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The Motherhood Penalty in China: Having A Child Increases Gender Inequality in the Labor Market

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Abstract: Using a comprehensive individual panel dataset in China and an event study method, we examined the effects of having a child on gender inequality from the perspectives of labor market outcomes and its mechanisms. Results show that becoming a mother implies a sharp decline in labor earnings, labor market participation, working hours and wage rate, while fathers' outcomes remain unaffected. These outcomes are driven by two potential channels: career choices and social norms. After having a child, mothers have a higher likelihood for engaging in informal jobs and less possibility of being promoted if they work in the formal sector. Moreover, social norms towards gender roles lead mothers to devote more time to housework and babysit, which generate motherhood earnings penalty in labor market. Finally, well-being analysis shows that subjective happiness and life satisfaction of both males and females are barely not changed after childbirth, and females experience an increase in social status after child arrival.

Keywords: motherhood penalty; gender inequality; gender gap; individual earnings

JEL classification: J13, J16, J22, J31, D13

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1. Introduction

Although gender inequality has been reduced in many countries over the past few decades, it still exists in labor markets (Klasen, 2018; Klasen, 2020). Women have made significant progress in catching up with men in both developed and developing countries, in domains such as education (Schwab et al., 2017; Klasen, 2018; Kunze, 2018) and political participation (Norris, 2002; National Bureau of Statistics, 2019). However, a gender gap still exists in the labor market and affects the whole process of achieving gender equality (Klasen, 2018; Klasen, 2020).

Recent literature indicates that having a child is a major contributor to persistent gender inequality in labor markets. Angelov et al. (2016) showed that income and wage gaps between genders significantly increase after parenthood in Sweden; women's income was 32% lower than men's after parenthood, and women's wage was 10% lower than men's. Kleven et al.(2019a) found that in Denmark having child leads to a long-term gender earnings gap of about 20%, which explains 80% of the gender earnings gap in 2013. Kleven et al.(2019b) revealed that the motherhood earnings penalty is widespread in a series of countries, such as Denmark, Sweden, United Kingdom, United States, Austria and Germany, but the magnitudes of the effects differ. Similar studies have appeared in Finland (Sieppi & Pehkonen, 2019), Spain (de Quinto et al., 2020) and UK (Costa Dias et al., 2020). However, there has been little study of the motherhood penalty in developing countries.

Most of the papers mentioned above focused on labor market outcomes like earnings and wage, but paid little attention to other aspects of labor market outcomes, such as informality

and promotion. Berniell et al. (2021) are the first to explore the effects of children on gender inequality in informal employment opportunities in Chile. They found that having a child led to a significant increase in labor informality among working mothers (38%), which explained a reduction in female employment. They further found that flexible working hours enable more people to engage in informal work; on the other hand, social protection in formal jobs discourage people from seeking informal employment.

Informal employment and job promotion are two important aspects of labor market outcomes. Informal jobs are universal in the labor markets of developing countries. Over half of non-agricultural informal workers are women in many regions, such as South Asia, Sub-Saharan Africa, East and Southeast Asia and Latin America (Vanek et al., 2014; SEDLAC, 2020). In these regions, informal jobs may harm women's career development and their livelihood because such jobs usually have lower pay, weaker social security, and poor prospects. Turning to the formal sector, job promotion is another type of labor market outcome. For enterprises, it is a method to attract talent and motivate employees. For individuals, it is essential for their career development. Promotion not only brings rich economic benefits to employees, but also meets their higher-level psychological needs (Naveed et al., 2011). However, employers are prone to discriminate against mothers when making promotion decisions (Correll et al., 2007). Both informal employment and promotion discrimination in formal employment play prominent roles in shaping the wage consequence of parenthood and could explain men's and women's career trajectories.

There is also a lack of experimental evidence on how social norms towards gender roles affect parenthood penalty disparities in the labor market. Through reviewing recent literature, Cortés & Pan (2020) documented that gender norms may be an essential channel through which children influence gender inequality in labor market. Using administrative data from Norway and an event study method, Andresen & Nix (2019) found that females in heterosexual and adoptive couples suffer similar maternity penalties, while for same-sex couples, the income loss of the birth mother is greater than that of the partner, but it can catch up within two years after childbirth. Then they concluded that the motherhood penalty in heterosexual couples is majorly due to women's preferences for childcare as well as gender norms, with slight contribution coming from the biological cost of fertility. However, these articles do not directly provide the experimental evidence of the gender norm effect.

