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Compulsory Education and Gender Inequality in China's Structural Transformation

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ABSTRACT *This paper examines whether education can play a role in mitigating gender inequality in the process of sectoral reallocation of labour. We exploit the exogenous variations in educational attainment induced by the implementation of the 1986 Compulsory Education Law (CEL) in China. Using data from the 2018 wave of the China Family Panel Studies (CFPS) and a cohort difference-in-differences (DID) approach, we find that the CEL narrowed the gender gap in education for rural residents, but it did not reduce gender inequality in labour market outcomes, such as wage labour participation and wage rate. Our analysis reveals that this persistent inequality in labour market outcomes can be attributed to gender differences in migration and occupational choices. Specifically, rural males exposed to the CEL were more likely to migrate outside local provinces and work in low-skilled manufacturing sectors, while rural females tended to stay within local counties and work in low-skilled service sectors. Furthermore, we provide evidence that their differential migration responses are driven by household labour divisions and social gender norms, rather than disparities in cognitive skills.*

KEYWORDS: compulsory education; gender inequality; structural transformation; China

1. Introduction

Education has been emphasised as a pathway towards gender economic equality and the empowerment of women. Over the past few decades, most countries, including low- and middle-income countries, have implemented compulsory education reforms (Urbina, 2022) and other public policies aimed at keeping children in school, such as conditional cash transfers, many of which explicitly target girls (Xu, Shonchoy, & Fujii, 2022). In addition, higher household incomes and greater economic opportunities for females have raised parental investment in girls' education (World Bank, 2012). Consequently, there has been a significant rise in female educational attainment, contributing to a marked reduction in the gender education gap in both developed and developing countries.

Despite the narrowed gender gap in education, disparities in labour market outcomes persist. While female labour force participation has increased with better education, it remains lower than that of men (Duflo, 2012). Additionally, women are more likely to engage in unpaid family work or be employed in the informal wage sector (ILO (International Labor Organization), 2010).

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Even in formal employment, they tend to be concentrated in traditionally 'female' occupations and sectors and typically earn lower wages than men (Bertrand, 2020; Blau & Kahn, 2017).

Why has the narrowing gender gap in education not translated into reduced gender inequality in the labour market? Emerging literature emphasises the significance of the structure of employment, asserting that structural transformation – especially the growth of the service sector – will help mitigate gender inequality (Ngai & Petrongolo, 2017; Rendall, 2013). Development economists have documented that economic growth is typically accompanied by a process of structural transformation, which involves a reallocation of employment and economic activities from agriculture to manufacturing and services (Herrendorf, Rogerson, & Valentinyi, 2014). In this process, females' access to economic opportunities has increased, particularly in services where there are lower job requirements for physical attributes ('brawn') and females reveal a comparative advantage (Olivetti, 2013; Rendall, 2010). However, a critical question remains: can women shift from agricultural to non-agricultural sectors as effectively as men? This paper aims to examine whether improvements in education yield a gender-heterogeneous effect on the sectoral reallocation of rural labour.

China provides a valuable setting for this study. On the one hand, China has experienced a rapid structural transformation over the past four decades with the share of agricultural GDP decreasing from 27.7 per cent in 1978 to 7.3 per cent in 2021. Concurrently, the agricultural employment share decreased from 70.5 per cent to 22.9 per cent.[1] On the other hand, in 1986, the Chinese government enacted the Compulsory Education Law (CEL), mandating nine years of education for all school-aged children. Prior to the implementation of the 1986 CEL, the Chinese labour force was generally undereducated, with females facing even greater educational disadvantages compared to males.[2] The CEL is therefore expected to improve educational attainment across the workforce, with proportionately greater benefits for females.

In this study, we examine the impact of exposure to the CEL on the educational attainment and labour market outcomes of rural residents, with a focus on gender heterogeneity. Specifically, we are interested in whether the CEL will reduce the gender gap in education, and whether the narrowed gender gap in education can be translated into a reduction in gender inequality in labour market outcomes, for example, extensive- (wage labour participation) and intensive-margin (wage rate) responses, and what are the underlying mechanisms. To do so, we utilise data from the 2018 survey wave of the China Family Panel Studies (CFPS). We identify the impact of the CEL by employing a cohort difference-in-differences (DID) strategy that exploits two sources of variations. One is the temporal variation in the province-level rollout of the CEL between 1985 and 1994. The other comes from the fact that individuals born in different cohorts were affected differently by the CEL.

We find that the CEL increased the educational attainment of rural residents and narrowed the gender gap in education. On average, the CEL increased the schooling of rural residents by 2.5 years. Although the CEL significantly increased the completion rate of nine-year compulsory education (by 36.0 percentage points), it did not impact the completion rate of senior high school or above. In terms of gender heterogeneity, the CEL led to more increases in years of schooling (3.5 vs 1.6 years) and the completion rate of junior high school (43.2 vs 28.9 percentage points) for rural females than for their male counterparts. However, we do not find any gender-heterogeneous impact of the CEL on completing senior high school or above.

As to labour market outcomes, our findings reveal that the CEL-induced improvement in education facilitated the reallocation of the rural labour force from agricultural to non-agricultural sectors, but did not reduce gender inequality in labour market outcomes. On average, exposure to the CEL increased rural residents' participation in wage labour by 18.7 percentage points and raised their monthly wages by 41.8 per cent. However, we find no evidence of gender-differentiated effects of the CEL on the likelihood of wage labour participation or monthly wage. Using exposure to the CEL and its interaction with the average years of schooling for the ineligible cohorts (born between 1960 and 1969) as the instruments for educational attainment, we find that an additional year of

schooling increased wage labour participation among rural residents by 6.4 percentage points and raised monthly wages by 17.9 per cent. However, relative to their male counterparts, rural females experienced a 4.0 percentage point smaller increase in wage labour participation and a 9.1 per cent smaller rise in monthly wages from an additional year of schooling.

We then examine potential mechanisms to understand why the CEL narrowed the gender education gap for rural residents but did not reduce gender inequality in labour market outcomes. First, we find gender differences in migration responses to improvements in education. Among those exposed to the CEL, rural males were more likely to migrate outside of local provinces, while rural females were more likely to remain within local counties. We provide evidence that their differential migration responses are related to household labour divisions and social gender norms, but not to gender gaps in cognitive skills. Second, we find rural females and males made different occupational choices when relocating from agricultural to non-agricultural sectors. Conditional on CEL exposure, males tended to work in the manufacturing sectors, whereas females tended to work in the service sectors, although both were predominantly engaged in low-skilled jobs. Notably, our descriptive statistics show that workers in low-skilled service sectors tend to be more female and better educated, yet earn lower monthly wages than those in low-skilled manufacturing. We also rule out alternative explanations, such as gender gaps in access to job information.

Our paper contributes to three strands of literature. First, we add to the body of research on education and gender inequality. A persistent puzzle is that, despite women in many countries gradually catching up with or even surpassing men in educational attainment, significant gender gaps in labour force participation and wages remain (Duflo, 2012; Goldin, 2006). Previous studies, primarily focused on developed countries, have highlighted the roles of the motherhood penalty (Kleven, Landais, & Søgaard, 2019; Lundborg, Plug, & Rasmussen, 2017) and gender differences in educational choices, such as degrees and fields of study (Black, Haviland, Sanders, & Taylor, 2008; Goldin, 2014). In contrast, this paper examines the role of education in narrowing down gender inequality in the labour market within the context of structural transformation in developing countries. We provide evidence that compulsory schooling may not effectively mitigate gender inequality during the sectoral reallocation of labour, primarily due to gender differences in migration decisions and occupational choices. These findings offer insights into why gender inequality in the labour market persists in developing countries, despite the narrowing gender gap in education.

Second, our study contributes to the literature on social returns to compulsory education. Many studies have found evidence of social returns to compulsory education for non-pecuniary outcomes, for example, lower crime (Lochner & Moretti, 2004), better health (Chen, Wang, Cheng, & Smyth, 2023), higher levels of civic participation (Milligan, Moretti, & Oreopoulos, 2004), lower chances of teenage pregnancy (Black, Devereux, & Salvanes, 2008), more pro-environmental behaviour (Meyer, 2015), better parental health (Ma, 2019), and better educational and health outcomes of children (Cui, Liu, & Zhao, 2019; Huang, Lei, Shen, & Sun, 2023). This paper complements and extends existing studies by leveraging a plausibly exogenous shock (the 1986 CEL) to identify the impact of compulsory education on the reallocation of labour out of agriculture, a shift often accompanied by productivity growth (Herrendorf et al., 2014). However, our findings reveal a gender gap in this process.

