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The Effect of Relaxing the Hukou System on Education:
Evidence from China

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Abstract: Does inequality in educational opportunities emerge as a result of limited educational resources or institutional barriers preventing individuals from accessing available public services? This paper aims to address the questions using China's hukou reform in 2014 as a quasi-natural experiment to investigate whether easing residency constraints can improve educational attainment. Using nationally representative data from the China Family Panel Studies (CFPS) along with the difference-in-differences framework, causal effects of the hukou reform on years of schooling are found. Findings demonstrate that hukou system reforms had a substantial impact on increasing education attainment, particularly in cities that witnessed greater policy liberalization. These results remained robustness under different identification strategies, such as event-study analysis, placebo tests, and propensity score matching in conjunction with difference-in-differences framework. Mechanism analyses also highlighted that the reform raised educational attainment through greater use of internet in households, engagement of households in business activities, and reduction in school sponsorship fees, implying that increased access to information, economic opportunities, and reduction in institutional barriers have positively affected outcomes. Furthermore, the education benefits accrue mainly to young people whose education was still incomplete when the reform was introduced. It is also found that educational inequality is shaped by disparities in distribution of educational opportunities and the access to public services through institutions. In general, the paper shows that reforming institutions can lead to higher human capital accumulation through increased educational attainment without the need for proportionate rise in educational investments and contributing towards inclusive development in developing economies.

Keywords: China; Hukou-Reform; Educational Attainment; Human Capital Accumulation; Institutional Reform; Difference-in-Differences

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1 Introduction

Notwithstanding that substantial advancement in education accessibility over the last few decades, the issue of educational inequality remains significant in developing nations. Governments have made investments to elevate school enrollments, improve educational outcomes, and develop education facilities, however, inequities in education levels still exist between regions, social classes, and migrant populations. Literature has also demonstrated that such discrepancies can neither be justified nor explained primarily in terms of disparities in individual endowment or state expenditure on education. In contrast, institutional framework governing access to public services has a major influence on the dynamics of educational opportunities. Accordingly, the question of whether institutional reform can lower the barriers to access public education and enhance attainment levels across populations has become highly relevant in developing economics. It is important to empirically address the question since education is a major factor in human capital accumulation and productivity, which leads to greater economic development and intergenerational mobility, and a decline in long-run inequality (Lucas, 1988; Romer, 1990; Aghion and Howitt, 1998; Fleisher et al., 2011).

In the case of China, there is an opportunity to analyze how institutional reforms impact educational opportunities considering that historically, the access to public services remained dependent on the hukou system. Whereas in many countries, the right to mandatory education is largely determined by actual residence, in China, public services access such as education is dependent on the registered address of residence and classification as rural or urban residents under the hukou system (Heckman, 2003; Heckman, 2005; Cheng and Selden, 1994; Chan and Buckingham, 2008). With the increasing pace of economic reforms since the late 1970s, a large number of people moved from the rural areas into the cities for job opportunities. However, hukou policy remained primarily unchanged, thus resulting in a notable gap between where people resided and the public services they could avail. Therefore, immigrant families faced difficulties in registering their children into local public schools due to further administrative demands or higher schooling costs. Through linking education directly to administrative status rather than actual residency, the hukou system has been among the most critical institutions in terms of educational disparity in modern China (Meng, 2012).

In the face of the increasing conflict between population mobility and the hukou system, the Chinese government began its national hukou reform in 2014. Instead of abandoning the hukou system, the reform eased the hukou settlement restrictions based on city sizes, thus lowering the constraints for those cities with less than five million residents, while keeping stringent constraints for megacities. The differentiated implementation of the policy demonstrated the government's efforts to combine urbanization process with the carrying capacities of major metropolises. However, the differentiation also created significant variations between institutional barriers in cities. As for migrants, it was significantly convenient to acquire local hukou in small and medium-sized cities and access public services, including education compared to megacities. Through decreasing the institutional costs associated with enrollment in local schools, the reform helped improve education through several mechanisms, including increased accessibility to public educational facilities, reduction in costs associated with admission to schools, and incentives to invest further in children's human capital accumulation. At the same time, the heterogeneous implementation of the reform in various cities serves as a valuable quasi-natural experiment to establish the causal effect of institutional

reform on educational attainment.

Literature has also illustrated that hukou system is one of the major institutional contributors to the challenges of educational inequality in China. Several studies have established that hukou plays a significant role in access to public schooling, levels of educational attainment, the quality of education received, and labor market outcomes (Brown and Park, 2002; Chan and Buckingham, 2008; Knight and Song, 1999; Sun et al., 2024). Recent literature further highlights that institutional barriers due to the hukou system have continued to influence the educational prospects of migrant children amid fast-paced urbanization and educational advancements (Li et al., 2010; Ye et al., 2024). Nevertheless, although the impacts of the hukou system have been comprehensively researched, limited evidence is found about whether easing the constraints of the hukou system can improve educational attainment outcomes across population. The literature on hukou reforms has mainly concentrated on labor mobility, urbanization, housing markets, and local economic development (An et al., 2024; Guo and Xu, 2025), with a paucity of work examining the implications for educational performance. Further, literature lacks in examining causal links between institutional reforms aimed at reducing administrative barriers to schooling and human capital accumulation. Therefore, whether successful expansions of educational opportunities occurred through hukou system reform still needs to be empirically investigated.

This paper takes advantage of the quasi-natural experiment of the nationwide hukou reform launched by China in 2014 to explore how this reform affects educational attainment through analyzing data collected by China Family Panel Studies (CFPS) from 2012 to 2022. The reform significantly reduced the restrictions on hukou status for small and medium-size cities but kept strong control in large cities, thus creating exogenous variation in policy exposure among different places. Based on this institutional background, this paper uses a difference-in-differences (DID) framework to evaluate the causal impact of hukou reform on educational attainment.

The empirical results yield three main conclusions. Firstly, the hukou reform has a large effect on educational attainment, and such effects have proved to be highly robust through a range of robustness checks, including parallel trends test, placebo test, and propensity score matching combined with DID estimation (PSM-DID). Second, the benefits appear much more pronounced for rural families while there is a lack of notable differences with regards to gender or economic development level in different regions. Third, the mechanism analysis indicates that hukou reform promotes educational attainment through several channels simultaneously, including more frequent usage household Internet usage, greater involvement of family members in business activities, and reduction of school sponsorship payments, which shows that hukou reform contributes to better education opportunities via enhanced access to information, economic opportunities, and reduced institutional obstacles to public education.

The findings of this study illustrate various areas within the development economics literature. First, this study adds to the literature on institutions and human capital in that it provides causal evidence for institutional reforms and improvements in educational attainment. Although previous scholars have provided evidences regarding hukou systems' impact on education, there is a lack of clarity about whether institution reforms can lead to human capital accumulation. The educational impacts of 2014 hukou reforms in China demonstrate that institutional change can produce positive effects on educational attainment.

Second, this paper contributes to the literature on educational inequality by highlighting the mechanism through which institutional change has an impact on education levels. Contrary to the view that improvements in education are caused directly by policy reform, the evidence presented demonstrates how the hukou system reform works through different channels, such as better information, greater economic opportunities for households, and reduced institutional costs of school enrollment.

Moreover, the present study contributes to the existing literature on development and structural change in terms of highlighting the impact of institutional change in generating equality of opportunity. The empirical evidence demonstrates that minimizing administrative barriers to public services can enhance education without any increase in educational expenditure, indicating that institutional changes can also supplement traditional educational investments. In other words, the evidence emphasizes the importance of reforms for equal access to public services in facilitating human capital accumulation.

The paper has been divided into several sections. Section 2 summarizes the institutional history of the Chinese hukou system and the 2014 hukou reform. Section 3 explains the data, variables, and methodology. Section 4 provides the estimation results for the benchmark case and several robustness tests using an event study method, placebo test, and propensity score matching with difference-in-differences estimation. Section 5 discusses how hukou reforms influence education and heterogeneous impacts of policies on various population segments. Finally, Section 6 concludes the paper by summarizing the results and their policy implications for institutional reforms, educational attainment, and human capital accumulation.