Time allocation can help us better understand the role and effect of gender norms on gender disparity, while there are few literatures focusing on this aspect. Most studies on the impact of childbirth on time-use based on cross-sectional analysis (Craig & Bittman, 2008; Dribe & Stanfors, 2009; Craig & Mullan, 2010; Cardia & Gomme, 2018). These researches compared families with and without children at each time point. However, cross-sectional analysis does not visually observe the changes of labor market outcomes before and after the first child was born. Tiefenthaler (1997) using longitudinal survey data in Philippines, compared the magnitudes and the differences between mothers and fathers in average working time, housework time, child care time, and leisure time in four time periods, that were before sample child was born and 2 months, 6 months, 14 months after child birth. Such study,

however, ignored the causation between child birth and time allocation, and lacked reliable identification strategies.

Gender norms may lead to an unequal division of non-market or household work, which may obstacle women's careers. Gender norms are a set of norms on the proper role of women in society. These identity norms, classified as “man” and “woman”, include prescriptions like “men are ought to work in labor market, while women should manage the household”. In social interaction, both men and women may (un)consciously adopt or comply with these norms for the purpose of avoiding social sanctions or because they have already internalized these specifications (Cortés & Pan, 2020). Gender norms are particularly associated with household work division and women's choices of labor supply, especially with children (Xiao & Asadullah, 2020). Affected by long-standing social norms, females, especially mothers, devote a greater share of their time to housework and raising children (Dotti Sani, 2014; Treas & Drobnic, 2010). Thus, women have to curtail their paid working hours or quit the labor market due to the heavy burden of housework and childcare. However, jobs with fewer working hours commonly pay lower hourly wages (Goldin, 2014; Cha & Weeden, 2014). Both disparities in wage (due to different working hours), number of working hours, and labor supply are all important components for studying motherhood penalties (Weeden et al., 2016). Given these, it is necessary to identify the effects of having a child on time allocation, which can provide us a unique perspective to comprehend the factors resulting in gender inequalities.

This paper first comprehensively analyzes the effects of parenthood on both labor market outcomes (i.e., individual earnings, labor participation rate, working hours and wage rate).

Then, we discuss the potential mechanisms, that are career development (informality and promotion) and social norms (different stereotypes on gender roles), through which parenthood penalty generated. The effects of parenthood on subjective human-wellbeing (i.e., life satisfaction, happiness and social status) are examined as well.

Following Angelov et al. (2016) and Kleven et al. (2019), we investigate the effects of parenthood on gender inequality using a quasi-experimental event study method. As stated by Kleven et al. (2019), this method is valid and robust to estimate the causal effect of giving birth. Our results show that a large disparity in individual earnings appears between women and men after childbirth, although the trajectories are quite similar before the birth of their first child. On average, women's individual earnings decline by about 23.8% over the first seven years of motherhood. We also find that labor force participation falls by 14.9%, working hours reduces by 25%, and wage rate declines by 13.8% during the same period.

We find two mechanisms, career choices and social norms regarding gender roles, could contribute to explain the relative underperformance of women in labor markets. In terms of career choices, parenthood leads to a 26% increase among working women of engaging in informal work. In the formal sector, women fall behind men by 47% in terms of the possibility of job promotion after childbirth. These two factors may help to explain why mothers hired at lower wage rates than man after childbirth. For social norms, mothers facing a weaker traditional stereotype of “men managing external affairs, women internal” experience a lower child penalty (about 15%) in labor market compared to women with a stronger traditional stereotype (about 60%). Due to the traditional stereotype, women voluntarily or involuntarily

choose to cut down their working hours and reallocated them to housework and babysit activities with the arrival of the first child, which limit their performance in labor market. Intergenerational care can help them share childcare tasks and help to reduce the gender gap.

We further explore the changes of the human-wellbeing after the baby born. Results show that subjective happiness and life satisfaction for both males and females are almost not affected by parenthood. Interestingly, the subjective social status of mothers increased by 7.4% on average relative to men around 7 years after child birth.