Finally, our study also relates to studies that use the instrumental variable approach to estimate the private return to education. Since the pioneering work by Angrist and Krueger (1991), a large literature has exploited compulsory education law as the instrument for schooling to estimate the private returns to education (Card, 2001). Our estimates of the returns to education are comparable to those in the United States (Angrist & Krueger, 1991), the United Kingdom (Oreopoulos, 2006), and Canada (Oreopoulos, 2007), but higher than those in China before the 1990s (Byron & Manaloto, 1990; Meng & Kidd, 1997). Fleisher (2005) also finds low returns to education in transitional economies (for example, Bulgaria, Czech Republic, Romania, Russia,

and Ukraine), but these returns increased substantially after transitioning to market-based economies. Moreover, consistent with Devereux and Hart (2010) and Fang, Eggleston, Rizzo, Rozelle, and Zeckhauser (2012), we find the return to education for rural females is much lower than that for their male counterparts.

The rest of the paper is organised as follows. Section 2 provides a brief overview of the 1986 Compulsory Education Law in China. Section 3 outlines the conceptual framework. Section 4 describes the data and estimation strategy. Section 5 presents the estimation results on educational attainment and labour market outcomes. In Section 6, we explore potential mechanisms. Section 7 concludes.

2. The 1986 Compulsory Education Law in China

The Compulsory Education Law (CEL) in China was passed on April 12, 1986 and officially went into effect on July 1 of the same year. Several important features of the 1986 CEL are related to this study. First, nine years of education became compulsory. Second, children are generally supposed to start their compulsory education at six years of age (or sometimes age seven). Third, compulsory education is free for all students.[3] Fourth, organisations and individuals are prohibited from employing children of compulsory education age. With the implementation of the CEL, a typical child will begin her/his compulsory schooling at age six and be eligible to leave by age 15. Additionally, students younger than 15 years old who had already left schools by the effective date of the CEL were required to return to school and remain in school until they turned 15 years old.

In practice, the timing of the CEL implementation varies across provinces in China. The 1986 CEL stipulated that the provincial governments were responsible for implementing the law. However, prior to the implementation of the law, the central government issued the *Decision to Reform the Education System* in 1985, which established a decentralised system of financing and administration of basic education. This reform left local governments in less developed provinces or regions with insufficient resources to fully implement the CEL immediately (Du, Xiao, & Zhao, 2021). Thus, the central government allowed provinces to set their own effective dates according to local economic and development conditions. As shown in Table 1, Shanghai and Zhejiang, the two most developed coastal provinces (municipalities) in China then and now, implemented nine-year compulsory education on 1 September 1985, before the CEL was passed in 1986. In contrast, Ningxia and Tibet, two underdeveloped western provinces, did not make nine-year education compulsory until 1993 and 1994, respectively. The other 27 provinces (municipalities) gradually implemented the CEL between 1986 and 1992.

Rural children, especially girls, were expected to benefit from the CEL. Prior to the CEL implementation, the dropout rate at junior high school level was high in rural China. Even in Beijing and Shanghai, the two most educated municipalities in China, the average years of schooling among those born between 1960 and 1969 (the ineligible cohorts) were only 8.9 and 8.5, respectively, (Table 1). Consequently, rural children who would have dropped out of school in the absence of the CEL will receive more years of schooling due to exposure to the CEL. Moreover, a wide gender gap in education existed in rural China before the implementation of the CEL.[4] In most provinces, rural females lagged far behind their male counterparts in average years of schooling, with few exceptions in Beijing, Tianjin, and Shanghai. Therefore, rural girls were expected to experience more increase in years of schooling relative to rural boys.

3. Conceptual framework

To better understand the role of education in facilitating the reallocation of labour from agricultural to non-agricultural sectors, we sketch out a simple conceptual framework.

Table 1. Implementation of the CEL and educational attainment of the ineligible cohorts

Province	Implementation date	Effective year	The first affected birth cohort	Average years of schooling of the ineligible cohorts (1960–1969)		
				All	Male	Female
Shanghai	1985/09/01	1985	1970	8.513	8.590	8.423
Zhejiang	1985/09/01	1985	1970	7.097	7.721	6.453
Jiangxi	1986/02/01	1986	1971	5.992	7.233	4.723
Shanxi	1986/07/01	1986	1971	8.054	8.307	7.799
Liaoning	1986/07/01	1986	1971	7.728	7.880	7.577
Sichuan	1986/07/01	1986	1971	7.068	7.493	6.638
Hebei	1986/07/01	1986	1971	7.829	8.350	7.317
Heilongjiang	1986/07/01	1986	1971	7.236	7.676	6.772
Chongqing	1986/07/01	1986	1971	7.068	7.493	6.638
Beijing	1986/07/08	1986	1971	8.888	8.836	8.937
Jiangsu	1986/09/09	1987	1972	7.877	8.558	7.233
Shandong	1986/09/12	1987	1972	7.670	8.444	6.933
Guangdong	1986/09/28	1987	1972	7.381	8.087	6.662
Henan	1986/10/01	1987	1972	7.813	8.481	7.138
Yunnan	1986/10/31	1987	1972	5.002	5.988	3.968
Tianjin	1986/11/06	1987	1972	8.167	8.294	8.017
Jilin	1987/02/20	1987	1972	7.190	7.450	6.926
Hubei	1987/03/01	1987	1972	7.479	8.176	6.793
Shaanxi	1987/09/01	1987	1972	7.221	7.854	6.558
Anhui	1987/09/01	1987	1972	6.001	7.245	4.754
Guizhou	1988/01/01	1988	1973	4.982	6.269	3.608
Xinjiang	1988/05/28	1988	1973	7.371	7.574	7.157
Fujian	1988/08/01	1988	1973	6.002	7.179	4.848
Inner Mongolia	1988/09/15	1989	1974	7.044	7.672	6.370
Qinghai	1988/10/01	1989	1974	4.176	5.275	2.967
Gansu	1990/09/03	1991	1976	5.306	6.586	3.972
Guangxi	1991/09/01	1991	1976	7.328	7.826	6.793
Hunan	1991/09/01	1991	1976	7.537	8.027	7.040
Hainan	1991/12/16	1992	1977	7.722	8.292	7.145
Ningxia	1993/08/21	1993	1978	5.276	6.526	4.008
Tibet	1994/07/01	1994	1979	1.242	1.886	0.618

Notes: This table reports, by province, the CEL effective date, the first birth cohort eligible for the CEL, and the average years of schooling of the ineligible birth cohorts (those born between 1960 and 1969).
Source: The 2018 CFPS survey, the 1990 China's Population Census, and authors' collection of the province-level CEL implementation dates.

In particular, we focus on potential channels that may underlie the gender-heterogeneous roles of education for rural labourers in the process of sectoral reallocation.

Our starting point is some factors exist that impede the reallocation of labour from the lower-productivity (paying) agricultural sector to the higher-productivity (paying) non-agricultural sector (Restuccia, Yang, & Zhu, 2008), but the improvement in education weakens the strength of these factors (Porzio, Rossi, & Santangelo, 2022). According to Lee and Malin (2013), these factors may include: (a) the costs of collecting and processing information about potential jobs; (b) the cost associated with migration regulations, or more generally, the costs of relocating for work; and (c) individual preferences for certain types of jobs (for example, those that require 'brawn' more than 'brains').

However, rural females may be more hampered by these factors than rural males in sectoral reallocation. First, rural females generally have less access to job information than males, partly due to gendered networks in the labour market (de Mel, McKenzie, & Woodruff, 2014).

Additionally, females in rural areas of developing countries typically receive less education (Duflo, 2005) and have limited control over productive resources (Mason & King, 2001), making it more difficult for them to use information and communication technologies such as the Internet and mobile phones (World Bank, 2005). If exposure to the CEL can expand rural females' social networks and increase their utilisation of information and communication technologies, it will help to narrow the gender gap in access to job information and reduce gender inequality in labour market outcomes.

