents the results regarding the impact of free compulsory education on labour supply and its mechanisms. Section 5 analyses the impact of free compulsory education on gender gaps. Section 6 concludes.

## 2. Data

### *2.1. Inter-census population survey*

We use two datasets for empirical analysis. The primary dataset is the 2015 inter-census population survey, a 10 percent sample of the original 1% National Population Sample Survey. For our analysis of the impact of free compulsory education on labour supply, we restrict our sample to rural cohorts between 1988 and 1994. The earliest cohort affected by the free compulsory education reform was the one born from September 1990 to August 1991, who would have been in their $15^{th}$ year of age in 2006 and benefitted from the reform for about one year, their final year of compulsory education. The latest cohort 1994 would have been in their $12^{th}$ year of age in 2006 and would have instead benefitted for about three years. Additionally, to the greatest possible extent we retain individuals whose province of residence aligns with their household registration province to ensure consistency between the province in which compulsory education was received and the current province of residence. This yields a sample of 57,008 observations. In our identification strategy, the education levels of the father and mother serve as important controls. However, the inter-census population survey does not directly provide information on the educational attainment of individuals' parents, so we construct a family structure diagram (family tree) based on the 'relationship to the head of household' variable, and then match each individual with their parents' educational attainment. This process restricts that an individual and their parents share the same household code, as this survey has children sampled without having sampled their parents and vice-versa.[3] Finally, our sample comprises 32,944 rural individuals

aged 21–27, ideal for assessing labour market outcomes. We did not use earlier census data, like the 2010 one, as individuals born between 1988 and 1994 were only around 20 years old in 2010. They would be too young for assessing their employment outcomes.

For each individual, we examine labour supply outcomes across three dimensions: the probability of participation in the labour force (LFP), the probability of employment, and the probability of unemployment (Zuo, 2021; Brückner & Pappa, 2012). The employment status is coded as 1 if an individual has a job (including seasonal closure), and 0 otherwise. The unemployment status is coded as 1 if an individual is jobless but has actively searched for work in the past three months or is willing to begin a job within two weeks if suitable jobs are available. LFP is defined as the sum of the employment and unemployment variables. Additionally, for those employed, we further disaggregate the outcomes by industry sector, categorising employment into the primary, secondary, and tertiary industries according to national economic classification standards.

We merge the inter-census data with information on the rollout of the free compulsory education reform across provinces. Each individual is assigned to a province, and we use this information to map the number of exposed semesters based on the time of the reform implementation in their province during the compulsory education period. The number of exposed semesters measures the number of semesters during the ages of 6 to 15 when individuals should have been impacted by the free compulsory education reform. In China, each academic year starts in September and ends in July of the following year. According to enrolment policies, individuals typically start the primary school at age 6 and complete compulsory education by 15. The exposure to free education is calculated based on the reform implementation time in each province and the individual's birth date. We use September as the dividing point for each academic year. Individuals born from September 1989 to August 1990 are defined as 'cohort 1990', those born from September 1990 to August 1991 are defined as 'cohort 1991', and so on for other cohorts. For example, 'cohort 1992' (born from September 1991 to August 1992) should have entered the primary school on September 1st, 1998, and graduated from the junior high school in July 2007. If the implementation time of the reform in their province was in March 2006, 'cohort 1992' would have been exposed to the reform for 3 semesters. If the implementation time of the reform in their province was in September 2006, 'cohort 1992' would have been exposed to the reform for 2 semesters. Similar calculations apply to other scenarios. To enhance clarity, Table A1 in the Appendix presents the number of semesters of exposure by cohort and by the timing of policy implementation across provinces, which provides a clear illustration of the variation in exposure intensity across different birth cohorts and provincial reform timelines.

### *2.2. China Family panel studies (CFPS)*

The second dataset is the China Family Panel Studies (CFPS). The survey was initiated by the Institute of Social Science Survey at Peking University in 2010 which subsequently conducted six follow-up surveys in 2012, 2014, 2016, 2018, 2020 and 2022. The CFPS provides nationally representative samples of Chinese family and society. The survey implements multistage probability proportional to size sampling with implicit stratification and covers 25 provinces in China, representing approximately 95% of China's population. CFPS provides additional information for further investigation and mechanism analysis, such as work types, cognitive ability, and health. For our study, we focus on the 2014, 2016, 2018, 2020 and 2022 waves, as the classification of work types in the 2010 and 2012 waves differs from later waves.[4]

Preprocessing of the CFPS dataset involved combining the five-wave datasets into a single cross-section, following Cui et al. (2019). We exclude observations with missing key variable data, such as rural/urban areas, birth year, birth month, and employment conditions. Subsequently, we retain rural individuals who have a job. In order to determine the province

where individuals reside, we use the province information at age 12.[5] It was assumed that the province at age 12 corresponded to the province where individuals should have received compulsory education.[6] The dataset was further refined by limiting the birth cohorts to the years 1988 to 1994, resulting in a final sample of 6,585 observations. These individuals, aged 20–34, are ideal for assessing labour market outcomes.

We define four work types from CFPS: farming (engaged in agricultural production activities); formal employment (employed by enterprises or organisations where individuals enter into contractual agreements and receive social insurance benefits, etc); casual employment (engaged in informal or casual work); and entrepreneurship (self-employed or owner of private firms).

To assess human capital, we use three measures: educational attainment, cognitive ability and health. Educational attainment is measured by years of education, as well as high school completion and university graduation (both represented as binary variables, where Yes = 1 and No = 0). High school education here refers to a higher level of education than the minimum requirements set by compulsory education.

Cognitive abilities are measured using scores from verbal tests and mathematical tests. In the CFPS, individuals over 10 years old were given 34 verbal and 24 maths questions in 2014, 2018 and 2022. These questions have standard answers. Each correct answer accumulates 1 point.

