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**Fertility responses to the relaxation of migration restrictions: Evidence from
the Hukou reform in China**

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ABSTRACT

This study examines the impact of a relaxation of internal migration restrictions on internal migrants' fertility in China. Exploiting the variation in the city-by-city rollout of the Hukou reform after 2014, we find that lifting barriers to local citizenship significantly increases fertility among unregistered migrants, and the positive effect mainly appears in second-child births. An investigation of potential mechanisms suggests that the Hukou reform is associated with improved access to public services, better integration into the host society, and a significant increase in intermarriages with locals.

Keywords

Internal migration restrictions; Hukou reform; Fertility

1. Introduction

Over the past decades, a growing population has been covered by migration policies with the continuously accelerating flows of both international and internal migration. There are currently more than 281 million international immigrants (IMO, 2021) and 1.3 billion internal migrants, which is almost 4-5 times the former global number (FAO, 2018). International immigrants have attracted considerable attention in recent decades, and the related research has shown that immigration policies affect their schooling and labor market outcomes, social integration, economic assimilation and intermarriage (Amuedo-Dorantes and Antman, 2017; Amuedo-Dorantes et al., 2007; Gathmann and Keller, 2018; Kelly, 2010). Moreover, studies based on the United States and Europe have provided evidence that immigration policies (such as PRWORA) and legal status in host countries are responsible for the fertility reduction of likely undocumented immigrants (Avitabile et al., 2014; Amuedo-Dorantes et al., 2016; Amuedo-Dorantes and Arcenas-Arroyo, 2021). However, few studies have explicitly investigated the effects of internal migration policies on the fertility of internal migrants.

Similar to immigrants, people who migrate within a developing country also face serious regulatory and institutional barriers set by governments. For example, migrants are required to show proof of residence to access government programs and apply for formal jobs in Ethiopia (Selod and Shilpi, 2021). In Vietnam, the *ho khau* system prevents migrants from obtaining urban citizenship and related services, such as public education and health insurance (Nguyen, 2018). Since these registration barriers limit many migrants' access to various benefits at their destinations, many studies in economics have shown that migration restrictions have negative impacts on the employment, income, health and consumption of internal migrants (Song, 2014; An et al., forthcoming; Nguyen, 2018; Pham et al., 2018; Locke et al., 2012).

This paper examines the causal relationship between internal migration policies and migrants' fertility in the context of China. We focus on China for three reasons. First, as a typical representative of developing countries, China has perhaps the most widely known internal migration policy—the household registration system (also known as the Hukou system). Although it has no longer controlled population mobility since the 1980s, it still seriously hinders migrants from obtaining local Hukou and related social welfare (Jin and Zhang, 2022). Second, as one of the fastest urbanizing countries in the world, China has a sizeable migrant population. China is one of the countries with the largest scale of internal migrants, accounting for approximately 18.5% of the global total. According to the China Population Census in 2020, the absolute number of total internal migrants in China reached 376 million, accounting for 26.9% of the total population. In the past decade, the

number of migrants increased by nearly 70% (Appendix Figure 1). Third, similar to other developing countries, China also faces the challenge of extraordinarily low fertility. According to the National Bureau of Statistics of China, China's birth rate was only 8.52‰ in 2020, reaching a new low in the past 40 years (Appendix Figure 1). Furthermore, according to the China Floating Population Development Report (2017), the fertility of migrants is significantly lower, and their willingness to have a second child is even less than the national average. Therefore, the conclusions drawn from China may be instructive for other countries with migration barriers, large numbers of migrants and low fertility.

To gauge the impact of internal migration policies on migrants' fertility, we exploit a significant migration relaxation reform in China, namely, the Hukou reform. In response to the growing needs of urban migrants for local Hukou and citizenship rights, the Chinese government announced in 2014 that it would make a significant adjustment to the existing Hukou system, requiring prefecture-level governments to relax the restrictions on local settlement and to provide equal basic public services to the nonregistered population. Under the direction of the central government, the reform was gradually introduced at the city level, which provides us with an ideal exogenous shock to study how migrant fertility responds to the relaxation of internal migration restrictions. We manually collect the timing of the reform implementation in 311 Chinese cities and then exploit a difference-in-differences (DID) framework on the basis of comparisons among migrants in cities that adopted the reform at different times and the changes in their fertility before and after exposure to identify the causal effect of internal migration policies on the fertility of migrants. Specifically, we aim to answer the following questions in this paper: 1) whether and to what extent internal migration policies affect migrants' fertility and 2) what possible mechanisms underlie the effects of lifting barriers to local citizenship.

This paper first evaluates whether experiencing the Hukou reform improves the fertility of migrant women using data extracted from the China Migrants Dynamic Survey (CMDS) conducted in 2011-2017. The DID results show that the fertility of unregistered women increases by 0.9 percentage points in response to the relaxation of migration restrictions, and the likelihood of second-child childbearing rises significantly. The results prove robust to several identification and robustness tests that take into account several concerns about the identifying assumptions. We also find that migrants with high education and those living in large cities are more sensitive to the reform, and the fertility of individuals who migrate within home provinces increases more than that of those who move across provinces.

We also explore the underlying mechanisms through which the Hukou reform improves migrants' fertility by investigating the impacts of the rollout of the Hukou relaxation reform on a series of outcomes. First, the introduction of the Hukou reform is associated with a significant increase in

the use of public services, including medical care services and public education, among migrants. Moreover, improved access to local citizenship facilitates the social integration of non-Hukou holders and improves their willingness to settle down in the cities where they live. In addition, the marriage patterns of migrants experience great changes in the process of relaxation. Although the marriage counts do not see any increase, the probability of intermarriage with locals is significantly improved.

Our paper contributes to several strands of literature. First, it joins an emerging literature on the economic effects of migration policies, either within or between countries. Existing research on international migration policies focuses on the impact on migrants' employment, earnings, marriage and fertility, economic assimilation, social integration, and children's access to healthcare and schooling outcomes (Amuedo-Dorantes and Antman, 2017; Amuedo-Dorantes et al., 2007; Kelly, 2010; Amuedo-Dorantes et al., 2016; Amuedo-Dorantes and Arenas-Arroyo, 2021; Gathmann and Keller, 2018; Watson, 2014; Amuedo-Dorantes and Lopez, 2015).¹ In addition, with the growth of internal migration caused by rapid urbanization in developing countries, studies on the effects of internal migration policies are emerging (Locke et al., 2012; Song, 2014; Nguyen, 2018; An et al., forthcoming). As the most well-known migration policy of the largest developing country, China's household registration system has been widely discussed (Song, 2014; Pan, 2017; Wen et al., 2021; An et al., forthcoming). We complement the literature by investigating the impact of China's 2014 Hukou relaxation reform on unregistered migrant women's fertility. To the best of our knowledge, this is one of the few quantitative studies to analyze the impact of internal migration policies on the fertility of migrants.

Second, our study is relevant to the literature on fertility and its policy determinants. Given the extraordinarily low fertility rates worldwide in recent decades, economists have given unprecedented attention to government policies aimed at improving fertility, including policies providing economic incentives (Cohen et al., 2013; Raute, 2019), job protection (Lalive and Zweimüller, 2009; Cygan-Rehm, 2016), parental leave (Farré and González, 2019) and various welfare benefits for children (González and Trommlerová, 2021). We focus on the relationship between the childbearing decisions of China's internal migrants and the nation's unique migration policy and thus contribute to the literature. The studies that are most relevant to this paper may be those by Avitabile et al. (2014) and Amuedo-Dorantes and Arenas-Arroyo (2021), who examine the effects of access to citizenship and intensified immigration enforcement, respectively, on the likely fertility of undocumented immigrant women. In comparison, the contribution of this research is twofold. First, Avitabile et al. (2014) and Amuedo-Dorantes and Arenas-Arroyo (2021) investigate the adjustment of the

¹ These studies are based on the fact that immigrants in host countries suffer from various types of discrimination, such as limited access to resources (such as employment and social welfare) and marginalization. These unfair treatments largely stem from immigration policies and citizenship and affect various economic behaviors.

childbearing behavior of international immigrants, while our study focuses on people who migrate within a country. Second, we provide more channels for migration policies to affect migrants' fertility.

Third, our paper contributes to the literature by providing new evidence for potential channels behind the positive effects of the Hukou reform on fertility. Notably, previous studies mostly adopt the perspectives of uncertain environments and constrained access to jobs and other resources supported by the neoclassical approach to fertility (Becker, 1960) to discuss the mechanisms underlying the influence of migration policies (Amuedo-Dorantes et al., 2016; Amuedo-Dorantes and Arenas-Arroyo, 2021; Dupray and Pailhé, 2018). There are also a few studies that try to explain immigrants' childbearing and child rearing patterns from the perspective of spousal separation (Locke et al., 2012; Amuedo-Dorantes and Arenas-Arroyo, 2021). Our work stands out by providing extensive evidence involving public services, social integration, and mating behavior. Our findings in mechanism analysis also promote understanding of how the Hukou reform and other migration relaxation policies that aim to remove barriers to local citizenship affect unregistered migrants' outcomes in other fields.