Second, rural females face greater barriers to migration. On the one hand, female migration is more constrained by domestic responsibilities. Females bear significantly heavier family and childcare burdens in household labour divisions, which discourages their migration and labour participation (Zhang, Dong, Liu, & Bai, 2018). This disincentive effect is further exacerbated by migration regulations. For example, under China's household registration (Hukou) system,[5] rural labourers are allowed to work in cities without local Hukou, but they have very limited access to urban public services such as housing, medical care, and public education (Xie, Xu, & Zhang, 2023). These restrictions make it difficult for rural families to migrate together, with males typically migrating alone while females stay behind to care for children and the elderly (Wang & Zuo, 1999). If the improvement in educational attainment brought about by the CEL can increase females' bargaining power within households, it could free them from domestic work and reduce the gender gap in migration.

On the other hand, there are social barriers to female migration. One of them is social gender norms. People with conservative gender norms often hold the belief that the appropriate place for women is within the home (Alesina, Giuliano, & Nunn, 2013). These norms exist widely across the globe, including in China, and they significantly constrain female migration and employment (Amirapu, Asadullah, & Wahhaj, 2022; Fan & Wu, 2023). Another social barrier to female migration is son preferences, which prevail in rural China (Qian, 2008). Rural parents' educational expectations for their children are generally gender-biased in favour of boys (Shi, 1997). Lower educational expectations for girls compared to boys can lead to an unequal allocation of family resources, such as parental care, attention, and financial resources. Additionally, a girl's perception of her parents' educational expectations may negatively impact her own aspirations for education. As a result, even though the CEL increased schooling years for both rural females and males, with a relatively larger increase for females, a gender gap in cognitive skills may persist. This gap could lead to gender differences in migration responses and labour market outcomes. Therefore, the CEL will narrow the gender gap in education, but it may not reduce gender inequality in labour market outcomes.

Third, gender differences in occupational choices may arise as workers transition from agricultural to non-agricultural sectors. A robust body of literature highlights the persistence of gender-based occupational segregation (Blau, Brummund, & Liu, 2013), driven by disparities in human capital or skills (Bacolod & Blum, 2010; Baker & Cornelson, 2018), differences in preferences for job attributes (Akerlof & Kranton, 2000), discrimination (Riach & Rich, 2002), and gender norms (Das, Delavallade, Fashogbon, Ogunleye, & Papineni, 2023). This segregation is widely recognised as a key determinant of the gender wage gap, with women disproportionately sorting into lower-paying occupations (Bertrand, 2020). If similar patterns hold for rural women moving into non-agricultural sectors, we can expect gender heterogeneity in the impact of education on labour market outcomes.

In sum, we anticipate that the CEL-induced improvement in education will facilitate rural labourers' reallocation from agricultural to non-agricultural sectors. However, whether the narrowed gender gap in education induced by the CEL could translate into narrowed gender inequality in labour market outcomes is ambiguous, which depends on the interaction of the CEL and the aforementioned factors that impede the sectoral reallocation of rural labourers.

4. Data and empirical strategy

4.1. Data sources, sample construction, and variables

4.1.1. Data sources. To examine the impact of the CEL on education and labour market outcomes, we draw on data from the China Family Panel Studies (CFPS), a large-scale, nationally representative, longitudinal survey of Chinese families. The CFPS collects data at the individual, household, and community levels and provides comprehensive information on economic activities, family dynamics, education, migration, income, and so forth. The baseline survey, conducted in 2010, sampled 14,960 households and 42,590 individuals across 25 provinces (excluding Inner Mongolia, Xinjiang, Tibet, Hainan, Ningxia, and Qinghai), representing approximately 95 per cent of China's population. Between 2012 and 2020, there have been five waves of follow-up surveys conducted every other year. We primarily rely on data from the 2018 survey wave for two reasons. First, by 2018, the youngest individuals in our sample (the 1985 birth cohort) had completed their schooling, entered the labour market, and likely started families, which enables us to evaluate the long-run impact of the CEL and explore the potential mechanisms. Second, the 2018 CFPS is the latest survey wave that was publicly available before the COVID-19 pandemic.[6]

To identify the specific implementation dates of the CEL in each province (Table 1), we collected data from provincial education yearbooks, records of China's National People's Congress, and the Chinese Laws and Regulations Information Database. We then merged these province-level CEL implementation data with the 2018 CFPS dataset.

4.1.2. Sample construction. We take a four-step procedure to construct our study sample. First, from the rural sample of the CFPS 2018 survey, we include individuals born between 1960 and 1985. Second, from the urban sample, we include individuals born during the same period who either held a rural Hukou at age 12 or whose parents retained a rural Hukou at the time of the survey. These individuals are likely former rural residents who migrated to urban areas for work after completing their education. Excluding them could underestimate the CEL's impact on rural residents' educational attainment and labour market outcomes.[7] Third, we exclude individuals who are self-employed in the non-agricultural sector.[8] Finally, we retain only those with complete information on individual characteristics and labour market outcomes. This procedure yields a final sample of 6,564 individuals from 25 provinces (or 28 birth provinces).

4.1.3. The CEL exposure variable. We implicitly assume that rural residents receive their compulsory education in their province of birth. Thus, an individual's exposure to the CEL depends on her/his year and province of birth simultaneously. Following Ma (2019) and Huang et al. (2023), we use a linear function to measure an individual's CEL exposure as follows,

$$Exposure_{icp} = \begin{cases} 0, & if \;\; age\_reform_{icp} \geq 16 \\ \dfrac{16 - age\_reform_{icp}}{10}, & if \;\; 6 \leq age\_reform_{icp} < 16 \\ 1, & if \;\; age\_reform_{icp} < 6 \end{cases}$$

Where c and p denote the year and province of birth of individual i, respectively. The CEL exposure variable, $Exposure_{icp}$, ranges from 0 (for individuals aged 16 or older by the effective date of the CEL) to 1 (for those aged six or younger by the effective date of the CEL). The underlying assumption behind this linear approximation is that the effect of the CEL increases with the number of years an individual is eligible for compulsory education by the CEL effective date.

4.1.4. Outcome variables. Our analysis centres on individuals' educational and labour market outcomes. To measure educational outcomes, we construct three key variables: years of schooling and two dummy variables indicating whether an individual has completed at least junior high school and senior high school education, respectively. For labour market outcomes, we assess extensive-margin responses by examining wage labour participation and intensive-margin responses by analysing monthly wages in wage employment. Detailed definitions of all variables are provided in the Online Appendix, and descriptive statistics for the main dependent and independent variables are presented in Online Appendix Table A1.

Figure 1 shows the trend in educational attainment and labour market outcomes of our sample individuals by birth cohort and gender. Among the ineligible birth cohorts (1960–1969), rural males have significantly more years of schooling on average than rural females. Similarly, males have higher wage labour participation rates and monthly wages compared to females. Starting with the 1970 birth cohort (the first cohort affected by the CEL), the years of schooling for both rural males and females have gradually increased, with females' schooling rising more rapidly, thus narrowing the gender gap. However, the gap in wage labour participation rates and monthly wages between males and females has not narrowed, despite gradual increases in both outcomes for both genders.

4.2. Empirical strategy

The non-random implementation of the CEL across provinces introduces endogeneity concerns in identifying its impact on educational and labour market outcomes. To address this, we