Health-related human capital includes self-rated health, physical health, and mental health. Self-rated health (SRH) refers to the subjective evaluation of an individual's own health condition, rated on a scale of 1 to 5, representing very poor to very good health, respectively. Physical health is measured using three binary variables: whether the individual experienced physical discomfort in the past two weeks, had a chronic illness in the past six months, or was hospitalised in the past year. Our measure of mental health is computed using the 20-item Centre for Epidemiologic Studies Depression Scale (CES-D) (Li et al., 2023). The CES-D are widely used screening instruments for non-specific psychological distress in the general population and have been validated and used in more than 30 countries, including China. Details of the CES-D scale are shown in Supplementary Materials Section II. A higher score indicates poorer mental health.

We merge CFPS data with information on the rollout of free compulsory education reform across provinces and then calculate each individual's number of exposed semesters (following the method in Section 2.1).

### 2.3. *Supplementary data*

In addition to the CFPS and census data, we collect provincial-level data. The implementation dates of free compulsory education are sourced from the Ministry of Education and Ministry of Finance for each province. We cross-check these implementation dates with existing literature to ensure their accuracy. Provincial economic and demographic characteristics are taken from the *China Statistical Yearbook*.

### 2.4. *Summary statistics*

Table 1 presents the summary statistics, focusing on the rural population whose cohorts are from 1988 to 1994. Panel A, based on the 2015 Inter-Census Population Survey, shows that 86.7% of individuals participate in the labour market. Among them, 73.1% are employed, while 13.6% report being unemployed. Employment is distributed across sectors, with 44.0% engaged in the primary sector, reflecting the rural economy's traditional reliance on agriculture, 28.5% work in the secondary sector, and 27.5% are in the tertiary sector. On average, individuals experienced 1.693 semesters of exposure to the free compulsory education reform. For those individuals exposed to the reform, the average number of semesters of exposure was 3.560.

**Table 1.** Summary statistics

| Variable | Obs | Mean | Std. dev |
|---|---|---|---|
| Panel A: Sample for 2015 inter-census population survey | | | |
| LFP (Yes = 1) | 32,944 | 0.867 | 0.339 |
| Employment (Yes = 1) | 32,944 | 0.731 | 0.443 |
| Unemployment (Yes = 1) | 32,944 | 0.136 | 0.343 |
| Primary_ind \| Employment = 1 | 24,089 | 0.440 | 0.496 |
| Secondary_ind \| Employment = 1 | 24,089 | 0.285 | 0.451 |
| Tertiary_ind \| Employment = 1 | 24,089 | 0.275 | 0.446 |
| The number of exposed semesters | 32,944 | 1.693 | 2.242 |
| Male (Yes = 1) | 32,944 | 0.624 | 0.484 |
| Father's years of education | 32,944 | 7.919 | 2.457 |
| Mother's years of education | 32,944 | 6.936 | 2.826 |
| Panel B: Sample for CFPS | | | |
| Farming | 6,585 | 0.189 | 0.392 |
| Formal Employment | 6,585 | 0.672 | 0.469 |
| Casual employment | 6,585 | 0.030 | 0.170 |
| Entrepreneurship | 6,585 | 0.109 | 0.312 |
| The number of exposed semesters | 6,585 | 1.422 | 2.156 |
| Years of education | 6,318 | 10.502 | 3.831 |
| High school graduation | 6,318 | 0.440 | 0.496 |
| University graduation | 6,318 | 0.244 | 0.430 |
| Vocabulary test score | 1,797 | 22.904 | 8.494 |
| Mathematics test score | 1,797 | 12.799 | 5.303 |
| Self-rated health | 6,533 | 3.636 | 1.038 |
| Discomfort (Yes = 1) | 5,448 | 0.173 | 0.378 |
| Chronic illness (Yes = 1) | 5,448 | 0.046 | 0.210 |
| Hospitalised (Yes = 1) | 5,448 | 0.052 | 0.221 |
| Mental health (CES-D) | 4,249 | 32.881 | 6.965 |
| Male | 6,585 | 0.606 | 0.489 |
| Father's years of education | 6,585 | 6.426 | 4.087 |
| Mother's years of education | 6,585 | 5.325 | 2.870 |

*Notes*: Data on mental health is only available in the waves after 2016. Data on vocabulary and mathematics test scores are only available in waves 2014, 2018 and 2022.

Panel B, based on the CFPS, focuses on individuals who have a job. Among the employed, 18.9% work in farming, 67.2% have formal employment, 3.0% are in casual employment, and 10.9% are engaged in entrepreneurship. This indicates that for the relatively young rural population (aged 20–34), being formally employed by enterprises or organisations remains the predominant employment type.

## 3. Empirical framework

Drawing on Duflo (2001)'s identification strategy, we employ the generalised Difference-in-Differences (DID) approach to identify the causal effect of free compulsory education on labour supply. It utilises the variations in birth cohorts across provinces. Specifically, we estimate:

$$Y_{ipc} = a + \beta Semester_{ipc} + X_{ipc}\omega + \delta_p + \theta_c + T_p + X_p \times \theta_c + \varepsilon_{ipc} \quad (1)$$

where $i$, $p$, $c$ denotes individual, province, and birth cohort. The dependent variable, indicates the outcomes of interest, including labour supply and human capital. $Semester_{ipc}$ represents the number of semesters exposed to this reform, which is the number of semesters

individuals should be eligible for free compulsory education. $X_{ipc}$ represents individual and parental control variables, including gender and parental education years. For all specifications, we include provinces ($\delta_p$), and cohort ($\theta_c$) fixed effects. The regressions are weighted using the population sampling weights.

It is worth noting that there may be unobservable factors specific to certain provincial cohorts that are related to the timing of the reform and outcomes. We address this issue in two ways. First, to control for factors that vary linearly with the birth cohort across different provinces, Equation (1) includes province-specific linear cohort trends ($T_p$).[7] Second, to allow the cohort trend of the outcome variable to vary with pre-determined provincial characteristics, we include the interaction terms between pre-reform (i.e. 2005) provincial-level characteristics and cohort dummy variables $\theta_c$. $X_p$ includes per capita GDP, the ratio of fiscal expenditure to GDP, the ratio of fiscal revenue to GDP, the proportion of rural population, per capita education expenditure for rural primary school students, and per capita education expenditure for rural junior high school students in 2005.