2 Institutional Background and Policy

2.1 The Hukou System and Educational Inequality

China's Household Registration (Hukou) System is among the significant institutions in China that control internal migration and provision of public services. The institution was formulated in the 1950s and it defines people in terms of where they are registered and whether they have rural or urban status. Apart from being a registration system for people in different locations, hukou decides eligibility for various public services in the area such as education, healthcare, housing, and social security (Chan and Buckingham, 2008). As a result, hukou system has traditionally affected migration and access to education in various regions and among different social strata.

Since the delivery of compulsory education in China relies heavily on local government finances, the issue of access to public schools has historically been dependent on local hukou status. For example, while millions of people migrated from rural to urban areas after the economic liberalization of China, they primarily had a challenging experience in accessing public education services due to the non-urban hukou status. Children lacking a local urban hukou had to enroll in institutes lacking appropriate resources or pay higher fees to enroll in public schools, whereas some children had to be sent back to their registered area in order to receive compulsory schooling (Wu and Treiman, 2004; Chan and Buckingham, 2008). As a consequence, hukou emerged as a crucial factor in education inequality along with income inequality and regional economic differences.

Several pathways by which the hukou policy influences educational attainment have been highlighted in previous studies. One pathway is that the inequity of public educational resource distribution causes huge discrepancies in school quality between rural and urban regions (Hannum, 2005). Another pathway involves the lack of local hukou leading to higher costs of education due to additional admission and sponsorship fees for migrant children (Zhang, 2017). Thirdly, institutional barriers that arise due to hukou status affect household expectations about education and investments in children's human capital accumulation (Qu and Zhao, 2017; Guo and Zhao, 2019). These mechanisms imply that educational inequality in China is shaped by differences in family resource challenges and institutional barriers present within the hukou system.

2.2 Evolution of Hukou Reform

With the emergence of economic reforms in China in the late 1970s, the hukou system has gradually evolved from its role of being a stringent instrument of controlling population mobility to an adaptive institutional arrangement designed to facilitate labor movement and urbanization processes. With the process of rapid industrialization and economic growth, there has been a significant need for migrant workers in cities, which made the distinction between the rural and urban population groups unsustainable with regard to economic development (Meng and Xue, 2020). In that respect, the central government introduced gradual reforms of the hukou system instead of adopting a single comprehensive policy change.

One notable achievement in this regard was the reform of the hukou policy in 1998, when the regulations regarding inheritance of hukou status by children were changed. Before the reform, children inherited the hukou status from their mother. As a result, the children of urban fathers and rural mothers were usually considered rural people and could not receive the same urban public education. However, 1998 reforms provided an opportunity to choose between inheritance of hukou status from the father or mother, and thus removed some institutional barriers for mixed hukou families (Han et al., 2015). Despite the fact that the reform expanded educational options for a limited number of children, structural challenges persisted for a notable percentage of the population.

Over the subsequent decade, local governments introduced a number of pilot programs to encourage workers and promote urbanization. However, these programs were primarily fragmented, and varied highly between cities, creating substantial regional differentiation in terms of hukou regulations. Furthermore, it was evident that access to public schooling in urban areas remained notably related to local hukou status for most urban centers. Non-local hukou migrants' children found themselves disadvantaged in gaining admission into public schools or had to pay additional sponsorship fees in such schools, thus undermining equal access to education despite rising internal migration.

These incremental reforms set the institutional stage for the national level hukou reform, which was initiated in 2014. The national hukou reform of 2014 differs from all prior policy reforms since it created a unified framework at the national level for relaxing hukou regulations while allowing implementation intensity to systematically depend on the size of the city. This policy change was the first time that there was a comprehensive reform of China's hukou system at the national level and sets the stage for the empirical examination performed in this paper.

2.3 The 2014 Hukou Reform

The most significant step in the reform of China's hukou system is the nation-wide hukou reform that started in 2014. After the Third Plenary Session of the 18th Central Committee of the Communist Party of China in November 2013, the central government identified hukou system reform critical to their overall strategy of achieving people-oriented urbanization. On July 24, 2014, the State Council promulgated the *Guiding Opinions on Further Promoting the Reform of the Household Registration System*¹, which was the first nationwide blueprint for relaxing hukou restrictions.

Whereas previous reforms had been independently carried out by the local governments, the 2014 reform set up uniform national standards but left room for flexibility in implementation depending on city sizes. This was based on the assumption that there were varying degrees of pressure on the cities in terms of provision of public services. Thus, the reform was carried out with consideration of labor mobility and carrying capacity of the cities.

As shown in Table 1, the reform divided China's cities into four types based on permanent urban population, and it set different hukou access criteria for each city category. Small cities and towns with less than 500,000 urban population were obligated to abolish hukou restriction completely. Mid-size cities that have populations ranging from 500,000 to one million people were instructed to significantly ease hukou policies such that migrant workers who could provide proof of employment and residence would be able to get hukou registration conveniently. In contrast, big cities with population sizes ranging from one to five million people were allowed to continue with hukou admission policy by means of point and social insurance systems. Further, megacities with populations of over five million people kept strict control over the registration of their hukou system due to the apprehensions about congestion and fiscal burden.

This differentiated policy approach resulted in high levels of variance in the extent of hukou reform efforts in individual cities. Though residents from smaller and medium-size cities experienced a marked decline in institutional barriers associated with acquiring local hukou, those from larger cities and metropolitan areas witnessed insignificant changes in policies. Hence, the reform produced exogenously different variations in institutional relaxation while simultaneously implemented across the country.

The educational implications of these policy changes are potentially substantial. Obtaining local urban hukou affects children's eligibility for public schooling, reduces administrative barriers to school enrollment, and lowers additional education-related costs associated with non-local registration. Therefore, the reform is expected to improve educational attainment by expanding access to local public schools.

¹"See the official website of the State Council for more details of the decree (http://www.gov.cn/gongbao/content/2014/content_2729568.htm)".

reducing institutional barriers faced by migrant families.

This institutional setting provides a suitable quasi-natural experiment for identifying the causal effects of hukou reform. Considering that the timing of the reform was determined by the central government while its intensity varied systematically according to predetermined city-size classifications, the policy generated cross-sectional and temporal variation that can be exploited using a difference-in-differences framework. The following section describes the empirical strategy based on this policy design.

Tabel 1. Differential Hukou Admission Policies under the 2014 Hukou Reform

City category	Permanent urban population	Hukou policy	Treatment status in this study
Small cities	<0.5 million	Remove all restrictions	Treatment
Medium cities	0.5–1 million	Substantially relax restrictions	Treatment
Large cities	1–5 million	Gradual relaxation	Treatment
Megacities	>5 million	Strict control	Control

Notes: This table summarizes the major provisions of the 2014 hukou reform based on the *Guiding Opinions on Further Promoting the Reform of the Household Registration System* (State Council, 2014). Cities are classified according to their permanent urban population, and the policy descriptions report the corresponding hukou admission requirements established by the reform.

2.4 Why the 2014 Reform Provides a Quasi-natural Experiment

A central challenge in evaluating the educational consequences of hukou reform is that individuals who obtain urban hukou are unlikely to be randomly selected. In other words, families with higher incomes, educational preferences, or labor force opportunities may have greater ability to migrate and acquire urban hukou. As such, any simple comparison between the hukou and the non-hukou population is susceptible to selection bias, thus making it challenging to identify the causal effect of hukou reform on educational attainment.

The 2014 nationwide hukou reform helps to overcome this issue to a large extent through the use of credible policy variations. Instead of allowing local authorities to decide on their own when and how they would implement reforms, the national government undertook unified national reforms across the country while specifying the hukou policies based on city-size categories. These classifications were made prior to the implementation of policies and based on the permanent population of urban areas, and they created significant differences in the intensity of institutional reforms independent of household-specific characteristics.

