



Research Paper

Gender norms and the child penalty in China

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ABSTRACT

We utilize a comprehensive individual panel dataset from China and employ an event study approach to investigate the influence of childbirth on gender disparities across various labor market outcomes, emphasizing the role of gender norms in shaping the child penalty. Our findings show a pronounced decline in individual earnings, labor force participation and working hours for women after childbirth, though labor force participation returns to pre-childbirth level in the long term. Such trends are not observed among men. These gender differentiated outcomes are driven by a key factor: gender norms, specifically women's and their husbands' views toward gender roles. Parents' or in-laws' views play a smaller role. Women suffer a larger child penalty in individual earnings if they or their spouses hold traditional views compared to those who, or whose spouses, hold more egalitarian views. Potential channels are that traditional views may predispose mothers to focus more on household activities and/or engage in informal jobs that are more flexible and family friendly.

1. Introduction

Gender gaps still exist in labor market (Klasen, 2018, 2020; Liu and Zuo, 2023) despite the fact that women have made significant progress in catching up with men in education (Schwab et al., 2017; Klasen, 2018; Kunze, 2018) and political participation (Norris, 2002; National Bureau of Statistics, 2019) in both developed and developing countries. One prominent factor contributing to this persistent gender gap is the phenomenon known as the “child penalty”. Highlighted in recent empirical literature, mainly from developed countries, the child penalty refers to a substantial reduction in women's earnings and overall labor market outcomes following transition to motherhood (Kleven et al., 2019a; Sieppi and Pehkonen, 2019; de Quinto et al., 2021; Costa Dias et al., 2020). This penalty often prevents women from realizing their professional ambitions, such as taking leadership roles or achieving greater economic benefits. While the child penalty has been extensively studied in developed countries, there is a pressing need to examine its impact in developing countries, where different social, economic and cultural contexts might present unique challenges and opportunities. China, with its transformation from a planned to a market economy and evolving fertility policies, offers a valuable lens to explore this issue. Further empirical evidence is needed to demonstrate whether the hedge between fathers and mothers in the labor market is closing in developing countries or if traditional gender norms continue to reinforce this form of inequality despite the modern economic transformation.

Gender norms are social rules and expectations that govern the roles and behaviors considered appropriate for women and men. These often confine individuals to stereotypical roles such as “men as breadwinners and women as caregivers”. In recent years, scholars

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have turned their attention to the role of gender norms in explaining the child penalty (Cortés and Pan, 2023; Kleven et al., 2022), as other factors, such as biology cost, comparative advantage (Andresen and Nix, 2022; Kleven et al., 2021), and government policy (Kleven et al., 2023; Mari and Cutuli, 2021; Andersen, 2018; Olivetti and Petrongolo, 2017), appear to have limited influence in explaining the phenomenon. The connection between gender norms and the child penalty is particularly noticeable in household work division and women's choices of labor supply, especially after having children (Xiao and Asadullah, 2020; Cavapozzi et al., 2021). Influenced by long-standing gender norms, female allocate more time to housework and raising children (Dotti Sani, 2014; Treas and Drobnic, 2010). They, therefore, have to curtail their paid working hours or even quit the labor market, leading to a gender gap in the labor market. Despite this understanding, there remains a shortage of detailed microlevel evidence to precisely delineate how gender norms affect the child penalty in the literature.

In context of this global issue, our paper is among the few to comprehensively analyze the effects of parenthood on various labor market outcomes (i.e., individual earnings, labor force participation, working hours and wage rate) in contemporary China. Following established methodologies in Angelov et al. (2016) and Kleven et al. (2019a), we explore the causal effects of childbirth on gender inequality using a quasi-experimental event study method while nonparametrically controlling for lifecycle and time trends. As demonstrated by Kleven et al. (2019a), this method is valid and robust for estimating the causal effect of childbirth. We also use a DID strategy as a robustness check. We find women significantly lag behind men after childbirth, although their trajectories are quite similar before the birth of their first child. On average, women's individual earnings decline by approximately 21.4 % over the first seven years after childbirth compared with men. This disparity comes from two channels: one is that females' labor force participation rate declines by 14.1 % compared to their male counterparts; the other is from decreased working hours (17.9 %) rather than a shrinking wage rate. Intriguingly, we find that China has a lower child penalty compared with results from other developed and developing countries. One possible reason is that China has placed strong emphasis on promoting women's participation in the labor market and gender equality when it had a planned economy.

More importantly, this paper further delves into the mechanism of the child penalty through the lens of gender norms. Combing a time invariant measure of gender norms with the comprehensive individual panel dataset, we examine how each family member's, couple's and local society's gender norm shape the child penalty. We find suggestive evidence that gender norms play a large role in explaining the child penalty. Women suffer a larger child penalty when they or their husbands hold traditional views (35–40 %) as opposed to those who, or whose spouses, hold egalitarian views (19–24 %). The child penalty is even more pronounced when both the husband and wife hold traditional views. Furthermore, the results show that local society's views also matter. The child penalty is more severe in provinces where more people hold traditional views (33 %) than in provinces where more people hold egalitarian views (14 %). In addition, we find that when women or their spouses hold traditional views, they are more likely to spend more time on housework or switch to informal work after childbirth.

The primary challenge when examining the role of gender norms is that gender norms are not randomly allocated and are likely correlated with variables that potentially shape labor outcomes after having a child. We therefore combine a propensity score matching (PSM) approach with event study and DID strategies. Another challenge is reverse causality, i.e., gender norms might change after having a child. We therefore keep the sample whose first child was born after the year when questions on gender norms were asked. We also examine the influence of migration and fertility on gender attitudes using a fixed-effects model and find that gender norms do not change with migration and fertility.

This paper makes two contributions to the existing literature. First, this paper stands as one of the first few studies to explain the child penalty from the perspective of gender norms, adding depth to the broader literature on gender norms and the gender gap. Our paper builds upon and complements existing studies by Cortés and Pan (2023), Andresen and Nix (2022), and Kleven et al. (2022), as we provide more solid evidence using microlevel data in a different socioeconomic context. Through a review of recent literature and a simple theoretical framework, Cortés and Pan (2023) argued that gender differences in job preference, caused by psychological and personality traits as well as gender norms, were possible channels leading to the child penalty in the labor market. Using model derivation, Andresen and Nix (2022) discussed the important roles of gender-specific preferences for childcare and gender norms in explaining the child penalty in the labor market. Kleven et al. (2022) is the first quantitative study on how gender norms explain the child penalty in the labor market. However, their study used state-level gender norms rather than individual-level measurements of gender attitudes. In addition, their paper did not make efforts to discuss the endogeneity issue when estimating the role of gender norms. By employing *matched* event study and *matched* DID strategies, we come closer to identifying the difference in the child penalty among individuals with different gender attitudes. Moreover, we analyze how interactions of household members' gender attitudes shape the child penalty.

Second, we enrich the literature by providing additional evidence on the child penalty in developing countries, focusing on Asian contexts like China. The majority of relevant work concentrates on developed countries, notable exceptions include studies conducted in Chile (Berniell et al., 2021), Russia (Lebedinski et al., 2023), Uruguay (Querejeta Rabosto and Bucheli, 2021), Mexico (Aguiar-Gomez et al., 2019; Campos-Vazquez et al., 2022), and China (Zhou et al., 2022; Meng et al., 2022). Given the fact that developed and developing countries have different economic, social, and cultural contexts, the impact of fertility on labor market outcomes may also be different.

Two papers that are most closely paralleling our paper are Zhou et al. (2022) and Meng et al. (2022). Our paper complements their findings in two significant ways. First, we offer a different perspective to discuss the mechanism of the child penalty in China—gender norms, which has not been discussed in the other two studies. Zhou et al. (2022) discussed the roles of the relaxing of the one-child policy and state-owned enterprise reform in the evolution of the child penalty in China. Meng et al. (2022) found that intergenerational arrangements for childcare could alleviate the motherhood effect. But an underlying question remains: Why do these policies and intrafamily arrangements matter for mothers but not fathers? We explain the underlying disparities by exploring the role of

gender-related social norms. Second, our sample is representative of couples from all occupations. Meng et al. (2022) excluded agricultural and self-employed workers. This may overestimate the overall child penalty, as in the economies with a higher share of agriculture employment and self-employment, the child penalty tends to be lower (Kleven et al., 2022). Informal jobs, including self-employment without staff, require flexible working hours that prevent some women from leaving the labor market upon motherhood (Berniell et al., 2021). Thus, self-employment could be an occupation transition outcome chosen by women following childbirth. Excluding these samples may miss an essential part of the broader narrative. In this paper, we uncover the importance of gender norms in shaping women's career choice between formal and informal jobs after childbirth. Collectively, these three studies, complementing each other, provide a detailed and comprehensive picture of the patterns and mechanisms of the child penalty in China.