This paper makes three contributions to the literature. First, to the best of our knowledge, this paper is the first to empirically study the role of gender norms on the effect of child on gender gap in labor market based on a comprehensive long-term dataset. Previous studies usually use literature review or model derivation to demonstrate the role of social norms on parenthood in labor market (Cortés and Pan, 2020; Andresen and Nix, 2019), lacking direct empirical evidence.

Second, this paper is also the first to study the impacts of childbirth on time allocation. Researches have mostly focused on the child penalty on parents' working hours, failing to explore the effect on family and leisure activities (Argyrous et al., 2017; Kleven et al., 2019 a,b; Sieppi & Pehkonen, 2019; de Quinto et al., 2020; Costa Dias et al., 2020; Berniell et al., 2021). Some studies looking at the impact of the birth of the child on individuals' time allocation on cross-sectional analysis, failing to capture the long period effect (Craig & Bittman, 2008; Dribe & Stanfors, 2009; Craig & Mullan, 2010; Cardia & Gomme, 2018). Some

studies, additionally, discussed the association relationship of childbirth and time-use, leaving the causation between them unclear (Tiefenthaler, 1997).

Third, this paper is among the few studies to explore the mechanisms of gender gaps in the labor market from the perspectives of both informal employment and job promotion in formal employment. While the studies cited above have provided solid evidence on gender inequality in the labor market (Angelov et al., 2016; Lundborg et al., 2017; Vere, 2018; Kleven et al., 2019 a,b; Sieppi & Pehkonen, 2019; de Quinto et al., 2020; Costa Dias et al., 2020; Berniell et al., 2021), only Berniell et al.(2021) has explored the link between the child penalty and female labor informality in detail.

Forth, we supplement the literature by providing additional evidence on the gender gap in developing countries. Most related work has focus on developed countries, except for one in Chile (Berniell et al., 2021). Social and economic development varies substantially across developed and developing countries, so that the impact of fertility on labor market outcomes is different. Meanwhile, China, as the largest developing country in the world, has unique conditions – such as the transition from a planned to a market economy and the changing fertility policies – as well as patterns of urbanization and informal markets that can provide insights for other developing countries.

2. Background

With the transformation of Chinese society over the past few decades, gender inequality in China experienced complicated changes. In the traditional society before the founding of new China in 1949, widespread discrimination against women existed (Hughes & Maurer-

Fazio, 2002). For instance, foot binding, forbiddance of widows to remarry, forbiddance of women to take the imperial examination, and permitting a man to take concubines were common in early imperial China (Hinsch,1994). During this period, women's rights were not protected by any laws.

Since the founding of new China, a series of laws have been promulgated to guide gender equality, wherein women were granted equal rights with men in nearly all respects. 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 husband and wife. The *Electoral Law of the People's Republic of China* passed in 1953 empowered women to vote and to be voted for. The *Constitution of the People's Republic of China* in 1954 enabled men and women have equal rights in all political, economic, cultural, and social fields and family life.

The promulgation of these laws, coupled with the distribution system of the planned economy during the 1950s-1960s, resulted in great improvements in women's status, especially their workplace status. In the context of the planned economy, all resources were distributed by the state rather than market mechanisms. Labor recruitment and distribution were planned by the state. Enterprise managers had no choice but to accept the workers allocated to their enterprises. Women therefore had a higher likelihood of receiving good jobs (Loscocco & Bose,1998). As reported in the third National Population Census in 1982, their labor participation rate at ages 15-54 reached as high as 83% in 1982. Benefiting from the planned economy and the laws mentioned above, females' average education also improved (Tang &

Parish, 2000; Hughes & Maurer-Fazio, 2002). Compared to almost zero education rate for women before the new China, as high as 55% of women over the age of 12 had received some education as of 1982.

However, such gender equality has been challenged since the opening of the market economy with the reforms of 1978. The market economy enables enterprises to allocate resources. With the market incentives, enterprises have preferred male labor, considering that women bear more family responsibilities (Zhang et al., 2008). This exacerbated gender inequality by reducing the female labor participation rate (Maurer-Fazio et al., 1999; Rozelle et al., 2002; Gustafsson & Li, 2000; Chi & Li, 2008). Meanwhile, the women's wage rate declined significantly, from 55% of the man's wage in 1988 to 42% in 1994 (Maurer-Fazio et al., 1999).