The policy design provides two dimensions of variation which can be utilized for causal inference. First, the policy reform introduced a temporal discontinuity that enabled comparison of different time periods before and after 2014. Second, the differential application of the policy in different city-size groups provided variation in policy exposure. Residents in cities that witnessed greater relaxation of hukou constraints had higher institutional change compared to residents in cities with strong hukou control systems. The two elements discussed above are well suited for conducting a difference-in-differences analysis.

Another benefit of this context is the fact that the reform mostly changed the institutional access to local

hukou instead of focusing on educational outcomes. The policy was put into action under the scope of China's overall urbanization policy with the aim to achieve labor mobility and urbanization, among others. Thus, improvement in educational attainment emerges as a consequence of reduced institutional barriers. This factor makes the identification strategy credible by addressing any concerns about other education-related policies influencing the estimated effect. In light of these institutional characteristics, the next section utilizes a difference-in-differences framework to estimate the causal effect of the hukou reform of 2014 on educational attainment outcomes. The empirical approach uses the variation arising from the fact that some cities were more relaxed with their policies than others before and after the reforms, in addition to controlling for city and year fixed effects.

3. Data

3.1 Data Sources

The data used in this analysis is derived from the China Family Panel Studies (CFPS), which is a national representative panel survey conducted biennially by the Institute of Social Science Survey of Peking University. This survey has comprehensive individual, household, and community level data such as demographics, economic position of the household, hukou system, migration details, and educational attainment. The CFPS surveys cover 25 provinces, municipalities, and autonomous regions of mainland China, which accounts for about 95% of the Chinese population.

Empirical analysis is conducted using six panels of CFPS data for the years between 2012 and 2022 that cover both the pre-reform period and the post-reform period of 2014. This is supplemented by data on the extent of implementation of the hukou reform in 2014 at the city level. Based on the classification of policies mentioned above in section 2, cities with population less than five million are classified as treatment cities, while cities with a population of more than five million are classified as control cities.

3.2 Sample Construction

The primary dataset comprises individual-year data. Since the dependent variable is education, which is defined in terms of years of schooling, the data used are for people aged 16 years and above. Such a constraint is placed since people who are below this age tend to be still undergoing compulsory schooling and may not yet have gone through substantial educational transitions. The exclusion of younger people allows the outcome variable to capture more accurately educational attainment rather than school enrolment status.

The dataset contains data for the years 2012, 2014, 2016, 2018, 2020, and 2022. As a result of hukou reform in 2014 taking place in July 2014, the post-reform period is considered to be after 2016. The year 2014 is regarded as the baseline year under the event study specification. Treatment and control groups are classified based on the residence city of individuals using the population-size categorization of the 2014 hukou reform. There are several data-cleaning techniques used prior to estimating the model. All observations with missing key variables are excluded from respective regressions. The educational attainment variable is

winsorized by the maximum number of 24 years in order to decrease the impact of outliers, which equals having a doctorate degree completed. All continuous variables are winsorized by the first percentile in order to minimize the effect of outliers. After imposing these restrictions, the final sample consists of approximately 86,000 individual-year observations.

3.3 Variables and Descriptive Statistics

The main dependent variable is education attainment, represented by years of schooling. This variable represents the total formal education attained by the respondents. It forms the key measure of human capital in the analysis. The key independent variable is the treatment city indicator and post-reform indicator interaction. The treatment indicator takes the value of one for people living in the city if the population is less than five million, where hukou reform was implemented in 2014. On the other hand, it takes the value of zero for people living in the city with more than five million population, where strict hukou controls remained in place. The post-reform variable takes a value of one if the year is during or after the reform has been implemented, namely 2016, 2018, 2020, and 2022, while zero otherwise. The interaction coefficient represents the average effect of the hukou reform on educational attainment.

The analysis controls for various personal and household characteristics that may influence educational attainment. They include age, gender, hukou type, household income, and household size. Gender is coded as one for male and zero for female. Hukou is coded as one for urban hukou and zero for rural hukou. Household income denotes the level of household income, while household size denotes the number of people in the household. Descriptive statistics of the variables used in the study are presented in Table 2 below. The average years of schooling in the primary data set is 7.775 years with a median of 9 years. The average age of respondents is 49.76 while the proportion of males in the population is 56.3 percent. Nearly half of the sample is urban registered. Mean annual household income is 73,012 yuan despite the high variance in income. The average household size is 2.602 members.

Table 2. Variable Summary

Variable	N	Mean	p50	SD	Min	Max
Education	83554	7.775	9	4.745	0	24
Age	86261	49.76	49	14.55	15	97
Gender	86283	0.563	1	0.496	0	1
Hukou	84851	0.503	1	0.500	0	1
Income	83145	73012	45000	179486	0	1.600e+07
Size	86284	2.602	2	1.307	1	15

Notes: This table reports summary statistics for the main variables used in the baseline analysis. Education is measured as years of schooling. Gender equals one for males and zero for females. Hukou equals one for urban hukou and zero for rural hukou. Household income is measured in yuan. Household size refers to the number of household members. The sample is based on CFPS waves from 2012 to 2022

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

4 Empirical Strategy

4.1 Baseline Difference-in-Differences

The empirical analysis exploits the staggered implementation of the 2014 hukou reform across cities with different population sizes. As described in Section 2, the reform substantially relaxed hukou restrictions in cities with populations below five million while maintaining stringent admission policies in megacities with populations exceeding five million. This institutional variation generates plausibly exogenous differences in policy exposure across cities and provides the basis for a difference-in-differences (DID) research design.

The treatment group consists of individuals residing in cities where hukou restrictions were relaxed following the 2014 reform, namely cities with urban populations below five million. Individuals living in megacities with populations exceeding five million constitute the control group because these cities continued to impose strict hukou requirements throughout the study period. Since the reform was formally announced and implemented in July 2014, survey waves from 2016 onward are defined as the post-reform period, while observations from 2012 and 2014 from the pre-reform period.

The baseline estimating equation is specified as

$$Y_{i,c,t} = \beta_0 + \beta_1 Treatment_c * post_t + \beta_2 X_{i,c,t} + \gamma_c + \delta_t + \varepsilon_{i,c,t} \quad (1)$$

$$Treatment_c = \begin{cases} 0 & \text{control} \\ 1 & \text{treatment} \end{cases}$$
$$post_t = \begin{cases} 0 & \text{before} \\ 1 & \text{after (if year} \geq 2014) \end{cases}$$

where $Y_{i,c,t}$ denotes the educational attainment (years of schooling) of individual i residing in city c in survey year t . $Treatment_c$ is an indicator equal to one if the individual resides in a city with an urban population below five million and zero otherwise. $Post_t$ equals one for survey years after the implementation of the 2014 hukou reform (2016–2022) and zero for the pre-reform period (2012–2014). The interaction term $Treatment_c * post_t$ is the parameter of primary interest and captures the average effect of the hukou reform on educational attainment. $X_{i,c,t}$ includes age, gender, hukou status, household income, and household size. City fixed effects γ_c absorb time-invariant differences across cities, while year fixed effects δ_t control for nationwide shocks affecting educational outcomes. Standard errors are clustered at the city level to account for within-city serial correlation. The credibility of this identification strategy relies on the assumption that, absent the reform, educational attainment would have evolved similarly in treatment and control city. The following subsection evaluates this assumption using an event-study framework.

4.2 Event Study

Although the DID estimator identifies the average treatment effect under the parallel trends assumption, this assumption cannot be directly observed. To evaluate its plausibility and examine the dynamic effects of the reform, this study estimates an event-study specification following the standard event-study framework in the DID literature (Autor, 2003). Specifically, the baseline treatment indicator is replaced by a series of interactions between the treatment indicator and survey-year dummy variables:

$$Y_{i,c,t} = \sum_{k \neq 2014} \beta_k (Treatment_c * Year_k) + \beta X_{i,c,t} + \gamma_c + \delta_t + \varepsilon_{i,c,t} \quad (2)$$

where $Year_k$ denotes survey-year indicators and 2014 is omitted as the reference year. Consequently, each coefficient β_k measures the difference in educational attainment between treatment and control cities relative to the year immediately preceding the reform. The event-study analysis serves two complementary purposes. First, statistically insignificant coefficients before the reform provide evidence consistent with the parallel trends assumption. Second, the post-reform coefficients reveal the timing and persistence of the policy effects, allowing the analysis to distinguish between short-run and medium-run responses. The estimated coefficients and their 95 percent confidence intervals are presented graphically in the results section.

