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Public childcare and maternal labour supply in China's segmented urban labour market

Zhiming Fu[a], John Shideler[b] and Feng Zhu[a]

[a]School of Economics, Sichuan University, Chengdu, China; [b]Department of Business, Rollins College, Winter Park, FL, USA

ABSTRACT

This paper estimates the impact of public childcare on maternal labour supply in China's segmented urban labour market using data from the China Family Panel Study (2012, 2014, 2016, 2018). Our difference-in-differences analysis shows that public preschool eligibility increases the labour supply for rural-hukou mothers by 30.6% at a 1% significance level, whereas it has no significant effect on their urban-hukou counterparts. To investigate the underlying mechanism behind this heterogeneity, we implement a triple-differences (DDD) strategy. We find that hukou status – reflecting labour market segmentation and associated wage premiums – accounts for a 24.1% higher labour supply response among rural-hukou mothers compared to their urban counterparts, significant at the 5% level. Further controlling for predicted wages renders the DDD estimates statistically insignificant, suggesting that the observed heterogeneity is primarily driven by wage differentials linked to hukou-based labour market segmentation.

KEYWORDS

Public childcare; maternal labour supply; labour market segmentation; hukou

JEL CLASSIFICATION

J13; J22; J24

I. Introduction

There is strong evidence that childcare imposes time constraints on maternal labour supply (Bick 2016; Garca-Morán and Kuehn 2017).[1] To help mothers with young children balance work and family life, many industrialized nations have expanded public childcare services in recent years. However, research on the effectiveness of these policies in enhancing maternal employment remains inconclusive.[2]

In China, its cities include both urban residents with rural hukou and those with urban hukou, and the urban labour market is notably segmented by hukou (Meng and Zhang 2001; F. Wang and Zuo 1999). Specifically, the hukou system, introduced in 1958, divides citizens into rural or urban categories. Rural residents with rural-hukou live in rural areas and mainly work as farmers, whereas urban residents with urban-hukou reside in cities and work in industrial sectors. Since the reform and opening-up, Chinese cities have seen significant population growth for two main reasons. First, from 1978 to 1999, rural-to-urban migrants were the primary drivers of this growth (Zhang and Song 2003). Second, many formerly rural areas have been reclassified as urban, with a substantial portion of the population retaining rural hukou status, known as redefined urban residents. Gan et al. (2019) argue that these redefined urban residents, though not changing their residence, contribute significantly to urban population growth recently.[3]

This paper examines how public preschool attendance of the youngest child impacts maternal labour participation among redefined urban residents and female urban residents with urban hukou for the following reasons. First, in the dataset of China Family Panel Study (CFPS) from 2012, 2014, 2016 and 2018, female rural-urban migrants, redefined female urban residents and female urban residents with urban hukou constitute 7.08%, 51.06% and 41.86% of the sample, respectively, indicating a relatively small share of rural-urban migrants. Second, rural-to-urban migrants may

CONTACT Feng Zhu zhufeng@scu.edu.cn School of Economics, Sichuan University, No.24 South Section 1, Yihuan Road, Chengdu 610065, China

[1]According to Bick (2016), in Germany, mothers with children aged 0 to 2 have an employment rate of 31%, compared to 62% for those with children above 3. Garca-Morán and Kuehn (2017) adds that in OECD countries, female labour force participation is about 20% higher than for mothers with children under 3.

[2]While some studies find that public childcare significantly boosts maternal employment in certain countries (Baker, Gruber, and Milligan 2008; Bauernschuster and Schlotter 2015; Del Boca and Vuri 2007), others report no significant (Fitzpatrick 2010; Goux and Maurin 2010; Havnes and Mogstad 2011).

[3]Unlike rural-to-urban migrants, redefined urban residents have not changed their place of residence.

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differ from redefined urban residents with rural hukou (rural-hukou holders) and urban residents with urban hukou (urban-hukou holders) in various unobservable dimensions, such as ambitions and preferences regarding work and family life. Third, rural-hukou holders and urban-hukou holders work in different sub-markets, where similar workers are paid differently based on hukou status. This disparity might cause their maternal labour supply to respond differently to public preschool eligibility.[4]

The public preschool eligibility policy introduced by China's Ministry of Education in 1989, combined with the CFPS dataset structure, helps us effectively address endogeneity issues related to simultaneous causality and omitted variables. Firstly, the policy stipulates that children who turn 3 before September 1st of a calendar year are eligible for public preschool,[5] thus categorizing mothers into treatment or control groups. Secondly, since CFPS data is collected from June to next May and preschool starts on September 1st, the treatment group surveyed before September 1st is unaffected by the policy, as the school year has not yet begun. Therefore, September 1st serves as the threshold separating pre-treatment and post-treatment stages. This enables us to use the public preschool policy as a natural experiment and apply difference-in-differences (DD) estimation to address endogeneity issues. To our knowledge, we are the first to utilize the CFPS data structure for designing a DD estimator to tackle endogeneity.

Our empirical results first indicate that the labour force participation rate of rural-hukou holders in urban China increased by 30.6% at the 1% level of significance, while that of urban-hukou holders did not change significantly. Therefore, we proceed to apply a triple difference estimation strategy, which is based on the difference-in-differences estimators above, to examine to what extent hukou status accounts for differences in maternal labour supply between rural-hukou holders and urban-hukou holders. Our empirical results show that hukou status explains 24.1% of maternal labour supply difference between these two groups at the 5% significance level. To the best of our knowledge, this paper is the first empirical study which examines the impact of hukou status on explaining variations in maternal labour supply responses.

Moreover, existing studies, such as F. Wang and Zuo (1999) and Meng and Zhang (2001), find that rural-hukou holders typically work in lower-paid and less secure jobs with longer hours. To investigate the underlying mechanism behind this heterogeneous response, we examine whether China's hukou-based labour market segmentation helps explain it, given the well-documented evidence that China's urban labour market is segmented by hukou status (Feng, Lu, and Shen 2024; Song 2014). To address this, we incorporated predicted wage payments into our triple difference estimation to control for wage differentials caused by labour market segmentation. As a result, the coefficient in the triple difference estimator becomes statistically insignificant. This suggests that variations in maternal labour supply related to hukou status may be due to labour market segmentation, where labour supply responsiveness depends on the balance between work payment and non-maternal childcare costs. This finding is novel, as previous studies have focused on whether public preschool affects non-maternal childcare availability (Baker, Gruber, and Milligan 2008; Bauernschuster and Schlotter 2015; Del Boca and Vuri 2007). Ali, Herbst, and Makridis (2021) and Ali, Herbst, and Makridis (2024) demonstrate that public childcare programs (e.g. Head Start, CCDF) offer greater cost efficiency and stability compared to private alternatives, particularly benefiting cost-sensitive women. Consequently, expanding public childcare access may facilitate improved work-care reconciliation among low-income, less-educated women.