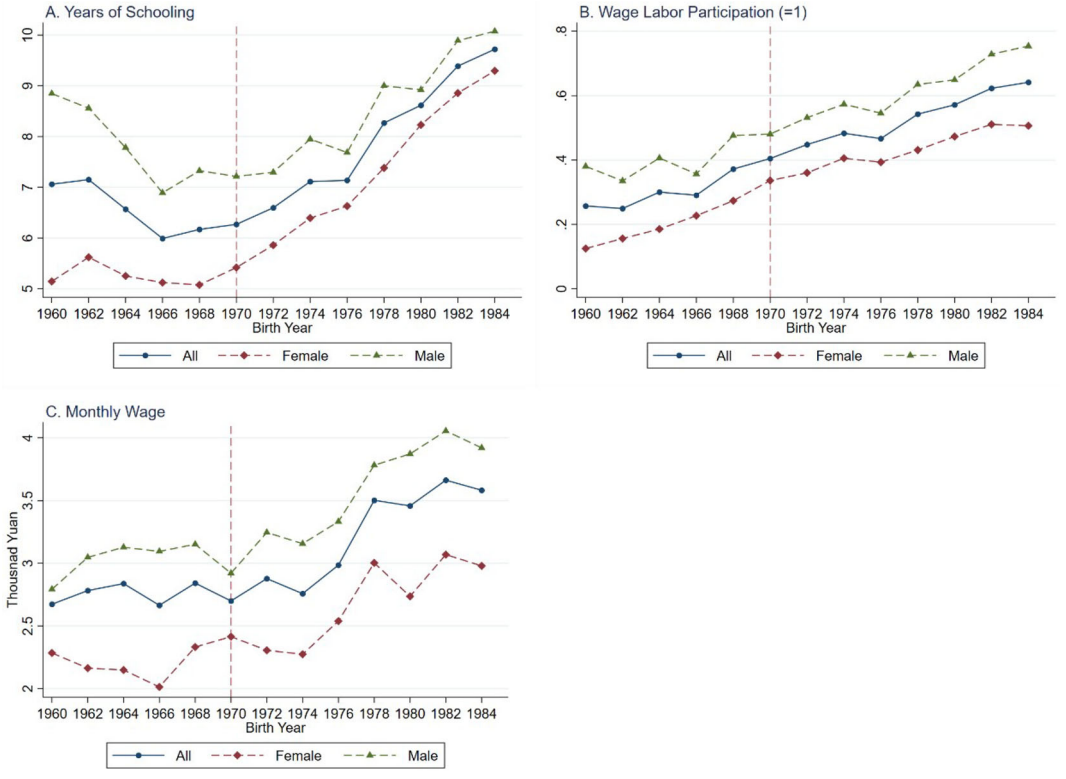

Figure 1. The trend of education attainment and labour market outcomes of rural residents.
Notes: This figure shows the trend of years of schooling (Panel A), wage labour participation (Panel B), and monthly wage (Panel C) of our sample individuals by birth cohort and gender. Each dot represents the current birth cohort and the subsequent one. For example, '1960' includes individuals born in both 1960 and 1961. The dashed vertical line represents the first birth cohort exposed to the CEL.
Source: The 2018 CFPS survey.

employ a cohort difference-in-differences (DID) approach. Our identifying assumption is that, conditional on province and birth cohort fixed effects, an individual's exposure to the CEL is as good as random. Specifically, we estimate the following DID specification:

$$Y_{icp} = \beta_0 + \beta_1 Exposure_{icp} + \beta_2 X_{icp} + \theta_c + \gamma_p + \gamma_p * T_c + \mu_{icp} \quad (1)$$

where Y_{icp} is the outcome variable (for example, years of schooling) of individual i born in year c in province p. The variable $Exposure_{icp}$ captures individual i's exposure to the CEL, determined by her/his province of birth p and year of birth c. X_{icp} is a vector of individual-level controls, including gender, ethnicity, parental education (measured by fathers' and mothers' years of schooling), and number of siblings. θ_c are birth year fixed effects, which capture the cohort heterogeneity in educational attainment and labour market outcomes. γ_p are province-of-birth fixed effects, which absorb all time-invariant province-level characteristics. μ_{icp} is the error term. Standard errors are clustered at the province-of-birth-year level.

One crucial concern with our DID strategy is that unobservable heterogeneous cohort trends may be correlated with the timing of CEL implementation. To alleviate this concern, we control for linear cohort trends at the province level, denoted by $\gamma_p * T_c$, which represents the interaction between province-of-birth dummies and a linear cohort trend. As a robustness check, we further allow the cohort effects to vary with the predetermined provincial characteristics that influenced the CEL's timing. Specifically, we include interactions between cohort dummies and provincial GDP per capita in 1985.[9]

To examine whether the CEL has gender heterogeneous effects on the educational and labour market outcomes of rural residents, we employ a triple difference (DDD) approach. Specifically, we add an interaction term between the CEL exposure variable and a gender dummy ($Exposure_{icp} * Female_{icp}$) to Equation (1). All other variables in Equation (2) remain the same as in Equation (1).

$$Y_{icp} = \beta_0 + \beta_1 Exposure_{icp} + \beta_1 Exposure_{icp} * Female_{icp} + \beta_2 X_{icp} + \theta_c + \gamma_p + \gamma_p * T_c + \mu_{icp} \quad (2)$$

Our identification strategy relies on the parallel-trend assumption that there should be a similar cohort trend in educational and labour market outcomes across provinces in the absence of the CEL. To formally test for pre-existing trends and explore the dynamics of the impacts of the CEL, we employ an event-study approach and estimate the following specification:

$$Y_{icp} = \beta_0 + \sum_j \beta_1^j D_{icp}^j + \beta_2 X_{icp} + \theta_c + \gamma_p + \gamma_p * T_c + \mu_{icp} \quad (3)$$

Where D_{icp}^j is a vector of dummy variables indicating whether an individual was born 9 or more years before, 7–8 years before, 5–6 years before, 3–4 years before, 1–2 years after, 3–4 years after, 5–6 years after, 7–8 years after, or 9 or more years after the first birth cohort exposed to the CEL.[10] The reference group consists of cohorts born 1–2 years prior to the first reform cohort. All other variables are identical to those in Equation (1). The coefficients of interest are the vector β_1^j. While the counterfactual is unobservable, estimates for the cohorts not exposed to the CEL provide suggestive evidence of pre-trends.

Following the literature, we estimate the impact of education on labour market outcomes by using an individual's exposure to the CEL and its interaction with the average years of schooling for the ineligible cohorts (those born between 1960 and 1969) as the instruments for education. Recent studies have leveraged the 1986 CEL as an exogenous shock to individuals' educational attainment to examine various outcomes, including health (Chen et al., 2023; Huang et al., 2023; Ma, 2019), children's development (Cui et al., 2019), gender role attitudes

(Du et al., 2021), female fertility decisions (Chen & Guo, 2022), and intrahousehold empowerment (Ma, 2025). Specifically, Cui et al. (2019) and Chen and Guo (2022) use exposure to the CEL as an instrument for years of schooling, while Ma (2019), Du et al. (2021), and Huang et al. (2023) combine CEL exposure with its interaction with pre-CEL local education levels as instruments. We find similar results when using only CEL exposure as the instrument for educational attainment. The first stage of the IV regression is specified as follows[11]:

$$Y_{icp} = \beta_0 + \beta_1 Exposure_{icp} + \beta_2 Exposure_{icp} * YSC_p + \beta_3 X_{icp} + \theta_c + \gamma_p + \gamma_p * T_c + \mu_{icp} \quad (4)$$

where YSC_p denotes the average years of schooling for the ineligible cohorts in province p (reported in Table 1). All other variables are the same as in Equation (1).

5. Empirical results

5.1. Impact of the CEL on educational attainment

Table 2 presents the estimated impact of the CEL on educational attainment. On average, exposure to the CEL increased years of schooling among rural residents by 2.5 years, significant at the 1 per cent level (Column 1). This corresponds to a 36.8 per cent increase relative to the ineligible cohorts (those born between 1960 and 1969), whose average years of schooling is only 6.8. Similarly, exposure to the CEL significantly increased the completion rate of junior high school among rural residents by 35.7 percentage points (Column 3). In contrast, the CEL had no statistically significant impact on senior high school completion, despite positive point estimates (Column 5).[12]

Our analysis also reveals significant gender heterogeneity in the CEL's effects on educational attainment. As shown in Column 2, the CEL led to a significantly larger increase in years of schooling for rural females (1.6 + 1.8 = 3.4 years) than for rural males (1.6 years). A similar pattern is evident for junior high school completion: while the CEL increased the completion rate

Table 2. Impact of the CEL on educational attainment

	(1)	(2)	(3)	(4)	(5)	(6)
	Years of schooling		Complete junior high school (= 1)		Complete senior high school (= 1)	
Exposure	2.508***	1.639**	0.357***	0.289***	0.051	0.040
	(0.810)	(0.830)	(0.083)	(0.085)	(0.086)	(0.089)
Female	−1.914***	−2.370***	−0.176***	−0.212***	−0.074***	−0.080***
	(0.129)	(0.158)	(0.013)	(0.016)	(0.009)	(0.010)
Exposure * Female		1.817***		0.143***		0.024
		(0.294)		(0.032)		(0.028)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Birthprov FE	Yes	Yes	Yes	Yes	Yes	Yes
Birthprov * time trend	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,564	6,564	6,564	6,564	6,564	6,564
R^2	0.318	0.323	0.236	0.239	0.161	0.161

Notes: This table estimates the impact of the CEL on the educational attainment of rural residents. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

for rural males by 28.9 percentage points, rural females experienced an additional 14.3 percentage point increase relative to their male counterparts (Column 4). Prior to the CEL, and conditional on relevant controls, females were estimated to have 2.37 fewer years of schooling (Column 2) and a junior high school completion rate 21.2 percentage points lower than males (Column 4). As a result, the CEL narrowed the gender gap in years of schooling and junior high school completion rate by 76.7 per cent and 67.5 per cent, respectively. However, we find no evidence of gender heterogeneity in the CEL's effect on senior high school completion (Column 6).