This paper is organized as follows. Section 2 discusses the changes in gender inequality and fertility policy in China. Section 3 describes the data sources and key variable construction. Section 4 presents the identification strategies. Sections 5 and 6 report the results of the child penalty and the influence of gender norms, respectively. Section 7 concludes and discusses the implication of this paper.

2. Background

Gender equality in China has evolved dramatically from a long history of entrenched discrimination to a progressive legal landscape. Early imperial China was marked by widespread discrimination against women, such as foot binding, forbiddance of widows to remarry, and forbiddance of women to take the imperial examination (Hughes and Maurer-Fazio, 2002; Hinsch, 1994). Such discrimination was pervasive until the founding of the PRC in 1949, which signaled a turning point through key legislations such as the 1950 Marriage Law, 1953 Electoral Law, and the 1954 Constitution.¹ These laws coincided with the planned economy during the 1950s–1960s, where state-driven labor recruitment and public childcare services made gender-neutral employment possible (Loscocco and Bose, 1998). As reported in the third National Population Census, women's labor participation rate at ages 15–54 reached 83% in 1982. Benefiting from the planned economy and the laws mentioned above, females' average education also improved (Tang and Parish, 2000; Hughes and Maurer-Fazio, 2002). Compared to a high illiteracy rate of 90% among women before 1949, 55% of women over the age of 12 had received some education as of 1982. Meanwhile, during this period, egalitarian gender attitudes were accepted as a widespread norm and ensured women's further participation in the labor market (Jie et al., 2004; Yao and You, 2016).

However, the market-oriented reform and opening up policy in 1978 introduced new challenges to gender equality. The opening of the market economy led to growing occupational segregation and a preference for male labor. With the abolishment of the state-driven labor recruitment, there was a decrease in women's labor force participation rate and wage rate (Zhang et al., 2008; Maurer-Fazio et al., 1999; Rozelle et al., 2002; Gustafsson and Li, 2000; Chi and Li, 2008). According to Maurer-Fazio et al. (1999), women's wage rate declined significantly, from 55% of men's wage rate in 1988 to 42% in 1994. This period also saw the emergence of the "women-return-home" movement, calling on women to exit the labor market to make way for men seeking jobs (Xiao and Asadulla, 2020). In response, the state introduced laws like the 1988 Regulations on Labor Protection for Female Workers and the 1992 Law on the Protection of Women's Rights, and several labor market regulations on gender equality after 2000.² Still, traditional gender attitudes became entrenched over time. According to the China Family Panel Studies (CFPS) 2014 survey data, 67% of women and 70% of men agreed with the statement that "men should focus on their careers and women should focus on their families". These traditional views undoubtedly aggravate inequality in the labor market.

China's evolving fertility policies also contribute to the gender landscape. In the late 1970s and early 1980s, the central government of China initiated the one-child policy to avoid the Malthus population trap. The one-child policy of the 1970s gave way to a two-child policy in 2016,³ and a three-child policy in 2021 to address declining birth rates (National Bureau of Statistics, 2019). Despite the fertility promotion policies, the fertility rate remains at a low level. One significant obstacle may be the labor market penalties faced by women due to childbirth. These penalties not only underline the ongoing conflict between career and family obligations for women but also form a segue into broader gender disparities in the Chinese labor market.

Building on the interplay between fertility policies and gender roles, it worth noting that, despite a robust legal framework, gender

¹ In 1950, the Marriage Law of the People's Republic of China was first promulgated, which protected marriage freedom and the rights to choose a career and to participate in work and social activities for both husbands and wives. The Electoral Law of the People's Republic of China passed in 1953 empowered women to vote and to be elected. The Constitution of the People's Republic of China in 1954 enabled men and women to have equal rights in family life and all political, economic, cultural and social fields.

² The Regulations on the Labor Protection for Female Workers in 1988 explicitly prohibited workplace discrimination against females. This was updated by the Law of the People's Republic of China on the Protection of Women's Rights in 1992, which stipulated standards for employment, equal payment for men and women, and special labor protection for women. In 2005, a revised version stipulated that labor contracts should not restrict women's marriage and childbirth. To further strengthen labor protections for female employees, the government implemented Interests and Special Provisions on Labor Protection of Female Employees in 2012, which specified many regulations on employment security for female employees. For example, enterprises should provide maternity care insurance, a maternity leave allowance, and other relevant protections; they must obey labor laws to protect female employees from hazardous work during pregnancy; and they must allow female employees 98 days of maternity leave. Moreover, in 2019, nine departments issued a Notice on Further Standardizing Recruitment and Promoting Women's Employment, which prohibited discrimination against female employees due to childbearing.

³ In 2013, after the government realized that the fertility level was declining below the replacement level. The single-two-child policy allowed parents to bear two children if both parents were single children. Three years later, China implemented a universal two-child policy in 2016, which allowed all families to have two children.

gaps persist. In 2021, women's labor participation rate in China (68.6 %) was much higher than the global average (52.6 %) but still lower than that of their male counterparts (82.8 %) (World Economic Forum, 2021). As reported by a leading online recruitment platform, women's monthly wages in urban areas were only 75–80 % that of their male counterparts during 2016–2021 (Boss Zhipin, 2016–2021). These wide gender gaps reflect challenges in achieving gender parity, where old sayings such as "Marrying well is more vital for women than doing well" still exert influence. The efforts to change fertility policies without addressing the fundamental gender relationship and the domestic burden on women reveal the complexity of achieving gender parity. These norms contribute to the current dilemma faced by women between career and family and explain the persisting inequalities.

3. Data and summary statistics

3.1. Data source and sample selection

To estimate the impact of childbirth on the labor market outcomes of women compared with men in China, we employ the China Family Panel Studies (CFPS), a widely used and comprehensive dataset. The CFPS is a nationally representative, biannual longitudinal survey of Chinese communities, families, and individuals launched by the Institute of Social Science Survey of Peking University, China. It covers 25 provinces and centrally administered municipalities in China.⁴ Initiated in 2010, the CFPS sampled approximately 16,000 households, with subsequent waves in 2012, 2014, 2016, and 2018.⁵ In addition, we also use the third wave of the Survey on Chinese Women's Social Status (SCWSS) in 2010 as supplementary data. SCWSS encompasses nine themes: politics, economy, social security, health, education, lifestyle, legal protection and awareness, marriage and family, and gender awareness and attitudes. This survey includes over 26,000 valid observations and covers all 31 provinces, autonomous regions and cities in China.

We tailored the samples to align with the purpose of this study. Since our main goal is to compare men's and women's labor market outcomes before and after childbirth, we keep the sample with the first childbirth occurring between 2011 and 2017, ensuring at least one year of observation before and after the first childbirth. We further narrow the selection to individuals aged over 16 at the time of the survey, with the first child born when the parents were between the ages of 18 and 50, and for whom spousal data can be observed. Our analytical timeframe spans from 5 years prior to childbirth to 7 years after.⁶ The distribution of the years relative to first childbirth is plotted in Appendix Figure S1 in the appendix. This dataset covers 2374 individuals who meet the above criteria across the 5 survey waves during 2010–2018.