4.2.1 Heterogeneous Policy Intensity Across City Sizes

To examine whether the effects of the hukou reform differ according to the intensity of policy relaxation, the baseline specification is extended by replacing the single treatment indicator with four treatment indication corresponding to the four city-size categories defined in the 2014 reform. The estimating equation is:

$$Y_{i,c,t} = \beta_0 + \beta_1 Treatment(< 0.5 \text{ million})_c * post_t + \beta_2 Treatment(0.5 - 1 \text{ million})_c * post_t + \beta_3 Treatment(1 - 3 \text{ million})_c * post_t + \beta_4 Treatment(3 - 5 \text{ million})_c * post_t + \beta X_{i,c,t} + \gamma_c + \delta_t + \varepsilon_{i,c,t} \quad (3)$$

where the four interaction terms correspond to cities with urban populations of (i) below 0.5 million, (ii) 0.5–1 million, (iii) 1–3 million, and (iv) 3–5 million, respectively. Megacities with populations above five million serve as the omitted reference category. This specification allows the analysis to investigate whether the magnitude of the educational effects varies with the degree of hukou liberalization across city sizes.

4.3 Robustness Checks

Although the baseline DID estimates provide evidence on the causal effect of the hukou reform, several robustness checks are conducted to assess the credibility of the identification strategy and the sensitivity of the empirical results. First, the event-study specification provides a direct assessment of the parallel trends

assumption. By using separate estimates of the treatment effect in every survey year, the above methodology tests the similarity of changes in education attainment between treatment and control cities before the reform. The lack of statistically significant values of the pre-treatment coefficient proves the effectiveness of the DID methodology.

Second, the placebo test is conducted through the assignment of a fictitious reform year prior to the introduction of the actual policy. In case the estimated impact effect disappears in the placebo specification, it implies that the initial estimates are not due to the presence of spurious correlation, differential trend, or any other shock independent of the hukou reform.

Third, the PSM-DID approach is used to resolve any possible problems related to the differences in observables between the treatment and control groups. People are first matched according to their observable before treatment and then the DID estimator is used for the matched sample. Comparable calculations using the matched sample highlighted that initial results are not sample dependent. Collectively, the robustness tests examine the identifying assumption from various angles and further support the causal nature of the estimated effect.

4.4 Heterogeneous Treatment Effects

The average treatment effect can mask significant variation across different population groups. In order to capture any distributional impacts arising from the implementation of the hukou policy, this paper analyzes whether there is differential impact among different demographic and geographic subgroups. Separate regression analysis for urban and rural families is conducted since the rural residents have experienced greater institutional barriers in accessing public education. Second, the study explores the issue of heterogeneity with regard to gender using separate estimates for men and women. It aims to determine whether there are any differences in the impact of the hukou reform on education between the two genders. Lastly, the sample is divided based on regional economic development before the reform. Classification of cities into low and high-GDP groups is carried out depending on the GDP per capita before implementing the policy in question to determine whether local economic environment affects the efficiency of hukou liberalization in enhancing education. These heterogeneous results also contribute further evidence as to which groups are best served by this reform and whether the policy helps to reduce educational inequality between socioeconomic groups.

5. Quantitative Analysis Results

5.1 Descriptive Evidence

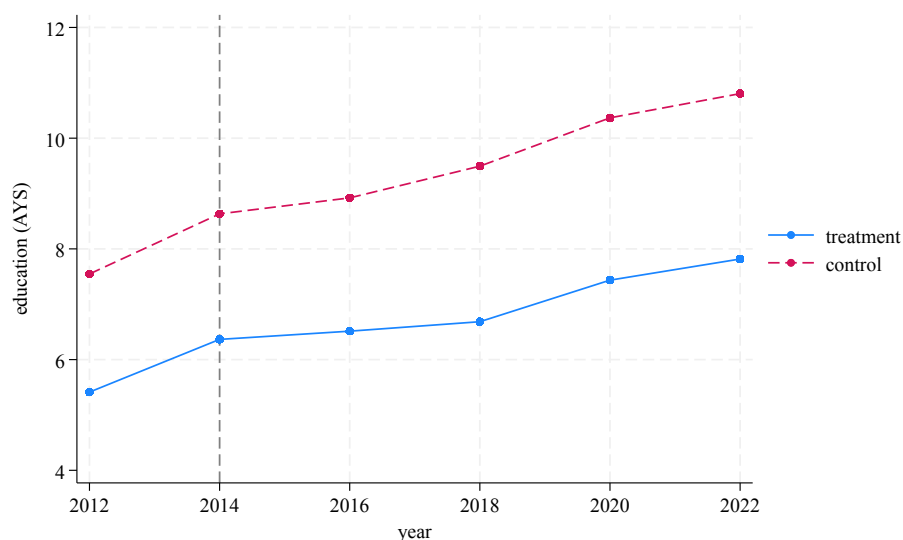
Before discussing the regression results, the section offers descriptive evidence about the pattern of educational attainment over time in the treatment and control cities. Figures 1 and 2 show the raw pattern of the average number of years of schooling before and after the 2014 hukou reform. In Figure 1, the average education level of those who live in treatment cities (urban city size below five million) and control cities (megacities of urban size above five million) is compared. As expected by the existing geographic inequality

in the provision of education in China, those who live in megacities have much higher average educational attainment throughout the sample period. However, the two groups exhibit an almost identical pattern before the reform policy is implemented. In the years from 2012 to 2014, both the treatment and control cities experienced an equal rise in educational attainment, which is the first descriptive evidence that supports the parallel trend assumption of difference-in-differences.

Figure 2 shows how the treatment cities are split based on the four population groups defined by the 2014 hukou reforms. Even though educational levels monotonically increase with increasing city sizes due to disparities in the availability of education opportunities and economic development, there are similar trends before the reforms in all groups of cities. After the reforms, educational attainment levels keep rising in all the groups, but the cities that underwent more liberal hukou reform seem to show higher improvements. It is crucial to note here that these numbers describe the trend without identifying causation. The raw trends do not control for differences in demographic characteristics, household socioeconomic conditions, or time-invariant city characteristics. Therefore, the following sections employ a series of difference-in-differences specifications to isolate the causal effect of the hukou reform on educational attainment.

In general, the descriptive evidence highlight that both the treatment and control cities had similar paths before the reform, whereas their education outcomes started to differ after the reform. These patterns provide preliminary support for the DID identification strategy, which is examined more formally in the following regression analysis.

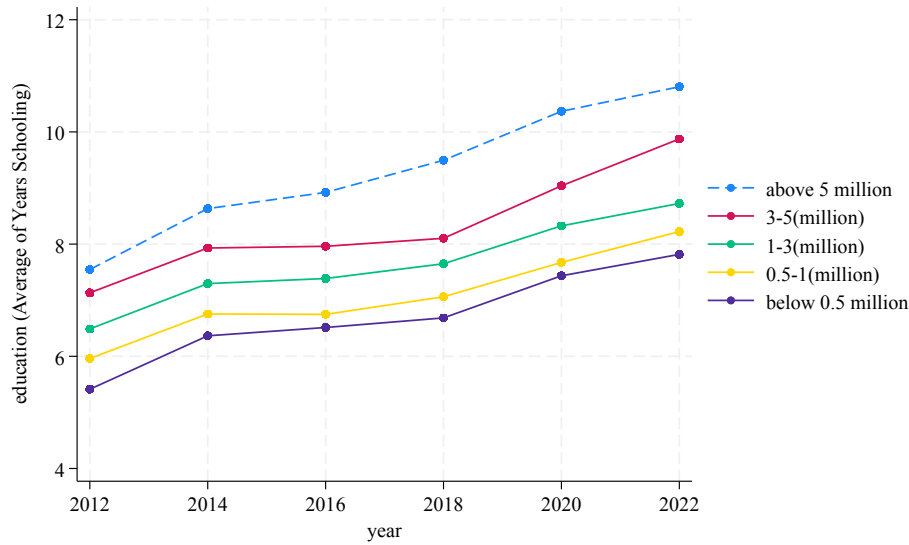
Figure 1. Raw Trends of Educational Attainment in 2012-2022 (Average of Schooling years (AYS))



Notes: Treatment represents the cities where population is below 5 million; Control represents the cities that population is below 5 million.