The estimated coefficient $\beta$ represents the intent-to-treat (ITT) effects of exposed semesters on outcomes. We conduct descriptive statistics on the schooling status of rural children aged 6 to 15 from CFPS2010, which (due to data availability) is close enough to the reform undertaken in 2006–07. It was found that 89.86% of children attended public schools, 2.64% attended private schools, 0.17% attended migrant children's schools,[8] and 7.32% were not attending school. In summary, in rural areas of China, 90% of children receive the treatment, so the ITT effects and TOT (treatment-on-the-treated) effects should be very close.

Our $\beta$ is, however, underestimated because the children included in our sample who benefitted from the reform for the longest period are those who were 12 years old when the reform set in, and, importantly, the sample does not include those who benefitted from the reform for the longest possible period, i.e. those who were 6 years old when the reform kicked in.[9] This implies that, in our estimates, the families of the treated children were able to send them to school at the age of 6, so these families may not be deeply poor. Therefore, the effect of reform should be stronger than what we estimate when using the full exposure to the reform.

When using the multi-wave CFPS data, we further include interactions between province fixed effects ($\delta_p$) and year fixed effects ($\eta_t$), to control for province-specific factors that vary over the years. We estimate:

$$Y_{ipct} = a + \beta Semester_{ipc} + X_{ipct}\omega + \delta_p + \theta_c + T_p + X_p \times \theta_c + \delta_p \times \eta_t + \varepsilon_{ipct} \quad (2)$$

All standard errors are clustered by province to account for correlations in outcomes between individuals in the same province.

## 4. Effects of free compulsory education on labour supply

### *4.1. Effects on labour force participation, employment and unemployment*

Table 2 presents the baseline estimates for specification (1) using the 2015 inter-census population survey. In column (1), the coefficient on the number of exposed semesters is statistically insignificant, indicating that additional exposure to compulsory education does not appear to have a strong impact on the overall probability of labour force participation. In column (2), which examines employment, the coefficient on exposed semesters is positive and statistically significant at the 5 percent level. Specifically, each additional semester of exposure to the reform would lead to a 1.7-percentage-point increase in the likelihood of being employed for rural residents. Column (3) focuses on unemployment, where the coefficient on exposed semesters is negative and statistically significant at the 5 percent level. Each additional semester of exposure to compulsory education is associated with a 2.2-percentage-point decrease in the likelihood of being unemployed. When we exclude the individual controls and pre-provincial controls from

**Table 2.** Effects of free compulsory education on LFP, employment, and unemployment

| | (1) LFP | (2) Employment | (3) Unemployment |
|---|---|---|---|
| Number of exposed semesters | −0.005 | 0.017** | −0.022** |
| | (0.008) | (0.007) | (0.009) |
| Controls | Y | Y | Y |
| Province FE & Cohort FE | Y | Y | Y |
| Province linear cohort trend | Y | Y | Y |
| Pre-provincial controls × Cohort FE | Y | Y | Y |
| *Obs* | 32,944 | 32,944 | 32,944 |
| $R^2$ | 0.072 | 0.073 | 0.023 |
| Mean of Y | 0.867 | 0.731 | 0.136 |

*Notes*: The sample comes from inter-census population survey and includes rural individuals whose birth cohorts were from 1988 to 1994. All regressions include controls, province fixed effects, cohort fixed effects, province linear cohort trend, and the interactions of provincial controls with cohort fixed effects. Standard errors clustered at province level are reported in parentheses. ***Significant at the 1 percent level; **Significant at the 5 percent level; *Significant at the 10 percent level.

the specification, while controlling for county and birth-month fixed effects, the results remain qualitatively unchanged (see Supplementary Material Section III, Table B1 for details).

The average number of exposed semesters for individuals affected by the reform is 3.56, based on descriptive statistics. We estimate that the reform increased the probability of employment by approximately 6 percentage points ($3.56 \times 0.017 \approx 0.061$) and reduced the probability of unemployment by approximately 8 percentage points[10] ($3.56 \times -0.022 \approx -0.078$). To provide a clear sense of the magnitudes of our effects, we compare them with previous findings on compulsory education reforms. For instance, Fischer et al. (2020) find that extending compulsory schooling in Sweden from six to seven years increased the probability of employment by 1.7 percentage points. In the context of Turkey, Torun (2018) shows that an additional year of compulsory schooling led to employment gains of 0.6 to 1.4 percentage points for individuals aged 20–29 who were not attending university. Compared to these findings, the effects estimated in our study seem to be more extensive. One explanation for this discrepancy lies in the unique design of China's rural free compulsory education reform. In contrast to earlier policies that primarily extended the duration of schooling or adjusted entry ages, this reform mandated attendance while eliminating both tuition and ancillary fees. While these measures primarily reduced direct costs, they also alleviated the financial burden of education, making it easier for families to afford schooling. Although the reform did not directly address forgone earnings, it made them less of a constraint by removing some of the financial pressures that might have forced families to rely on child labour. As a result, the reform more effectively improved educational attainment and, in turn, yielded long-term benefits in labour market outcomes. Taken together, the results in Table 2 underscore the dual impact of compulsory education on rural labour markets: it increases the likelihood of gaining employment while reducing the risk of unemployment. However, its lack of a significant effect on labour force participation suggests that it primarily reshapes the distribution between employment and unemployment, rather than drawing more individuals into the labour market. These findings highlight the role of compulsory education in strengthening rural labour market outcomes by improving both employability and job stability.