3.2. Variables and measures

Labor market outcomes Four variables characterize labor market outcomes: individual annual earnings, labor force participation, working hours, and wage rate. In our case, we define earnings as the wage income plus the labor income from self-employed business⁷ including agricultural (farming income, fishing income, gardening income, livestock income) and non-agricultural sectors. Zero earnings are assigned to the unemployed. If a respondent has multiple jobs, incomes from all jobs are aggregated. Labor force participation is captured by a dummy variable, with 1 indicating individual having jobs, or actively searching for jobs and 0 otherwise. Working hours specify monthly hours. It takes a zero value if a respondent was not employed in the survey year. Wage rate is measured by hourly earnings, calculated by dividing individual earnings by working hours, conditional on being employed. Income and wage rate are adjusted for inflation by using the CPI for 2010–2018 (2018 as the base period). When conducting mechanism analysis, we construct housework hours and informal jobs variables to examine the effects of parenthood on housework division and career choice. Monthly housework hours refer to the hours allocated to housework per month, including taking care of children, preparing meals, washing clothes, and other cleaning activities. Informal jobs indicate self-employment or jobs lacking social security/written contracts. Agricultural activities are not classified as informal employment.

Gender Stereotype Index (GSI) Derived from CFPS 2014, the GSI gauges attitudes toward traditional gender norms. Respondents rated several statements about gender role, such as "Men should focus on career and women should focus on family", "Marrying well is more vital for women than doing well", "Women ought to have at least one child", and "To continue the family lineage, women should bear at least one boy" (1–5 points). Following Kleven (2022), we establish the GSI at an individual level according to the answers to

⁴ The CFPS covers 25 provinces and centrally administered municipalities; it does not cover Hong Kong, Macao or Taiwan or Xinjiang, Tibet, Qinghai, Inner Mongolia, Ningxia or Hainan.

⁵ We also try to use a more up-to-date panel data (CFPS 2010–2020) to obtain child penalty. The average child penalty of labor force participation calculated according to the CFPS data from 2010 to 2020 is 9.4%, and the child penalty of working hours is 13.8%. The child penalty of labor force participation and working hours are lower than the penalties calculated using 2010–2018 data (14.1% and 17.9%). However, for two reasons, we use the 2010–2018 estimation as our main result in this paper. First, COVID-19 had huge negative shock to the labor market, which may bias our estimation. For example, if a household had a kid born in 2019 or 2020 and both the father and mother experienced job loss during COVID-19, then the child penalty would be underestimated. Second, due to data limitations, we are unable to obtain the total individual income in 2020.

⁶ Ideally, there are observations 6 or 7 years before childbirth if a child was born in 2018 and the parents were surveyed in 2010. However, there are very few cases of this in the sample. Instead, we retain observations between 5 years before and 7 years after childbirth.

⁷ Individual self-employment income is obtained by dividing the household income from self-employed activities by the number of individuals engaged in self-employed activities. In general, there are two types of self-employed business, i.e., labor intensive and capital intensive. We only keep the labor-intensive self-employed sample, as we lack data to separate labor income and capital income from capital intensive activities. In the case of labor intensive, we assume that the income from self-employed activities for a specific household is mainly from labor.

these questions across the entire sample (encompassing all family members). High scores correspond to traditional views. The answer to each question is normalized to a z-score with a mean value of zero and a standard deviation of one. GSI is defined as the average normalized z-score across all the questions. We classify women based on their GSI and that of their husbands and parents⁸ to explore the effect of the gender norms of different family members. If a woman’s GSI is above zero, we categorize them into the traditional-view group, and if a woman’s GSI is below zero, they are assigned to the egalitarian-view group. In the same way, we also divide the female sample according to the GSI values of their husbands and parents. Furthermore, we construct a provincial GSI index using the SCWSS 2010 in a similar way. Compared with the CFPS, the advantage of the SCWSS is that its sampling framework is representative at the provincial level, which allows us to measure local society’s gender norms.⁹

Other variables Other control variables incorporated include education levels, urban/rural residence, and health status. Education level is coded as dummies indicating illiterate, primary school, junior-high school, senior-high school, junior college, bachelor’s, and master’s and above. Residence is 1 for urban and 0 for rural. Health status is coded as two dummy variables, poor health and good health, with fair as the omitted group.

3.3. Descriptive statistics

Table 1 offers insights into key metrics for males and females a year prior to becoming parents. Specifically, men outpaced women in earnings (25,721 yuan for men vs. 17,521 yuan for women), labor force participation (0.90 for men vs. 0.74 for women), monthly working hours (195 for men vs. 149 for women), and wage rates (12.69 yuan/hour for men vs. 11.27 yuan/hour for women), while women exhibited a higher inclination toward housework hours (32.5 for men vs. 44.3 for women) and informal jobs (0.56 for men vs. 0.61 for women). The GSI indicates that men generally held more traditional beliefs than women (−0.09 for men vs. −0.31 for women).

4. Empirical strategies

4.1. Estimating the effects of childbirth on labor market outcomes

4.1.1. Event study specification

We employ an event study approach to evaluate changes in labor market activities around the first childbirth, building on Angelov et al. (2016) and Kleven et al. (2019a). This approach allows us to plausibly estimate the causal effect premised on the assumption that there is no difference in the trend of potential outcomes for men and women in the absence of childbirth (parallel trends). Kleven et al. (2019a) demonstrated that the event study method performs favorably compared to alternative methods such as difference-in-differences (DID) and instrumental variables (IVs), particularly in identifying short- and long-term effects of having children.

The empirical specification for our estimation model is given by Eq. (1):

$$Y_{it}^g = \sum_{j=-5, j \neq -1}^7 \alpha_j^g \cdot I[j = \tau] + \sum_{k=17}^{55} \beta_k^g \cdot I[k = age_{it}] + \gamma_t + \delta^g X_{it}^g + v_{it}^g \tag{1}$$

where Y_{it}^g represents the outcome variables, including individual earnings, labor force participation, working hours and wage rate, for individual i of gender g (f for female and m for male) in year t and at event time τ . The event time τ ranged from -5 to 7 , indicating the year relative to the first childbirth. $\tau = 0$ in the year when the first child was born, and this number is a negative (positive) integer before (after) the first childbirth. $I[j = \tau]$ is a set of dummy variables for each event time. We use $\tau = -1$ as the omitted period. To nonparametrically control for the life cycle trend, we add a set of dummy variables for age $I[k = age_{it}]$. The variable age_{it} represents the age of individual i in year t , ranging from 16 to 55; $age = 16$ is the baseline to avoid perfect multicollinearity. γ_t is the year fixed effect to control for year-specific cofounders and nonparametric time trends. X_{it}^g represents other control variables, including individual education levels, permanent residence (urban/rural), and health status. We cluster the standard errors at the individual level, except for the models that include the interaction terms with provincial-level norms, where standard errors are clustered at the province level. We estimate the regressions separately for men and women. α_j^g is the coefficient of interest in this paper. It measures the effect of children relative to the year before the first childbirth.

A potential concern in our strategy is that unobserved factors may affect both fertility and labor outcomes, which may generate biased results. However, we argue that this is mitigated by factors such as the inability to perfectly control fertility.

4.1.2. Child penalty index

We convert the effect of having a child from absolute value $\hat{\alpha}_\tau^g$ to a proportion P_τ^g and define an index of the child penalty as $P_\tau =$

⁸ Parents include a woman’s parents and parents-in-law.

⁹ The correlation analysis shows that the correlation between gender norms among household members as well as province is not strong. The Spearman correlation coefficient of gender norms between wife and husband is 0.210 and significant at 1% level, and 0.151 and significant at 10% level between wife and parents. Other pairwise correlation coefficients are insignificant.

Table 1
Summary statistics at one year before the first childbirth.

	Male	Female
Complete sample		
Individual earnings (yuan per year)	25,721 (25,206)	17,521 (20,793)
Labor force participation	0.90 (0.30)	0.74 (0.43)
Working hours (per month)	195 (108)	149 (119)
GSI	-0.09 (0.97)	-0.31 (1.00)
Housework hours (per month)	32.5 (41.4)	44.3 (40.7)
Age	26.1 (4.06)	24.4 (4.05)
Sample of those who are currently employed		
Wage rate (yuan per hour)	12.69 (15.59)	11.27 (14.83)
Informal jobs (1=yes, 0=no)	0.56 (0.50)	0.61 (0.49)
No. of individuals in complete sample	664	555

Note: The table shows the mean and standard deviation (in parentheses) of the key variables for both males and females one year before their first childbirth ($\tau = -1$). Individual earnings and working hours are 0 for those who are not employed. Individual earnings and wage rate are adjusted using the consumer price index (CPI) for 2010–2018 (2018 as the base period). The sample is restricted to individuals who are aged over 16 years and whose first child was born when they were between 18 and 50 years old. The event year refers to the year when first child was born ($\tau = 0$). The years before (after) the first child born was indexed by negative (positive) numbers. The sample includes individuals observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) the first childbirth. We limit the sample to the individuals who were observed at least one year before and one after their first childbirth.