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

Figure 2. Raw Trends of Educational Attainment in 2012-2022 (Average of Schooling years (AYS))



Notes: Above 5 million represents the cities where population is below 5 million; 3-5 million represents the cities where population is 3-5 million; 1-3 million represents the cities where population is 1-3 million; 0.5-1 million represents the cities where population is 0.5-1 million; Below 0.5 million represents the cities where population is below 0.5 million.
Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

5.2 Baseline Difference-in-Differences Results

Table 3 reports the baseline difference-in-differences (DID) estimates of the effect of the 2014 hukou reform on educational attainment. The coefficient of the **Treatment** and **Post** interaction term in all estimations is found to be consistently positive and statistically significant, thus offering consistent support for the hypothesis that loosening of hukou controls improved education outcomes. Column (1) shows the DID estimation without fixed effects. The estimated effect of the policy is positive and statistically significant, thus suggesting that higher educational attainment has occurred after the policy in cities where there was relaxation of the hukou policy than in those where strict hukou policies remained. This specification controls for the average effect of the policy but fails to control for unobserved heterogeneity among cities or time-shocks.

Column (2) includes both city and year fixed effects, which form the preferred baseline specification for the entire paper. After accounting for time-invariant city variables and national trends that affect education, the coefficient is still found to be positive and statistically significant. The similarity of the coefficient estimates for the first two cases shows that our results are robust to the addition of fixed effects and not biased because of any omitted variables at the city level or macroeconomic shocks.

In order to test whether the size of the policy effect differs based on the intensity of the hukou reform, column (3) introduces four interaction variables which are divided according to the classification of cities by the reform in 2014. The estimates show substantial heterogeneity among different city sizes. The largest educational gains are observed in cities with urban populations below 0.5 million, followed by cities with

Table 3. Regression of Results of Difference-in-Differences Model

	(1)	(2)	(3)
	education	education	education
Treatment	-0.948*** (0.055)		
Post	0.463*** (0.055)		
Treatment*post	0.251*** (0.067)	0.311*** (0.071)	
Age	-0.116*** (0.001)	-0.125*** (0.001)	-0.125*** (0.001)
Gender	1.194*** (0.030)	1.591*** (0.031)	1.591*** (0.031)
Hukou	2.059*** (0.032)	1.610*** (0.038)	1.609*** (0.038)
Income	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Size	-0.288*** (0.012)	-0.112*** (0.012)	-0.113*** (0.012)
Treatment (<0.5million) *post			0.346*** (0.079)
Treatment (0.5-1million) *post			0.318*** (0.119)
Treatment (1-3 million) *post			0.299*** (0.100)
Treatment (3-5 million) *post			0.185 (0.119)
City FE	No	Yes	Yes
Year FE	No	Yes	Yes
_cons	12.031*** (0.082)	11.738*** (0.082)	11.738*** (0.082)
N	66559	58962	58962
r2	0.330	0.381	0.381
ar2			

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

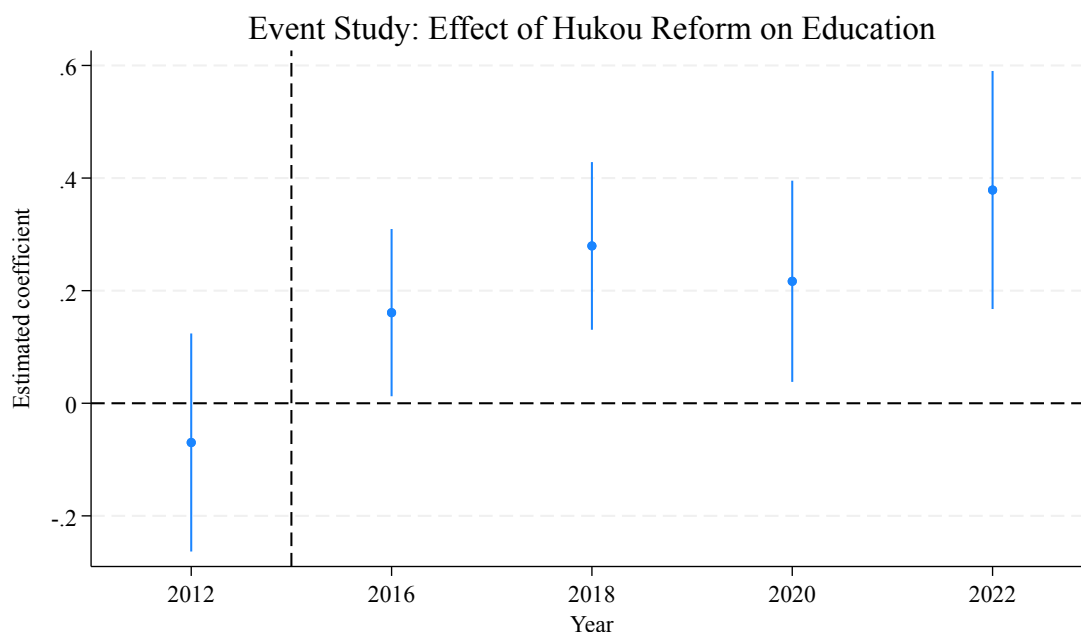
Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

populations of 0.5 to 1 million and 1 to 3 million. In contrast, the estimated effect for cities with populations between 3 and 5 million is considerably smaller and statistically insignificant. The above pattern is almost similar to the pattern observed in 2014 where small cities had more liberalized policies while large cities maintained relatively stricter policies regarding hukou liberalization. The results show that the 2014 hukou reform policy greatly improved education achievements. Besides, the estimates for the policy effects have varying degrees depending on the extent of hukou liberalization in cities. This pattern is consistent with the institutional design of the 2014 reform and suggests that the observed improvements in educational attainment are more likely to reflect the effects of hukou liberalization than broader nationwide improvements in educational outcomes.

5.3 Dynamic Effects (Event Study)

In order to check the validity of the parallel trends' assumption, an estimation of dynamic difference-in-differences specification has been performed by replacing the DID interaction term with a series of interactions between the treatment indicator and year dummies. Figure 3 presents the coefficients and their 95% confidence intervals as well as the event study estimates for the baseline model specification. Taking 2014 to be the omitted year, the coefficient of the period before reform (2012) is statistically insignificant, meaning that there is a lack of evidence for pre-treatment differences between the treatment and control group. The treatment effect estimates become positive after the reform period and continue to be statistically

Figure 3. Event-Study Estimates of the Effect of Hukou Reform on Education



Notes: The omitted (baseline) year is 2014. Dots represent coefficient estimates, and vertical bars denote 95% confidence intervals. The insignificant pre-treatment estimate (2012) supports the parallel trends assumption. Standard errors are clustered at the city level.

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

significant through the entire post-reform period, which is consistent with the main difference-in-differences treatment effect estimates provided in Table 3. The estimated coefficients for the pre-treatment period are statistically insignificant and provide no evidence of differential pre-treatment trends or anticipatory behavior before the policy is implemented.