Among those not yet entering the labour market, over 60% were still enrolled in school. Being a student can serve as a positive indicator of human capital accumulation, suggesting that this group is likely to enter the labour market upon completing their education. Supplementary Material Section III Table B2 reports the effects of free compulsory education on current school enrolment.[11] The results indicate that each additional semester of exposure to

compulsory education is associated with approximately a 1-percentage-point increase in the likelihood of attending university. This finding highlights another positive outcome of the free compulsory education reform, as it further underscores its role in promoting continued education and skill development among rural individuals.

The credibility of our identification depends on the parallel trends assumption, which posits that if there was no reform, the average labour market outcomes across birth cohorts would have evolved similarly regardless of whether the individuals resided in provinces that implemented the reform earlier or later. To empirically assess this assumption, we conduct an event study analysis. This event study enables a formal statistical test of the parallel trends assumption by analysing the pattern of $\beta_k$ coefficients for $k < -1$, which correspond to periods prior to the implementation of the free compulsory education reform. In addition, it allows us to examine the dynamic effects of the reform over time. This approach provides deeper insight into how the impacts of receiving free compulsory education evolve and helps assess whether the average treatment effects identified in the DID specification may conceal important temporal variations. Specifically, we estimate:

$$Y_{ipct} = a + \beta_k \sum_{k=-3,\, k\neq -1}^{2+} I(c - c_{p0} = k) + X_{ipc}\omega + \delta_p + \theta_c + T_p + X_p \times \theta_c + \varepsilon_{ipct} \tag{3}$$

where $c_{p0}$ represents the earliest treated cohort in province $p$, defined as the cohort that first received exposure to the reform based on the provincial implementation schedule. The variable $k$ measures the relative distance between an individual's birth cohort $c$ and $c_{p0}$. For instance, as shown in Table A1, in provinces where the reform was implemented in March 2006, $c_{p0}$=1991, so individuals born in 1990 belong to $k$=−1, those born in 1989 to $k$=−2, and those born in 1992 to $k$ = 1, and so forth. The term $I(c-c_{p0}=k)$ is a dummy variable that equals 1 if the equation in brackets holds true, and 0 otherwise. We omit $k$=−1 as the reference group.

Figure 1 presents the estimated coefficients $\beta_k$ along with 95% confidence intervals for employment and unemployment outcomes. The results show no significant pre-trends in labour market outcomes prior to the reform. This supports the parallel trends assumption, reinforcing the validity of our Difference-in-Differences design. Furthermore, the figure illustrates the

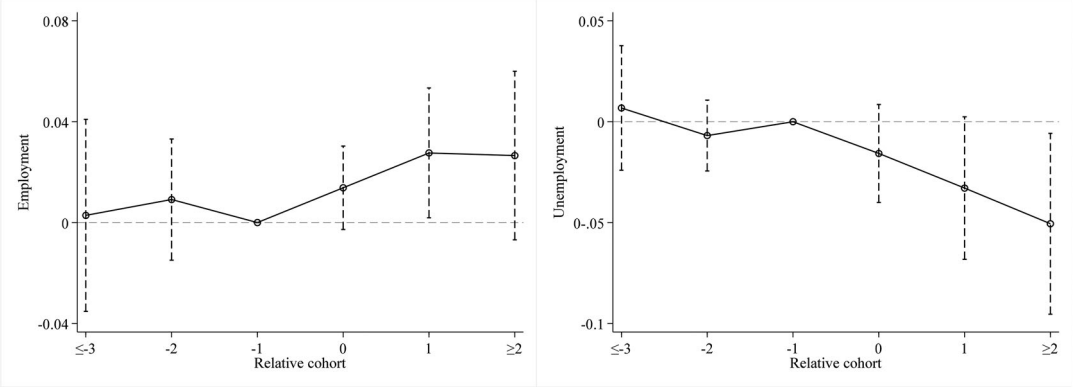


**Figure 1.** Event study estimate: Impacts of the reform on employment and unemployment.
*Notes*: The figure plots the estimated coefficients and 95% confidence intervals from analysis as per Eq. (3). The sample comes from inter-census population survey and includes rural individuals whose birth cohorts were from 1988 to 1994. All regressions include province fixed effects, cohort fixed effects and province linear cohort trend. The group with k= −1 serves as the reference group. To address concerns about small sample sizes and potential multicollinearity, the four earliest cohorts (k= −4) are combined into period −3, and the three latest cohorts (k = 3) are combined into period 2, as sample size decreases with the absolute distance of $k$ from the earliest treated group ($c_{p0}$).

growing impact over time of the reform, with a significant rise in employment and a drop in unemployment, suggesting a lasting and intensifying effect of free compulsory education on labour market participation.

### *4.2. Effects on the industry distribution of the labour force*

For the employed population, we examine the impact of free compulsory education on the industry distribution of the labour force, as shown in Table 3. The results show that free compulsory education increases the share of employment in the tertiary sector while reducing the share in the primary sector for rural residents. An additional semester of reform exposure decreases the probability of employment in the primary sector by 3.4 percentage points and increases the probability of employment in the tertiary sector by 2.7 percentage points. This causal effect accounts for approximately 10% of the mean of the outcome variables, indicating a substantial upgrading effect of free compulsory education on rural residents' employment. Additionally, free compulsory education does not significantly enhance secondary sector employment, likely for two reasons. First, jobs in manufacturing, mining, and construction often do not demand high educational attainment. Second, this sector is more vulnerable to technological change and automation, which can reduce employment opportunities. In contrast, tertiary sector employment depends more on service-oriented traits and professional skills, which education reforms are better positioned to develop.