In sum, our results indicate that the CEL significantly improved educational attainment among rural residents, primarily by increasing the likelihood of completing the nine-year compulsory education stipulated by the CEL. Additionally, the CEL contributed to a substantial reduction in the gender gap in educational outcomes in rural China.

5.2. Impact of the CEL on labour market outcomes

In this subsection, we examine whether the CEL-induced increase in educational attainment facilitated the reallocation of rural labour from agricultural to non-agricultural sectors and whether the narrowed gender education gap reduced gender disparities in labour market outcomes.

Table 3 presents the results regarding the impact of the CEL on labour market outcomes. Our findings indicate an overall positive effect of the CEL on both extensive and intensive-margin responses. Specifically, on the extensive margin, exposure to the CEL significantly increased wage labour participation among rural residents by 18.7 percentage points (Column 1). On the intensive margin, the CEL led to a 41.8 per cent increase in the monthly wages of rural residents (Column 3). However, we find no significant gender heterogeneity in the effects of the CEL on either participation (Column 2) or monthly wages (Column 4). Thus, while the CEL significantly narrowed the gender gap in education, our results suggest that it did not reduce the existing gender disparities in labour market outcomes – either in terms of participation or wage rates – among rural residents.

Table 3. Impact of the CEL on labour market outcomes

	(1)	(2)	(3)	(4)
	Wage labour participation (= 1)		Log (monthly wage)	
Exposure	0.187**	0.191**	0.418**	0.406*
	(0.076)	(0.079)	(0.205)	(0.209)
Female	−0.183***	−0.182***	−0.438***	−0.453***
	(0.012)	(0.013)	(0.035)	(0.048)
Exposure * Female		−0.007		0.040
		(0.032)		(0.084)
Individual controls	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Birthprov FE	Yes	Yes	Yes	Yes
Birthprov * time trend	Yes	Yes	Yes	Yes
Observations	6,564	6,564	2,691	2,691
R^2	0.244	0.244	0.170	0.170

Notes: This table estimates the impact of the CEL on the labour market outcomes of rural residents. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

We provide a thorough discussion of potential threats to the validity of our estimates and test the robustness of our main results. Results from these robustness checks are reported in Online Appendix Table A2.

5.3. Event-study estimation

The validity of our DID estimations relies on the parallel-trend assumption. To test for pre-existing trends and examine the dynamics of the treatment effect, we estimate Equation (2). Figure 2 illustrates the time pattern of treatment effects on educational attainment and labour market outcomes surrounding the implementation of the CEL. In Panel A, the estimated coefficients for years of schooling are small and insignificant in the years preceding the CEL, suggesting no evidence of heterogeneous cohort trends in education across provinces that adopted the CEL at different times. Similarly, pre-reform estimates for wage labour participation (Panel B) and monthly wages (Panel C) are also generally small and insignificant. These figures lend strong support for the parallel-trend assumption.

Another key takeaway from Figure 2 is that the coefficients for both educational attainment and labour market outcomes become significant and steadily increase following the implementation of the CEL. One possible explanation is that rural residents who might have otherwise dropped out of school attained more education, as the CEL required them to remain in school until completing the nine-year compulsory education. Consequently, the impact of the CEL on years of schooling increases with the duration of exposure to compulsory education (Panel A),

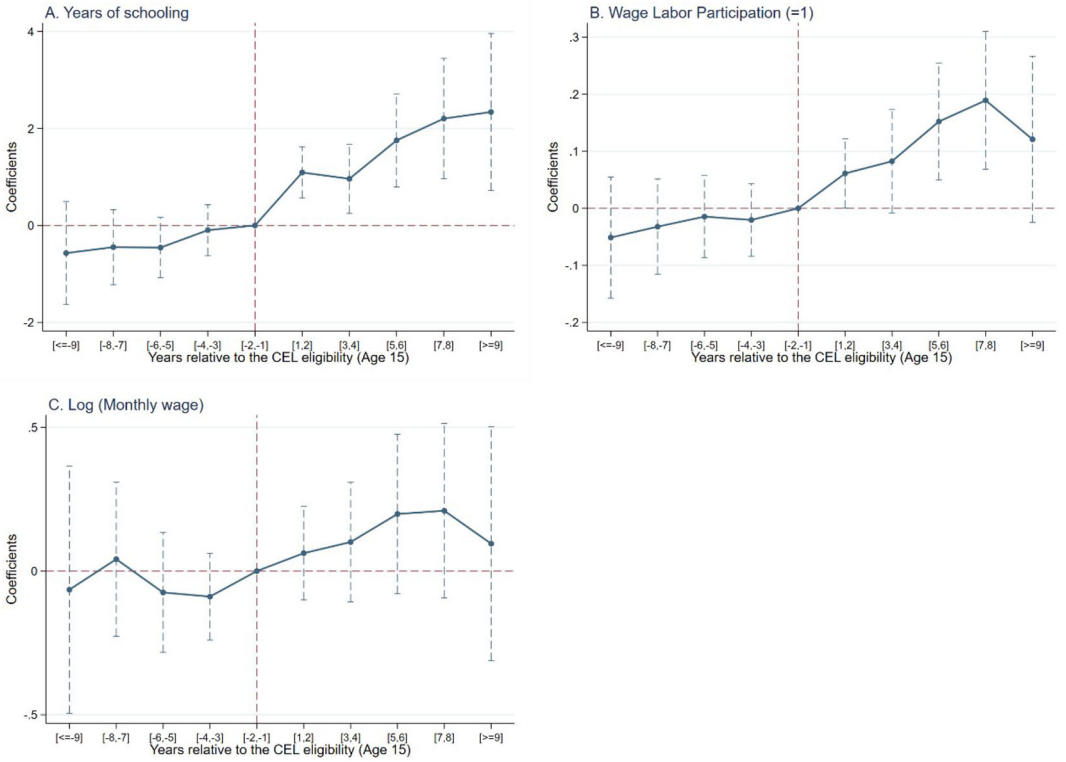

Figure 2. Dynamic results.

Notes: This figure shows the coefficient estimates and 95 per cent confidence intervals of the β_1^j from Equation (3). In Panels A–C, the X-axis shows the years since the first birth cohort was exposed to the CEL, and the Y-axis reports the estimated coefficients. The reference group are individuals born 1–2 years earlier than the first CEL-exposure birth cohort.

Source: The 2018 CFPS survey.

validating the linearity assumption underlying our definition of CEL exposure. Importantly, the CEL-induced improvement in education for rural residents also translated into increased labour market participation (Panel B) and higher wages (Panel C), with the magnitude of these positive impacts increasing in line with the duration of CEL exposure.

5.4. The role of education in the sectoral reallocation of rural labour

The finding that the CEL narrowed the gender gap in educational attainment but did not reduce gender inequality in labour market outcomes suggests that there may be gender-differentiated effects of educational improvements on the sectoral reallocation of rural labour. In this subsection, we investigate the impact of education on labour market outcomes for rural residents and formally test for gender heterogeneity using an instrumental variable (IV) approach.

Table 4 reports the IV estimation results, revealing significant positive effects of education on labour market outcomes. Specifically, an additional year of schooling increased wage labour participation among rural residents by 6.4 percentage points (Column 1), indicating that higher educational attainment has facilitated their shift from agricultural to non-agricultural sectors. Moreover, an additional year of schooling raised monthly wages by 17.9 per cent (Column 3), highlighting substantial returns to education for rural labourers. These findings suggest that education not only improves labour market participation but also enhances earnings potential for rural residents.

However, the positive effects of education on labour market outcomes are significantly smaller for rural females compared to rural males. Specifically, relative to their male counterparts, an additional year of schooling resulted in a 3.9 percentage point smaller increase in wage labour participation among rural females (Column 2) and a 9.1 per cent smaller increase in their monthly wages (Column 4). These findings imply that education is less effective in facilitating the shift of rural females from agricultural to non-agricultural sectors and that the returns to education for females are lower than those for males. The next section delves into potential explanations for these disparities.