Finally, this study adds to the rapidly growing literature on household registration system reform in China. With the gradual relaxation of China's Hukou system, many scholars have examined whether the reform may improve the disadvantage of migrants caused by the initial system arrangement (Pan, 2017; Wu and You, 2020; An et al., forthcoming; Jin and Zhang, 2022). However, empirical results vary significantly owing to differences in measures of the relaxation of the Hukou system and corresponding identification strategies. Unlike previous measures that rely on either provincial-level variations in the timing of relaxing the Hukou system (Sun et al., 2011; Kinnan et al., 2018) or city-level variations in the on-paper entry requirements of obtaining local Hukou (Fan, 2019; Zhang et al., 2019), we manually construct a new dataset by determining variations in the timing of relaxation of the Hukou system across 311 Chinese cities after 2014. By employing a DID model based on different implementation dates, we rigorously address various identification issues, such as sample selection and endogeneity problems, and thus provide solid evidence of the benefits of the Hukou reform.

The remainder of the paper is organized as follows. In Section 2, we provide details on the background of the Hukou system in China. Section 3 presents a theoretical framework that shows how migrants' fertility might respond to the relaxation of the Hukou system. Section 4 describes the dataset and lays out the identification strategy. Section 5 reports the main findings as well as the results of heterogeneity analysis. Section 6 explores potential mechanisms through which the Hukou reform affects migrants' fertility decisions. Section 7 includes robustness checks, and Section 8 concludes.

2. Policy Background: Hukou Reform and Internal Migrants

Internal migration in China has been regulated by the household registration system (also known as the Hukou system) since 1958. In the early stages of China's planned economic system, to control labor mobility and facilitate the allocation of resources, China established the Hukou system, which is considered one of the strictest population regulation mechanisms in the world (Pan, 2017). Under this system, every Chinese citizen was assigned a Hukou, which was affiliated with a specific locality. Individuals were allowed to enjoy welfare benefits and economic resources only in the place where their household registration was located, and leaving or changing legal residence locality was prohibited or subject to control (Song, 2014). In the context of the planned economy at that time, this institutional arrangement was considered important because it facilitated planning and concentrating employment management, wages and commodity (including food) distribution.

After the economic reform and opening up in 1978, as China began to develop a market economy, the restrictions on population migration were partially relaxed. In particular, the government allowed people to migrate from rural areas to urban areas or between urban areas without holding the Hukou of their destinations after the 1980s, which led to large-scale rural–urban migration. In the following decades, China witnessed a dramatic increase in the number of migrants. According to the China Population Census, the nationwide number of migrants increased from 6.6 million (0.64% of the population) to 376 million (26.9% of the population) during 1982–2020, with an average growth rate of over 11%. The number of internal migrants in China accounts for nearly 18.5% of the global total.²

However, China still imposes strict restrictions on migrants, and they have restricted access to Hukou in their destinations. As the public services available are still tied to the local Hukou, migrants are not eligible for welfare benefits, including educational resources, social security, medical care, public housing, etc., in their current place of residence (Song, 2014). Unregistered migrants are also at a disadvantage in the marriage market. Most local urban men would rather undertake a prolonged search than marry a migrant woman (Han and Shi, 2019). In the labor market, migrants are more likely to face discrimination, such as a lack of job opportunities and lower wages (Song, 2014).

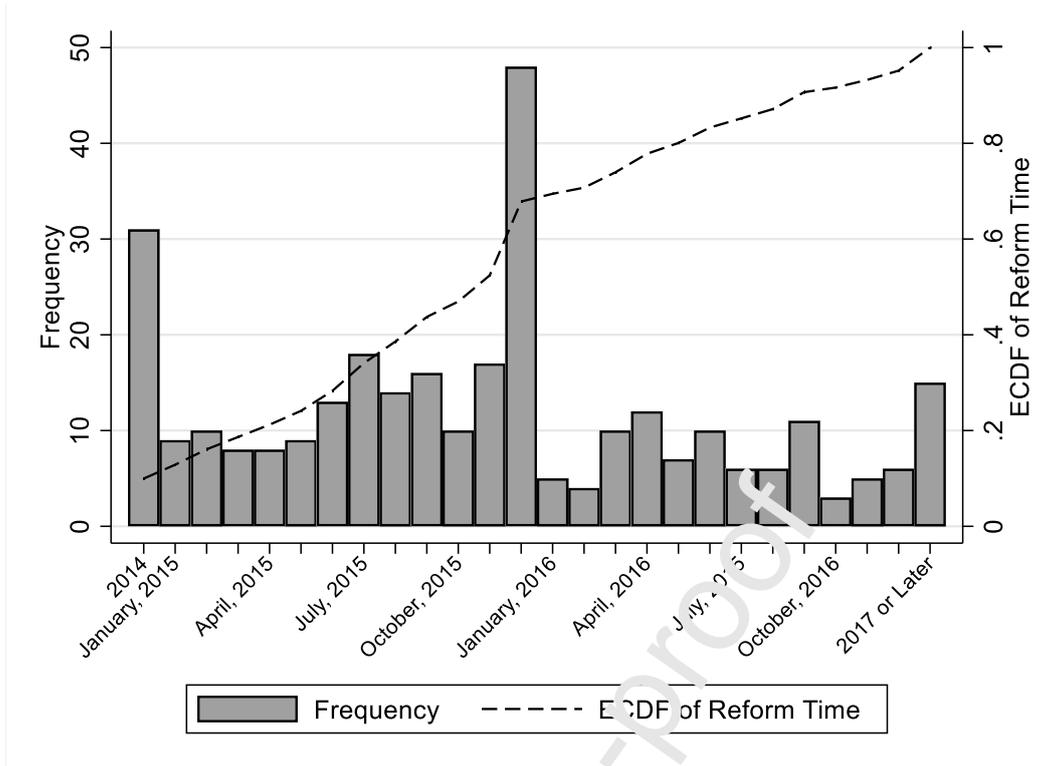
To help millions of migrants settle down in their destinations and enjoy urban public services equally, the Chinese government issued *Opinions on Further Promotion of the Reform of the Household Registration System* in July 2014. Specifically, the 2014 Hukou reform relaxed restrictions on

² The most recent estimate was 1.3 billion internal migrants globally in 2018 (FAO, 2018), and China had 241 million migrants at that time.

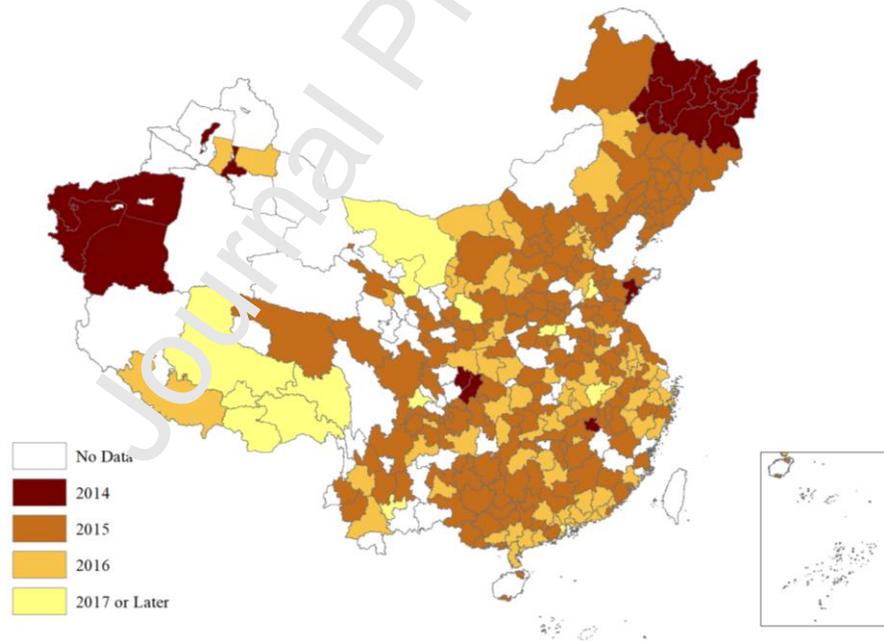
migrants in three aspects. First, a unified urban and rural household registration system was established nationwide, and the distinction between agricultural and nonagricultural Hukou was eliminated. Since people from rural areas dominate internal migration in China and the hostility against them is particularly serious, this measure alleviates the discrimination faced by most migrants to a large extent. Second, prefecture-level city governments were required to relax the conditions on settlement and lower the threshold for obtaining a local Hukou. For example, in Hefei, a provincial capital city, individuals who have a legal job for at least two consecutive years and a stable residence (either owned or rental units) and who have participated in urban social insurance for at least one year are able to apply for a local urban Hukou. Compared with the previous regulations, the durations of having a stable occupation and of participating in social insurance for local Hukou applications were shortened by 1 year. Third, all cities were to expand the coverage of social benefits and provide equal and basic public services to permanent residents based on residence permits rather than Hukou. Migrants who have lived in a destination city for half a year should be, in principle, allowed to obtain residence permits and then enjoy the same rights as natives in terms of labor employment, basic public education, and medical and health services, even if they have not yet obtained a local Hukou.