### *4.3. Effects on work types of labour force*

CFPS categorises employment types into four categories: farming, formal employment, casual employment, and entrepreneurship. Table 4 presents the results of the impact of free compulsory education on employment types. The number of exposed semesters has a negative effect on casual employment, showing that one additional semester of schooling reduces the probability of casual employment by 1.9 percentage points, but at 10% significance level, while the coefficients associated with the impact on farming employment and entrepreneurship are not statistically significant. Importantly, the reform has significantly increased the probability of being employed in the formal sector by 7.8% percentage points, and this result is statistically significant at the 1% significance level. Our results show that the reform of free compulsory education

**Table 3.** Effects of free compulsory education on the industry distribution of the labour force

| | (1) Primary_ind | (2) Secondary_ind | (3) Tertiary_ind |
|---|---|---|---|
| Number of exposed semesters | −0.034*** | 0.006 | 0.027* |
| | (0.011) | (0.016) | (0.015) |
| Controls | Y | Y | Y |
| Province FE & Cohort FE | Y | Y | Y |
| Province linear cohort trend | Y | Y | Y |
| Pre-determined provincial controls × Cohort FE | Y | Y | Y |
| *Obs* | 24,089 | 24,089 | 24,089 |
| $R^2$ | 0.152 | 0.090 | 0.057 |
| Mean of Y | 0.440 | 0.285 | 0.275 |

*Notes*: The sample comes from inter-census population survey and includes rural individuals who have a job and whose birth cohorts were from 1988 to 1994. All regressions include controls, province fixed effects, cohort fixed effects, province linear cohort trend, and the interactions of provincial controls with cohort fixed effects. Standard errors clustered at province level are reported in parentheses. ***Significant at the 1 percent level; **Significant at the 5 percent level; *Significant at the 10 percent level.

**Table 4.** Effects of free compulsory education on work types

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Farming | Formal emp. | Casual emp. | Entrep. |
| Number of exposed semesters | −0.033 | 0.078** | −0.019* | −0.025 |
| | (0.032) | (0.033) | (0.012) | (0.025) |
| Controls | Y | Y | Y | Y |
| Province FE & Cohort FE | Y | Y | Y | Y |
| Province linear cohort trend | Y | Y | Y | Y |
| Pre-provincial controls × Cohort FE | Y | Y | Y | Y |
| Province FE × Year FE | Y | Y | Y | Y |
| *Obs* | 6,585 | 6,585 | 6,585 | 6,585 |
| $R^2$ | 0.157 | 0.104 | 0.038 | 0.042 |
| Mean of Y | 0.189 | 0.672 | 0.030 | 0.109 |

*Notes*: The sample comes from CFPS and includes rural individuals who have a job and whose birth cohorts were from 1988 to 1994. All regressions include controls, province fixed effects, cohort fixed effects, province linear cohort trend, and the interactions of provincial controls with cohort fixed effects. Standard errors clustered at province level are reported in parentheses. ***Significant at the 1 percent level; **Significant at the 5 percent level; *Significant at the 10 percent level.

encourages individuals to choose non-agricultural employment and formal employment. Supplementary Material Section III, Table B3 confirms the robustness of results under alternative specifications for formal employment, farming and entrepreneurship, but the coefficients for casual employment are not always significant.The results in column 4 show that the number of exposed semesters has a negative but insignificant effect on the probability of engaging in entrepreneurship. This could be due to other individual barriers like access to finance, which are not accounted for in our model, or the fact that we do not observe these individuals over very long periods in the job market. What we observe here is the younger adults' entrepreneurship rate, which we expect to be lower than for older adults, as young workers may want to gain professional experience before setting up their own business. Also, some studies have shown that compulsory education reforms enhance individuals' risk aversion levels (Jung, 2015).

In summary, we find that the free compulsory education reform increases the probability of individuals being employed. Employment here refers to jobs in enterprises, government, or institutions. These jobs usually offer stable and relatively high income, as well as social security benefits. The labour law requires employers to sign labour contracts with employees to protect employees' legal rights. In other words, this reform has improved the quality of individual employment.

### *4.4. Robustness checks*

We conduct a series of robustness checks. First, we address concerns about heterogeneous treatment effects by employing the staggered DID estimator of de Chaisemartin and D'Haultfoeuille (2024), which accommodates non-binary treatments. Second, we rule out confounding from major concurrent policies, including the 1986 Compulsory Education Law, the 1999 university expansion, and the 2003 'Two Exemptions and One Subsidy' program. We further control for rural school closures by incorporating provincial school accessibility measures, and for trade liberalisation using province-level indices following Ahsan and Chatterjee (2017). Placebo tests assigning reform timing to urban samples and to earlier cohorts yield no significant effects, supporting causal validity. Finally, we address potential multiple counting in CFPS by retaining only the latest observation per individual, confirming that the estimates remain consistent. Full details of robustness checks and trade liberalisation measurements are provided in Supplementary Materials Section IV & V respectively.

### *4.5. Mechanisms*

The impact of the reform of free compulsory education in improving labour supply outcomes is achieved by human capital channels. Table 5 provides evidence regarding mechanisms.

*4.5.1. Education mechanism* Columns 1 to 3 of Table 5 present the effects of the reform on individuals' educational outcomes. Since education was already compulsory at the time of the reform, the introduction of free compulsory education was not expected to have a significant impact on years of schooling, a result that is confirmed by our data. This suggests that the reform likely influences labour market outcomes through alternative channels beyond the years of schooling. Although compulsory education is mandated by law prior to the 2006 reform, many rural families still faced substantial financial barriers, including tuition, textbooks, and miscellaneous fees, that led to absenteeism, delayed enrolment, or early dropout. By reducing the financial burden of schooling, the reform directly improves students' school attendance and actual learning within compulsory grades, especially for families with significant financial constraints. An indirect explanation is that the reduction in schooling costs also reduced child labour, as prior studies have shown (Chyi & Zhou, 2014; Tang et al., 2020). Child labourers tend to study fewer hours and attend school less regularly (Tang et al., 2018), so by reducing child labour, the reform likely allowed children to devote more time to schooling, which in turn contributed to the observed improvements. In summary, even without extending the years of schooling, the free compulsory education reform increased students' school attendance and real learning time.We also find weak evidence suggesting that the reform increases the probability of completing high school graduation but does not have a similar effect on university graduation. This may be due to the fact that the reduction in schooling costs allows rural students to access more education, enabling them to gain admission to high school and graduate, but did not provide the same impetus for continued education at the university level.