5.4 Robustness Checks (Placebo Test)

In order to further investigate if the base year results are due to spurious correlation, a placebo test is conducted using an artificially designated reform year before the implementation of the hukou reform. Specifically, the treatment effect is estimated using only the pre-reform sample (2012-2014), with 2014 treated as a fictitious post-reform period. The findings from the estimation exercise are shown in Table 4. The coefficient associated with the placebo interaction term is insignificant, indicating that there is no

Table 4. Placebo Test Using a Fake Reform Year

	(1) education
Fake_did	0.073 (0.100)
Age	-0.119*** (0.004)
Gender	1.704*** (0.108)
Urban	1.809*** (0.175)
Household income	0.000*** (0.000)
Size	-0.026 (0.029)
City FE	Yes
Year FE	Yes
Constant	10.676*** (0.258)
Observations	22253
R-squared	0.346

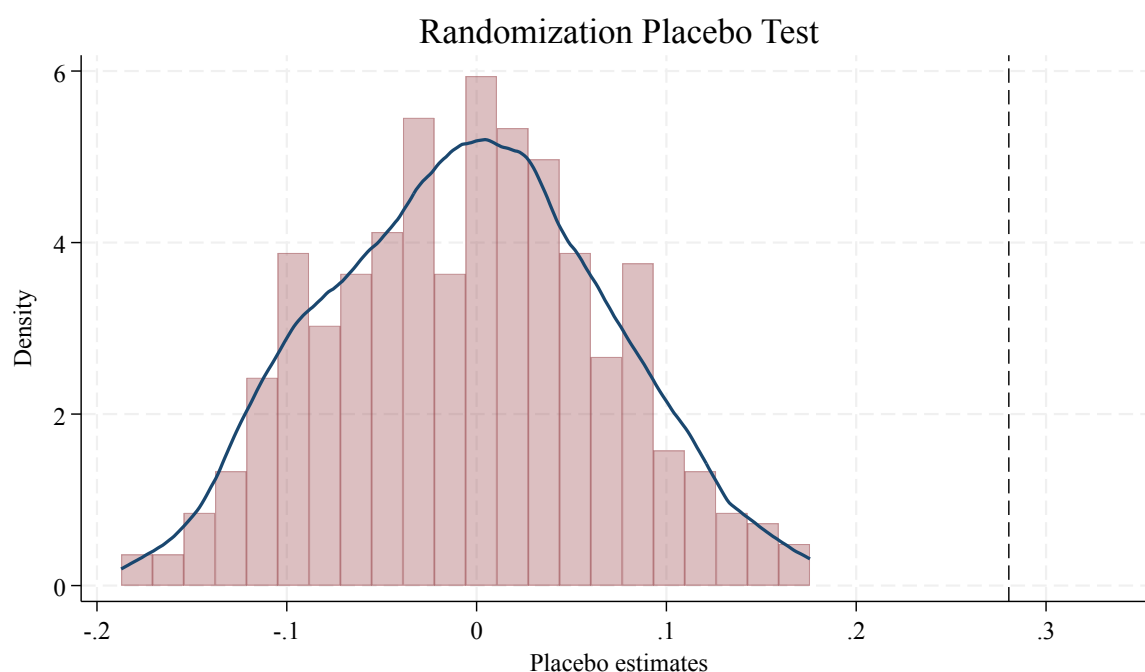
Notes: This table reports the results of the placebo test using a fake reform year. The dependent variable is years of schooling. City and year fixed effects are included. Standard errors clustered at the city level are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

statistical evidence of any difference in changes in education levels of the treatment and control groups prior to the actual reform policy. The results provide further support to the identification strategy.

In order to further investigate if the estimated treatment effect arises from random allocation of the treatment group, a placebo test was conducted using randomization. In this case, the allocation of treatment was randomly reassigned 1,000 times without changing the sample structure, and the baseline DID model was re-estimated for each iteration. As shown in Figure 4, the placebo estimates are roughly normally distributed with a mean of 0, while the DID estimate (0.2804) is well outside the placebo distribution. This result indicates that the estimated treatment effect is highly unlikely to have appeared randomly, thus providing additional support for main findings' validity.

Figure 4. Distribution of Placebo Estimates



Notes: The figure presents the distribution of placebo treatment effects obtained from 1,000 random. assignments of the treatment. The dashed vertical line indicates the actual DID estimate (0.2804).

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

5.5 Robustness Checks (PSM—DID)

In order to make the comparison between the two groups more reliable, this paper combines propensity score matching with the DID estimator following Rosenbaum and Rubin (1983). Figure A1 in the appendix displays the comparison of the balance of covariates before and after matching, and shows that the standardized bias of all covariates is greatly decreased after matching. Table 5 shows the results of PSM-DID estimation, which is still consistent with the baseline result.

Additionally, Table 5 shows the results of the robustness check through propensity score matching difference-in-differences (PSM-DID) approach. Individuals were first matched on observable pre-treatment characteristics through the one-to-one nearest-neighbor propensity score matching method and then re-estimated using the DID specification. The coefficient estimate of $Treat \times Post$ is still positive and statistically significant at the 1% level, showing that the policy makes people have an additional 0.29 years of education in consideration of possible selection bias. The agreement between the baseline DID analysis and PSM-DID

Table 5. Robustness Check Using Propensity Score Matching Difference-in-Differences (PSM-DID)

	(1) PSM-DID
Treatment*post	0.288*** (0.085)
Age	-0.108*** (0.005)
Gender	1.658*** (0.131)
Urban	1.683*** (0.180)
Household income	0.000*** (0.000)
Household size	-0.011
City FE	Yes
Year FE	Yes
Observations	28931
R-squared	0.323

Notes: The table reports the results of the propensity score matching difference-in-differences (PSM-DID) estimation. Propensity scores are estimated using a logit model based on pre-treatment characteristics, including age, gender, urban residence, household income, and household size. One-to-one nearest-neighbor matching with a caliper of 0.05 is employed. The DID model includes city and year fixed effects, and robust standard errors clustered at the city level are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

analysis implies that the conclusions obtained in this paper are robust and not because of possible differences in observable characteristics between the two groups. Along with the event-study analysis and placebo test

results, the PSM-DID analysis offers evidence for the robustness of the policy effect estimate.

5.6 Mechanism Analysis

To analyze further how the hukou reform influences educational achievement via specific pathways, Table 6 evaluates three possible pathways through which the influence occurs: the use of the Internet, household business, and school sponsorship fees. Such measures reflect three different but related aspects of the reform, which include increased access to information, improved household economic prospects, and reduction in institutional barriers on educational attainment. Collectively, they illustrate the way in which relaxing hukou restrictions improves educational attainment.

First, the hukou reform results in greater internet usage among households. This implies that easing up on hukou regulations will enhance access to digital information and knowledge. Having access to the internet allows for more informed access to relevant information pertaining to enrollment into schools, education policies, public services as well as learning materials on the internet. Through the reduction in information asymmetries, the reform can assist households in making better decisions on education related matters.

Secondly, the reform brings about an increase in household involvement in business operations. This finding shows that the effects of hukou reform extend beyond education to include the improvement in the economic situation of households through job and business creation. Increased economic involvement may improve household financial capability and therefore enable households to invest in children's education.

Third, the reform of the hukou system substantially reduces household spending on school sponsorship fees². Before the reform was introduced, migrant households were likely to incur extra costs related to sponsorship of schools or choosing between schools when they enrolled their children in public schools. The fact that the coefficient is negative and statistically significant implies that easing hukou requirements decreases these costs and thereby eases access to public schooling. Admission fee reduction may thus lead to an increase in school enrollment and educational attainment.

Overall, the mechanism analysis indicates that the educational benefits of the hukou reform arise through multiple complementary channels. In addition to improving households' access to information and expanding economic opportunities, the reform also reduces institutional costs associated with school enrollment. These findings provide further support for the argument that hukou reform promotes educational attainment.

² School sponsorship fees (often referred to as school selection fees in Chinese Context) are additional payments historically charged by some public schools to children without local hukou, particularly migrant children, as a condition for school enrollment. Unlike ordinary tuition or enrollment fees, these payments arose primarily from hukou-related enrollment restrictions and therefore represent an institutional cost of accessing public education.