This paper is closely related to three key strands of literature. The first involves research examining the impact of birthday-based public childcare eligibility on maternal labour supply across various countries. Findings are mixed: some studies find significant positive effects, while others do not. For instance, Nollenberger and Rodrguez-Planas (2015) reported a significant increase in maternal employment in Spain, Del Boca (2002) and Del Boca and Vuri (2007) observed similar effects in

[4]Here, 'labour supply' refers to maternal labour supply when not specified otherwise.
[5]Hereafter, eligibility for public childcare will refer to parents having the option to send their child to government-funded preschool.

Italy, and Bauernschuster and Schlotter (2015) found significant results in Germany. In contrast, Fitzpatrick (2010) found minimal and insignificant effects in the US, while Goux and Maurin (2010) noted that early school eligibility significantly boosted labour supply only for single mothers in France, with no impact on two-parent families. Similar findings were reported by Havnes and Mogstad (2011) in Norway. Unlike these studies, which focus on how public childcare affects other childcare options and labour supply, our paper highlights the heterogeneous impacts of universal public preschool policies across different groups.

The second strand of literature explores how institutional factors explain labour supply differences among groups in China. Research by Meng and Zhang (2001) and Pi and Zhang (2016) shows that urban-hukou holders have more secure, higher-wage jobs compared to migrants. Chen and Zhang (2018) links these wage disparities to the two-tier labour market structure created by hukou status. However, these studies do not address how mothers' labour supply responses to public childcare. The closest related work is Fang and Miao (2024), which highlights that kindergarten eligibility significantly affects the labour supply of rural mothers, who can switch between agricultural and non-agricultural jobs. In contrast, our study examines how preschool eligibility impacts the labour supply of urban mothers with different hukou statuses and explores the extent to which these variations are due to labour market segmentation.

The third strand of literature uses difference-in-differences or triple difference methods to assess the impact of policy shocks on maternal labour supply (Bauernschuster and Schlotter 2015; Carta and Rizzica 2018; Havnes and Mogstad 2011; Nollenberger and Rodrguez-Planas 2015). Like these studies, we treat public childcare eligibility as an exogenous shock and use a difference-in-differences approach to address endogeneity from simultaneous causality and omitted variables. Additionally, we apply triple difference estimations to explore how institutions influence varying responses across different groups.

This paper is organized as follows. Section II presents the model and estimation strategy. Section III briefly describes the data. Results are presented in section IV and robustness checks are performed in section V. We conclude in section VI.

II. The model

This section first outlines the institutional background influencing maternal labour supply and childcare decisions. It then describes our estimation strategy, including difference-in-differences estimation to address endogeneity, and introduces triple difference estimation to explore whether labour market segmentation due to hukou status explains the varying labour supply responses.

Institutional background

This subsection outlines the institutional background relevant to our study. First, like many countries, China uses age as a criterion for public preschool eligibility. According to the Regulations on preschool Management and Rules by the Ministry of Education in 1989, public childcare is available only to children aged 3 and older.[6] To enroll in the current academic year starting in September, a child must turn 3 before September first, making age 3 the cutoff for eligibility.[7] Children under 3 years old are usually cared for by their mothers, grandparents, or through private childcare.

Second, the hukou registration system, implemented in 1958, was designed to control internal migration by classifying citizens as either agricultural (rural) or nonagricultural (urban). Those with rural hukou lived in rural areas, had access to arable land, and primarily worked as farmers, while urban hukou holders resided in urban areas and were employed in the industrial sector. This system established China's rural-urban dual structure and created significant disparities between rural and urban areas (Liu 2005; F. Wang and Zuo 1999; Whyte 1996; Zhang and Song 2003).

[6]The age 3 cut-off applies exclusively to public preschools. Children under 3 can attend private preschools. According to CFPS data, preschool attendance rates for children under 3 are 11.1% for rural-hukou holders and 15.4% for urban-hukou holders.

[7]Public preschools admit children aged 3 to 6, while those over 6 are eligible for elementary school. Although some children aged 3 to 6 attend private preschools, the rate is only about 1.98% according to CFPS. Therefore, our focus is on the effects of public preschool.

Third, since the reform and opening-up, China has experienced a large influx of rural-urban migrants and rapid urban expansion (Gan et al. 2019; F. Wang and Zuo 1999; Zhang and Song 2003). According to the National Bureau of Statistics, non-agricultural employment in China increased from 35% to 58%, and the urban population grew from 26.2% to 61.5% between 1989 and 2018. This has resulted in urban areas being populated by rural-urban migrants, redefined urban residents with rural hukou and urban residents with urban hukou. However, in our sample, redefined female urban residents with rural hukou (rural hukou holders) and female urban residents with urban hukou (urban-hukou holders) constitute 51.06% and 41.86%, respectively, while female rural-urban migrants only account for 7.08%. We thus focus on study the labour supply responses of rural-hukou holders and urban-hukou holders. Additionally, the data shows significant differences between rural-hukou and urban-hukou holders in income, family structure, and wealth between these groups in descriptive statistics. Rural-hukou holders exhibit fewer years of formal schooling, lower income levels, fewer houses and diminished urban social insurance enrolment. They also demonstrate larger household sizes and higher fertility rates. These characteristic variations contribute to significant differences in maternal labour supply decisions between the two groups.

Fourth, it is well recognized that the Chinese urban labour market is segmented by residents' hukou status (Fu Keung Wong, Li, and Song 2007; Meng and Zhang 2001; F. Wang and Zuo 1999). In particular, rural-hukou holders typically face long hours, poor working conditions, and low, unstable pay compared to their urban-hukou counterparts. Despite the existence of segmented labour markets due to hukou status, we do not find significant differences in public preschool enrolment eligibility between the children of redefined urban residents and those of registered urban residents (Fang and Miao 2024; Lin and Wang 2019). According to local government documents, eligibility for enrolment depends solely on whether the child has reached age three, regardless of hukou status (Fang and Miao 2024). These documents also emphasize that public preschool fees are determined by operational costs and enrolment size, not by neighbourhood or hukou composition, ensuring fee consistency across urban communities (Fang and Miao 2024; Lin and Wang 2019).[8] In addition, our descriptive statistics show nearly identical preschool availability rates between communities inhabited by rural- and urban-hukou holders.

Estimation strategy

The decision of maternal labour supply

We follow Anne Hill (1983), David (1993) and Michalopoulos and Philip (2000) to build a model to characterize maternal labour supply. Specifically, we assume a mother has two mutually exclusive alternatives indexed by $Y \in \{0, 1\}$. While $Y = 0$ implies that mothers stay home for childcare, $Y = 1$ indicates that mothers actively participate in the labour market. Further, we categorize workers into two groups indexed by $k \in \{1, 2\}$ based on their hukou status, which also segment workers into different labour market. Group 1 are rural-hukou holders, and group 2 are urban-hukou holders. We use the following model to estimate the maternal labour supply decision:

$$Y_k = \alpha_0 + \alpha_1 E_k + Z_k \alpha_2 + \epsilon_k. \tag{1}$$

where Y_k is a dummy variable measuring the labour supply of a mother from group k. E_k is defined as childcare costs. Z_k is the vector of control variables which includes individual characteristics, family features, and information on childcare. The coefficients α_0, α_1 and α_2 are the constant, the response of childcare costs on maternal labour supply, and coefficients associated with the vector of control variables, respectively.