*4.5.2. Cognitive ability mechanism* Columns 4 and 5 of Table 5 examine the impact of the reform on cognitive ability. The results show that an additional semester of reform exposure increases vocabulary test scores by approximately 0.16 points and mathematics test scores by 0.14 points.[12] This suggests that the reform likely improves school attendance and, in doing so,

**Table 5.** Education and cognitive ability mechanisms

| | (1) Years of education | (2) High school graduation | (3) University graduation | (4) Vocabulary test score | (5) Mathematics test score |
|---|---|---|---|---|---|
| Number of exposed semesters | 0.080 | 0.058* | −0.028 | 0.160** | 0.144* |
| | (0.241) | (0.030) | (0.030) | (0.066) | (0.082) |
| Controls | Y | Y | Y | Y | Y |
| Province FE & Cohort FE | Y | Y | Y | Y | Y |
| Province linear cohort trend | Y | Y | Y | Y | Y |
| Pre-provincial controls × Cohort FE | Y | Y | Y | Y | Y |
| *Obs* | 6,318 | 6,318 | 6,318 | 1,797 | 1,797 |
| $R^2$ | 0.241 | 0.158 | 0.138 | 0.225 | 0.204 |
| Mean of Y | 10.502 | 0.440 | 0.244 | 22.904 | 12.799 |

*Notes*: The sample comes from CFPS and includes rural individuals who have a job and whose birth cohorts were from 1988 to 1994. All regressions include controls, province fixed effects, cohort fixed effects, province linear cohort trend, and the interactions of provincial controls with cohort fixed effects. Standard errors clustered at province level are reported in parentheses. ***significant at the 1 percent level; **significant at the 5 percent level; * significant at the 10 percent level.

**Table 6.** Health mechanisms

| | (1) Self-rated health | (2) Discomfort | (3) Chronic illness | (4) Hospitalised | (5) Depression (CES-D) |
|---|---|---|---|---|---|
| Number of exposed semesters | −0.041 | 0.029 | −0.006** | −0.007* | −1.369*** |
| | (0.066) | (0.030) | (0.003) | (0.004) | (0.442) |
| Controls | Y | Y | Y | Y | Y |
| Province FE & Cohort FE | Y | Y | Y | Y | Y |
| Province linear cohort trend | Y | Y | Y | Y | Y |
| Pre-provincial controls × Cohort FE | Y | Y | Y | Y | Y |
| *Obs* | 6,533 | 5,448 | 5,448 | 5,448 | 4,249 |
| $R^2$ | 0.044 | 0.028 | 0.036 | 0.041 | 0.064 |
| Mean of Y | 3.636 | 0.173 | 0.046 | 0.052 | 32.881 |

*Notes*: The sample comes from CFPS and includes rural individuals who have a job and whose birth cohorts were from 1988 to 1994. All regressions include controls, province fixed effects, cohort fixed effects, province linear cohort trend, and the interactions of provincial controls with cohort fixed effects. Standard errors clustered at province level are reported in parentheses. ***Significant at the 1 percent level; **Significant at the 5 percent level; *Significant at the 10 percent level.

expands the access to knowledge and skills, which contributes to the observed improvements in cognitive performance.

*4.5.3. Health mechanism* Table 6 examines the impact of the free compulsory education reform on health outcomes. The results indicate that the reform significantly reduces the probability of hospitalisation in the previous year and the likelihood of having a chronic illness in the past six months, with both effects being close to 1 percentage point. These results indicate improved objective physical health. Furthermore, the reform has a notable positive effect on mental health, as an additional semester of exposure decreases depression levels (measured by the CES-D score) by 1.4 points. The effect on self-rated health is negligible and not statistically significant. While the reform improves objective health outcomes, it simultaneously raises individuals' expectations regarding their health, leading to no perceptible change in self-assessments. In sum, the reform improves physical and mental health, especially objective health and depression. These findings are consistent with prior literature that highlights the positive relationship between compulsory education and health outcomes (Liu et al., 2025; Jürges et al., 2013).[13]

Our findings align with Xiao et al. (2017), demonstrating that this reform in rural China is positively associated with individuals' educational attainment and cognitive achievement in early adulthood. We extend this by adding evidence on health, key to human capital and labour supply. Importantly, we build on the work of Xiao et al. (2017) by demonstrating that this reform not only enhances human capital but also leads to significant improvements in labour market outcomes during early adulthood.

## 5. Further analyses: Free compulsory education and gender gap in labour supply

In rural China, traditional gender norms have historically disadvantaged girls in accessing education (Hannum et al., 2009). Economic constraints often meant rural families could not afford tuition fees and, under deeply ingrained gender norms that favoured males, families prioritised boys' education to ensure their access to the labour market. The implementation of the free compulsory education reform, however, substantially alleviated these financial burdens, increasing opportunities for girls to attend school. This shift may affect gender disparities in the labour market. To investigate this, we incorporate interaction terms between the number of exposed semesters and gender into equation (1), with the estimates reported in Table 7.

**Table 7.** Heterogeneity effects by gender

| | (1) LFP | (2) Employment | (3) Unemployment | (4) Tertiary_ind | (5) Formal emp. |
|---|---|---|---|---|---|
| Number of exposed semesters | −0.004 | 0.024*** | −0.028*** | 0.003 | 0.080** |
| | (0.008) | (0.007) | (0.009) | (0.003) | (0.035) |
| Number of exposed Semesters × male | −0.001 | −0.011*** | 0.010*** | 0.025 | −0.003* |
| | (0.002) | (0.003) | (0.001) | (0.016) | (0.002) |
| Controls | Y | Y | Y | Y | Y |
| Province FE & Cohort FE | Y | Y | Y | Y | Y |
| Province linear cohort trend | Y | Y | Y | Y | Y |
| Pre-provincial controls × Cohort FE | Y | Y | Y | Y | Y |
| *Obs* | 32,944 | 32,944 | 32,944 | 24,089 | 6,585 |
| $R^2$ | 0.072 | 0.073 | 0.024 | 0.057 | 0.104 |
| Mean of Y | 0.867 | 0.731 | 0.136 | 0.275 | 0.672 |

*Notes*: Columns 1 to 4 use the inter-census population survey, while column 5 uses CFPS. All regressions include controls, province fixed effects, cohort fixed effects, province linear cohort trend, and the interactions of provincial controls with cohort fixed effects. Standard errors clustered at province level are reported in parentheses. ***significant at the 1 percent level; **significant at the 5 percent level; * significant at the 10 percent level.