Table 4. Impact of education on labour market outcomes

	(1)	(2)	(3)	(4)
	Wage labour participation (= 1)		Log (monthly wage)	
Years of schooling	0.064***	0.081***	0.179***	0.211***
	(0.019)	(0.026)	(0.063)	(0.072)
Years of schooling * Female		−0.039**		−0.091**
		(0.016)		(0.045)
Individual controls	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Birthprov FE	Yes	Yes	Yes	Yes
Birthprov * time trend	Yes	Yes	Yes	Yes
Observations	6,564	6,564	2,691	2,691
R^2	0.260	0.250	0.053	0.033
F-stat of excl. instrument	12.850	24.090	10.350	10.650

Notes: This table reports the IV estimates of the impact of education on labour market outcomes of rural residents. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

6. Discussion of mechanisms

Why did the CEL narrow the gender gap in educational attainment but fail to reduce gender inequality in labour market outcomes among rural residents? This section builds on the conceptual framework outlined in Section 3 to explore three potential explanations: unequal access to job information, differences in migration decisions, and gendered occupational choices.

6.1. *Access to job information*

We begin by examining whether rural females and males have unequal access to job information, focusing on the specific channels they utilise and the frequency of use. In our study sample, the primary sources of information include television, the Internet, and mobile phone SMS (Online Appendix Table A3). Our results indicate that rural females exposed to the CEL tended to spend more time watching TV and movies than their male counterparts (Column 1, Table 5). Regarding the other two channels, 94.6 per cent of rural females and 98.3 per cent of rural males report using mobile phones, while 44.2 per cent of rural females and 52.1 per cent of rural males indicate Internet usage (through mobile phones or computers) (Online Appendix Table A4). Regression results reveal that, on average, the CEL had no significant effect on either mobile phone or Internet use among rural residents (Columns 2–3, Panel A, Table 5). However, there seems to be a more pronounced positive effect of the CEL on mobile phone and Internet use among rural females compared to males (Columns 2–3, Panel B).

To further examine the frequency of Internet use, we leverage the detailed information collected by the 2018 CFPS regarding individuals' Internet use for various purposes, including study, work, social activities, entertainment, and commercial purposes (for example, online shopping). Descriptive statistics suggest that both rural females and males frequently use the Internet for social activities (38.0% vs 42.6%) and entertainment (32.9% vs 39.9%) (Online Appendix Table A4). Regression results show that the CEL did not significantly affect the frequency of Internet use for study or work (Columns 4–5, Table 5); however, it had significant positive effects on the frequency of Internet use for social activities, entertainment, and commercial activities (Columns 6–8, Panel A). Notably, we find no evidence of gender heterogeneity in this regard, regardless of the purpose of Internet use (Columns 4–8, Panel B).

Still, could gender disparities in social networks contribute to the gender gap in access to job information? Referrals from relatives and friends are indeed a crucial source of job information for rural residents. Unfortunately, the lack of data on social interactions limits our ability to fully assess the influence of social networks. However, we offer two points to mitigate this concern. First, a reduction in the educational gap between genders could reasonably be expected to narrow the gender gap in social networks. Second, our findings indicate no significant difference between females and males in the frequency of Internet use for social activities (Column 6 of Table 5), suggesting that gender differences in social networks may not be substantial.

6.2. *Migration decisions*

Next, we investigate the impact of the CEL on the migration decisions of rural females and males, with a focus on their migration destinations. To do so, we create two dummy variables based on the location of their workplaces: within the local county and outside the local province. Regression results, presented in Table 6, suggest that on average, exposure to the CEL had no significant impact on their probability of working within local counties (Column 1) or outside local provinces (Column 3), though both coefficients are positive. However, we do find significant gender heterogeneity in migration decisions: conditional on exposure to the CEL, rural males tended to move outside local provinces (Column 4), whereas rural females were more likely to work within local counties (Column 2) and less likely to work outside local provinces (Column 4).

Table 5. Impact of the CEL on access to job information

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Frequently use the internet for				
	Time for watching movies and TV per week (hours)	Use mobile phone (=1)	Use the internet (=1)	Study (=1)	Work (=1)	Social activity (=1)	Entertainment (=1)	Commercial activity (=1)
Panel A								
Exposure	2.198	0.022	0.021	0.062	0.088	0.149*	0.205**	0.128**
	(1.560)	(0.026)	(0.083)	(0.073)	(0.073)	(0.082)	(0.089)	(0.060)
Observations	6,519	6,547	6,564	6,564	6,564	6,564	6,564	6,564
R^2	0.059	0.041	0.221	0.110	0.168	0.215	0.187	0.187
Panel B								
Exposure	1.703	0.006	−0.007	0.052	0.085	0.136	0.198**	0.140**
	(1.609)	(0.026)	(0.084)	(0.075)	(0.076)	(0.085)	(0.091)	(0.061)
Exposure * Female	1.030*	0.034***	0.059**	0.022	0.007	0.028	0.016	−0.027
	(0.570)	(0.010)	(0.029)	(0.025)	(0.027)	(0.029)	(0.030)	(0.024)
Observations	6,519	6,547	6,564	6,564	6,564	6,564	6,564	6,564
R^2	0.060	0.042	0.221	0.110	0.168	0.215	0.188	0.187

Notes: This table estimates the impact of the CEL on rural residents' access to job information. All regressions include controls for individual-level characteristics, along with birth year fixed effects, province-of-birth fixed effects, and linear cohort trends at the province level. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

Table 6. Impact of the CEL on location of workplace

	(1)	(2)	(3)	(4)
	Within the local county (= 1)		Outside the local province (= 1)	
Exposure	0.053	0.012	0.054	0.072**
	(0.068)	(0.068)	(0.034)	(0.036)
Exposure * Female		0.081***		−0.035**
		(0.023)		(0.016)
Individual controls	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Birthprov FE	Yes	Yes	Yes	Yes
Birthprov * time trend	Yes	Yes	Yes	Yes
Observations	5,386	5,386	5,386	5,386
R^2	0.080	0.083	0.057	0.058

Notes: This table estimates the impact of the CEL on rural residents' location of workplace. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

The observed gender differences in migration destinations may help explain the persistent gender gap in labour market outcomes. Wang and Li (2015) provide empirical evidence that given their education levels, rural-urban migrant workers, including low-skilled workers, can achieve higher wages in large cities than in small ones. Their findings align with the established literature that underscores the positive relationship between city size and both labour productivity and wages (Au & Henderson, 2006; Combes, Démurger, Li, & Wang, 2020). Since rural females tend to stay within local counties, they are less likely to benefit from employment opportunities in larger cities, where wage premiums exist (Duranton & Puga, 2004). This may explain why the return to education for rural females is lower than that for rural males.

The differing migration responses of rural females and males to the CEL-induced increase in education could be attributed to household labour division, social gender norms, and disparities in cognitive skills. We further explore which of these forces dominate.

6.2.1. Household labour division. Female specialisation in household work and male specialisation in labour-market work are widely observed over time and across countries. Thus, the extent to which the increase in female educational attainment induced by the CEL can promote female migration and sectoral reallocation depends on whether it can change the traditional household labour division.

6.2.1.1. Housework time. As shown in Table 7, on average, the CEL had no significant impact on the daily hours rural residents devote to housework, either on weekdays (Column 1) or weekends (Column 3). In terms of gender heterogeneity, we find no gender heterogeneous effects of the CEL on housework time during weekends (Column 4). For weekdays, the coefficient on the interaction term is negative and significant, but the magnitude is small (−0.301) (Column 2). Overall, these findings suggest that the CEL did not significantly reduce the time rural females and males allocate to housework.

In sum, our analysis reveals that the CEL did not alter the traditional division of labour within rural households or free rural females from domestic responsibilities. Consequently, despite their increased educational attainment, rural females remain less likely to migrate compared to their male counterparts.

Table 7. Impact of the CEL on housework time

	(1)	(2)	(3)	(4)
	Daily hours for housework on weekdays (hours)		Daily hours for housework on weekends (hours)	
Exposure	−0.095	0.050	0.395	0.425
	(0.382)	(0.384)	(0.351)	(0.357)
Exposure * Female		−0.301**		−0.064
		(0.120)		(0.133)
Individual controls	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Birthprov FE	Yes	Yes	Yes	Yes
Birthprov * time trend	Yes	Yes	Yes	Yes
Observations	6,210	6,210	6,205	6,205
R^2	0.160	0.160	0.139	0.139

Notes: This table estimates the impact of the CEL on rural residents' housework time. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
$^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: The 2018 CFPS survey.