$\frac{\hat{\alpha}_\tau^m - \hat{\alpha}_\tau^f}{E[\hat{Y}_{it\tau}^g | \tau]}$, following Kleven et al. (2019a). $\hat{Y}_{it\tau}^g$ is the counterfactual labor market outcome if an individual did not become a parent at time τ , which is computed by $\hat{Y}_{it\tau}^g - \hat{\alpha}_\tau^g$ given τ as predicted by Eq. (1). $\hat{\alpha}_\tau^m$ denotes the effect of having a child for males at time τ , $\hat{\alpha}_\tau^f$ denotes the effect of having a child for females at time τ , and $\hat{Y}_{it\tau}^f$ is the counterfactual outcome if females did not become mothers at time τ . This index quantifies the relative difference in the effects of having a child on labor market outcomes between men and women as a proportion of women’s counterfactual labor market outcome in each event time.¹⁰

4.1.3. Robustness check using difference-in-differences

We also use a difference-in-differences (DID) approach to estimate the child penalty as a robustness check. Following Andresen & Nix (2022), the regression model is as follows:

$$Y_{it} = \zeta C_{it} * G_i + \eta C_{it} + \theta W_{it} * G_i + \vartheta W_{it} + \delta_i + \lambda_t + \epsilon_{it} \tag{2}$$

where Y_{it} represents the outcome variables, including individual earnings, labor force participation, working hours and wage rate, for individual i in year t . C_{it} is an indicator for childbirth, 1 for having a child and 0 otherwise. G_i is the indicator of gender, 1 for female, 0 for male. W_{it} represents the control variables, including a set of age dummy variables, individual education levels, whether permanent residence is urban or rural, and health status. δ_i indicates individual fixed effects, controlling for individual-level unobservable characteristics not varying across time that may affect the outcome. λ_t represents year fixed effects, controlling for year-level unobservable characteristics not varying across individuals that may affect the outcome. ζ is our main coefficient of interest, which estimates the effect of childbirth.

4.2. Estimating the role of gender norms in the child penalty

The primary challenge in our study is that gender norms are not randomly allocated and are likely correlated with variables that potentially shape labor outcomes after having a child. To address this selection bias, we employ a Propensity Score Matching (PSM)

¹⁰ Some studies show that the outbreak of COVID-19 affected both fertility decisions and people’s income (Aassve et al., 2020; Dang and Nguyen, 2021). That is also the reason we did not use CFPS 2020 for our main results.

approach to match the sample within a specific group (women, men, and their parents), i.e., an individual holding traditional views is matched with an individual holding egalitarian views according to a propensity score calculated by running a logit model. Women in each pair of matched group have similar demographic characteristics (age, individual income before childbirth, marriage age, education level, permanent residence, and survey year). The balance test and matching results, presented in Appendix Table S1, show a significant reduction in overall bias between the matched groups. All the *t*-test results for the treated and control groups after matching are statistically insignificant. Due to paper length, we only display the matching results for wives' gender norms. The common value range of propensity scores is shown in Appendix Figure S2, which shows that most of the samples meet the common support assumption.

We apply the PSM method to an event study to explore the role of household members' gender norms on child penalty. Specifically, we run Eq. (1) for men, women with traditional views and women with egalitarian views. We define women with traditional/egalitarian views according to different attitudes, i.e., women's own attitudes, their husbands' attitudes, their parents' and parent-in-laws' attitudes and their local society's views.

We also use a matched DID strategy as a robustness check. We keep only the women sample and divide it into one group with traditional views (control group) and a group with egalitarian views (treatment group). The model is as follows:

$$Y_{it} = \alpha C_{it} \cdot N_i + \kappa C_{it} + \xi W_{it} + \delta_i + \lambda_t + \varepsilon_{it} \quad (3)$$

where Y_{it} represents the individual earnings for women i in year t . C_{it} is an indicator for childbirth, 1 for having a child and 0 otherwise. N_i is a dummy variable representing whether a woman (or her husband, or their parents, or their residence province) holds egalitarian or traditional views. All other variables in Eq. (3) are defined as in Eq.(2).

Another potential concern is the issue of reverse causality – gender norms might change after having a child. To further exclude the possibility that gender norms may change after childbirth, in a robustness test in Appendix Figure S5, we keep the sample whose first child was born after 2014, i.e., the year questions about gender norms were asked. In this way, we ensure that gender norms are not affected by childbirth. This is not an issue when we examine the province-level gender norms, as the gender norms questions were asked in SCWSS 2010 and all childbirths were after 2010 in the CFPS dataset. To address the additional concern that individuals' gender norms may change in response to other behaviors such as location change or childbirth after 2014, we also analyze the influence of migration and fertility on gender attitudes using a fixed-effects model. As shown in Appendix Tables S3 and S4, there is no statistically significant correlation between gender norms and migration or childbirth.

Next, we examine how the combination of gender norms within a household influences the child penalty. To this end, we classify the women into four groups, i.e. egalitarian wife and egalitarian husband, traditional wife and egalitarian husband, egalitarian wife and traditional husband, and traditional wife and traditional husband. In this case, N_i is a categorical variable with egalitarian wife and egalitarian husband as baseline. All other variables are defined as in Eq. (3).

A potential concern when evaluating the impact of gender norm combinations on the child penalty is the association of these combinations with couples' comparative advantages in education or in the labor market. To address this concern, we check whether the child penalty differs by couples' comparative advantages. Specifically, we first utilize the prechild education gap and the prechild wage rate between husbands and wives as metrics to measure the comparative advantage within a couple. We then adapt Eq. (3) to include the interaction items of dummy variables of whether to have a child and the prechild wage rate gap as well as the education gap. Note that if the individual is not employed, the value of the wage rate is assigned as 0. Our findings, as detailed in Table 4, confirm that couples' gender norm combinations still work and comparative advantage in education and the labor market does not affect the child penalty. This allows us to exclude the possibility that the effects of gender norm combinations on the child penalty are confounded by underlying differences in education and labor market within couples.

Lastly, we explore the potential mechanism through which gender norms affect child penalty. For this purpose, we replace the dependent variable with housework hours and informal jobs in Eq. (3).

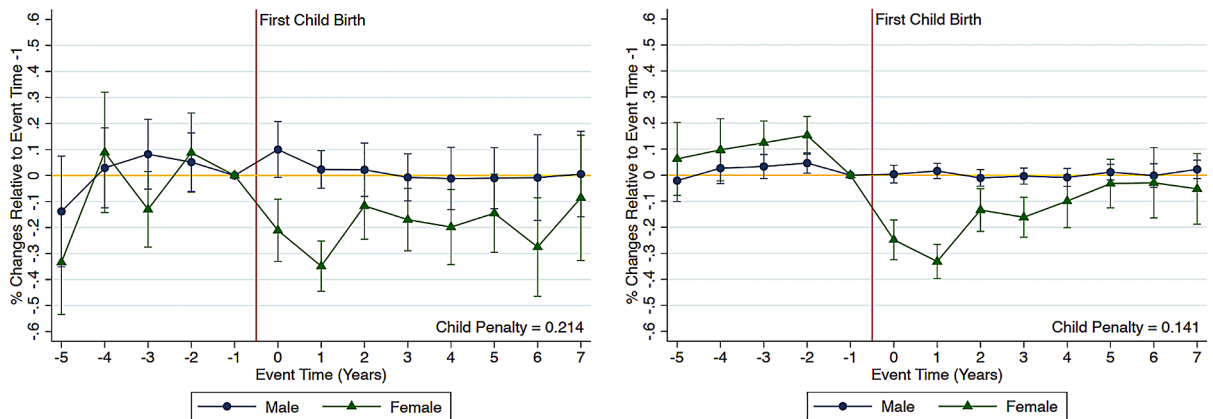
5. Child penalty on labor market outcomes

Fig. 1 presents the gender-specific effects of childbirth on individual earnings, labor force participation, working hours and wage rate over a 12-year period around the first child's birth. As defined in Eq. (1), these coefficients indicate outcomes at year t relative to the year before the first childbirth ($\tau = -1$). This figure includes 95 percent confidence intervals around the event coefficients. Panel A shows that the earnings of men and women evolve in almost parallel trends before the first childbirth and diverge after the first childbirth, with the difference continuing for several years. Women experienced an immediate drop of 21 % in individual earnings in the year immediately after the first childbirth. The decline in women's earnings continues for 7 years, despite showing a modest recovery in the second year after the first childbirth. However, men's earnings remain stable after childbirth. The average child penalty on the women's earnings relative to men's is equal to 21.4 % over the 7 years after the first childbirth.