In the process of promoting Hukou reform, considering the differences in economic development level, comprehensive carrying capacity and the ability to provide basic public services, prefecture-level city governments are allowed to adopt differentiated relaxation strategies based on their own conditions. After the guidelines of the central government, the governments of prefecture-level cities successively issued their own on-paper implementation details. Figure 1 (a) plots the number of new cities initiating the Hukou reform by month and the cumulative distribution of the city-level reform rollout since 2014, and (b) shows the geographical differences. It is clear that in the year when the instruction document was released, only a few cities, approximately 10% of the samples, started to relax the Hukou system. In 2015 and 2016, 58% and 27% of the prefecture-level cities adopted the Hukou reform, respectively, and the remaining cities responded after 2017. The difference in the timing of the introduction of the Hukou reform at the city level facilitates the design of identification strategies, which we describe in Section 4.

(a) City-level rollout of the Hukou reform



(b) Regional differences in the rollout of the Hukou reform



Notes: The city rollout data for Hukou reform adoption are from the authors' collection from various official documents of local governments.

Figure 1. City-by-city rollout of the Hukou reform over time

3. Conceptual Framework

In this section, we present a theoretical framework of fertility decision-making that serves two

purposes. First, it reveals how migrants' fertility responds to the relaxation of the Hukou system. Second, the model helps analyze possible channels through which improved access to local citizenship affects migrants' demand for children.

Becker (1960) characterized children as one type of household good and considered the household to have preferences over children and other goods. More formally, parents decide the optimal number of children and consumption of other goods to maximize a utility function. For simplicity, we assume without loss of generality that parents have a Cobb–Douglas utility function, as follows:

$$u(x_r, n_r) = x_r^\alpha n_r^{1-\alpha}, \quad 0 < \alpha < 1 \quad (1)$$

where x_r is the consumption of a composite good and n_r is the number of children. Meanwhile, representative parents face the following budget constraint:

$$p_{xr}(b_r)x_r + p_{nr}(b_r)n_r = I_r(b_r) - c_r(b_r) \quad (2)$$

In this linear budget constraint, p_{xr} is the price of the consumption good (e.g., housing, public services). p_{nr} is the per unit price of children. b_r denotes the barriers to local citizenship in region r . I_r is the income of the household. Since migrants suffer from separation from family, safety concerns, deep-rooted discrimination, etc. (Wang and Zuo, 1999; Su et al., 2018; Fields and Song, 2020), we assume that the psychological costs related to these challenges can be fully monetized. In other words, migrants need a certain amount of money c_r to compensate for the psychological trauma they suffer in their destination. Moreover, $I_r(b_r) - c_r(b_r) > 0$ is assumed to satisfy positive demands.

Note that Becker (1992), Willis (1973) and Sato (2007) regarded children as a normal good, and the demand for children n_r and its price p_{nr} thus yield the following relationship:

$$\frac{dn_r}{dp_{nr}} < 0 \quad (3)$$

That is, a decrease in the cost or price of children will lead to an increased demand for children, and programs or policies that are associated with the cost of children will cause changes in the optimal number of children. Many recent studies have already confirmed this point. For example, financial incentives to have additional children directly decrease the marginal costs of children, p_{nr} , and thus increase n_r (Milligan, 2005; Cohen et al., 2013). If parents evade health care and public benefits for fear they might be identified, intensified enforcement may decrease n_r since it raises the per unit price of children (Watson, 2014). Reduced costs of contraceptive methods work in a similar way: an increase in the cost of children, which leads to a lower n_r (Canning and Paul, 2012).

In addition, the comparative statics and literature regarding the barriers to local citizenship yield the following relationships (see Liao and Zhang, 2021; Nguyen, 2018; Wang et al., 2020;

Chen, 2018; Wang and Zuo, 1999; Su et al., 2018; Song and Smith, 2021):³

$$\frac{dp_{xr}(b_r)}{db_r} > 0, \frac{dp_{nr}(b_r)}{db_r} > 0, \frac{dI_r(b_r)}{db_r} < 0, \text{ and } \frac{dc_r(b_r)}{db_r} > 0 \quad (4)$$

where the price of the other goods p_{xr} and the per unit price of children p_{nr} may increase in b_r , while the household income $I_r(b_r)$ may decrease in b_r . For $c_r(b_r)$, since it measures the monetary expenditure used to compensate for migrants' psychological damage, it may also increase in b_r .

Using the Lagrange multiplier approach, the utility-maximizing number of children can be derived:

$$n_r^* = (1 - \alpha) \frac{I_r(b_r) - c_r(b_r)}{p_{nr}(b_r)} \quad (5)$$

To examine how improved access to local citizenship affects migrants' optimal number of children, take the derivative with respect to barriers to local citizenship b_r on both sides of Equation (5):

$$\frac{dn_r^*}{db_r} = (1 - \alpha) \left[\frac{\left(\frac{dI_r(b_r)}{db_r} - \frac{dc_r(b_r)}{db_r} \right)}{p_{nr}(b_r)} - \frac{(I_r(b_r) - c_r(b_r)) \frac{dp_{nr}(b_r)}{db_r}}{p_{nr}(b_r)^2} \right] \quad (6)$$

Given the relationships presented in Equation (4), $\frac{dn_r^*}{db_r} < 0$ is obtained, which suggests that a decrease in barriers to local citizenship will lead to a larger optimal number of children n_r^* . As the Hukou reform substantially lifts barriers to local citizenship, we expect that migrants will respond to the reform with an upward adjustment in their fertility decisions.

Using this simple framework, we can foresee how migrants' fertility might respond to the relaxation of the Hukou system. We can also analyze possible channels through which the Hukou reform affects migrant fertility decisions. For example, the availability of social welfare and public services induced by the reform directly reduces the price of children, p_{nr} ; the measure of lifting barriers to local citizenship may alleviate disadvantages of migrants in the marriage market, which is also associated with a decrease in the price of children.⁴ In addition, monetized psychological

³ For example, urban residents with rural Hukou face less housing price discount, and they must pay for private health services even public hospitals at much higher cost (Liao and Zhang, 2021; Nguyen, 2018). Access to and price of education for children are also different since migrants have limited access to public educational services and migrants who want to enroll their children in schools in their destinations face additional fees and associated costs (Wang et al., 2020; Selod and Shilpi, 2021). Moreover, Chen (2018) and Wang et al. (2020) suggested that without local Hukou, migrants have less employment opportunities and often have to undertake inferior, low paid jobs. In addition, Song and Smith (2021) proved that converting to local Hukou could benefit the well-being of migrants.

⁴ Generally, people only give birth to children when their marriage is ascertained, which means that childbirth usually occurs after marriage. If fertility is postponed to a later age due to late marriage, it will become difficult to conceive a child, which means an increase in the price of children (Sommer, 2016). In the absence of marriage, the

cost, c_r , may be reduced through better social integration triggered by the elimination of identity discrimination. As the decreases in the price of children, p_{nr} , and monetized psychological cost, c_r , both support an increasing optimal number of children, all these improvements could be potential mechanisms underlying the possible positive effects of the Hukou reform on migrants' fertility. We provide empirical evidence for these underlying mechanisms in Section 6.

4. Data and Identification Strategy

4.1 Data

We used two important datasets for this study. The main dataset we use comes from the China Migrants Dynamic Survey (CMDS), which has been conducted annually by the National Health Commission of China (formerly named the National Population and Family Planning Commission of China) since 2009. This survey covers more than 340 cities in 31 provinces across the country and implements a stratified probability proportional to size sampling (PPS) approach so that the sample size is proportional to the total number of migrants in each city. It targets migrants aged 15-59 years old who have lived in their destination cities for more than a month but do not have a local Hukou and provides comprehensive information on demographic characteristics, employment and income, medical insurance, social integration, etc. In particular, information on their fertility, including their children's gender, date of birth, and current residence, is recorded in detail, which helps us understand the dynamic process and final outcomes of their childbearing decisions. Specifically, we use the data extracted from the CMDS conducted from 2011 to 2017.

We process the raw data via the following procedures. First, following González and Trommlerová (2021), we focus on only married women aged 15-44 years old, who are of childbearing age. We will adjust the age group in the robustness checks. Second, to prevent the interference of labor mobility caused by the relaxation of migration restrictions on the estimation results, we further restrict the sample to migrants who arrived at their destinations at least one year ago. Finally, since the rights tied to the Hukou are not significantly different in the same city, we drop individuals who migrate across districts and counties within a city; that is, we focus on the fertility of interprovincial or intercity migrants.