6.2.2. Social gender norms. While the CEL has improved the educational attainment among rural females, traditional conservative gender norms may discourage them from migrating and participating in the labour market. If so, we would expect the CEL to have a less pronounced positive effect on migration decisions and labour market outcomes in regions where conservative gender norms are more prevalent. To test this hypothesis, we estimate a quadruple difference specification as follows:

$$\begin{aligned} Y_{icp} = {} & \beta_0 + \beta_1 Exposure_{icp} + \beta_2 Exposure_{icp} * Gendernorms_p + \beta_3 Female_{icp} * Gendernorms_p \\ & + \beta_4 Exposure_{icp} * Female_{icp} + \beta_5 Exposure_{icp} * Female_{icp} * Gendernorms_p + \beta_6 X_{icp} \\ & + \theta_c + \gamma_p + \gamma_p * T_c + \mu_{icp} \end{aligned} \tag{5}$$

Where $Gendernorms_p$ denotes one of two alternative dummy variables indicating whether individual i was born in a province with relatively less conservative gender norms prior to the implementation of the CEL. Specifically, one dummy variable takes the value of one if an individual was born in a province where the sex ratio of the rural population born in 1960–1985 was below the median of the sample provinces and zero otherwise; The other dummy variable takes the value of one if the average years of schooling of rural females born in 1960–1969 (the ineligible cohorts) was above the median of the sample provinces and zero otherwise.[13] All other variables are the same as those in Equation (1). β_4 indicates the gender heterogeneous impact of the CEL in regions with relatively more conservative gender norms, while β_5 reflects the difference in the gender heterogeneous effect of the CEL between regions with more and less conservative gender norms.

Our estimation results suggest that conservative social gender norms impede rural female migration. Specifically, in regions with more conservative gender norms, rural females exposed to the CEL were more likely to remain within their local counties (Column 2 of Table 8) and less likely to migrate outside their local provinces (Column 3), despite achieving greater gains in educational attainment (Column 1) compared to their male counterparts. In contrast, we find

Table 8. The role of social gender norms in migration and labour market outcomes

	(1)	(2)	(3)	(4)	(5)
		Location of workplace:		Labour market outcomes:	
	Years of schooling	Within the local county (= 1)	Outside the local province (= 1)	Wage labour participation (= 1)	Log (monthly wage)
Panel A					
Exposure	1.882**	−0.003	0.094***	0.223***	0.645***
	(0.841)	(0.070)	(0.036)	(0.084)	(0.224)
Exposure * Female	1.894***	0.118***	−0.067***	−0.076*	−0.052
	(0.421)	(0.030)	(0.018)	(0.044)	(0.109)
Exposure * Female * Female_edu_high	−0.217	−0.086*	0.074**	0.145**	0.181
	(0.550)	(0.047)	(0.034)	(0.063)	(0.167)
Observations	6,564	5,386	5,386	6,564	2,691
R^2	0.327	0.085	0.060	0.245	0.173
Panel B					
Exposure	1.866**	0.014	0.076**	0.230***	0.527**
	(0.847)	(0.072)	(0.037)	(0.084)	(0.218)
Exposure * Female	2.143***	0.111***	−0.068***	−0.072	0.005
	(0.440)	(0.032)	(0.018)	(0.045)	(0.105)
Exposure * Female * Sex_ratio_low	−0.782	−0.068	0.070**	0.138**	0.083
	(0.564)	(0.046)	(0.031)	(0.063)	(0.171)
Observations	6,564	5,386	5,386	6,564	2,691
R^2	0.326	0.085	0.060	0.245	0.171

Notes: This table investigates the role of social gender norms in the migration decisions and labour market outcomes of rural residents. Female_edu_high is a dummy variable that takes the value of one if the average years of schooling of rural females born during 1960–1969 (the ineligible cohorts) is higher than the median of the sample provinces and zero otherwise. Sex_ratio_low is a dummy variable that takes the value of one if the sex ratio of rural residents born during 1960–1985 in one province is lower than the median of the sample provinces and zero otherwise. All regressions include controls for individual-level characteristics, along with birth year fixed effects, province-of-birth fixed effects, and linear cohort trends at the province level. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

no significant gender heterogeneous effect of the CEL on migration decisions in regions with relatively less conservative gender norms.

Similarly, significant differences in the gender heterogeneous effect of the CEL on labour market outcomes exist between regions with relatively more and less conservative gender norms. In regions with more conservative gender norms, rural females exposed to the CEL experienced smaller increases in both wage labour participation (Column 4) and monthly wage (Column 5) compared to their rural male counterparts. In contrast, the gender heterogeneous impact of the CEL on labour market outcomes appears to reverse in regions with less conservative gender norms. Taken together, these findings suggest that our baseline results that the CEL narrowed the gender gap in education but did not reduce gender inequality in labour market outcomes for rural residents are primarily driven by regions with more conservative gender norms.

Overall, we provide evidence that traditional conservative gender norms pose significant social barriers to female migration in rural China, which contributes to the persistent gender inequality in labour market outcomes.

6.2.3. Cognitive skills. Another potential explanation to consider is whether rural females acquire fewer cognitive skills than rural males through compulsory schooling. If so, the observed increase in years of schooling for rural females may not necessarily translate into improved labour market outcomes. In this subsection, we examine the impact of the CEL on individuals' cognitive skills, measured by literacy and numeracy test scores from the CFPS 2018 survey data. These test scores are standardised to a mean of 0 and a standard deviation of 1.

Our estimation results show that the CEL significantly improved numeracy test scores among rural residents (Column 3, Table 9), though it did not have a comparable effect on literacy scores (Column 1). Consistent with the gender-differentiated impact on schooling years, the CEL had a significantly larger positive impact on both literacy (Column 2) and numeracy test scores (Column 4) for rural females than for rural males. These findings suggest that the CEL not only improved cognitive skills for rural residents but also narrowed the gender gap in cognitive skills. Therefore, we can rule out the possibility that gender disparities in migration decisions and labour market outcomes are attributable to rural females lagging behind rural males in terms of cognitive skills.

6.3. Occupational choices

The final possibility we explore is whether, despite transitioning from agricultural to non-agricultural sectors as a result of increased educational attainment, rural females engage in different occupations than rural males and thus experience different labour market outcomes. In this subsection, we examine how exposure to the CEL affects occupational choices among rural residents.

The 2018 CFPS provides detailed information on individuals' occupations, classifying occupations according to the International Standard Classification of Occupations 1988 (ISCO-88), a skill-based classification system.[14] The ISCO-88 groups all occupations (excluding the armed forces) into nine major categories, each assigned a skill level: legislators, senior officials and managers; professionals; technicians and associate professionals; clerks; service workers and shop and market sales workers; skilled agricultural and fishery workers; craft and related trades workers; plant and machine operators and assemblers; and elementary occupations. Online Appendix Table A5 presents the descriptive statistics for these occupations.[15]

Table 9. Impact of the CEL on cognitive skills

	(1)	(2)	(3)	(4)
	Literacy test score		Numeracy test score	
Exposure	0.295	0.035	0.409*	0.277
	(0.230)	(0.230)	(0.241)	(0.249)
Exposure * Female		0.478***		0.242***
		(0.070)		(0.072)
Individual controls	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Birthprov FE	Yes	Yes	Yes	Yes
Birthprov * time trend	Yes	Yes	Yes	Yes
Observations	5,392	5,392	5,392	5,392
R^2	0.275	0.282	0.338	0.340

Notes: This table estimates the impact of the CEL on rural residents' cognitive skills. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

Table 10. Impact of the CEL on occupational choices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Legislators, senior officials and managers (=1)	Professionals (=1)	Technicians and associate professionals (=1)	Clerks (=1)	Service workers and shop and market sales workers (=1)	Skilled agricultural and fishery workers (=1)	Craft and related trades workers (=1)	Plant and machine operators and assemblers (=1)	Elementary occupations (=1)
ISCO-88 skill level	–	4th	3rd	2nd	2nd	2nd	2nd	2nd	1st
Panel A									
Exposure	−0.005	0.055	−0.031	−0.048	0.112**	−0.219***	0.040	0.096**	−0.001
	(0.034)	(0.042)	(0.039)	(0.029)	(0.046)	(0.076)	(0.066)	(0.043)	(0.029)
Observations	6,494	6,494	6,494	6,494	6,494	6,494	6,494	6,494	6,494
R^2	0.040	0.058	0.049	0.037	0.054	0.250	0.081	0.063	0.030
Panel B									
Exposure	−0.003	0.043	−0.036	−0.055*	0.082*	−0.215***	0.055	0.139***	−0.009
	(0.035)	(0.042)	(0.039)	(0.029)	(0.047)	(0.079)	(0.067)	(0.046)	(0.030)
Exposure * Female	−0.004	0.026	0.012	0.014	0.062***	−0.009	−0.030	−0.089***	0.0170
	(0.011)	(0.017)	(0.015)	(0.011)	(0.018)	(0.032)	(0.021)	(0.018)	(0.013)
Observations	6,494	6,494	6,494	6,494	6,494	6,494	6,494	6,494	6,494
R^2	0.040	0.058	0.049	0.037	0.055	0.250	0.081	0.068	0.030

Notes: This table estimates the impact of the CEL on rural residents' occupational choices. All regressions include controls for individual-level characteristics, along with birth year fixed effects, province-of-birth fixed effects, and linear cohort trends at the province level. Robust standard errors clustered at the province-of-birth-year level are in parentheses. Significance levels.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: The 2018 CFPS survey.