Results reveal heterogeneity in labour market outcomes. From Column 2, we observe that each additional semester of reform exposure increases the probability of employment for women by 2.4 percentage points, compared to 1.3 percentage points for men, a statistically significant difference. Similarly, the reform has a stronger effect on reducing unemployment rates for females, as shown in Column 3. The reform also shows heterogeneity in its effects on formal employment. As indicated in Column 5, an additional semester of exposure increases the probability of females being in formal employment by 8.0 percentage points, compared to 7.7 percentage points for males. This highlights the potential of the reform to improve women's access to stable, formal jobs that often come with social insurance benefits.

In summary, the free compulsory education reform has contributed to reducing gender inequality in rural labour markets, particularly by increasing women's likelihood of being employed, especially in formal and stable jobs. These findings align with Ma (2025), who found that compulsory education positively influenced egalitarian intrahousehold decision-making, women's employment in non-agricultural sectors, and women's income. However, Ma (2025) focuses exclusively on the female population and does not directly provide evidence on gender differences. In contrast, our results offer new insights into the relationship between compulsory education and gender equality, highlighting the role of the reform in narrowing gender disparities in rural labour markets.

Since the effects of the free compulsory education reform on employment outcomes exhibit gender heterogeneity, it is reasonable to expect similar heterogeneity in its effects on human capital accumulation. To extend, we analyse the gender-specific impacts of the reform on education, cognitive ability, and health outcomes.

Results are presented in Supplementary Materials Section III, Tables B4 and B5. As shown in Table B4, the reform improves years of education, high school graduation rates and cognitive test scores, with these effects being more pronounced for women. Turning to health outcomes, Table B5 highlights the role of the reform's role in improving physical and mental health, with gendered differences emerging in some areas, particularly in mental health. The reform reduces depression scores, and the interaction term for men shows a significant positive effect, indicating that the mental health benefits of the reform are accruing only to women.

In summary, the results suggest that the free compulsory education reform has played a critical role in narrowing gender disparities in human capital accumulation. By significantly

improving high school graduation rates, cognitive ability, and mental health outcomes for females, the reform has contributed to reducing gender inequalities, particularly in education and mental well-being. These findings reinforce the importance of education policies in addressing structural gender disparities in rural China, with long-term implications for labour market outcomes and social equity. These results also provide supportive explanations and evidence for the heterogeneity observed in Table 7.

## 6. Conclusion

China's economic and social development has long relied on its abundant labour force. Nonetheless, in recent times, China has encountered a shortage of labour, indicating a decline in its longstanding competitive advantage stemming from its once 'limitless' labour supply (Cui et al., 2018; Cai, 2016). Against this context, we examine the long-run causal effects of free compulsory education reform on labour supply in China. Based on a cohort difference-in-differences analysis, we find that exposure to free compulsory education significantly promotes individual employment in adulthood and reduces unemployment. Moreover, exposure to free compulsory education reduces the probability of engaging in lower-end subsistence farming and increases the probability of being employed in the tertiary industry. Additionally, rural individuals are more likely to engage in formal employment, which is of great significance to the upgrading of the industrial structure and rural poverty alleviation. Our findings further suggest that investments in education might play a role in reducing poverty in the long run by improving employment outcomes.

Although many countries have implemented compulsory education reforms, access to education is often not free. In countries such as Bangladesh, Tanzania, Kenya, amongst others, families frequently bear significant out-of-pocket expenses for uniforms, learning materials, and informal school fees. These financial burdens can severely limit equitable access to education (Asadullah & Chaudhury, 2013; Lindsjö, 2018; Evans & Ngatia, 2021). Our findings suggest that increasing access to free education and eliminating tuition fees for compulsory education could improve employment rates and job quality, thereby contributing to broader economic development. These long-term improvements are consistent with the Life Course Perspective, which underscores how early-life interventions can generate lasting effects on adult socioeconomic outcomes. We offer practical insights for policymakers seeking to narrow educational and labour disparities on a global scale. China's phased implementation strategy demonstrates how large-scale education reforms can be adapted to local contexts, a model that holds promise for other developing nations with diverse regional needs.

Furthermore, the mechanism analysis shows that the free compulsory education reform increases the likelihood of high school completion, improves health, and strengthens cognitive abilities. These human capital gains positively influence labour market outcomes. In addition, the heterogeneous analysis indicates that the reform has reduced gender gaps in labour market outcomes, highlighting its role in both fostering human capital and promoting equity.

While widely debated, long-term evidence on educational subsidies remains limited. Focusing on a Free Compulsory Education Reform in rural China, this study offers robust evidence that free schooling improves adult employment outcomes, especially for women. The findings have broader significance for other low-and middle-income countries undergoing economic structural transformation and grappling with persistent inequality. In this regard, the paper offers a valuable framework for assessing the role of educational policies in shaping economic opportunities and reducing disparities across comparable contexts.