Table 6. Mechanism Analysis: Channels Through Which Hukou Reform Improves Educational Attainment

	(1)	(2)	(3)
	Internet use	Business participation	School Sponsorship Fees
Treatment*post	0.036*** (0.013)	0.025*** (0.007)	-0.809*** (0.211)
Age	-0.017*** (0.000)	-0.002*** (0.000)	0.002** (0.001)
Gender	0.044*** (0.005)	0.013*** (0.003)	0.011 (0.019)
Urban	0.097*** (0.009)	0.050*** (0.008)	0.014 (0.023)
Household income	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Household size	-0.013*** (0.002)	0.005*** (0.001)	-0.032*** (0.010)
City FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	49321	60979	9515
R-squared	0.432	0.080	0.764

Notes: The table reports the estimated effects of the hukou reform on three potential mechanisms: internet use, household business participation, and school sponsorship fees. Internet use is measured as a binary indicator of household internet access. Business participation indicates whether any household member is engaged in business activities. Sponsor refers to the logarithm of annual household expenditures on school sponsorship (or school selection) fees, calculated as $\ln(\text{sponsorship fees} + 1)$. All regressions include the same control variables as in the baseline specification, together with county and year fixed effects. Robust standard errors clustered at the county level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

5.7 Heterogeneity Analysis

In order to examine the differential effect of relaxation of the hukou system on educational attainment according to the group and regional economic development stage, Table 7 provides heterogeneous treatment effects according to the rural/urban residence, gender, and initial stage of regional economic development.

Column (1) and column (2) represent the results for rural residents and urban residents, respectively. The coefficient of the interaction term **Treat** $\times$ **Post** is found to be positive in both cases but statistically significant only for rural residents. This observation implies that the gains from the reform in terms of education were experienced by rural residents who had previously been restricted by institutions. This is because relaxation of hukou constraints led to higher marginal gains for rural residents than for urban residents.

The columns (3) and (4) show the results by gender. Both coefficients have remained positive and significant in case of both males and females. Furthermore, the estimated effects have been similar in magnitude, which signifies that there was no major gender differences created in terms of the educational

attainment from the reform.

Finally, columns (5) and (6) consider the role of regional disparity based on the GDP per capita level in the pre-policy period (2012). The estimated coefficient of **Treat** $\times$ **Post** remains positive and statistically significant in both low- and high-GDP cities. Although the estimated effect is slightly larger in economically more developed cities, the difference is modest, suggesting that the reform generated broadly similar educational benefits across regions with different levels of economic development. Overall, the heterogeneous analyses indicate that the educational gains from relaxing hukou restrictions are particularly pronounced among rural residents while remaining broadly consistent across gender and regional economic development groups.

Table 7. Heterogeneous Effects of Relaxing Hukou Restrictions on Educational Attainment

	(1)	(2)	(3)	(4)	(5)	(6)
	Rural	Urban	Male	Female	Low GDP	High GDP
Treatment*post	0.171** (0.075)	0.186 (0.115)	0.271*** (0.080)	0.273** (0.113)	0.214** (0.098)	0.274** (0.106)
Age	-0.128*** (0.004)	-0.140*** (0.005)	-0.100*** (0.004)	-0.158*** (0.004)	-0.120*** (0.004)	-0.131*** (0.006)
Gender	1.702*** (0.112)	0.953*** (0.100)			1.740*** (0.134)	1.406*** (0.131)
Household income	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Household size	-0.024 (0.020)	-0.226*** (0.037)	-0.051** (0.025)	-0.200*** (0.031)	-0.133*** (0.027)	-0.078** (0.036)
Urban			1.405*** (0.160)	1.840*** (0.152)	1.634*** (0.189)	1.553*** (0.219)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,510	15,519	31,369	27,593	34,522	24,060
R-squared	0.356	0.369	0.333	0.463	0.346	0.413

Notes: This table reports heterogeneous treatment effects of relaxing hukou restrictions on educational attainment across different population groups. Columns (1) and (2) present the estimates for rural and urban residents, respectively. Columns (3) and (4) report the results for male and female individuals, respectively. Columns (5) and (6) present the estimates for cities with low and high baseline GDP per capita (measured in 2012), respectively. All regressions control for age, gender (where applicable), urban residence (where applicable), household income, and household size, and include city and year fixed effects. Standard errors clustered at the city level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

5.8 Effects on the Policy—Relevant Population (Aged 15-30)³

Although the baseline analysis demonstrates that the 2014 hukou reform significantly increased educational attainment, the estimated effects may differ across age cohorts because individuals face different educational opportunities over the life cycle. Older individuals have generally completed their formal education before the reform was introduced, whereas younger individuals remain in school or continue to make important educational decisions. Therefore, the policy is bound to affect more effectively those people who were in the usual age group for secondary, tertiary, or graduate education when the change occurred. In order to address this concern, the analysis is conducted again with a selected subsample of those people whose age was from 15 to 30 years in 2014. This age bracket includes people who have been most affected by the educational opportunities provided through the liberalization of hukou constraints. Summary statistics of the restricted sample are highlighted in Table 8. Compared to the entire sample, those belonging to the policy-relevant sample possess higher average educational attainment (11.56) and higher household income due to their younger age distribution and possibility of pursuing further education.

Table 9 shows the results of the DID regressions for the policy-relevant population. In columns (1) and (2), the basic DID regressions are shown with and without fixed effects. In all cases, the Treatment*Post interaction is positive and statistically significant at the 5 percent significance level. This means that the impact of the hukou reform in 2014 on education is mostly experienced by younger people who were making decisions about school during the reform period. Furthermore, the point estimates for the treatment effect are also economically large compared to those derived for the full sample. With respect to the preferred model which has the city and year fixed effects, the coefficient value rises from 0.311 in the full sample to 0.520 for the policy relevant sample. The results support the expectation that any institutional changes impacting school access will affect individuals whose educational journey is not complete.

Column (3) also explores how policy impacts vary depending on the degree of hukou reform in different city sizes. As seen from the base-line findings, larger educational gains are generally observed in cities where hukou restrictions were relaxed more substantially. The estimated impacts are 0.490, 0.758, 0.599, and 0.268 for cities with urban population less than 0.5 million, 0.5-1 million, 1-3 million, and 3-5 million, respectively. The estimated effects are statistically significant for the first three city categories, whereas the coefficient for cities with populations of 3—5 million is smaller and statistically insignificant. The general pattern remains consistent with the policy design, as educational gains are concentrated in cities where hukou restrictions were relaxed more substantially.

On the whole, the findings show that the benefits of education resulting from the hukou reform of 2014 were mostly obtained by young people who were still making educational choices at the time the reform took

³ This paper defines the policy-relevant cohort as individuals aged 15–30 in 2014 because this group was still likely to make important educational investment decisions, including upper-secondary, tertiary, or postgraduate education, when the reform was implemented. By contrast, individuals older than 30 had largely completed their formal education before the policy change and were therefore less likely to be directly affected.

place. This implies that, in addition to promoting education in general, the hukou reform made education accessible to those individuals most susceptible to any relaxation of hukou requirements, thus adding more relevance to the baseline findings.

Table 8. Summary Statistics for the Policy—Relevant Population (Aged 15—30 in 2014)

Variable	N	Mean	p50	SD	Min	Max
Education	9979	11.56	12	3.918	0	24
Age	10548	27.59	27	4.529	15	39
Gender	10548	0.497	0	0.500	0	1
Hukou	9888	0.604	1	0.489	0	1
Income	10107	104609	68000	251546	0	1.600e+07
Size	10549	2.076	2	1.273	1	10

Notes: This table reports summary statistics for the main variables used in the analysis of Effects on the Policy—Relevant Population (Aged 15-30). Education is measured as years. of schooling. Gender equals one for males and zero for females. Hukou equals one for urban hukou and zero for rural hukou. Household income is measured in yuan. Household size refers to the number of household members. The sample is based on CFPS waves from 2012 to 2022.