Another important dataset is unique city-level data that record the specific date of the adoption of the Hukou reform in prefecture-level cities in mainland China. We visited the "Law Library", "Peking University's magic weapon" and other regulatory and policy databases and the websites of local governments and public security bureaus to manually collect the timing of the relaxation of

price of children is extremely high due to the lack of partners and the possibility of being criticized. Moreover, the marriage pattern of whether to intermarry with locals may directly affect the price of children through the availability of public services.

the Hukou system across 311 Chinese cities since 2014. For example, the municipal government of Guangzhou (one of the most developed cities in China) published opinions on promoting Hukou reform on its official website in February 2016, which provided us with a credible policy launch time for the city. In particular, we pinpoint the starting date of the reform to the month, which is helpful for accurately judging whether the changes in individual fertility decisions take place after the Hukou relaxation reform.

We follow Amuedo-Dorantes and Arenas-Arroyo (2021) and focus on the fertility of female migrants of childbearing age in the past year. Specifically, we create a dummy variable that takes the value of 1 if a woman has given birth to a child in the past year (12 months) and 0 otherwise as the main dependent variable in this paper. In addition, due to the existence of pregnancy, the impact of the relaxation policy on fertility does not occur in the same period of implementation (Qin et al., 2017; Amuedo-Dorantes and Arenas-Arroyo, 2021). We therefore take individuals in cities where the Hukou reform was adopted at least one year ago as the treatment group; conversely, the control group consists of migrant women living in cities that implemented or did not experience any relaxation in the last year. Panel A of Table 1 reports the summary statistics of the treatment variable, outcome variables and basic characteristics of the sample.

4.2 Identification Strategy

To identify the effect of relaxing migration restrictions on internal migrants' fertility, we use time and geographic variations in the Hukou reform since 2014. Specifically, DID estimation involves comparing the fertility of migrants before and after being exposed to the city's reform with that of migrants in cities that had not yet adopted the policy during the same period. We begin our analysis by investigating the dynamic differences in the outcomes of interest over the exposure time. In particular, we conduct an event study for migrants:

$$Y_{icpt} = \alpha + \sum_{k=-6}^2 \alpha_k l(t - \tau_c = k) + X_{icpt}\beta + \gamma_c + \lambda_t + \eta_{pt} + \varepsilon_{icpt} \quad (7)$$

where Y_{icpt} is the dependent variable, indicating whether woman i living in city c of province p in year t gave birth to a child in the past year. $l(t - \tau_c = k)$ indicates different times before and after the Hukou reform. Due to the existence of pregnancy, we believe that the Hukou reform has a one-year lag effect rather than a contemporaneous impact on migrant childbearing. Therefore, we set the time τ_c when the fertility behavior of migrants in prefecture-level city c is affected by the relaxation policy as one year after the adoption of the reform. Therefore, $k = -1$ indicates the year when the Hukou system was relaxed, and $k \geq 0$ means that the Hukou reform took place at least one year ago. The coefficients are measured relative to the omitted coefficient ($k = -1$). α_k then can be interpreted as the causal effect of different event dates on migrants' fertility. X_{icpt} is a vector of exogenous individual characteristics, including age, age squared, ethnicity (=1

if Han ethnicity), and years of schooling. γ_c represents city fixed effects that capture all the time-invariant characteristics of the city that may affect the outcomes of interest. λ_t is the fixed effects for the year of the survey, controlling the national shocks that may affect all cities in the same way in a certain year. In addition, considering that some time-variant unobservable factors at the provincial level may affect the timing of the Hukou reform of cities in the province, we include province-by-year fixed effects. ε_{icpt} is the error term. The standard errors are clustered by city of residence to account for correlations in outcomes between migrants in the same city.

After presenting an event study specification, we use a staggered DID framework, which is more efficient. We use the following main estimation equation:

$$Y_{icpt} = \alpha + \delta l(t - \tau_c \geq 0) + X_{icpt}\beta + \gamma_c + \lambda_t + \eta_{it} + \varepsilon_{icpt} \quad (8)$$

where $l(t - \tau_c \geq 0)$ is the treatment variable that is equal to 1 if a woman experienced the Hukou reform before the past year and 0 otherwise. The coefficient δ indicates how exposure to the Hukou relaxation reform affects the fertility of unregistered migrant women. Specifically, a significant and positive δ means that lifting barriers to local citizenship contributes to migrants' childbearing; conversely, a negative δ suggests that the reform cannot play any promoting role in their fertility. Since the relaxation of the Hukou system provides migrants with improved access to local Hukou and the right to obtain related welfare, which helps lower the cost of childbearing and reduce uncertainty about the future (Doepke et al., 2022), we expect migrants to make an upward adjustment in their fertility decisions, which means δ has a positive value. The setting of control variables, fixed effects and standard error is consistent with Equation (7).

There are several concerns regarding our empirical design. First, migrant women's childbearing behavior may have improved prior to the actual adoption of the Hukou reform in which we are interested. Although the event study results suggest no significant evidence for this, we still rerun the baseline regression using pseudo treatment but do not find any significant influence. Second, if treatment effects are heterogeneous across groups or over time and if already-treated units serve as part of the control group for later-treated units, the DID estimates may be seriously biased (De Chaisemartin and D'Haultfoeuille, 2020). To address this concern, we further introduce a new estimator that is valid even if the treatment effect is heterogeneous to check the robustness of our results. Finally, the identified effects could be driven by contemporary confounding factors during the Hukou relaxation period, so we control for a series of simultaneous government programs and do not find any material changes in the results. The corresponding tests will be discussed in detail in Section 7.

Table 1. Summary Statistics

(1) (2) (3)

	N	Mean	S.D.
Panel A: Variables in Baseline			
<i>Treatment Variable</i>			
Experienced the Hukou Reform before the Past Year	258,988	0.111	0.314
<i>Dependent Variable</i>			
Gave Birth to a Child in the Past Year yYearyear.mmmMonths	258,988	0.081	0.273
<i>Control Variables</i>			
Age	258,988	33.114	6.063
Age Squared	258,988	1,133.274	405.566
Han Ethnicity	258,988	0.936	0.246
Years of Schooling	258,988	9.804	2.975
Panel B: Treatment and Dependent Variables in Mechanisms			
Have Experienced the Hukou Reform up to Now	263,828	0.259	0.438
Experienced the Hukou Reform before Marriage	213,254	0.002	0.047
Urban Medical Insurance	202,325	0.245	0.430
Children Attending Primary Schools in Cities	263,828	0.203	0.402
Children Attending Junior Schools in Cities	263,828	0.104	0.305
Being a Local Member	46,917	0.943	0.231
Being Accepted	46,917	0.926	0.262
Facing Discrimination	46,917	0.186	0.389
Settlement Intention	37,194	0.591	0.492
Getting Married	225,845	0.981	0.136
Intermarriage with Locals	213,254	0.383	0.486

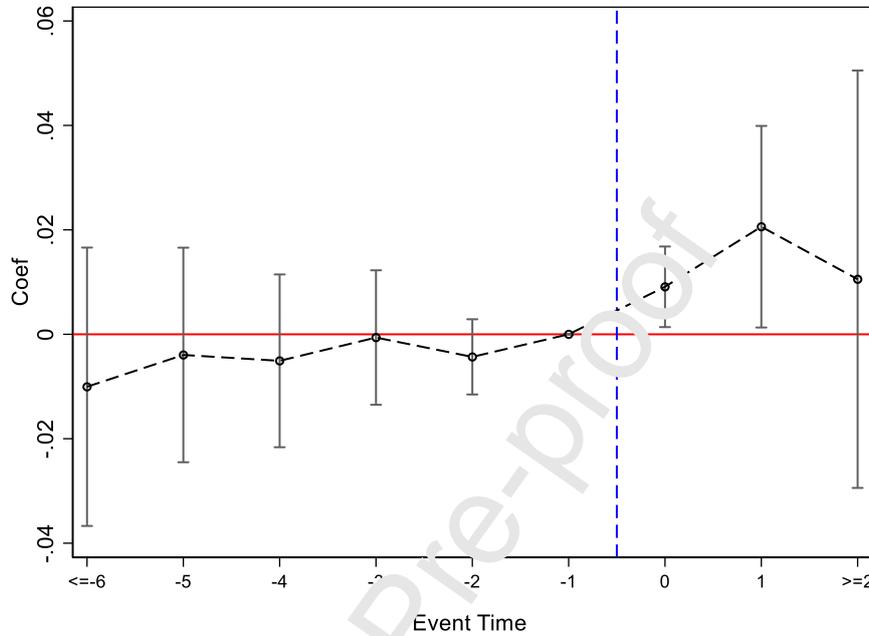
Notes: This table reports the summary statistics of the key variables in the CMDS dataset.

5. Main Results

5.1 Event Study

We first present the results of the event study, which effectively shows the conditional correlation between exposure to the Hukou reform and fertility for all our samples. Figure 2 plots the estimates of α_k and the 90% confidence intervals from estimating Equation (7) for the fertility of migrants. It is clear that the coefficient values fluctuate around zero among the negative event times, indicating that there is no significant change in the childbearing propensity of migrants in the year before and during the reform of the Hukou system. However, migrants' likelihood of giving birth increases significantly a year after the adoption of the reform since there is a clear mean shift in fertility from negative to positive event times. The change is most salient two years after the reform,

when the childbearing likelihood of migrants experiences the largest increase. For the remaining event times, α_k remains positive but is not statistically significant. These findings suggest that the relaxation of internal migration policy has a short-term release effect on migrants' fertility, as explained in Crump et al. (2011), because most of the affected migrant women choose to give birth to children within two years after the Hukou reform.