In order to reduce the gender gap in the labor market and to protect women's rights and interests, the state has adopted various legislation. The *Regulations on the Labor Protection for Female Workers* in 1988 explicitly prohibited workplace discrimination against females. This was replaced by the *Law of the People's Republic of China on the Protection of Women's Rights* in 1992, which stipulates standards for employment, equal pay 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. What's more, in 2019, nine departments issued a *Notice on Further Standardizing Recruitment and Promoting Women's Employment*, which prohibited discriminating against female employees due to childbearing.

Although all these laws and regulations have improved gender equality, the remaining gender gap should not be ignored. In 2021, the labor participation rate of females in China (68.6%) is much higher than the global average (52.6%), but still lower than their male counterparts (82.8%) (World Economic Forum, 2021). Women's average income shows a declining trend, from 78% of that of men in 1990 to 66% in 2010 (Chinese Academy of Social Sciences, 2016). As reported by *Zhipin* website, the women's wage is only 75-80% of their male counterparts in the last six years (Boss Zhipin, 2016-2021). These large gender gaps in the labor market indicates that there is still a long way to go for a full realization of gender parity.

Because having children is one of the major causes of gender inequality (Angelov et al., 2016; Kleven et al., 2019a), recent developments in China's fertility policy provide us with evidence of gender inequality in labor markets. In the late 1970s and early 1980s, the central government of China initiated the one-child policy to limit a great majority of family units to one child, with a policy rationale of reducing its enormous population. This policy was replaced by a single-two-child policy in 2013, after the government realized that the fertility level was dropping below replacement level. The single-two-child policy allowed parents to bear two

children if both parents were single children. Only three years later, China implemented a universal two-child policy in 2016, which allowed all families to have two children. From 2013 to 2016, the overall number of newborns and natural growth rate only increased slightly. After 2016, both the number of newborns and the natural growth rate show a downward trend (National Bureau of Statistics, 2019). In this situation, the government introduced a three-child policy in 2021.

There are primarily two factors for the persisting gender inequalities in labor market that are associated with children. One is the women's career choices which may restrict women's development in the labor market after childbirth. Previous literatures have documented that the strongest disadvantage that females encounter in working place is based on motherhood (Correll et.al.,2007; Gui,2020). Due to discriminations by employees or their own preferences, once becoming mothers, women are more likely to suffer career adjustments, which are typically related to lower wages and limited career development. The other is the heavy burden for domestic responsibilities that women have to undertake due to the deeply rooted gender norms. Despite gender equality has been greatly improved, the state-stipulated equal employment for men and women failed to change the radical gender relations (Xiao & Asadulla, 2020). Both men and women in China accept this view, “Men should be career oriented and women should be family oriented” (nanzhuwai, nuzhunei). Due to this gender role traditionalism and gender-based division of labor, females are expected to share more household burden on childcare and housework, and suffer dilemma between career and family

devotions. These two directions can provide insights for us to explain labor market gender inequality.

3. Data and summary statistics

To estimate the impact of childbirth on labor market outcomes of women compared with men in China, we used a commonly used and comprehensive dataset, i.e., the China Family Panel Studies (CFPS). CFPS is a nationally representative, annual longitudinal survey of Chinese communities, families, and individuals launched by the Institute of Social Science Survey of Peking University, China. It covers all 25 provinces, cities and autonomous regions of China (except Hong Kong, Macao and Taiwan, Xinjiang, Tibet, Qinghai, Inner Mongolia, Ningxia and Hainan). Around 16000 households were sampled in the baseline year 2010 and were tracked in 2012, 2014, 2016 and 2018.

We restrict the samples to meet our study purpose. Because our main goal is to compare men's and women's outcome variables before and after a childbirth, we keep the sample with the first childbirth falling between 2011 and 2017 to ensure that the household has been observed for at least one year before and after the first childbirth. We further restrict the sample to those who are aged 16-60, with their first child born after the parents were age 18 and before age 50. We then keep the observations between 5 years before the first childbirth and 7 years after. The distribution of the years relative to the first childbirth are plotted in Figure S1 in the appendix. This dataset cover 2,152 individuals who meet the above sample restrictions in the 15 years during 2010-2018.