Direct estimation of the above model may be threatened by simultaneous causality and omitted variable (Bauernschuster and Schlotter 2015; Carta and Rizzica 2018; Hardoy and Schøne 2015; Kimmel and Connelly 2007). First, existing studies argue that mothers, especially who lack other means of childcare, weight between childcare costs and labour income from working to make

[8]Policy reference: https://www.gov.cn/lianbo/difang/202309/content_6904732.htm.; http://drc.haikou.gov.cn/xxxgk/zcwj/flfg/202302/t1226789.shtml.

labour supply and childcare decisions, which implies these decisions are made simultaneously. Second, variables, such as children's unobserved abilities, mothers' preference on market work or family life, and macroeconomic shocks, are missing from our dataset. Thus, the estimation results will be biased.

Difference-in-differences estimation

The design of the public preschool eligibility rule and the feature of the CFPS dataset allow us to overcome the above endogeneity problems by using a difference-in-differences estimation strategy. This is because public preschool eligibility, which can be taken as an exogenous shock, is contingent on the cut-off age and does not depend on individual features, family background, or the labour supply decisions of mothers. In addition, as the CFPS data is collected from June to next May of each survey year, September first, which is first day of school year, divides the treatment stages into pre-treatment and post-treatment stages.

First-order difference estimation. To examine maternal labour supply responses to public preschool, we use a first-order difference between the labour supply of the treatment group and that of the control group to help resolve endogeneity problems above, provided that the treatment group and the control group are the same other than public preschool eligibility. We define the treatment group as the sample of mothers whose youngest child falls in the age between 3 and 4 before September first of the survey year. The control group contains the sample of mothers with youngest child whose age fall in $[2, 3)$ by September first. The regression equation is

$$Y_k = \alpha_0 + \alpha_1 T_k + Z_k \alpha_2 + \epsilon_k. \quad (2)$$

where T_k is a dummy variable, equal to 1 for the treatment group and 0 for the control group. The coefficient α_1 measures the responsiveness of maternal labour supply.

The bandwidth is 12 months in our model for two reasons. First, the sample size becomes small when we control children's age and other characteristics. Second, previous studies argue that the cut-off policy causes mothers to manipulate their children's date of birth, which lead the distribution of children's birthdays to follow a cyclical pattern (Dickert-Conlin and Elder 2010; Lovász and Szabó-Morvai 2019). This could cause sample self-selection bias. However, the first-order difference with a bandwidth of 12 months helps us alleviate possible bias from birth timing selection as it circumvents the cyclical pattern within a year.

Difference-in-differences estimation. The first-order difference estimation is not enough to eliminate the endogeneity since the treatment group differs from the control group. Children from the treatment group are one year older and generally have higher skills than children from the control group. In addition, mothers' preference on working and family life changes as children get older, the labour supply decision of the treatment group might differ from that of the control group even without the effect of public childcare. Therefore, we apply the difference-in-differences estimation strategy to resolve the above issue.

Figure 1 illustrates our difference-in-differences structure. The x-axis is the timeline, while the y-axis measures female labour force participation rate. Given that the CFPS data is collected from June to next May of each survey year and preschool starts on September first, the treatment group, surveyed between June and August, will not be affected by the eligibility of public preschool since the school year has not started yet, while the treatment group, surveyed during September and next May, will be affected by public preschool policy. Therefore, September first serves as the policy threshold, which divides treatment stages into pre-treatment and post-treatment stages. The dummy variable $POST_k$, indicating that the sample is surveyed before or after the start of September first, can be defined as

$$POST_k = \begin{cases} 1, \text{if a sample is surveyed during September and next May} \\ 0, \text{if a sample is surveyed during June to August.} \end{cases}$$

Given September first as the policy threshold, we proceed to categorize our control group and treatment group into subsamples based on the treatment stages. Specifically, the treatment group T is divided into a treatment group in pre-treatment

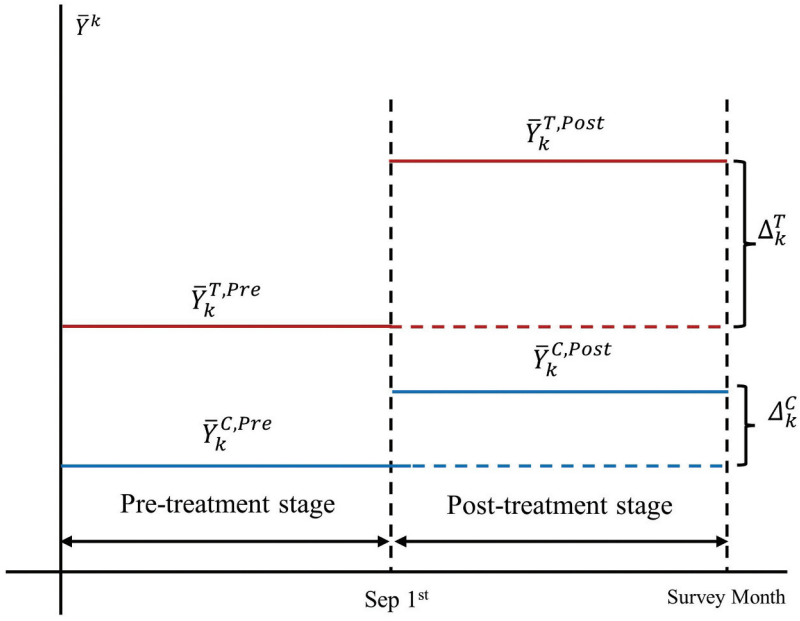


Figure 1. Illustration of difference-in-differences structure.

stage T^{Pre} and the treatment group in post-treatment stage T^{Post}. While T^{Pre} includes mothers of the treatment group who are surveyed during June and August, T^{Post} includes mothers of the treatment group who are surveyed during September and next May. Accordingly, the control group C is divided into the control group in pre-treatment stage C^{Pre} and the control group in post-treatment stage C^{Post}.