Panel B presents analogous results for childbirth effects on labor force participation. Men and women have parallel labor force participation trends pre-childbirth. However, women experience a sharp decline of 25 % in labor force participation in the year immediately after the first childbirth relative to the year before childbirth, gradually converging thereafter, with no significant motherhood effect on labor force participation five years later. The average child penalty of labor force participation amounts to 14.1 % over the first seven post-childbirth years.

Panel C presents the estimates for childbirth effects on working hours, reflecting men's and women's comparable trends pre-childbirth. Following the birth of the first child, women's working hours fall dramatically by 24 % compared with the level one

Panel A: Annual individual earnings (unconditional) Panel B: Labor force participation



Panel C: Monthly working hours (unconditional)

Panel D: Wage rate (conditional)

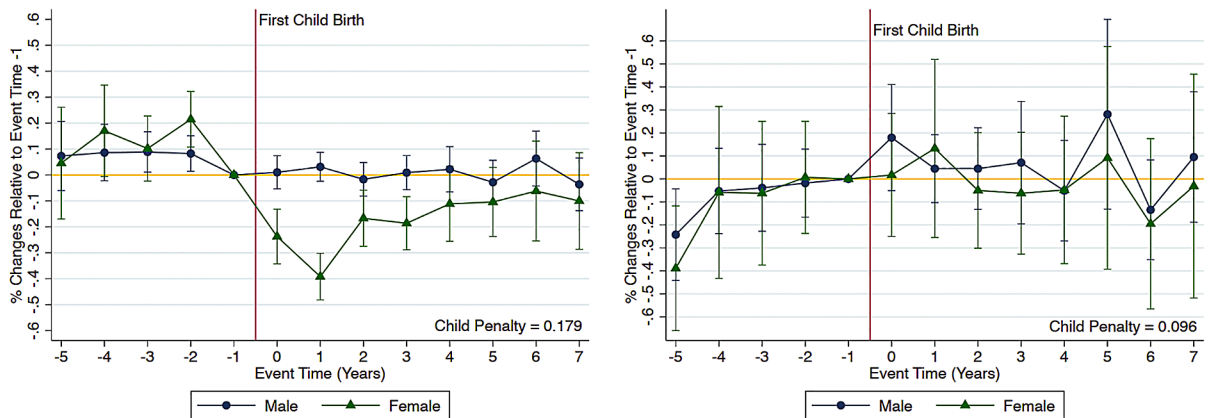


Fig. 1. Impacts of children on labor outcomes.

Note: This figure shows the percent change in labor market outcomes relative to one year before the first childbirth, as calculated by $P_t^g = \hat{\alpha}_t^g / E[\tilde{Y}_{it}^g | \tau]$ for men and women from an event study. The 95 % confidence intervals of the impact are also reported. The outcome variables are individual earnings (Panel A), labor force participation (Panel B), working hours (Panel C) and wage rate (Panel D). The effects on wage rate are estimated using samples that are currently employed (i.e., conditional). The child penalty, reported at the right-bottom corner in each panel, represents the percentage of women lagging behind men due to parenthood, defined as $P_t = (\hat{\alpha}_t^m - \hat{\alpha}_t^f) / E[\tilde{Y}_{it}^f | \tau]$. The control variables include calendar year, age dummies and other variables, including education level, permanent residence, and health status, as in Eq. (1). The standard errors are clustered at the individual level. The event year refers to when the first child was born ($\tau = 0$). The years before (after) the first child was born were indexed by negative (positive) numbers. The sample is restricted to individuals who are over 16 years of age and whose first child was born when the individuals were between 18 and 50 years old. The sample includes individuals who were observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first childbirth. We limit the sample to the individuals who were observed at least one year before and after the first childbirth.

year before childbirth, in contrast to men’s negligible change. Despite a substantial rebound two years post-birth, women’s working hours do not recover to their pre-birth level. The average child penalty in working hours for women in comparison with men is approximately 17.9 % over 7 years subsequent to the first child.

Panel D reveals parallel results for men and women regarding wage rate pre-childbirth, with no discernible divergence post-birth. This suggests that the effect of children on wage rate is mild and not significant. Note that this analysis is confined to the employed sample, which may potentially lead to underestimating the true impact of the first child on wage rate outcomes (Berniell et al., 2021).

In order to validate that the observed child penalty is specifically attributable to the first childbirth, rather than being confounded by other factors, we run a placebo test. In this test, we replace the birth year with a set of random numbers ranging from 2011 to 2017 and conduct a regression following Eq. (1). The results suggest that under the placebo tests: 1) fertility has no significant impact on those labor market outcomes and that 2) parenthood effects on labor market outcomes are very similar between fathers and mothers

(Appendix Figure S3). These results verify that the changes in our labor market outcomes are attributable to childbirth rather than other factors.

We further refine our investigation by limiting the sample to families with only one child, thereby eliminating the potential impact of the arrival of a second child. The results in Appendix Figure S4 show that the child penalty across all four labor market outcomes exhibits a pattern that is consistent with the full sample analysis. Specifically, the child penalty for women's annual earnings with only one child (0.206) closely mirrors the penalty in the full sample (0.214) despite a slight decrease. The penalties in labor force participation and monthly working hours are relatively reduced in magnitude (0.097 vs. 0.141 and 0.096 vs. 0.179, respectively), and the penalty in wage rate is marginally reduced (0.078 vs. 0.096).

Our robustness checks from Eq. (2) affirm the consistency between the results derived from the DID strategy and the event study analysis. As shown in Table 2, having a child significantly affects women's labor market performance compared to men. Specifically, following the birth of a first child, females' individual earnings diminish by 8760 RMB relative to men. Additionally, females' labor force participation rate is 33 % lower, and their working hours fall by 72.05 h per month. Interestingly, their wage rate reveals no significant decline.

To further check for potential bias from omitted variables, such as working motivation and physical and mental health, we examine whether having a child affects those outcome variables. Working motivation is measured by a category variable from 1 to 5. In the CFPS survey in 2010 and 2018, respondents were asked about their views on the statement "In today's society, hard work is rewarded", with options 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree). We use this to measure work motivation. Physical health level is measured by health status (1 for poor or fair, 0 for good). The degree of mental health is measured based on the 8-item version of Center for Epidemiologic Studies Depression Scale (CES-D). CES-D asks respondents how often over the past week they experienced symptoms associated with depression, such as sadness, restless sleep, loneliness, etc. We construct a CES-D score ranging from 0 to 24 using an equipercenile equating method. The higher the value is, the higher the degree of depression is.¹¹ The mental health variable is constructed as a dummy variable with a value of 1 for the CES-D score exceeding 8, and 0 otherwise. The results show that there is no significant change for males and females in these outcome variables after childbirth (Appendix Table S2), which indicates that omitting these variables would not generate biased results.

6. Role of gender norms

6.1. Individual and local society's views

We then explore one potential mechanism, gender norms, that may drive the child penalty. The results in Fig. 2 show that the child penalty in terms of individual income is larger for the group with traditional gender norms than for those with egalitarian norms. The attitudes of females themselves, their husbands and local society matter, while their parents' views on gender norms do not play a role. To exclude the possibility that gender norms may change after childbirth, we keep the sample whose first child was born after 2014 as a robustness check. Appendix Figure S5 shows consistent results when using the sample with the first child born after 2014 with the full sample results. It should be noted that, due to the small sample size, these results are much noisier.