Our study makes two key contributions to the existing literature. First, we assess the long-term impact of free compulsory education on adult labour supply. While such reforms have been associated with improvements in various outcomes, including higher educational attainment, delayed marriage, better health, and reduced child labour, their influence on labour market participation remains mixed (Liu et al., 2025; Xie et al., 2025; Dessy et al., 2023; Chyi &

Zhou, 2014; Tang et al., 2020; Xiao et al., 2017; Adu Boahen & Yamauchi, 2018). We extend this work by exploring long-run labour supply effects. Second, we provide new evidence on the role of education reforms in shaping gender disparities in labour market outcomes. Prior research on the impact of educational programs on gender gaps in education and employment has produced mixed findings (Xie et al., 2025; Didier, 2021; Patel-Campillo & García, 2022). However, Du et al. (2021) suggest that China's compulsory schooling reform has fostered more egalitarian gender role attitudes. Our analysis shows that educational expansion has narrowed the gender gap in employment, including formal employment. We build on Xie et al. (2025) by examining gendered labour market outcomes and show that free compulsory education has narrowed the gender gap in employment, including formal employment.

As for limitations, our micro-level survey data lacks income information, limiting our ability to assess the income-enhancing effects of this reform. We can infer that improvements in employment quality are likely to raise income, as formal work generally offers higher earnings than agricultural labour. Moreover, if the reform increases return to education, it may also foster intergenerational benefits, as recipients may invest more in their children's schooling. Yet, in the present sample, most adults' children have not yet reached school age. Examining older cohorts in future research would enable a better assessment of these effects. This study highlights the ongoing need to assess the role and value of education policies in addressing inequality across developing nations.

## Notes

1. In 2006, China had a total population of 259.61 million children aged 0–14. With rural residents accounting for 56% of the total population that year, we can roughly estimate that the number of rural children was close to 150 million.
2. The Law on Compulsory Education enacted in 1986 was a milestone for China. The law introduced the right for all school-age children with Chinese nationality to receive compulsory education and made parents responsible for enrolling their children in school and making sure they finish nine years of compulsory schooling.
3. This procedure restricts the sample to households where children live with their parents, which may potentially reduce the representativeness of our sample. Supplementary Materials Section III, Table B1, Panel A presents the results based on 57,008 observations without controlling for the parents' years of education. The main conclusions of our paper remain unchanged.
4. According to the "China Family Panel Studies User Manual", CFPS initially classified jobs into agricultural and non-agricultural categories in 2010, with limited detail. In 2012, interviewers found many respondents were unsure about their job type, leading to inaccurate reporting. Starting in 2014, the survey introduced two objective questions for each job, allowing the computer program to automatically determine the job category, ensuring consistent classification from then on.
5. CFPS provides province addresses of individuals when they were 3 years old and 12 years old. Individuals are more likely to reside in provinces where they receive compulsory education at the age of 12, compared to where they resided at the age of 3.
6. This assumption was supported by the 2005 inter-census population survey, which indicated that the proportion of interprovincial migrants was less than 4% of the total population. Thus, it can be reasonably inferred that the probability of individuals in the compulsory education age range experiencing interprovincial migration was very low.
7. Dube et al. (2010) similarly used state-specific linear trends to control for differential trends in employment across states when identifying the effect of minimum wage changes on earnings and employment. Adding quadratic cohort trends in our regressions has little effect on our results.
8. "Migrant children's schools" refers to schools that are specifically designed to enroll migrant children. These schools can be either privately or publicly funded.
9. The children who benefited from the age of 6 were born around 2000, and we cannot evaluate their labour supply outcomes in our sample.
10. When different cohort ranges are used in our sample, both the average number of exposed semesters (if $> 0$) and the estimated coefficients vary to some extent. However, their product remains stable at approximately 6 percentage points for employment and 8 percentage points for unemployment, indicating the robustness of the reform's overall effects.

11. Given that the age range of our sample for inter-census population survey is 21–27, "being enrolled in school" typically refers to attending university.
12. Cognitive ability is highly correlated with an individual's educational attainment. Even after controlling for years of schooling in the regressions, the coefficient remains significantly positive.
13. Although the existing literature presents mixed findings on the health effects of compulsory education, the Chinese context – characterised by poorer baseline health and limited access to health knowledge, especially in rural areas – may provide more room for education to generate health improvements. Our finding of significant health effects is thus consistent with evidence from similar settings within China (Liu et al., 2025; Huang, 2015).

## Author contributions

CRediT: **Zengdong Cao**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing; **Sara Maioli**: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing; **Nichola Latoya Williams**: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing; **Drew Woodhouse**: Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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## Data availability statement

The data that support our study are available from CFPS project (http://www.isss.pku.edu.cn/cfps/en/index.htm) and the National Bureau of Statistics (https://www.stats.gov.cn/sj/). We have shared the replication codes for the empirical analysis via Figshare: 10.6084/m9.figshare.30273631.

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## Appendix

**Table A1.** Number of exposed semesters by cohort and province reform timelines

| The timing of the reform implementation by province | Cohorts | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| March 2006 | 0 [1347] | 0 [1470] | 0 [1895] | 1 [1628] | 3 [1720] | 5 [1667] | 7 [1708] |
| September 2006 | 0 [641] | 0 [738] | 0 [875] | 0 [801] | 2 [827] | 4 [899] | 6 [801] |
| March 2007 | 0 [2028] | 0 [2261] | 0 [2867] | 0 [2354] | 1 [2271] | 3 [2180] | 5 [1966] |

*Notes*: Each columns represents a cohort of individuals born from September of the previous year to August of the year indicated, and the rows represent the timing of the free compulsory education reform implementation at provincial level. The reported figures indicate the number of exposed semesters by cohort and province reform timelines. The numbers in square brackets represent the number of observations using the sample from the inter-census survey. The provinces reformed in March 2006 were Tianjin, Shanghai, Fujian, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Beijing, Inner Mongolia, Xizang, Qinghai, Ningxia, and Xinjiang. The provinces reformed in September 2006 were Jiangsu, Zhejiang, and Guangdong. The provinces reformed in March 2007 were Hebei, Shanxi, Liaoning, Jilin, Heilongjiang, Anhui, Jiangxi, Shandong, Henan, Hubei, Hunan, and Hainan.