Based on the categorization above, we obtain two first-order difference estimators. One is the difference between maternal labour supplies before and after the treatment in the treatment group, which is $\overset{T}{k} = \bar{Y}_k^{T,Post} - \bar{Y}_k^{T,Pre}$ and measures the effects of the policy shocks and unobserved macroeconomic shocks on maternal labour supply. The other is the difference between maternal labour supplies before and after the treatment in the control group, which is $\overset{C}{k} = \bar{Y}_k^{C,Post} - \bar{Y}_k^{C,Pre}$ and measures the effect of unobserved macroeconomic shocks between the pre-treatment and post-treatment stages on maternal labour supply. Note that the effects of children's unobserved abilities and mothers' preference on market work or family life are eliminated in both Δ_k^T and Δ_k^C given that the features of children and mothers are similar within each group. Then, the difference-in-differences estimator $DD_k = \Delta_k^T - \Delta_k^C$, which isolate the effect of simultaneous causality and omitted variables, measures the net effect of public preschool eligibility on maternal labour supply. Our estimation strategy is thus the classic two-group/two-period difference-in-differences estimator as in Card and Krueger (1994), which gives

$$Y_k = \beta_0 + \beta_1 T_k \cdot POST_k + \beta_2 T_k + \beta_3 POST_k + Z\beta_4 + \alpha_p + \eta_{ym} + wave + \epsilon_k \equiv \mathbf{X}\beta + \epsilon_k \quad (3)$$

where α_p, η_y, and *wave* are the variables controlling provincial fixed-effect, the fixed effect of the youngest child's birth month and year, and the fixed effect of survey year, respectively. Denote the observed independent correlates as $\boldsymbol{X}$ and the corresponding coefficients as β. Then, β_1 is the coefficient, which quantifies the responses of maternal labour supply to public childcare after controlling for simultaneous causality and omitted variables.

The triple difference estimation

Given that the Chinese urban labour market is segmented according to workers' hukou status, we perform a heterogeneity test by applying the triple difference estimation to examine the effects of hukou status on explaining possible observed

heterogeneity in maternal labour supply responses to public preschool eligibility between rural-hukou holders and urban-hukou holders as in Ruhm (1998), Costa and Kahn (2000), and Olden and Møen (2022).

Let H be the indicator for hukou status, which equals 1 for urban-hukou holders and 0 for rural-hukou holders. We have the following triple difference estimation equation:

$$Y = \beta_0 + \beta_1 T \cdot POST + \beta_2 T + \beta_3 POST + \beta_4 T \cdot H + \beta_5 POST \cdot H + \beta_6 T \cdot POST \cdot H + Z\beta_7 + \alpha_p + \eta_{ym} + wave + \epsilon_H \quad (4)$$

where β_6 is the coefficient which measures the difference in maternal labour supply responses.

III. Data

Our empirical model uses the CFPS dataset, which is a nationally representative, bi-annual longitudinal survey of Chinese communities, families, and individuals. The survey is conducted every other year by the Institute of Social Science Survey of Peking University since 2010. In each survey year, respondents are visited or called from June to next May. The CFPS respondents are tracked through annual follow-up surveys and can leave the study only through death. Each subsample in the CFPS is drawn through three stages: county, village, household. The data is available every other year from 2010 to 2018. To have a larger sample size, we pool the data of 2012, 2014, 2016, and 2018 together to have a pooled cross-section sample as in Lee and Lemieux (2010) and Lovász and Szabó-Morvai (2019).

Table 1 defines variables used in our analysis. The variables of interest are maternal labour force participation and the dummy variables for policy analysis. The control variables include: personal features including the age of a female, education, ethnicity, marital status, whether they are passive job seeker, and whether have urban medical insurance; family characteristics, which consist of nuclear family size, number of children, age of the youngest child (AYC), and gender of the youngest child (GYC), husband's log annual income (HLAI), husband's employment status (HES), log value of durable consumption, and number of houses; childcare costs including whether there exists a preschool in the community, expenditures on childcare, whether they have education savings for children, child insurance, maternal childcare,

Table 1. Variable definitions.

Variable	Definition
Key variables	
Labour force participation	1– with jobs or searching for jobs; 0 – staying home.
Predicted wage	a mother's predicted annual wage.
Dummies for policy analysis	$T^k_{i,t}$, $Post^k_{i,t}$, $L_{i,t}$, $H_{i,t}$.
Personal features:	
Age	age of an individual female.
Years of schooling	number of years a mother spent at school
Ethnicity	1 – han ethnicity, 0 – minor ethnicity.
Passive job seeker	1 – not actively seeking employment in the past month but will accept jobs when offered, 0 – otherwise.
Urban medical insurance	1 – having urban medical insurance, 0 – otherwise.
Family characteristics:	
Nuclear family size	number of nuclear family members.
No. of children	number of children within a family.
AYC	age of the youngest child.
GYC	gender of the youngest child. 1 – boy, 0 – otherwise.
HLAI	husband's log annual income (CNY).
HLFP	husband's labour force participation.
No. of houses	number of houses of the family.
Childcare costs:	
Preschool	1 – having preschool in community, 0 – otherwise.
Childcare expenditures	expenditures on childcare (CNY).
Education savings	1 – having education savings for child, 0 – otherwise.
Child insurance	1 – having insurance for child, 0 – otherwise.
Maternal childcare	1 – using maternal children, 0 – otherwise.
Public preschool attendance	1 – attending public preschool, 0 – otherwise.
Private preschool attendance	1 – attending private preschool, 0 – otherwise.
Non-parental childcare	1 – having skip-generation or private childcare, 0 – otherwise.

whether attending private preschool, and whether they have non-parental childcare. Here, we preclude maternal childcare, expenditures on childcare, whether they have education savings for children and whether attending private preschool from our estimation as they might be bad controls.

Table 2 summarizes statistics of the relevant variables.[9] From Table 2, we find that mothers are heterogeneous in several dimensions across groups. First, in terms of personal features, there exist huge gaps in education levels across groups. While the average years of schooling for rural-hukou mothers are 9.2, the average years of schooling for urban-hukou mothers are 12.33. In addition, it is obvious that these groups differ sharply in the ownership of urban medical insurance.

Second, in terms of family features, we find that mothers with rural hukou have the larger nuclear family size and number of children than urban-hukou holders. Existing studies, such as Blundell, Pistaferri, and Saporta-Eksten (2018) and Ma and Shi (2020), highlight the importance of husbands' employment status and income in affecting females' labour supply decision. Thus, we match female respondent with their husband in the CFPS, which gives us husbands' employment status and annual income. Descriptive statistics reveal significant differences in income, years of schooling, family structure, and property ownership between rural- and urban-hukou holders, which may induce divergent labour supply decisions.

Third, the last part of Table 2 presents the statistics related to childcare costs. The corresponding available rates of preschool in the community of rural-hukou holders and urban-hukou holders are 0.626 and 0.627, respectively.[10] Moreover, childcare costs of rural-hukou holders and urban-hukou holders are 833.61 and 2061.50 RMB per year on average, respectively. Note that childcare expenditures of more than half of the families

Table 2. Descriptive statistics.