We use four variables to indicate labor market outcomes, i.e., individual earnings, labor force participation, working hours, and wage rate. Individual earnings are indicated by individual annual incomes, including wage income (i.e., all income from work and retirement income), operating income (including business income, farming income, fishing income, gardening income, livestock income), and other income (i.e., donations from relatives and friends and subsidies from governments). For those who were not employed, we assign zero as their earnings. If a respondent had multiple jobs, income from all jobs is included. We deflate individual earnings by the consumer price index (CPI) of 2018. Labor force participation is measured by a dummy variable equal to 1 if a respondent was currently employed and 0 otherwise. Working hours (hours per week) refers to the hours allocated to work per week. It takes a zero value if a respondent was not employed in the survey year. Lunch time is excluded from working hours. Wage rate is measured by hourly earnings, calculated by dividing individual earnings by working hours. It is conditional on employment status.

In order to examine the effects of parenthood on career development, we construct dummy variables for informal employment and job promotion. Following Berniell et al. (2021), we define informal employment as jobs without social insurance contributions, jobs without a written labor contract, self-employed work with no staff, and temporary jobs. The dummy variable for informal employment is equal to 1 if the jobs meet at least one of the above situations and 0 otherwise. We use a dummy variable for job promotion to indicate career development. The dummy variable is equal to 1 if he/she had administrative promotion (such as promotion from section member to section chief and section chief to director) or a technical

promotion (such as a promotion from assistant engineer to engineer and engineer to senior engineer), and 0 otherwise. We treat the observations with jobs unsuitable for promotion as missing data.

We are also interested in the heterogeneity parenthood effects of different gender norms. In the CFPS survey, individuals were asked for their attitude on the view “Men should be career oriented and women should be family oriented” (1-5 points, higher score means higher level of gender stereotype). We construct a binary index to measure gender norms, where responses scoring “4-5” count as “1”, indicating holding stronger stereotype on gender roles, and “0” otherwise (that is, holding weaker stereotype toward gender roles).

We use the parenthood effects on time allocation to better understand the role of gender norms. Two variables were used to indicate time allocation to housework and leisure activities: housework hours as well as family & leisure hours. Housework hours refers to the hours allocated to housework per week, including preparing meals, washing clothes, and other cleaning activities, while it does not include time to take care of family members. Due to the restrictions of the data available, we cannot completely separate the time spent caring for household members from the time spent in leisure. We subtract working hours, housework hours and sleep hours from total hours per week (7×24 hours) to obtain hours devoted to take care of family and leisure activities, which simplified as family & leisure hours. Fortunately, the dataset allows us to identify hours assigned to several representative leisure activities, those are doing exercise, watching TV and movies, and amateur Internet access. We sum up the hours spending on the above activities to roughly represent the leisure hours. We also investigate the

heterogeneity parenthood effects of intergenerational care or not. Respondents in CFPS survey were asked “Does your father / mother share domestic work or babysit for you?”. If they answer "yes", intergenerational care equal to 1, otherwise 0.

We finally explore the effects of parenthood on subjective human-wellbeing. Three variables were adopted to represent human-wellbeing, which are self-valued happiness, life satisfaction and social status. In CFPS survey, respondents were required to rate for the following three statements (1-5 points, higher score means higher level of happiness /satisfaction/ social status): How happy do you feel? How do you rate your life satisfaction? How do you rate your social status in the local community? Thus, we obtain the corresponding variable data.