Table 10 presents the estimated impact of the CEL on occupational choices among rural residents. Consistent with previous findings indicating a positive effect of the CEL on wage labour participation (Column 1, Table 3), the CEL decreased the likelihood of rural residents working as 'skilled agricultural and fishery workers' (Column 6, Panel A, Table 10). Instead, rural residents exposed to the CEL were more likely to work as 'service workers or shop/market sales workers' (Column 5, Panel A) and as 'plant/machine operators or assemblers' (Column 8, Panel A). According to the ISCO-88, these two occupations are among the two lowest categories of occupations, generally considered low-skilled jobs. The high concentration of rural residents in low-skilled jobs is closely related to their low levels of education as the CEL only increased their education up to the nine-year compulsory level. Importantly, we find significant gender heterogeneous effects of the CEL on occupational choices. Compared to rural males, rural females were more likely to work as 'service workers or shop/market sales workers' (Column 5, Panel B) and less likely to work as 'plant/machine operators or assemblers' (Column 8, Panel B).

The observed gender gap in returns to education may be associated with gender-based occupational segregation among rural residents. In Online Appendix Table A6, we use the full CFPS 2018 sample, including both rural and urban residents, to present the demographic characteristics, educational attainment, and labour market outcomes of individuals by occupation. Compared to plant and machine operators and assemblers (predominantly held by rural males), service workers and shop and market sales workers (predominantly held by rural females) tend to be more educated but have lower monthly wages. In other words, rural females engage in occupations with relatively lower returns to education than rural males.

7. Conclusions

In this paper, we investigate whether education can help reduce gender inequality during the sectoral reallocation of labour. Leveraging the staggered rollout of the CEL across provinces in China, we estimate the impact of the CEL on educational attainment and labour market outcomes of rural residents, with a focus on gender heterogeneity. Our findings indicate that while the CEL narrowed the gender gap in education, it did not reduce gender inequality in labour market outcomes. We provide evidence that this persistent gender inequality can be attributed to gender differences in migration decisions and occupational choices. Additionally, we find that gendered migration patterns are driven by household labour divisions and social gender norms, rather than disparities in cognitive skills.

Our findings have multiple policy implications. First, removing barriers to female migration could greatly reduce gender inequity. This would involve, on the one hand, further relaxing institutional migration restrictions, such as the Hukou system, to lower the costs of living and education for migrants in urban areas, thereby supporting rural women migrating with their children. On the other hand, the expansion of affordable, high-quality public services (for example, childcare and eldercare) in rural areas could alleviate domestic burdens on women, enabling them to migrate for employment. Moreover, recent research indicates that higher educational attainment can foster more egalitarian gender role attitudes (Du et al., 2021). Over time, the CEL could shift social gender norms and beliefs, reducing social barriers to female migration. Second, there is considerable scope for policies to reduce gender inequality in the labour market, such as easing regulations and entry barriers to boost productivity in the service sector, where females reveal a comparative advantage.

We acknowledge at least three limitations of this study. First, due to data constraints, our analysis focuses solely on individual labour market outcomes in the non-agricultural sector, omitting the agricultural sector, though almost all income growth for rural households in China has come from non-agricultural employment. Second, we have concentrated on supply-side factors that could lead to gender heterogeneity in off-farm employment, demand-side factors (for example, differential gender labour demand) may also contribute to gender disparities in labour

market outcomes (for example, participation and wages), even though rural females are catching up with rural males in terms of education. Third, we only shed light on the role of nine-year compulsory education in reducing gender inequality in the context of China's structural transformation. How will senior high school and higher education attainment impact gender inequality in the process of structural transformation? This is left as a future research question.

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Disclosure statement

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

Data availability statement

Data and code will be made available by the authors upon request.

Notes

1. Data source: China Statistical Yearbooks, 2022.
2. According to our calculations based on the 1982 China's Population Census, only 38.9 per cent of the labor force (16–65) completed junior high school; The completion rate of junior high school is 46.5 per cent for male laborers and 30.6 per cent for female laborers.
3. Although the 1986 CEL specified that the nine years of compulsory education should be tuition-free, the law was never strictly enforced in the early years. In reality, compulsory education in China was not provided free of charge in rural areas until 2006 and in urban areas until 2008.
4. The completion rate of junior high school of the female and male ineligible cohorts (born between 1960 and 1969) are 33.4 per cent and 56.7 per cent, respectively, and the average years of schooling of the female and male ineligible cohorts are 5.216 and 7.757, respectively.
5. The Hukou system, established in 1958, identified each person as a resident of a specific area, where he or she was assigned either rural or urban Hukou; Under the Hukou system, rural residents were not allowed to move to cities till the 1980s (Xie et al., 2023).
6. As shown in the robustness check, we find similar results when using the 2016 CFPS.
7. We find that the impact of the CEL on years of schooling and the completion of junior high school of rural residents decreases when excluding rural-urban migrants from the urban sub-sample (Results are available upon request).
8. There are several reasons. First, this paper focuses on whether the improvement in education leads to gender-heterogeneous effects on labor market outcomes (such as participation and wages) among rural workers. Unfortunately, the CFPS lacks information on the labor market outcomes of individuals self-employed in the non-agricultural sector. Second, in China, off-farm self-employment among rural residents is often a household decision rather than an individual one. Third, self-employment in non-agricultural sectors may be influenced by factors beyond individual education. Our findings suggest that the positive impact of exposure to the CEL on off-farm employment is primarily driven by those engaged in wage employment. Moreover, we find that exposure to the CEL does not significantly increase participation rates in non-agricultural self-employment, nor do we observe significant gender heterogeneity in this effect. Therefore, off-farm self-employment is a different decision-making process that warrants separate study.
9. Data on GDP per capita by province were obtained from the 1986 China Statistical Yearbook.
10. We combine two adjacent birth cohorts to improve the precision of estimation.
11. To estimate the gender-heterogeneous effects of education on labor market outcomes, our IV specification includes two endogenous variables: years of schooling and its interaction with gender. We use three instruments to address endogeneity: an individual's exposure to the CEL, its interaction with gender, and its interaction with the average years of schooling for ineligible cohorts.
12. In all regressions shown in Tables 2 and 3, estimated coefficients on ethnicity (Han = 1), years of schooling of fathers and years of schooling of mothers are all positive and statistically significant, while those on gender

(Female = 1) and number of siblings are negative and statistically significant. For the sake of brevity, we do not report coefficients on individual-level controls in the tables (results are available upon request).

13. These calculations are based on the 1990 China's Population Census.
14. The 2018 CFPS also includes occupation codes based on the Chinese Standard Classification of Occupation (CSCO), an industry-based classification system. We find consistent results when analyzing the impact of the CEL on occupational choices based on the CSCO (results are available upon request).
15. According to the ISCO-88, approximately 90 per cent of individuals in our sample occupy positions within the two lowest occupational categories, typically considered low-skilled jobs. Specifically, those in agricultural employment are largely classified as 'skilled agricultural and fishery workers'. For those engage in non-agricultural employment, the most common occupations include 'service workers and shop and market sales workers', 'plant and machine operators and assemblers', or 'Craft and related trades workers'. While both rural females and males predominantly work in low-skilled jobs, notable gender differences in occupational choices emerge: males tend to work in the manufacturing sector as 'plant and machine operators and assemblers' or 'Craft and related trades workers', whereas females are primarily employed in the service sector as 'service workers and shop and market sales workers'.

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