	(1) RH		(2) UH	
	(a) Mean	(b) Std. Dev.	(a) Mean	(b) Std. Dev.
Key variables:				
Labour force participation	0.501	0.501	0.723	0.448
Predicted wage	10.177	0.511	10.184	0.29
Personal features:				
Age	29.37	4.821	30.79	4.558
Years of schooling	9.200	3.821	12.33	3.748
Ethnicity	0.897	0.304	0.927	0.260
Passive job seeker	0.0747	0.263	0.0925	0.290
Urban medical insurance	0.0929	0.291	0.593	0.492
Family characteristics:				
Nuclear family size	4.857	1.911	4.162	1.532
No. of children	1.608	0.700	1.278	0.481
AYC	2.932	0.501	2.939	0.496
GYC	0.562	0.497	0.580	0.494
HLAI	9.646	3.259	9.815	3.454
HLFP	0.808	0.394	0.833	0.374
No. of houses	0.770	0.697	0.890	0.949
Childcare costs:				
Preschool	0.626	0.484	0.627	0.484
Childcare expenditures	1.803	3.239	2.610	3.773
Education savings	0.170	0.376	0.268	0.443
Child insurance	0.117	0.322	0.207	0.406
Maternal childcare	0.448	0.498	0.287	0.453
Public preschool attendance	0.152	0.359	0.142	0.350
Private preschool attendance	0.012	0.110	0.003	0.05
Non-parental childcare	0.418	0.494	0.547	0.498
Observations	495		400	

RH and UH are abbreviations for rural-hukou holders and urban-hukou holders, respectively.

[9]Note that Table 2 only reports the statistics of mothers with youngest children between the age of 2 and 5 most of who have attended preschool but have not attended elementary school yet.

[10]Though it seems that preschool eligibility in the community where rural-hukou holders live is close to that of urban-hukou residents from the data, it is possible that some preschools accept children based on the hukou status of their parents. Due to the restriction of the dataset, we could not exclude the influences of these preschool. In our heterogeneity analysis, we ascribe this into differences in hukou status.

are close to zero, which gives a very high dispersion and a low log mean of childcare expenditures. In terms of non-public childcare, the data shows that urban-hukou holders have more access to non-parental childcare than rural-hukou holders.

IV. Empirical results

In this section we present our empirical findings. The first subsection examines the effects of public preschool eligibility on public preschool attendance. The second subsection reports the benchmark results on the impact of public childcare on mothers' labour supply of different groups. The third subsection tests the importance of the institutional barriers in explaining the heterogeneous labour supply responses between holders of rural hukou and urban hukou.

Effects on public preschool attendance

Table 3 presents the results how public preschool eligibility affects public preschool enrolment. Columns $(1)-(2)$ show that public preschool enrolment of rural-hukou holders and that of urban-hukou holders increased by 26.1% at 1% level of significance and 27.0% at 1% significance level, respectively. The inter-group p-value from the Wald test is 0.9115. This minimal difference quantitatively confirms a negligible practical disparity in post-age-3 eligibility between groups. We find that non-parental childcare is significantly negatively correlated with children's enrolment in preschool, reflecting how these caregiving arrangements substitute for public preschool.

Table 3. Effects on public preschool attendance.

	(1) Rural-hukou holders	(2) Urban-hukou holders
T*post	0.261***	0.270***
	(0.076)	(0.101)
T	1.438*	−0.354
	(0.738)	(0.983)
post	−0.037	0.047
	(0.030)	(0.052)
Age	−0.029	0.030
	(0.027)	(0.045)
Age2	0.000	−0.001
	(0.000)	(0.001)
Years of schooling	0.011**	0.007
	(0.005)	(0.006)
Ethnicity	0.001	0.143**
	(0.067)	(0.065)
Passive job seeker	0.074	−0.015
	(0.058)	(0.066)
Urban medical insurance	0.008	0.006
	(0.066)	(0.042)
Nuclear family size	−0.012	0.006
	(0.008)	(0.014)
No. of children	0.009	−0.092*
	(0.030)	(0.048)
AYC	−1.043	0.638
	(0.741)	(0.987)
GYC	−0.010	−0.021
	(0.032)	(0.037)
HLAI	0.004	0.000
	(0.005)	(0.005)
HLPF	0.034	0.002
	(0.040)	(0.049)
No. of houses	−0.026	0.043*
	(0.033)	(0.022)
Preschool	0.007	0.153***
	(0.041)	(0.040)
Child insurance	0.020	0.046
	(0.054)	(0.043)
Non-parental childcare	−0.097***	−0.211***
	(0.032)	(0.045)
N	495	400
adj. R-sq	0.322	0.342

[a]Columns (1)–(2) regress public preschool attendance on T*post using DD method. All regressions control for maternal age (and squared), years of schooling, ethnicity, passive job seeker status, enrolment in urban medical insurance; youngest child's age, gender and birth month; household-level indicators (HLAI, HLFP, no. of houses and children, nuclear family size); community preschool availability; provincial and survey year fixed effects. [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Benchmark results

Table 4 reports the benchmark results on labour supply responses of mothers, whose youngest children are between the age of 3 and 4, to public childcare. Columns $(1)-(2)$ present the results of rural-hukou holders and urban-hukou holders, respectively. In particular, column (1) shows that the maternal labour supply of rural-hukou holders increased by 30.6% at 1% level of significance in the response to the eligibility of public childcare $T^{*}post$, while column (2) suggests that maternal labour supply of urban-hukou holders responded insignificantly to public childcare provision.

We further discuss the impact of personal features, family characteristics, and childcare costs on maternal labour supply in the benchmark results. First, it is of interest that the eligibility for urban medical insurance, which are highly associated with the types of jobs, are positively and significantly correlated with maternal labour supply of each group. Second, we also find that most variables describing family characteristics do not play significant roles in affecting maternal

Table 4. Maternal labour supply responses.

	(1) Rural hukou holders	(2) Urban hukou holders
T*post	0.306***	0.096
	(0.087)	(0.086)
T	0.376	1.063
	(1.391)	(1.114)
post	−0.110*	0.005
	(0.062)	(0.052)
Age	0.009	−0.031
	(0.038)	(0.056)
Age2	−0.000	0.000
	(0.001)	(0.001)
Years of schooling	0.017**	0.012
	(0.007)	(0.007)
Ethnicity	0.032	−0.069
	(0.098)	(0.064)
Passive job seeker	−0.455***	−0.645***
	(0.048)	(0.045)
Urban medical insurance	0.280***	0.153***
	(0.057)	(0.047)
Nuclear family size	−0.021	−0.018
	(0.014)	(0.016)
No. of children	0.026	−0.010
	(0.033)	(0.054)
AYC	−0.399	−1.073
	(1.393)	(1.129)
GYC	0.009	0.011
	(0.038)	(0.038)
HLAI	−0.001	0.002
	(0.007)	(0.006)
HLPF	0.140**	0.108*
	(0.056)	(0.056)
No. of houses	0.021	0.074***
	(0.058)	(0.025)
Preschool	−0.005	−0.070
	(0.044)	(0.051)
Child insurance	0.037	0.008
	(0.065)	(0.045)
Non-parental childcare	0.332***	0.142***
	(0.046)	(0.044)
N	495	400
adj. R-sq	0.295	0.441