Notes: The samples used for analysis are married women aged 15-44 who came to the destinations at least one year ago and whose mobility type is interprovincial or intercity. Event time $k = -1$ indicates the year when the Hukou system was reformed, and $k \geq 0$ means that the Hukou reform took place at least one year ago. The coefficients are measured relative to the omitted coefficient ($k = -1$).

Figure 2. Event study estimates of the Hukou reform on the fertility of migrants

The result that the estimates for negative event times are not significantly different from 0 partly alleviates our concern about the heterogeneity of fertility trends between the treatment and control groups. It is reasonable to question whether unparallel preexisting trends in fertility lead to different changes in subsequent childbearing. In that case, we should observe similar and significant estimates among the negative event times in cities with different dates of reform adoption. However, Figure 2 shows that there is no statistically significant impact of all negative event times on fertility, and the coefficients are distributed around 0. This finding, together with the significant estimates for positive event times, suggests that no heterogeneous time trend in migrants' fertility is found across cities, which provides evidence for the parallel trend.

5.2 Baseline Results

Table 2 displays the results from estimating Equation (8) for migrant women, as captured by

female migrants who do not have a local Hukou. We estimate several specifications that progressively added controls to assess the robustness of our findings. Regardless of the model specification used, the Hukou reform appears to have a positive impact on the childbearing likelihood of migrants, and the effect remains significant at the confidence level of 5% or 1%. Focusing on the most complete model specification, the result in Column (3) shows that the Hukou reform increases the childbearing likelihood of migrants by 0.9 percentage points (11%), on average.⁵ Some important fertility intervention policies, such as China's Two-Child Policy, have led to an approximately 10% increase in the fertility rate (Wu, 2022).⁶ Hence, the magnitude of the effect of the Hukou reform is substantial, as its impact is close to that of the Two-Child Policy.

In addition, compared with the impact of international migration policies on fertility, the 11% increase found in this paper represents a relatively modest improvement. Amuedo-Dorantes et al. (2016) argued that the childbearing propensities of noncitizen women decreased by 47% in response to PRWORA, which is legislation that denied most means-tested assistance to immigrants during their first 5 years of legal residency in the USA. The magnitude of the effect of the Hukou reform is approximately one-fourth of that of PRWORA. The gap may stem from the different levels of deterrence associated with internal and international migration policies. Undocumented immigrants who migrate across countries are exposed to the risk of spousal separation and deportation, while internal migrants rarely face such problems. Given that our main purpose is to examine whether and to what extent internal migration policies affect the childbearing decisions of migrants, it can be concluded that migrants' fertility experiences a moderate increase due to the relaxation of migration restrictions.

Notably, our estimation should be interpreted as a conservative lower-bound estimate of the Hukou reform's effect on migrant fertility for two reasons. First, this paper focuses on the fertility behavior of migrants only in the past year, without considering their previous childbearing history. It is possible that the migrants in cities where the Hukou reform was adopted much earlier may have finished their fertility as early as several years ago, so there were no children born in the period of the past year investigated in this paper. In such a scenario, we would underestimate the effect of the reform on the treated group. Second, our baseline specification regards samples who have experienced the Hukou reform in the last year as the control group, but in fact, some of them may have also been affected by the relaxation policy. Regardless of whether premature delivery occurs, it is possible for people who experienced the reform last year to give birth in the same year. Since the affected individuals are classified as the control group, the impact of the Hukou relaxation reform

⁵ The coefficient at the baseline is 0.009 and 8.1% of unregistered migrant women gave birth in the past year. Therefore: $0.009/0.081=0.11$ or 11%.

⁶ In the robustness checks, we control for the Two-Child Policy to confirm that it does not affect the main results.

on fertility would be underestimated again.

Table 2. Effect of the Hukou reform on migrant fertility

VARIABLES	Gave Birth to a Child in the Past Year		
	(1)	(2)	(3)
	0.010**	0.014***	0.009**
Experienced the Hukou Reform before the Past Year	(0.005)	(0.005)	(0.004)
City FE	YES	YES	YES
Year FE	YES	YES	YES
Province* Year FE	NO	YES	YES
Control Variables	NO	NO	YES
Observations	258,988	258,988	258,988
R-squared	0.022	0.024	0.094

Notes: The samples used for analysis are married women aged 15–44 who came to the destinations at least one year ago and whose mobility type is interprovince or intercity. Standard errors clustered at the city level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.3 Effect on Parity-specific Fertility

Based on the main result that the Hukou reform improves the fertility of migrants, we further investigate which birth parity presents the positive effect. We define parity-specific childbearing of the past year and run the regression using the same model specification as that in Equation (8). The results in Table 3 show that the Hukou relaxation reform mainly increases the childbearing propensity to have a second child but has no statistically significant impact on the fertility decisions of other parities. In particular, migrants do not change their preference to have their first child. A possible reason is that the demand for the first child is usually inelastic; that is, the decision to have the first child is unlikely to be affected by any external policies. In contrast, the intention to have a second child is closely related to various government policies and programs (Lalive and Zweimüller, 2009; Farré and González, 2019).

Table 3. Effect of the Hukou reform on migrant parity-specific fertility

VARIABLES	Gave Birth to the First	Gave	Gave
	Child	Birth to	Birth to
	in the Past Year	the	the
		Third	Third

		Second Child in the Past Year	or Higher Order Child in the Past Year
	(1)	(2)	(3)
		0.006*	
Experienced the Hukou Reform before the Past Year	0.003 (0.005)	* (0.003)	0.001 (0.001)
Control Variables	YES	YES	YES
City FE	YES	YES	YES
Year FE	YES	YES	YES
Province* Year FE	YES	YES	YES
Observations	258,988	258,98	258,98
R-squared	0.102	0.019	0.004

Notes: We define parity-specific childbearing of the past year and run the regression using the same model specification as that in Equation (8). Standard errors clustered at the city level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.4 Heterogeneity Analysis

We present the average impacts of the Hukou reform on migrants' fertility in Table 2 and Table 3. In this subsection, we examine whether the effects vary according to individual characteristics. We investigate the heterogeneous effects of the Hukou reform from three dimensions: education level, size of destination cities, and type of mobility. The following conclusions can be drawn from Table 4.

First, the relaxation of the Hukou system leads to a greater increase in the fertility of migrant women who have no less than a junior high school education. One reasonable explanation for this is that well-educated migrants often have stronger urban settlement intentions than their counterparts (Sheng and Yang, 2020). Since the Hukou reform provides improved access to local citizenship, highly educated individuals substantially raise their expectations for the future and are more likely to have additional children.

Table 4. Heterogeneity effects of the Hukou reform

VARIABLES	Gave Birth to a Child in the Past Year		
	Educa- tion Level (1)	Size of Destination Cities (2)	Type of Mo- bility (3)
	-		
	0.016*		
Experienced the Hukou Reform before the Past Year (Treat)	** (0.006)	0.004 (0.005)	0.006 (0.005)
Treat# High Education	0.030* ** (0.005)		
Treat# Large Cities		0.014** (0.006)	
Treat# Intraprovince			0.007 (0.005)
Control Variables	YES	YES	YES
City FE	YES	YES	YES
Year FE	YES	YES	YES
Province* Year FE	YES	YES	YES
Observations	258,98 8	252,377	258,988
R-squared	0.096	0.094	0.094

Notes: The samples used for analysis are married women aged 15-44 who came to the destinations at least one year ago and whose mobility type is interprovince or intercity. Well-educated and less-educated migrants refer to those who have at least a junior high school education and those with less than a junior-school education. Since the Hukou reform reached its climax in 2015, we divide the cities by size according to the registered population at the end of 2015, recorded in the China City Statistical Yearbook. Standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Second, although the Hukou system in large cities experienced a limited relaxation, the positive effect of the reform exceeded that in cities with an urban population below 3 million. A possible explanation is that, in fact, after more than three decades of gradual optimization and reform, conditions for obtaining local Hukou in small cities are relatively low. However, large cities maintain a

strong attraction, and the restrictions for settling down are still very strict (Wang and Cai, 2008). As a result, the marginal impact of the Hukou relaxation reform on large cities is greater than that on small cities. Given the differences in preexisting Hukou-related barriers between large and small cities, the finding that migrants in megacities are more sensitive to the reform is not surprising.

Third, the reform seems to have a larger effect on migrants who move within their home provinces, although such an impact is statistically insignificant compared to the impact presented by the interprovincial migration groups. Hu et al. (2011) believed that permanent migrants are more likely to settle in urban centers of their home provinces due to the lower financial or psychological costs. Su et al. (2018) also proved that internal migrants prefer to stay within the border of their home provinces. The Hukou reform relaxed the restrictions on their settlement in cities of home provinces and thus improved their settlement willingness, future expectation, and fertility tendencies.