Fig. 2 presents the effects of childbearing on individual earnings across the event time for household members and local society with different gender norms with a PSM method.¹² Panel A in Fig. 2 shows that both the short-run and long-run impacts of parenthood are larger for women who hold traditional views than for those with egalitarian views. Women with traditional views face an average child penalty of approximately 40 percent relative to men over seven years after childbirth, while women with egalitarian views encounter a child penalty of approximately 18.6 percent on average. Panel B reveals that husbands' perceptions of gender norms can also affect women's labor market performance. The child penalty of women whose husbands hold traditional views is larger (approximately 35.3 % on average over seven years) than that of women whose husbands hold egalitarian views (approximately 23.7 %). Panel C reveals that the norms hold by parents has little influence on women's labor market performance. The child penalty of women whose parents hold traditional views is 31.2 % on average over seven years, which is slightly larger than that of women whose parents hold egalitarian views (25.6 %). It should be noted that due to data limitations, we have parents' information only for parents who live or have economic relationships with their children. We expect this to be an upward-biased estimation, as the attitudes of parents who do not live with their descendants or have no economic relationship should have an even smaller impact on the child

¹¹ The full version of CES-D questionnaire contains 20 items, but a shorten version 8-item CES-D is often used. In CFPS, the 20-item CES-D was administered in the 2012 and 2016 surveys, while the 8-item CES-D was used in 2018. To maintain consistency across the datasets, we extract the 8-item questions from the 20-item version and calculated the 8-item CES-D score for 2012 and 2016 data, aligning them with the 2018 data.

¹² The sample used to estimate child penalty by gender norms in Fig. 2 is smaller (1590) than that used in estimating overall child penalty in Fig. 1 (2374). We present the overall child penalty using the same sample as Fig. 2 in Appendix Figure S6 for comparison. The child penalty on individual earnings using the same sample with available gender norm is 25.6%, as shown in Appendix Figure S6, which is slightly higher than that in Fig. 1 (21.4%). One possible explanation is that the sample with data on gender norms (surveyed in 2014) experienced childbearing earlier than the entire sample and child penalty goes down as time goes.

Table 2
DID estimates on the effects of having a child.

Dependent variable	(1) Individual earnings	(2) Labor force participation	(3) Working hours	(4) Wage rate
Child*Female	−8760*** (1656)	−0.330*** (0.0275)	−72.05*** (9.072)	1.309 (2.996)
Child	620.0 (1306)	−0.0174 (0.0136)	−3.871 (5.658)	0.312 (1.629)
Individual fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Control variables*Female	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Observations	8442	8615	7446	5832
Mean of the dependent variable	26,907	0.840	180.3	15.42
R2 (within)	0.249	0.102	0.073	0.081
Number of individuals	2356	2370	2366	2240

Note: This table shows the DID estimates on the effects of having a child for females compared to males. The treatment indicator is 1 for parents who have had a child and is 0 otherwise. The control variables include a set of age dummy variables, individual education level, permanent residence, and health status. We add the interactions between all control variables and the gender dummy. The model controls for individual and year fixed effects. The standard errors are clustered at the individual level. The sample is restricted to individuals who are over 16 years of age and whose first child was born when the individuals were between 18 and 50 years old. The sample includes individuals who were observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first childbirth. We limit the sample to the individuals who were observed at least one year before and after the first childbirth.

penalty. Panel D reveals that local society's views on gender roles also matter. The results show that the child penalty in provinces where more people hold traditional views is larger (32.7 %) than that in provinces where more people hold egalitarian views (14.4 %).

We then employ a matched DID strategy as a robustness test. The results are consistent with the main results in Fig. 2. Table 3 compares the child penalty in terms of female individual earnings across women with different gender norms.¹³ The results from Columns 1 to 4 show that the coefficients of the interaction terms between post-childbirth and the gender attitudes of wives, husbands, and provinces are all negative and significant, while the interaction terms of post-childbirth and parents' gender attitudes are insignificant. The pooled results in Column 5 show that the effects of women themselves and husbands' gender norms are notably similar in magnitude and both statistically significant at the 5 % level, and the local society's gender norms is comparatively smaller in magnitude and significance. These results indicate that the gender norms of both partners within a couple and of local society are crucial factors influencing the child penalty. Couples' attitudes seem to have more substantial influences than local society's attitudes. However, parents' gender norms do not appear to play a significant role. The possible reason is that in most cases in modern Chinese society, both men and women hold crucial decision-making power in a family, while their parents typically take on more caregiving or receiving caregiving roles rather than decision-making roles.

Two possible concerns regarding these findings are that fertility or some other factors, such as migration, might influence gender norms and potentially confound our results (Kuziemko et al., 2018). We use samples in 2020 and 2014 to test the effect of migration and fertility on gender attitudes. Gender norms are measured using the aggregation of the gender-related questions mentioned above. The migration variable is a dummy variable, where 1 indicates that migration has occurred. If there is a change in an individual's residential district or county before the survey year, we consider it as migration. The regression results are shown in Appendix Table S3 and Appendix Table S4,¹⁴ which indicate that migration and childbirth have no impact on the gender attitudes of either men or women. This may be because it is difficult for some experiences or short-term environmental changes to influence deeply rooted traditional gender concepts.

We also investigate the potential influence of gender attitudes on men's incomes. The results shown in Appendix Figure S7 indicate that there is barely any significant difference in individual earnings for the two men groups with different gender norms.

6.2. Combination views of couples

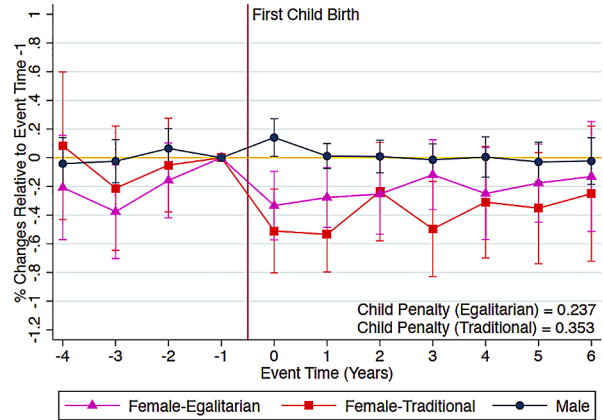
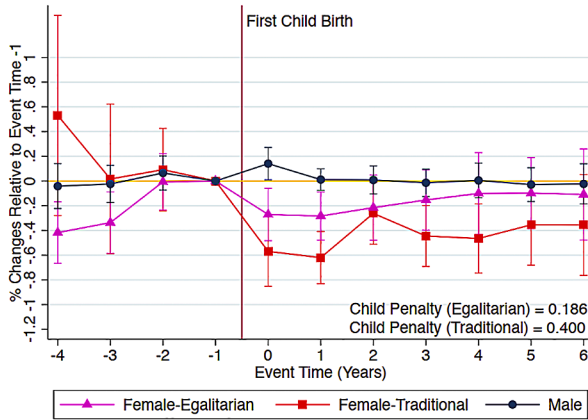
Why do gender norms matter for the child penalty? According to Cortés and Pan (2023) theoretical framework, under a noncooperative model of the household, couples' preference parameters for public goods (i.e., children) and their earnings have a

¹³ The variation of sample size depends on the attrition in responses to gender norms across different groups (wives, husbands, parents, and provinces). Columns 1 to 3 utilize the female sample, with available data on their own, their husbands' and their parents' individual gender norms, respectively, which is only available for the year 2014. Column 4 involves the female sample for whom provincial-level gender norms are available, obtained through matching with provincial-level data, offering a larger set of observations.

¹⁴ Appendix Table S3 and Appendix Table S4 display the FE estimates of the effects of migration and childbirth on gender norms respectively. The regression model is as follows: $Y_{it} = \alpha M_{it} + \pi W_{it} + \delta_i + \lambda_t + \omega_{it}$, where Y_{it} represents gender norms for individual i in year t . M_{it} denotes indicators for migration and childbirth. Note that because we have data for two years (2000 and 2014), we can implement a fixed effects model. All other specifications are the same as Eq. (2). The standard errors are clustered at the individual level.