[a]Columns (1)–(2) regress maternal labour supply on T*post using DD method. All regressions control for maternal age (and squared), years of schooling, ethnicity, passive job seeker status, enrolment in urban medical insurance; youngest child's age,gender and birth month; household-level indicators (HLAI, HLFP, no. of houses and children, nuclear family size); community preschool availability; provincial and survey year fixed effects. [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

labour supply response to public preschool eligibility. However, we find that the job status of their husbands significantly affects female labour supply, which is consistent with quite a few existence studies. Last, we find that non-parental childcare is significantly and positively correlated with maternal labour supply of all groups, while public preschool eligibility is not significant. This indicates that alternative caregiving methods from the elderly or the private market help increase women's labour supply. Similar results are reported in Bratti, Frattini, and Scervini (2018) and Berlinski et al. (2024).

Mechanism analysis via triple differences

This subsection investigates the role of hukou status as a potential mechanism behind the heterogeneous labour supply responses identified previously. We conduct a triple difference estimation, regressing the difference in maternal labour supply between rural- and urban-hukou holders on the interaction term $T * post * H$, aiming to uncover how hukou-based labour market segmentation drives these differential responses. The results are presented in Column (1) of Table 5. It shows that hukou status accounts for 24.1% of the difference in maternal labour supply responses between rural-hukou holders and urban-hukou holders at 5% significance level.

Furthermore, numerous studies show that hukou, as an institutional factor, segments China's urban labour market into distinct submarkets. For example, rural-hukou holders typically occupy jobs characterized by longer working hours, fewer benefits, and lower wages (Meng and Zhang 2001; W. W. Wang and Cindy Fan 2012; F. Wang and Zuo 1999),resulting in significant wage disparities across these segmented labour markets. Building on this understanding, we naturally ask whether these hukou-induced wage differences contribute to variations in maternal labour supply responses. To investigate this, we estimate

Table 5. Explaining heterogeneous responses between groups.

			(3)	
	(1)	(2)	(3a)	(3b)
T*post*H	0.241**	0.142	0.146	0.150
	(0.118)	(0.128)	(0.122)	(0.130)
T*post	0.110	0.113	0.114	0.119
	(0.081)	(0.082)	(0.081)	(0.081)
Predicted wage	–	0.306**	0.302**	0.349**
	–	(0.150)	(0.143)	(0.163)
Passive Job Seeker	−0.548***	−0.550***	−0.543***	−0.547***
	(0.033)	(0.034)	(0.032)	(0.036)
Urban Medical Insurance	0.178***	0.199***	0.176***	0.189***
	(0.037)	(0.038)	(0.031)	(0.034)
HLPF	0.084**	0.091**	0.082**	0.089**
	(0.041)	(0.041)	(0.043)	(0.042)
No. of Houses	0.045*	0.050**	0.044*	0.051**
	(0.023)	(0.023)	(0.024)	(0.026)
Non-parental childcare	0.265***	0.266***	0.264***	0.267***
	(0.033)	(0.032)	(0.034)	(0.031)
N	895	895	895	895
adj. R-sq	0.385	0.386	0.389	0.385

[a]Column (1) and column (2) regresses differences in maternal labour supply on T*post*H using DDD method. Column (3) combines results for different specifications, with sub-columns (3a) and (3b). [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

a wage equation to construct predicted wages for each mother.[11] We find that the average wage payment of rural-hukou holders is 38.1 lower than urban-hukou holders at 5% significant level after controlling individual characteristics. Then, we put the predicted wage in the triple difference estimation. Column (2) shows that after controlling predicated wages, the coefficient on $T * POST * H$ reduces by 41.07% and become insignificant. This suggests that heterogeneous responses in maternal labour supply explained by hukou status may stem from labour market segmentation. Intuitively, as rural-hukou mothers are generally paid less, their relative value of wage payment to childcare costs is lower than their urban-hukou counterparts, which discourages rural-hukou mothers, whose youngest child is less than 3, from working. Thus, rural-hukou holders' labour supply is more responsive to public childcare eligibility compared to urban-hukou holders.

Last, column (3) presents the DDD estimates based on predicted wages re-estimated using alternative explanatory variables. Specifically, following Ribar (1992) and Kimmel (1998), we replace the original female employment rate – stratified by the youngest child's age and survey year – with two alternative measures. This adjustment addresses the concern that the original employment rate may be collinear with the $T * post * H$ interaction term, which could cause the predicted wage to inadvertently absorb its effect. Specifically, column (3a) shows results based on the provincial-level female employment rate, while column (3b) uses the county-level female employment rate. We conduct this exercise because the original employment rate variable may be collinear with $T * post * H$, potentially causing the predicted wage to spuriously capture its effect. Column (3a) shows that the coefficient of $T * post * H$ decreases by 39.41% and becomes insignificant, while column (3b) shows a reduction of 37.76% with the coefficient also becoming insignificant. These results confirm the robustness of the findings reported in column (2).

V. Robustness analysis

We perform sensitivity analysis in this section. Specifically, we first perform a balancing test to check the pre-determined properties of mothers of each group before and after the treatment. Second, we present the results of event study. Third, we test our results under different treatment groups. Fourth, we allow the bandwidth to change.

Balancing test

In this subsection, we perform a balancing test to check the composition of mothers before September 1st and after among both control and treated groups. Table 6 presents the results of the balancing test and shows that there does not exist any significant differences in the pre-determined characteristics between the treatment group and the control group. This indicates that there does not exist a positive correlation between individual characteristics and public preschool eligibility.

Event study

Figure 2 presents the results of the event study, which is used to check the parallel trend in the pre-treatment stage and examine the effect dynamics in the post-treatment stage. We use July or August as the reference to avoid perfect multicollinearity as in Freyaldenhoven, Hansen, and Shapiro (2019), Kleven, Landais, and Egholt Søgaard (2019), and Miller (2023). Taking rural-hukou holders as an example, we find that the coefficient in the pre-treatment stage is close to zero, which indicates that maternal labour supply in the pre-treatment stage has a parallel trend. However, for these mothers surveyed in and after September, the coefficients in September, October and November are

[11] Following Ribar (1992) and Kimmel (1998), we use the Heckman two-stage procedure to estimate women's predicted wages and correct for potential sample selection bias arising from the fact that wages are only observed for working mothers. In the first stage, we estimate a probit model of maternal labour supply to compute the inverse Mills ratio. In the second stage, we include this correction term in the OLS estimation of the wage equation to obtain bias-adjusted predicted wages. Moreover, in the first stage, we include explanatory variables such as mother's years of schooling, linear and quadratic work experience, hukou status, youngest child's age, number of children, nuclear family size, husband's labour supply and income, number of houses, province-year fixed effects, and female employment rate stratified by child's age and survey year. In the second stage, variables that affect wages only indirectly through labour supply – namely youngest child's age, number of children, nuclear family size, husband's labour supply and income, and number of houses – are excluded from the wage equation to satisfy the exclusion restriction. Hukou status remains included because it directly influences both labour supply and wages.