6. Mechanism Analysis

Our main results suggest that the Hukou reform increases the childbearing likelihood of migrants. In this section, we explore the mechanisms through which improved access to local citizenship can lead to an increase in migrants' fertility. We consider three possible channels, including access to public services, better social integration, and an improved chance of marrying. Notably, the definition of the treatment variable in the mechanism analysis is slightly different from that in the baseline specification since migrants can immediately respond to the Hukou reform in the above three aspects. The summary statistics of relevant variables in the mechanism analysis are presented in Panel B of Table 1.

6.1 Access to Public Services

Better access to local public services is found to have direct effects on fertility by reducing the cost of children. For example, Omori (2009) believed that public education and social security lower the cost of childcare, which partly compensates for the savings cut caused by childrearing and thus incentivizes parents to have children. Furthermore, Amuedo-Dorantes and Arenas-Arroyo (2021) explained the relationship between public services and fertility through a standard consumer demand model. They argued that the lack of medical care and public welfare raises the per-unit price of children, which leads to a reduced demand for children. Given that the public services available in China strongly depend on the local Hukou, the relaxation of the Hukou system may improve the fertility of migrants through the availability of related public programs since they may contribute to a reduction in the cost of having children.

Table 5. Mechanism analysis - Effect of the Hukou reform on migrants' access to public services

VARIABLES	Public Education Services		
	Urban Medical Insurance	Children Attending Junior Primary Schools in Cities	Children Attending Junior Schools in Cities
	(1)	(2)	(3)
Have Experienced the Hukou Reform up to Now	0.019** (0.003)	0.019* (0.006)	0.003 (0.003)
Control Variables	YES	YES	YES
City FE	YES	YES	YES
Year FE	YES	YES	YES
Province* Year FE	YES	YES	YES
Observations	202,222	263,828	263,828
R-squared	0.324	0.114	0.090

Notes: The dependent variable in Column (1) is an indicator that equals 1 if the migrant reports having medical insurance for urban employees or residents as the measure of the status of obtaining medical service. The dependent variables in Columns (2)-(4) are indicators of whether migrants have children of primary school age (8-13) and junior high school age (14-16) who are currently living in the cities, as the measure of the status of obtaining public education. Considering that dropouts for various reasons usually occur at the stage of entry into higher education, we focus on children aged 8-13 and 14-16 who have passed the promotion since their participation in education is unlikely to face interference by other factors; thus, we can better measure the popularity of education services. Standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

As medical care and public education are closely related to migrants' childbearing decisions

(Amuedo-Dorantes and Lopez, 2015; De la Croix and Doepke, 2004), we investigate the channel of the increased use of public services from these two aspects. We construct a dummy variable based on whether migrants have medical insurance for urban employees or residents as the measure of the coverage of public health care. Public education services are measured by the indicators of whether migrants have children of primary and junior high school age who are currently living in their destination cities. The estimates in Table 5 show that the Hukou reform increases the rate of migrants' participation in medical services and the probability of the accompanying migration of their primary school-aged children. However, we do not find a similar pattern for children in junior high school. This is not surprising and can be explained by the fact that most prefecture-level governments in China do not allow migrant children to receive local high school education and participate in college entrance examinations. Overall, these results offer some suggestive evidence that there is a general improvement in the availability of local services to migrants, which may be a reason for the increase in fertility.

6.2 Social Integration

The literature documents that social integration plays an important role in fertility, especially for nonethnic and migrant populations. For example, Bar-Gill and Fershtman (2016) showed that integration policies aimed at reducing the size of a minority may have the opposite effect and even increase their fertility and growth rates. Dupray and Pailhé (2018) argued that family formation and having children can be regarded as an embodiment of the successful integration of immigrants with

Table 6. Mechanism analysis - Effect of the Hukou reform on migrants' social integration

VARIABLES	(1) Being a Lo- cal Member	(2) Being Ac- cepted	(3) Facing Discrimina- tion	(4) Settle- ment Intention
Have Experienced the Hukou Reform up to Now	0.040*** (0.000)	0.082** * (0.000)	-0.048*** (0.000)	0.044*** (0.001)
Control Variables	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province* Year FE	YES	YES	YES	YES
Observations	82,581	82,581	82,581	74,273
R-squared	0.033	0.033	0.046	0.159

Notes: The data used in this subsection come from the special section on social integration of the China Migrants

Dynamic Survey, which was conducted only in 2013, 2014 and 2017. In 2013 and 2014, the CMDS selected 8 sample cities to carry out this special survey. In 2017, all sample cities, not just 8 of them, were required to conduct social integration surveys. All the dependent variables in Table 6 are dummy variables, which are derived from the CMDS questionnaire: “Do you agree that you are willing to be a member of the city?”, “Do you agree that the local residents are willing to accept you as a member of the city?”, “Do you feel that local residents discriminate against you?” and “Do you want to shift your Hukou to your current city of residence?”. Standard errors clustered at the city level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

natives. Ost and Dziadula (2016) further showed that cultural integration, an important part of social integration, affected the gender preference of children among Asian immigrant mothers in the US. Since obtaining citizenship is the most important way to foster immigrant assimilation (Gathmann and Keller, 2018), it is therefore reasonable to suspect that Hukou reform improves the fertility of migrants by facilitating their social integration.

To investigate this potential channel, we use four indicators to measure the degree of social integration based on the following statements of migrants: whether they are willing to be a member of the city, whether they believe local residents are willing to accept them as a member of the city, whether local residents discriminate against them, and whether they are willing to settle down in their current city of residence, and then run separate regressions on these measures. The results in Table 6 show that the Hukou reform significantly improves the willingness of migrants to integrate with locals, increases their likelihood of being accepted, reduces the probability of being discriminated against, and increases their tendency to settle down locally. These findings suggest that the relaxation reform benefits the social integration of migrants, which may have a positive impact on their fertility.

6.3 Marriage Patterns

As documented in the literature, marriage is one of the main factors affecting fertility behavior, and delayed marriage and nonmarriage decisions have been considered important reasons for the declining fertility rate in recent decades (Keats, 2018; Jones, 2007; Dommaraju, 2011). In particular, the marriage pattern of whether to intermarry with locals directly affects the price of children through the availability of public services.⁷ Due to its unprecedented scale and far-reaching influence, the 2014 Hukou relaxation reform may have had a positive impact on migrants' marriage

⁷ Specifically, couples with one partner holding a local Hukou can access broader and better medical and reproductive health services, which means that their cost of childbearing is lower than that of couples who are both nonlocal Hukou holders. Moreover, Hukou is often used as a prerequisite for access to public education services in China. According to the common on-paper entry requirements, as long as one partner has local Hukou, their children can be granted local citizenship and then enjoy related public programs. As a result, the cost of childrearing is also lower for couples with one partner holding a local Hukou.

behavior. First, improved access to local citizenship could attract new unregistered migrants and reduce the number of unregistered migrants returning home (Kelly, 2010), which may expand the scope of spouses and provide opportunities for getting married. Second, the Hukou reform may alleviate the disadvantages of migrants in the marriage market and thus increase the probability of intermarrying with natives. Third, the elimination of identity discrimination induced by the reform may help to improve the matching efficiency of the marriage market, leading migrants to marry at an earlier age. Given the close relationship between marriage and subsequent childbearing, the Hukou reform may improve migrants' fertility by affecting their mating behavior.

To analyze the channel of mating behavior and marriage patterns, we run separate regressions on migrants' marital status and the registered locality of their spouses. Table 7 reports the results. As shown in Column (1), we find little evidence of a change in the number of marriages. However, the coefficient in Column (2) demonstrates that the introduction of the Hukou reform is associated with a significant increase in intermarriage. According to Han and Shi (2019), migrant women who lack local Hukou are unlikely to be favored by local urban men or to form families with them. Our finding implies that the Hukou reform alleviates discrimination against female migrants in the marriage market, which may be a possible mechanism by which the reform improves the fertility of migrants.

Table 7. Mechanism analysis - Effect of the Hukou reform on migrants' marriage patterns

VARIABLES	Getting Married	Intermarriage with Locals
	(1)	(2)
	0.001	
Have Experienced the Hukou Reform up to Now	(0.006)	0.044*
Experienced the Hukou Reform before Marriage		(0.026)
Control Variables	YES	YES
City FE	YES	YES
Year FE	YES	YES
Province* Year FE	YES	YES
Observations	324,929	211,324
R-squared	0.406	0.355

Notes: The dependent variable in Column (1) is an indicator of whether a migrant is married, and the samples used for analysis are women aged 15-44 who came to the destinations at least one year ago and whose mobility type is interprovince or intercity. In Column (2), we further examine whether the reform affects migrants' marriage patterns, that is, the incidence of intermarriage with natives. Due to data limitations, the dependent variable, intermarriage

with locals, is defined as whether the spouse has Hukou in the destination province since most waves of the CMDS contain information only on the spouse's registered province. Standard errors clustered at the city level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

7. Robustness Checks

To address concerns about the identifying assumptions described in Section 4.2 and corroborate our findings, we conduct a battery of robustness checks, including using “pretreatment” to conduct regression to test spurious trends, replacing the age group used for analysis, introducing the estimator proposed by De Chaisemartin and D’Haultfoeuille (2020) to cope with the concern that a two-way fixed effects model may not work well when heterogeneous treatment effects exist, randomly generating treatment status to check the extent to which the results are influenced by omitted variables, and controlling for contemporary confounding factors.