Panel A: By women’s norms

Panel B: By men’s norms



Panel C: By parents’ norms

Panel D: By provincial norms

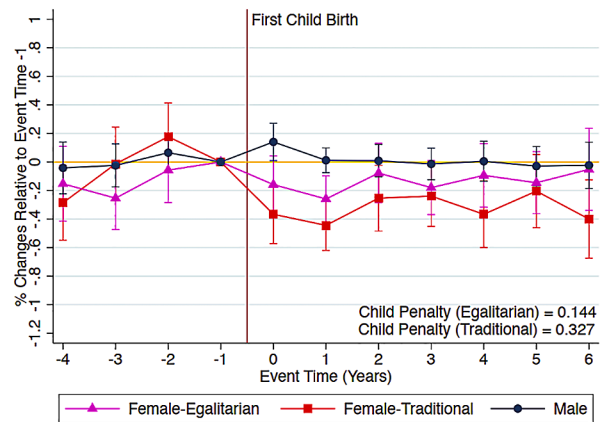
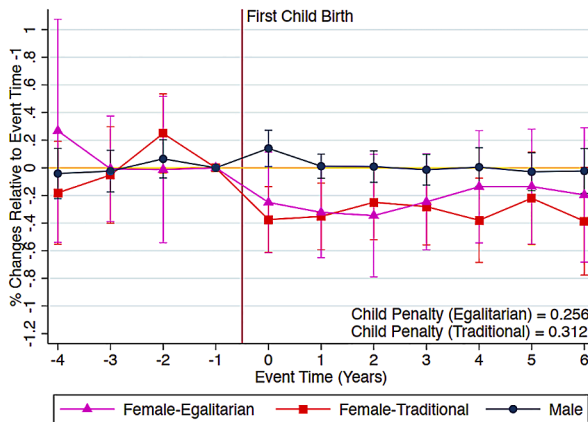


Fig. 2. Impacts of children on annual individual earnings under different gender norms.

Note: This figure shows the percent change in individual earnings, as calculated by $P_t^g = \hat{\alpha}_t^g / E[\tilde{Y}_{it}^g | \tau]$, using an event study for different groups, namely, women with traditional views, and women with egalitarian views, with a PSM method. Panel A divides females into two groups by their own attitudes, Panel B by their husbands’ attitudes, and Panel C by their parents(in-law)’s attitudes, and Panel D by their local society’s attitudes. The 95 % confidence intervals are also reported. The child penalty, reported at the right-bottom corner in each panel, represents the percentage of women lagging behind men due to parenthood, defined as $P_t = (\hat{\alpha}_t^m - \hat{\alpha}_t^f) / E[\tilde{Y}_{it}^f | \tau]$. For comparison, \tilde{Y}_{it}^f is calculated as the weighted average of two groups, i.e. women with traditional views, and women with egalitarian views. The control variables include calendar year, age dummies and other variables, including education level, permanent residence, and health status, as shown in Eq. (1). The standard errors are clustered at the individual level for Panel A-C and at the provincial level for Panel D. The event year refers to when the first child was born ($\tau = 0$). The years before (after) the first child was born were indexed by negative (positive) numbers. The sample is restricted to individuals who are over 16 years of age and whose first child was born when the individuals were between 18 and 50 years old. The sample includes individuals who were observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first childbirth. We limit the sample to the individuals who were observed at least one year before and after the first childbirth. Note that, due to the availability of the gender norm question, the sample sizes in panels A, B, and C are smaller than the whole sample used for Fig. 1. The average child penalty for the samples in this figure is slightly higher than that in Fig. 1.

relationship with a spouse’s career the couple’s decisions regarding work. Internalized social norms can generate these preference parameters. Traditional social norms cause women to suffer a utility penalty from working in the market and men to suffer a utility penalty from engaging in household production. If this is the underlying mechanism, then we should expect that when both members of the couple hold traditional gender norms, women experience the largest child penalty compared with that of other couple social norm combinations.

Table 3
Impacts of childbirth on females' individual earnings by gender norms.

Dependent variable	Female's individual earnings				
	(1)	(2)	(3)	(4)	(5)
Child × woman's own norm (1=traditional 0=egalitarian)	−4617*** (1678)				−4118** (1852)
Child × her husband's norm		−5436*** (1835)			−3781** (1898)
Child × her parents' (parents-in-law's) norm			−2333 (2350)		
Child × her local society's norm				−5621*** (1670)	−3439* (1825)
Child	−7146*** (1719)	−5272*** (1929)	−5977** (2660)	−5461*** (1279)	−3545 (2164)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	2136	1713	1578	3108	1630
R2 (within)	0.185	0.184	0.212	0.188	0.185
Number of individuals	554	440	426	848	420

Note: This table shows the estimated effects of having a child on individual earnings for females with different gender norms with a PSM method. We keep only the women sample and divide it into one group with traditional views (control group) and a group with egalitarian views (treatment group). Columns 1–4 divide the control and treatment groups by women's own norms, their husbands' norms, their parents(in-law)' norms, and their local society's norms, respectively. Column 5 includes all the interactions together except parents' norms, as parents' norms play limited role as shown in Column 3. The control variables include a set of age dummy variables, individual education level, permanent residence, and health status. The model controls for individual and year fixed effects. The standard errors are clustered at the individual level for Columns 1, 2, 3, and 5, and at the provincial level for Column 4. The sample is restricted to individuals who are over 16 years of age and whose first child was born when the individuals were between 18 and 50 years old. The sample includes individuals who were observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first childbirth. We limit the sample to the individuals who were observed at least one year before and after the first childbirth.

Table 4
Impacts of children on females' individual earnings under different combinations of household social norms.

Dependent variable	Female's individual earnings	
	(1)	(2)
Child × traditional wife and egalitarian husband	−4983* (2581)	−2687 (2842)
Child × egalitarian wife and traditional husband	−4568* (2483)	−1740 (3116)
Child × traditional wife and traditional husband	−7797*** (2323)	−6909** (2970)
Child × wage rate gap		885.5 (995.4)
Child × education gap		−133.1 (105.3)
Child	−4718** (2143)	−5622** (2554)
Individual fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Control variables	Yes	Yes
Observations	1630	1068
R2 (within)	0.174	0.182
Number of individuals	420	281

Note: This table shows the FE estimates with PSM on the impacts of children on females' individual income under different combinations of household social norms. Column 1 adds three interaction items to the dummy variable of whether to have a child and dummy variables of the wives holding traditional views and the husbands holding egalitarian views, the wives holding egalitarian views and the husbands holding traditional views, and both the husbands and wives holding traditional views. The group in which both the husbands and wives hold egalitarian views is set as the omitted group. Column 2 adds the interaction items of dummy variables of whether to have a child and the prechild wage rate gap as well as the education gap based on Column 1. The control variables include a set of age dummy variables, individual education level, permanent residence, and health status. The model controls for individual and year fixed effects. The standard errors are clustered at the individual level. The sample is restricted to individuals who are over 16 years of age and whose first child was born when the individuals were between 18 and 50 years old. The sample includes individuals who were observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first childbirth. We limit the sample to the individuals who were observed at least one year before and after the first childbirth.

To explore the role of the gender norm interaction between husbands and wives and test the hypothesis of Cortés and Pan (2023), we introduce interaction terms between having a child and a set of dummy variables of different combinations of gender norm attitudes into Eq. (3), with individual fixed effects and propensity score matching. We classify all the couples into four groups based on their gender norm attitudes: 1) both husbands and wives holding egalitarian views; 2) wives holding traditional views and husbands holding egalitarian views; 3) wives holding egalitarian views and husbands holding traditional views; and 4) both holding traditional views. We then incorporate the interaction terms between couple's gender norm combinations and the dummy variable representing post-childbirth status. The group where both the husbands and wives hold egalitarian views is set as the reference category. Note that this analysis could only be applied to women with complete data on their spouses' labor market outcomes and gender norm attitudes, thus reducing our sample size. To address this limitation, we opt for the interaction term specification, which is more suitable than regression by groups. The results are shown in Column 1, Table 4.