Table 6. Comparing pre-determined characteristics of both treatment and control groups.

	(1) Pre-treatment			(2) Post-treatment			
	(a) T	(b) C	(c) T–C	(a) T	(b) C	(c) T–C	(3) DD
Panel A: RH							
Age at last childbirth	26.457	26.372	0.085	25.961	26.975	−1.015	−1.100
			(0.471)			0.949	(1.065)
Years of schooling	8.837	9.704	−0.867	8.717	9.074	−0.357	0.510
			(0.543)			0.533	(0.652)
Ethnicity	0.888	0.923	−0.036	0.849	0.882	−0.033	0.003
			(0.033)			0.164	(0.063)
No. of children	1.601	1.561	0.04	1.679	1.706	−0.027	−0.067
			(0.062)			0.164	(0.186)
HLAI	9.567	9.783	−0.217	9.153	9.840	−0.687	−0.470
			(0.337)			(0.597)	(0.701)
PC	0.663	0.668	−0.005	0.547	0.471	0.077	0.082
			(0.049)			(0.093)	(0.101)
Panel B: UH							
Age at last childbirth	27.005	27.869	−0.864	29.161	29.044	0.117	0.981
			(0.532)			(1.054)	(1.135)
Years of schooling	12.432	11.987	0.445	12.378	13.059	−0.681	−1.125
			(0.423)			(0.731)	(0.854)
Ethnicity	0.945	0.937	0.008	0.867	0.902	−0.035	−0.044
			(0.026)			(0.065)	(0.069)
No. of children	1.260	1.316	−0.056	1.267	1.216	0.051	0.107
			(0.065)			(0.081)	(0.103)
HLAI	9.941	9.875	0.066	9.175	9.835	−0.661	−0.727
			(0.427)			(0.701)	(0.828)
PC	0.637	0.589	0.048	0.756	0.608	0.148	0.099
			(0.054)			(0.106)	(0.106)

[a]Testing if the mean of mothers' pre-determined characteristics were similar between the treatment group and control group. PC represents whether there exists a preschool in the community. [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

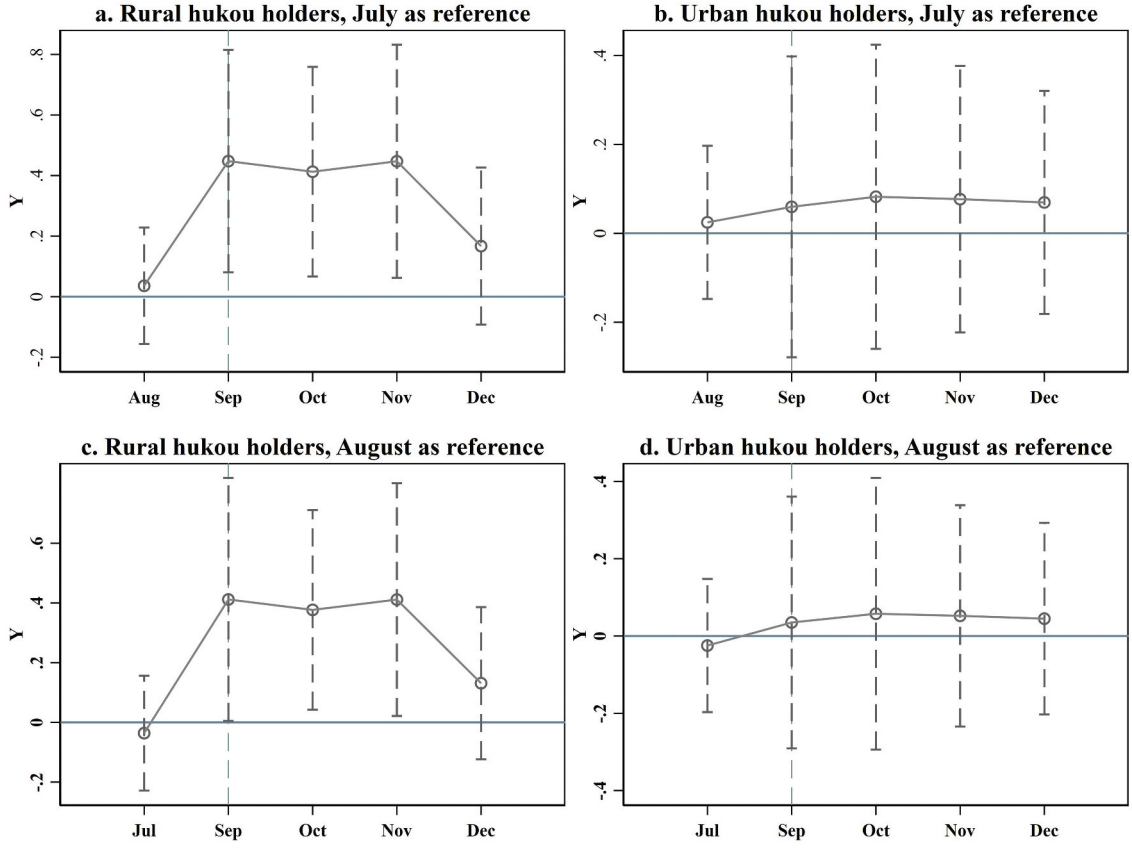


Figure 2. Event study. These figures plot the regression coefficients of event study and 95% confidence intervals of the dynamic impact of the preschool eligibility on maternal labour supply. The control variables are the same as those in Table 4. Standard errors are clustered at the community level.

very large, while the coefficients after November decreases sharply. This implies that maternal labour supply of treatment group begins to increase after their youngest child attends the public preschool but decline afterwards. For urban-hukou holders, the coefficients are all close to zero, implying public preschool eligibility does not have significant impact on maternal labour supply of this treatment group. Similar results are obtained when we use August as the reference.

Variation in the age of treatment and control groups

This subsection tests the robustness of our benchmark results by varying the age of the treatment and control groups. Specifically, we perform three robustness checks. In the first case, we restrict the sample to mothers with children aged between 1 and 3, which is further divided into a treatment group, whose children are between 2 and 3, and a control group whose children are between 1 and 2. In the second case, the sample of mothers includes those with children aged between 3 and 5, which is further divided into a treatment group whose children are between 3 and 4 and a control group whose children are between 4 and 5. In the third case, the sample of mothers includes those with children aged between 4 and 6, which is further divided into a treatment group whose children are between 5 and 6 and a control group whose children are between 4 and 5.