7.1 Pre-trend Tests

A potential threat to identifying the effect of the Hukou reform is the possibility that the migrants' fertility began to improve prior to the actual adoption of the reform. These spurious trends cannot be accounted for by controlling for individual characteristics and fixed effects and may lead to an invalid estimate in this paper. Although the event study results (discussed in Section 5.1) suggest no significant evidence for this, we provide further credence here by introducing pretreatment status in the regression. We uniformly shift the timing of the Hukou reform in each city by 6, 12 and 18 months and then generate corresponding pretreatment indicators in the same way as in our main specification. As the DID method requires that there be no significant difference in the fertility of migrants before the reform, the coefficient of interest will not be significant if the timing of adoption is set at a previous period. As we expected, Table A1 shows that no matter how far the relaxation date is advanced, all coefficients are no longer significant, which provides evidence for the validity of our identification strategy.

7.2 Alternative Samples

In our main analysis, migrant women aged 15-44 years old are selected as the analytical sample. In fact, the legally marriageable age of women stipulated in the Chinese Marriage Law is not younger than 20 years old, so individuals under that age are prohibited from marriage and subsequent childbearing. Moreover, women over 44 years old are still capable of giving birth, and the very availability of assisted reproductive technology causes women to delay their entire fertility planning further into later periods (Doepke et al., 2022). For that reason, we adjust the age group to 20-44, 15-49 and 20-49 and re-estimate the DID model using these new samples. The results are

shown in Table A2. We indeed find that the Hukou reform has a positive and significant impact on migrants' fertility, regardless of the cohorts chosen for analysis. Additionally, the estimates are of similar magnitude to those in the baseline regression, which indicates that our results are unlikely to be disturbed by sample selection.

7.3 Heterogeneous Treatment Effects

Recent discussions on the use of the DID specification with variation in timing indicate that we should be cautious in terms of heterogeneous treatment effects. Specifically, De Chaisemartin and D'Haultfoeuille (2020) and Callaway and Sant'Anna (2021) show that if treatment effects are heterogeneous across groups or over periods, DID estimates may be seriously biased, sometimes even presenting opposite signs. To check the robustness of our main findings, we resort to the new estimator proposed by De Chaisemartin and D'Haultfoeuille (2020), which is valid even if the treatment effect is heterogeneous, and report the results in Table A3. The coefficient is still positive and statistically significant, even if there is a small change in magnitude. Overall, the positive effect of the Hukou reform on the fertility of migrants still holds despite the heterogeneous treatment effect.

7.4 Permutation Placebo Tests

Another threat to the main results is the influence of random factors. That is, the increase in migrants' fertility found in this paper may come from unobservable factors, rather than the Hukou reform in which we are interested. To address this concern, we perform a placebo test by randomly choosing the treatment group. Specifically, we randomly assign the status of exposure to the reform and use those pseudo treatments for the regression. After 1,000 assignments and regressions, the cumulative distribution density of the estimated coefficients shown in Figure A2 is obtained. It is clear that estimates from random simulation are centered around zero, while the coefficient at the baseline (0.009) is completely independent of this distribution, suggesting that the positive and significant effect of the Hukou reform on the fertility of migrants is not driven by unobserved or accidental factors.

7.5 Confounding Factors

In reality, a series of policies and reforms were implemented in China during the period we investigated. To check whether the increase in migrants' fertility is driven by other simultaneous government programs, we re-estimate the baseline equation and consider the impact of two concurrent shocks: the Two-Child Policy and the unified basic old-age insurance system for urban and rural residents.

In early 2014, China implemented the Single Two-Child Policy, which allows couples to have a second child as long as one partner is an only child, while couples in most provinces were restricted

to having only one child before this change.⁸ In January 2016, the Chinese government further relaxed the birth restrictions and introduced a new population policy known as the Universal Two-Child Policy. Since then, all couples, regardless of region, have been able to have a second child. Given that the end of birth restrictions may be correlated with the increase in migrants' fertility, we control the interference of simultaneous birth relaxation policies with two different methods. First, we take rural migrants from specific provinces that are not affected by the Two-Child Policy as samples and investigate how their fertility responds to the Hukou reform. Specifically, we repeat the analysis using migrants with agricultural Hukou from Ningxia, Yunnan, Qinghai, Guangdong and Hainan since rural couples in these five provinces were allowed to have two children prior to the Two-Child Policy and present the result in Column (1) of Table A4. In Column (2), we further include rural migrants whose home province is Hebei, Shanxi, Inner Mongolia, Heilongjiang, etc., and whose first child is a girl for analysis. The coefficients of the two groups are positive and statistically significant, indicating that even for migrants who are not affected by the Two-Child Policy, the childbearing likelihood has also increased significantly after the reform. Second, we add the interaction terms between the dummy variables that indicate that the current period is before or after the Single Two-Child and Universal Two-Child Policy and the indicator of whether an individual has no fewer than two children in the regression since the Two-Child mainly affects second-child births. As shown in Column (3) in Table A4, the coefficient is consistent with that in the baseline regression in both significance and magnitude, which provides further evidence that the conclusion of this paper is not driven by the relaxation of the birth control policy.

Additionally, in 2014, the Chinese government unified the pension insurance system in urban and rural areas, which means that migrants can obtain the same level of pension security as urban residents receive. As this security alleviates worries about the future, this measure may enable migrants to make upward adjustments in the number of children. For that reason, we add controls for the interaction between indicators of whether the migrant joins the pension and whether the current period is before or after the national unification. The results in Column (4) of Table A4 are still positive and significant, which means that the main results in this paper are not disturbed by the

⁸ According to Feng and Hao (1992), in the process of promoting family planning policies (the most well-known is the One-Child Policy), local governments formulated different regulations on the number of births based on the guidelines of the central government and combined with their actual situation. The birth regulations for urban residents are basically the same across the country, allowing them to have only one child. Unlike those in urban areas, birth policies implemented in rural areas vary by province. Specifically, rural areas in Hebei, Shanxi, Inner Mongolia, Heilongjiang, Jilin, Liaoning, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangxi, Guizhou, Shaanxi, and Gansu implemented the one-and-a-half-child policy, which allows a rural couple to have a second child if the first is a girl. Some provinces, including Ningxia, Yunnan, Qinghai, Guangdong, and Hainan, even allowed all rural couples to have two children regardless of the gender of the first child. In contrast, in Beijing, Shanghai, Tianjin, Jiangsu, and Sichuan, rural residents face the same birth restrictions as urban areas; that is, they can have only one child.

unified basic old-age insurance system for urban and rural residents.

8. Conclusion

In this paper, we investigate how a relaxation of internal migration restrictions affects the fertility decisions of migrants who move within a country by making use of the Hukou reform in China. Exploiting the variation in the city-by-city rollout of the reform after 2014, we demonstrate that lifting barriers to local Hukou increases the likelihood of childbearing among unregistered migrants by 0.9 percentage points, and this positive impact mainly appears in second-child births. The results of heterogeneous analysis further suggest that the effect is larger for migrants with high education and those who live in large cities. For potential mechanisms, we show that the Hukou reform is associated with a significant improvement in migrants' public service use, better social integration, and an increase in intermarriage between them and locals.

The results of this paper have three policy implications. First, we find that the Hukou reform has significantly improved the fertility of migrants. Given that the scale of internal migrants in China is continuously growing, policies aimed at providing local citizenship and public services may have a release effect on overall fertility. Second, our conservative estimates suggest that lifting barriers for internal migrants has a positive and unexpected impact on their fertility. Therefore, if we only focus on the economic results of monetization and ignore other social returns, the benefits of the relaxation of migration restrictions will be underestimated. Third, we show that access to public welfare and the improvement in social integration contribute to the increase in migrants' fertility, which indicates that providing public services and eliminating social exclusion should be considered for policies aimed at improving the fertility of migrants.