The results show that all the interaction items are significantly negative, but there are differences in magnitude and significance. The group with the highest and most significant coefficient is the group in which both the husbands and wives hold traditional views, which indicates that this combination can greatly amplify the negative impact of having a child on individual earnings. Next is the group in which the wives hold traditional views and the husbands hold egalitarian views, followed by the group in which the wives hold egalitarian views and the husbands hold traditional views. The reference group, in which both wives and husbands hold egalitarian views suffers the smallest child penalty. This is consistent with the hypothesis of Cortés and Pan (2023).

There is a potential issue with this strategy. An individual's gender attitudes may be correlated with the relative education level and comparative advantage between couples, potentially introducing confounding factors in the labor market outcomes. To address this concern, we introduce two interaction terms in Eq. (3): one involving a dummy variable indicating whether the couple has a child interacting with the prechild wage rate gap, and the other involving the same dummy variable interacting with the education gap. This allows us to examine whether the relative education and comparative advantage in the labor market between couples influence the impact of gender norm combinations.

As presented in Column 2 of Table 4, after incorporating the interaction terms, the group in which both husbands and wives hold traditional views continues to exhibit a significant negative impact on individual earnings. However, the effects for the other two groups are no longer statistically significant. Importantly, the relative differences in wages and education levels between husbands and wives do not appear to have any discernible impact on the child penalty. Consequently, we can confidently assert that the observed results are attributable to gender norm differences rather than variations in education or labor market comparative advantages.

6.3. Impact of gender norms on other outcomes

Gender norms affect women's (and men's) labor market performance, probably because such norms affect housework division, or shape a person's career decisions, such as occupational choices (Hwang et al., 2019; Bertrand, 2020). We thus explore the effect of the child penalty on housework hours and informal jobs to understand how gender norms work. Considering that the gender views of their parents only have a small impact on females' labor market performance as shown in Table 3, here we discuss the heterogeneous effects of different perceptions of women, their husbands and the local society's views.

To explore how gender norms affect the child penalty, we use housework hours and engagement in informal work as dependent variables in Eq. (3). Columns 1 and 2 in Table 5 show that mothers with traditional gender norms tend to engage in more flexible informal jobs to better balance family and career rather than engaging in formal jobs.¹⁵ However, the results in Columns 3 and 4 indicate that if a husband holds traditional gender norms, his wife is more inclined to spend more time in household activities. The results in Columns 5 and 6 show that there is no significant difference in housework hours and informal employment between women living in provinces with traditional gender norms and those living in provinces with egalitarian gender norms. The above results reveal that gender norms are particularly associated with housework division and women's career choices, especially when they have a child, which results in a difference in individual earnings. Interestingly, women's, husbands' and provincial views have different impact channels. Women's attitudes mainly affect their own career choices. While husbands mainly influence women's housework decisions, encouraging them to focus more on domestic responsibilities, which may restrict their ability to remain in the labor force.

7. Conclusion and discussion

Using a comprehensive individual panel dataset in China and an event study method following Kleven et al. (2019a), this paper examines the effects of childbirth on gender inequality in China, with a particular focus on labor market outcomes. Our results reveal a dramatic decrease in females' labor market outcomes subsequent to childbirth, a phenomenon not observed among males. Compared with that of other countries, China's child penalty is lower. The child penalty on the earnings of women relative to men in China is 21.4 % after their first childbirth. This contrasts markedly with other countries, such as Austria and Germany (approximately 65 %) (Kleven et al., 2019a), as well as the US, the UK, Finland, and Russia (approximately 40 %) (Sieppi and Pehkonen, 2019; Lebedinski et al., 2023;

¹⁵ The variation in sample size arises from attrition in outcome variables and responses to gender norms across distinct groups (wives, husbands, provinces). The disparity in the number of observations between Column 1 and 2 is a result of outcome variable measurement. In estimating the impact on housework hours, the entire sample is encompassed, including both employed and unemployed individuals. Conversely, when assessing the impact on informal jobs, our focus narrows to the subset employed in the non-agricultural sector. The differences in sample size among Column 1, 3, and 5 can be traced back to the measurement of gender norms.

Table 5
Mechanisms behind the role of gender norms on the child penalty: effects on household work and informality.

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)
	By females' own view Housework hours	By females' own view Informal jobs	By husbands' view Housework hours	By husbands' view Informal jobs	By local society's view Housework hours	By local society's view Informal jobs
Child × gender norm (1=traditional 0=egalitarian)	−1.263 (5.112)	0.110* (0.0645)	11.40** (5.325)	0.105 (0.0679)	5.971 (3.915)	0.0414 (0.0351)
Child	9.305** (4.519)	−0.0878 (0.0538)	6.524 (5.852)	−0.0760 (0.0591)	6.410 (4.740)	−0.0607 (0.0383)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1680	1189	1344	936	2400	1793
R2 (within)	0.117	0.105	0.117	0.102	0.103	0.082
Number of individuals	553	462	439	356	843	715

Note: This table shows the DID estimates with PSM on the effects of having a child on females' housework hours and informal jobs under different gender norms. The control variables include a set of age dummy variables, individual education level, permanent residence, and health status. The model controls for individual and year fixed effects. The standard errors are clustered at the individual level for Columns 1–4, and at the provincial level for Columns 5–6. The sample is restricted to individuals who are over 16 years of age and whose first child was born when the individuals were between 18 and 50 years old. The sample includes individuals who were observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first childbirth. We limit the sample to the individuals who were observed at least one year before and after the first childbirth.

(Kleven et al., 2019a). Conversely, China's child penalty is akin to those observed in Denmark, Spain and Mexico (approximately 24 %) (Kleven et al., 2019b; Aguilar-Gomez et al., 2019; de Quinto et al., 2021; Campos-Vazquez et al., 2022) and slightly lower than that in Chile and Uruguay (approximately 28 %) (Berniell et al., 2021; Querejeta Rabosto and Bucheli, 2021). These findings potentially reflect China's efforts to achieve gender equality, a journey partially shaped during its history of a planned economy and a socialist period. Vigorous promotion of women's employment and gender parity during this period transformed Chinese women into "social individuals", fostering greater independence and social status, and contributing to a notable reduction in gender inequality (Meng, 2000; Ma, 2018).

Further, this paper examines the role of gender norms in explaining the mechanism of the child penalty using unique individual-level data. Our results highlight the significant impact of women's and their husbands' attitudes toward gender roles on women's labor market performance, while parents' perceptions show no considerable effect. Specifically, women suffer a larger child penalty if they or their spouses hold traditional views compared with those who (or whose spouses) hold more egalitarian views. This effect also extends to the broader societal level, where local society's gender norms significantly affect the child penalty. Correspondingly, women who or whose spouses hold traditional views on gender roles are more likely to emphasize housework activities or take informal jobs. These decisions reflect social norm pressures, both voluntary and involuntary, that direct women toward family responsibilities, often curtailing their paid working hours (Goldin, 2014; Correll et al., 2007; Cortés and Pan, 2023).

These insights provide crucial policy implications for closing the gender gap in labor markets. First and foremost, the persisting gender gap in developing countries' labor markets requires more attention. Furthermore, promoting more balanced gender attitudes among women and their spouses is essential to achieving gender equality. Both partners play a crucial role in shaping these attitudes. Empowering women to participate in the workforce and leadership positions requires a supportive home environment. A husband's understanding and support of his wife's career aspirations can greatly impact her decision to pursue employment and advancement opportunities. This challenge demands a rethinking of deep-rooted beliefs about gender roles and a more equitable division of domestic responsibilities. Moreover, the influence of local or provincial societal gender norms should not be overlooked. These norms significantly shape attitudes and behaviors related to gender roles, and effort to achieve gender equality must take into account both individual attitudes and broader societal influences. The challenge extends to society at large, where a cultural shift toward gender equality must be encouraged and sustained.

Declaration of competing interest

The authors declare that there is no conflict of interest.

Data availability

The authors do not have permission to share data.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jebo.2024.03.011](https://doi.org/10.1016/j.jebo.2024.03.011).

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