Panel A and B of Table 7 report the results of rural-hukou holders and those of urban-hukou holders, respectively. Columns (1) and (2) correspond to the threshold age of the child relative to September first, which we assumed to be 2, 4, and 5 years old, respectively. For rural-hukou holders and urban-hukou holders, maternal labour supply responses to public childcare are not significant for all the three alternative ages.

Table 7. Changing control group.

	(1) Age: 2	(2) Age: 4	(3) Age: 5
Panel A: Rural-hukou holders			
T*post	−0.065	0.021	−0.035
	(0.068)	(0.092)	(0.094)
N	583	461	461
adj. R-sq	0.329	0.330	0.299
Panel B: Urban-hukou holders			
T*post	0.052	0.001	−0.046
	(0.066)	(0.085)	(0.072)
N	532	426	468
adj. R-sq	0.462	0.331	0.340

[a]Columns (1)–(3) regress maternal labour supply on T*POST using DD method. The control variables are the same as those in Table 4. [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Variation in sample selection

In this section, we conduct additional sensitivity analyses by adjusting the ages of the youngest children in the sample. We consider two scenarios: mothers whose youngest child is aged between 1 and 4, with the treatment group aged 3 to 4 and the control group aged 1 to 3; and mothers whose youngest child is aged between 2 and 5, with the treatment group aged 3 to 5 and the control group aged 2 to 3.

Table 8 presents the impact of public childcare on maternal labour supply using the two alternative samples. Specifically, Column (1) presents results for the sample of mothers whose youngest child is aged 1 to 4, while Column (2) presents results for the sample of mothers whose youngest child is aged 2 to 5. The results are consistent with those of the benchmark model, indicating that our findings are robust to changes in sample selection.

Bandwidth

In the benchmark model, we set the bandwidth to 12 months around the cutoff point. To test the robustness of our results, we consider two different bandwidth levels, which are 6 and 9 months, respectively.

Columns (1) and (2) of Table 9 show the results of the impact of public childcare on maternal labour supply of rural-hukou holders and urban-hukou holders when the bandwidths are 6 and 9 months, respectively. We find that the results are consistent with those of the benchmark model, which means that our findings are robust to changes in bandwidth.

Table 8. Changes in sample selection.

	(1) Age: 1–4		(2) Age: 2–5	
	RH	UH	RH	UH
T*post	0.218***	0.077	0.208***	0.002
	(0.066)	(0.062)	(0.071)	(0.063)
N	900	845	768	700
adj. R-sq	0.314	0.432	0.328	0.374

[a]Columns (1)–(2) regress maternal labour supply on T*POST in DD method. The control variables are the same as those in Table 4. [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Table 9. Changes in bandwidth.

	(1) RH		(2) UH	
	(a)	(b)	(a)	(b)
	±6	±9	±6	±9
T*post	0.456***	0.325***	0.026	0.044
	(0.127)	(0.096)	(0.112)	(0.084)
N	304	451	280	398
adj. R-sq	0.275	0.279	0.418	0.428

[a]Columns (1)–(2) regress maternal labour supply on T*POST in DD method. The control variables are the same as those in Table 4. [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Table 10. Correcting self-selection.

	(1) IV:Land expropriation		(2) IV:Grandmother's hukou	
	RH	UH	RH	UH
Panel A: Public preschool attendance				
T*post	0.274***	0.262***	0.263***	0.272***
	(0.076)	(0.075)	(0.076)	(0.101)
IMR	0.166	0.016	0.007	0.014
	(0.136)	(0.063)	(0.141)	(0.029)
N	495	495	495	400
adj. R-sq	0.323	0.320	0.320	0.340
Panel B: Maternal labour supply				
T*post	0.313***	0.105	0.306***	0.096
	(0.088)	(0.087)	(0.087)	(0.087)
IMR	0.102	−0.062	−0.016	−0.002
	(0.131)	(0.038)	(0.115)	(0.026)
N	495	400	495	400
adj. R-sq	0.294	0.443	0.293	0.439

[a]Columns (1)–(2) regress maternal labour supply on T*post in DD method and inverse Mills ratio (abbreviated as IMR). The control variables are the same as those in Table 4 in the revised manuscript. [b]Standard errors are clustered at the community level and shown in parentheses. [c]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Correcting self-selection

It is possible that redefined urban residents choose to acquire urban hukou when their children turn three if they believe it increases their eligibility for public childcare. They may differ from those who retain their rural hukou in many unobserved characteristics, such as ability, social networks, and motivation for educational investment. This difference would introduce bias when estimating the response to public preschool eligibility (Le Wen et al. 2021; Liao and Zhang 2021).

To address this bias, we employ the Heckman two-step procedure. In the first stage, we estimate a probit regression with a binary dependent variable indicating whether the mother of a three-year-old child holds an urban hukou, and use the results to compute the inverse Mills ratio. The probit regression includes baseline control variables and one instrumental variable. We perform two separate estimations, each using a different instrument: (i) a dummy for family land expropriation (C. Wang et al. 2020); and (ii) a dummy for the maternal grandmother's hukou status (Liao and Zhang 2021). In the second stage, we incorporate the inverse Mills ratio into the DID estimation to assess whether the coefficient on $T * \text{post}$ differs significantly from the benchmark results.

Table 10 presents the results of the DID estimation after controlling the inverse Mills ratios, with public preschool enrolment and maternal labour supply as the dependent variables. Panel A shows that after correcting self-selection bias, the coefficient of $T * post$ for public preschool enrolment is similar and statistically significant in both groups, consistent with the results in Table 3. Panel B shows that after correcting self-selection bias, the $T * post$ coefficient for maternal labour supply is still significant for rural-hukou mothers, but not for urban-hukou mothers, consistent with the results in Table 4. The above results indicate that the basic empirical results are not affected by self-selection bias.

VI. Conclusion

This paper examines whether variations in hukou status, which segment mothers into different labour markets, explain their differing responses to public preschool eligibility using CFPS data from 2012, 2014, 2016, and 2018. We first find that rural-hukou holders have a significant response to public childcare, while urban-hukou holders do not. Next, we use a triple difference estimation to determine that hukou status accounts for 24.1% of the variation in labour supply responses at 5% significance level. Finally, we find that controlling for wage premiums associated with labour market segmentation renders the triple difference estimator insignificant, suggesting that the differences in maternal labour supply responses are primarily due to labour market segmentation.

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ORCID

Feng Zhu http://orcid.org/0000-0001-5699-9333

Data availability statement

The data used in this study comes from the China Family Panel Studies (CFPS) administered by the Institute of Social Science Survey (ISSS) of Peking University, available upon request at www.isss.pku.edu.cn/cfps/en/index.htm. The authors have no authority to give the data directly.

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