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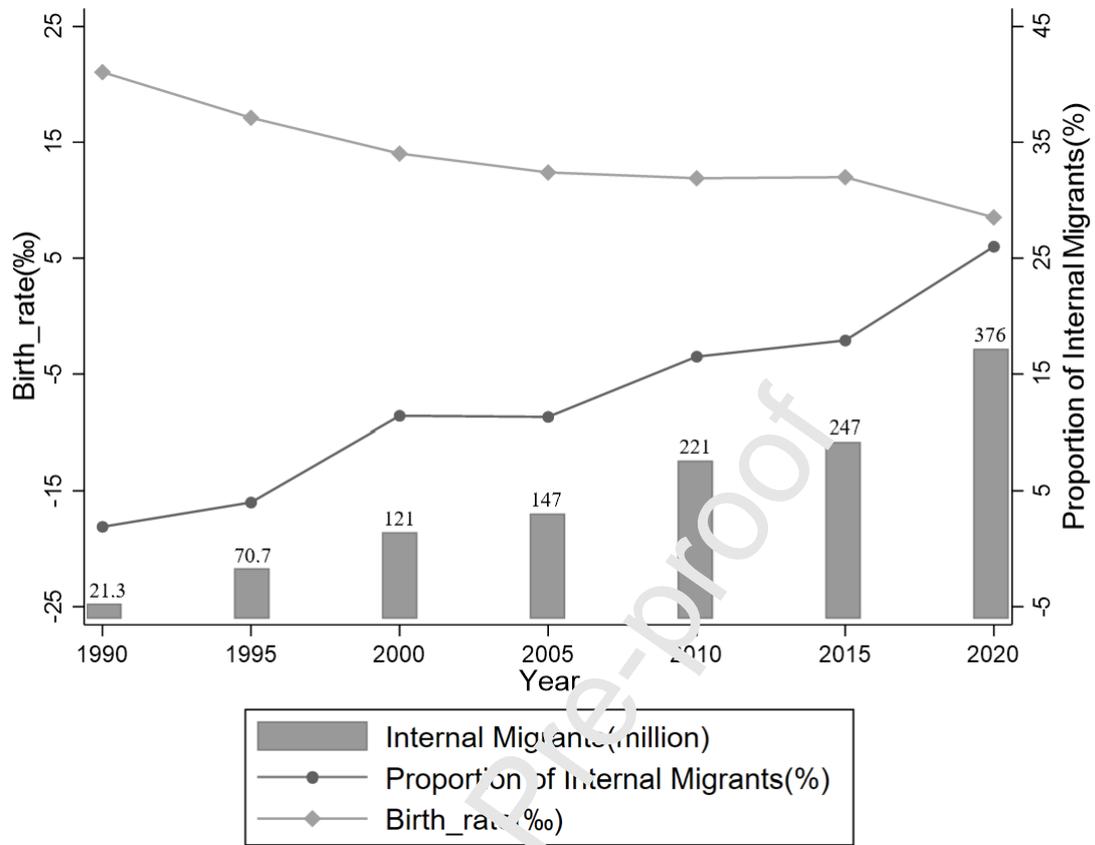
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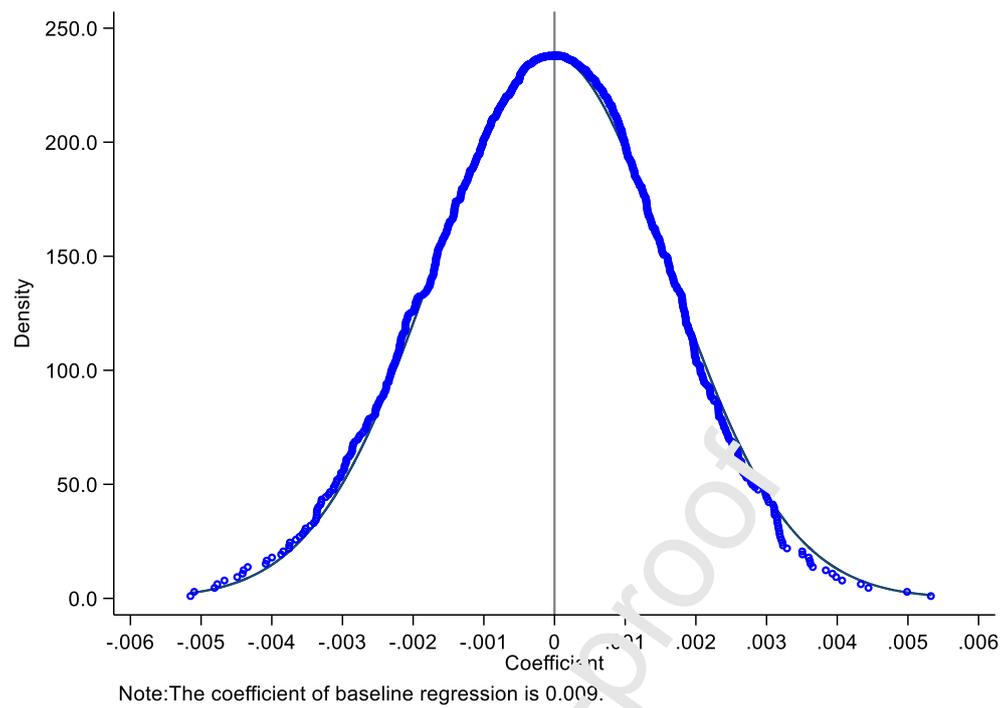
Appendix



Notes: The scale of migrants and their proportion in the total population come from the China Population Census.

The birth rate data are from the China Statistical Yearbook.

Figure A1. The scale and proportion of migrants and birth rate in China



Notes: We perform a permutation placebo test by randomly assigning the status of exposure to the Hukou reform. The process of random assignment is repeated 1,000 times, and the result in the main specification is noted at the bottom of the figure.

Figure A2. Estimated coefficients from the permutation placebo test

Table A1. Robustness checks: estimates using pretreatment status

VARIABLES	Gave Birth to a Child in the Past Year		
	(1)	(2)	(3)
Pseudo 6 Months' Pretreat	-0.002 (0.004)		
Pseudo 12 Months' Pretreat		0.002 (0.004)	
Pseudo 18 Months' Pretreat			0.003 (0.003)
Control Variables	YES	YES	YES
City FE	YES	YES	YES
Year FE	YES	YES	YES
Province* Year FE	YES	YES	YES
Observations	258,988	258,988	258,988
R-squared	0.094	0.094	0.094

Notes: We uniformly shift the timing of the Hukou reform in each city by 6, 12 and 18 months and then generate corresponding pretreatment indicators in the same way in our main specification. Standard errors clustered at the city level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A2. Robustness checks: estimates using alternative samples

VARIABLES	Gave Birth to a Child in the Past Year		
	20-44	15-49	20-49
	(1)	(2)	(3)
	0.009**	0.008**	0.008**
Experienced the Hukou Reform before the Past Year	(0.004)	(0.004)	(0.004)
Control Variables	YES	YES	YES
City FE	YES	YES	YES
Year FE	YES	YES	YES
Province* Year FE	YES	YES	YES
Observations	258,595	289,915	289,525
R-squared	0.095	0.099	0.098

Notes: The samples used for analysis are married migrant women who came to the destinations at least one year ago and whose mobility type is interprovince or intercity. Standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A3. Robustness checks: heterogeneity in the treatment effect

VARIABLES	Gave Birth to a Child in the Past Year
	0.015***
Experienced the Hukou Reform before the Past Year	(0.005)
Observations	107,520

Notes: The table runs the did_multipligt estimator, developed by De Chaisemartin and D'Haultfoeuille (2020). The model controls for the migrants' age, age squared, ethnicity and years of schooling. We allow for province-specific trends and city-specific linear trends. Standard errors clustered at the city level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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Table A4. Robustness checks: controlling for potential confounding factors

VARIABLES	Gave Birth to a Child in the Past Year			
	The Single Two-Child and The Universal Two-Child Policy			Unified Basic Endowment Insurance
	(1)	(2)	(3)	(4)
	0.040**	0.012	0.009*	
	*	*	*	0.009**
Experienced the Hukou Reform before the Past Year	(0.013)	(0.007)	(0.004)	(0.004)
Post 2014×No Fewer Than Two Children			YES	
Post 2016×No Fewer Than Two Children			YES	
Post 2014×Has a Pension				YES
Control Variables	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province* Year FE	YES	YES	YES	YES
		89,66	258,98	
Observations	17,807	5	8	241,466
R-squared	0.112	0.113	0.095	0.095

Notes: The samples for analysis in Column (1) are migrants with agricultural Hukou from Ningxia, Yunnan, Qinghai, Guangdong and Hainan. In Column (2), we further include agricultural migrants whose home provinces are Hebei, Shanxi, Inner Mongolia, Heilongjiang, Jilin, Liaoning, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangxi, Guizhou, Shaanxi, or Gansu and whose first child is a girl for analysis. In Column (3), we add the interaction terms between the dummy variables that indicate that the current period is before or after the Single Two-Child and Universal Two-Child Policy and the indicator of whether an individual has no fewer than two children. In Column (4), we add the interaction between indicators of whether the migrant has a pension and whether the current period is before or after the national unification to control for the impact of the unified basic old-age insurance system for urban and rural residents. Standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Highlight

- The relaxation of the Hukou system increases the likelihood of childbearing among unregistered migrant women.
- The positive impact mainly appears in second-child births.
- The effect is larger for migrants with high education and those who live in large cities.
- The Hukou reform improves migrants' access to public services, social integration, and intermarriage with locals.

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Acknowledgments

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