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

Table 9. Difference—in—Differences Estimates for the Policy—relevant Population (Aged 15—30 in 2014)

	(1) education	(2) education	(3) education
Treatment	-1.350*** (0.165)		
Post	0.570*** (0.137)		
Treatment*post	0.485*** (0.180)	0.520** (0.216)	
Age	-0.081*** (0.009)	-0.161*** (0.012)	-0.162*** (0.012)
Gender	0.122* (0.072)	0.432*** (0.089)	0.432*** (0.089)
Urban	1.772*** (0.081)	1.358*** (0.103)	1.360*** (0.103)
Income	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Size	-0.405*** (0.031)	-0.189*** (0.034)	-0.189*** (0.034)
Treat_post1			0.490** (0.242)
Treat_post2			0.758**

			(0.348)
Treat_post3			0.599*
			(0.332)
Treat_post4			0.268
			(0.365)
_cons	12.525***	13.932***	13.942***
	(0.276)	(0.353)	(0.354)
N	8431	5550	5550
r2	0.251	0.391	0.391
ar2			

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Sources: Calculated based on the China Family Panel Study (CFPS) in 2012-2022.

6. Conclusion

This paper analyzed the possibility that lowering the institutional barriers to access to public services may increase educational attainment. Using China's hukou reforms of 2014 as a quasi-natural experiment, as well as the nationally representative data from the China Family Panel Studies (CFPS) within a difference-in-differences framework, the paper presents novel empirical results regarding the effects of institutional reform on educational attainment. As compared to policies that enhance education by increasing the capacity of schools or increasing education expenditure, the Hukou reform policy of 2014 mainly involved easing access to already available public education services in terms of institutional barriers. This particular institutional arrangement provides an excellent context in which to understand the effects of minimizing institutional barriers.

Findings from the empirical analysis involve four primary results. First, the impact of the hukou reform in 2014 on educational attainment is statistically significant and is also robust under different identification approaches, such as event-study analysis, placebo tests, and propensity score matching with difference-in-differences approach. Secondly, the impact of education differs systematically depending on the level of policy liberalization, as the more significant effect is normally found in cities with more relaxed hukou policy. Thirdly, it is evident from the mechanism analysis that the reform took place through a number of complementary mechanisms. In particular, the hukou reform encouraged households to use the Internet more frequently, participate in household businesses and reduce school sponsoring fees. Lastly, the effects on education were experienced mainly by those who were young and had not yet completed their educations when the reforms took place, thus implying that the reforms targeted people who were more directly affected by educational opportunity.

The research adds value to the literature in three significant ways. First, while existing research on the impact of the reform of China's Hukou system has concentrated largely on migration, labor-market performance, urbanization and access to public services, this paper offers causal evidence on the education effects of the reform in the long run. Second, utilizing the variation in the intensity of the 2014 reform among

cities categorized differently according to their size, the study demonstrates that reforms lead to heterogeneous educational returns. Third, the paper broadens the scope of consideration beyond the specific hukou system in China. In this respect, institutional barriers have emerged as a significant limiting factor for educational opportunities and human capital accumulation. Although educational facilities might be available, unequal institutional access may limit the ability of less privileged groups to benefit from them. As a result, enhanced access to preexisting public services through institutional reforms could bring significant educational benefits even without additional education inputs. The primary implication of this research is that the existence of inequalities in educational opportunities is both the consequence of insufficient resources in education and institutional barriers to the appropriate sharing of available public resources. Hence, structural reforms should be viewed as equally important to resource allocation in human capital accumulation. In this regard, the paper complements the classical approach to education resource allocations by stressing on the importance of institution access as a key determinant of educational opportunities and future human capital accumulation.

Findings have further relevance to the process of hukou reforms in China, where, despite the significant advancements made after 2014, there is still an existence of institutions limiting the ability of the migrants in large cities to access quality public education and other public services. It may be concluded that relaxing residency requirements would further increase educational opportunities for migrants, without increasing educational expenses. In this respect, reforms in hukou system should be viewed as an important approach towards building up human capital for China's shift to high-quality growth.

Furthermore, the Chinese experience can provide useful insights into how other developing countries that are experiencing fast urbanization and substantial internal migration should deal with the problem. Educational opportunities should be enhanced by expanding educational provision and through ensuring that all people are able to access public services provided by the government irrespective of their residence permit and place of birth. In that sense, institutional changes aimed at promoting access to public services may be as effective as increased educational provision. In addition to this, this paper has demonstrated that reforming institutions should be considered an integral part of human capital policy in emerging nations. Greater emphasis on inclusive and sustainable development may lead to higher realization of the significance of making their institutions accessible along with investing publicly in human capital accumulation.

However, various limitations need to be taken into account. While this paper finds positive results related to educational attainment, the data used does not allow for conclusions regarding other aspects such as educational quality, academic performance, or labor market success, which can be considered as more long-run outcomes of education. Consequently, future research can explore how educational gains resulting from institutional changes affect lifetime human capital accumulation and socioeconomic mobility. This will provide additional insights into the effects of institutional changes on long-run development and the importance of institutional access for inclusive economic development.

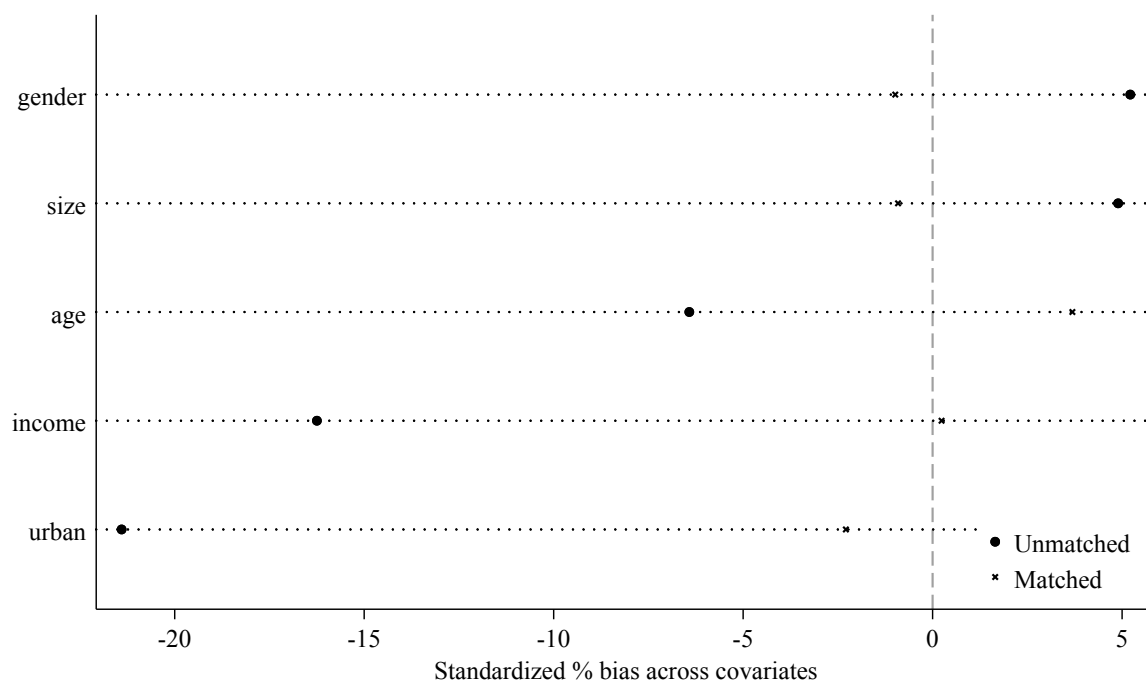
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Appendix

Figure A1. Covariate Balance before and after Propensity Score Matching



Notes: The table shows the standardized percentage bias for each covariate both before and after the process of matching through propensity scores. Propensity scores are estimated through logit models that use the pre-treatment covariates such as age, sex, living in urban areas, household income, and household size. A one-to-one nearest neighbor matching approach with a caliper size of 0.05 is used. Given the considerable reduction in the standardized bias following the matching process, there is evidence of significant improvement in the balance of the covariates between the treatment and control groups.

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