Table1 Summary Statistics at $\tau=-1$

	Female	Male
<i>Complete sample</i>		
Individual earnings (yuan per year)	15090 (19434)	25663 (25373)
Labor force participation	0.69 (0.46)	0.88 (0.32)
Working hours (per week)	34.1 (28.4)	45.2 (24.7)
Housework hours (per week)	10.1 (9.7)	6.7 (9.3)
Family & Leisure hours (per week)	60.1 (26.4)	56.3 (24.0)
Happiness (1-5 points)	4.18 (0.86)	4.10 (0.95)
Life Satisfaction (1-5 points)	3.70 (0.95)	3.42 (1.06)
Social Status (1-5 points)	2.57 (0.96)	2.68 (0.90)
Age when giving the first child	24.1 (4.1)	26.1 (4.5)
Education (years)	10.2 (4.2)	10.4 (4.1)
<i>Sample of those who are currently employed</i>		
Wage rate (yuan per hour)	9.8 (9.3)	11.4 (9.5)
Informal employments (1=yes, 0=no)	0.30 (0.46)	0.41 (0.49)
Job promotion (1=yes, 0=no)	0.18 (0.38)	0.17 (0.38)

Note: The table shows the mean and standard deviation (in parentheses) of the key variables for both female and male one year before their first childbirth ($\tau = -1$). Individual earnings and working hours are taken 0 for those who are employed. Individual earnings and wage rate are adjusted using the consumer price index (CPI) of 2018. Leisure time is calculated by subtracting working hours and housework houses from total life time (168 hours per week). The sample restricts parents that are in their age of 16 to 60, with their first child born after age 18 and before 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 index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) the first child birth. We limit the sample to the parents observed at least one year before and after first child birth. Informality professions and job promotion variables are only from the CFPS database.

Table 1 presents descriptive statistics of the key variables for females and males in our sample in the year before they became parents. Men have higher annual earnings than women in the year before the first childbirth (25663 yuan vs. 15090 yuan). Men also have a higher labor participation rate (0.88 vs. 0.69), working hours (45.2 vs. 34.1) and wage rate (11.4 yuan/hour vs. 9.8 yuan/hour) than women. As for time devoted to household and leisure activities, women have 3.4 more housework hours (6.7 vs. 10.1) and 7.8 hours more family & leisure hours (56.3 vs. 60.1) per week than men. As for labor informality and career development, the proportion of women in informal employments is lower than that of men (0.41 vs. 0.30) in the year before the first childbirth, and the proportion of women who had a job promotion is almost the same as men (0.17 vs. 0.18). As for human well-beings, women have higher self-rated happiness (4.10 vs. 4.18) and life satisfaction (3.42 vs. 3.70) than men, but their self-rated social status is not as high as men (2.68 vs. 2.57).

influenced by traditional culture, it is common for Chinese grandparents to take care of grandchildren.

4. Identification strategies

We use an event study approach to evaluate changes in labor market activities around the first childbirth, following Angelov et al. (2016) and Kleven et al. (2019). The event study methodology is a plausible method to estimate the causal effect of having a child, which overcomes the endogenous problem of fertility. Kleven et al. (2019) showed that compared with the widely used alternative methods, like differences-in-differences (DIDs) and instrumental variables (IVs), the event study methods we followed have a better performance

when identifying the short-term and long-term effects of children, which could also help to tackle the endogeneity problem of fertility (Berniell et al., 2021).

To set up the estimation models, we first recognize the year when the first child was born and denote it as $\tau = 0$. The years before (after) the first child born are indexed by negative (positive) integers. The estimation model is as follows:

$$Y_{it\tau}^g = \sum_{j=-5, j \neq -1}^7 \alpha_j^g \cdot I[j = \tau] + \sum_{k=17}^{60} \beta_k^g \cdot I[k = age_{it}] + \sum_{y=1990}^{2018} \gamma_y^g \cdot I[y = t] + \delta^g X_{it}^g + v_{it\tau}^g \quad (1)$$

In this equation, $Y_{it\tau}^g$ represents the outcome variables, including individual earnings, labor force participation and wage rate, for individual i of gender g (f for female and m for male) in year t and at event time τ . As we stated above, the event time τ ranges from -5 to 7, with 0 meaning the year when the first child was born. $I[j = \tau]$ is a set of event dummy variables, which is equal to 1 when j is equal to the event time τ , otherwise 0. We use $\tau = -1$ as the baseline to avoid perfect multicollinearity. To 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 60; $age = 16$ is the baseline to avoid perfect multicollinearity. To control time trends, we add a set of dummy variables for year fixed effects $I[y = t]$. The variable t represents the calendar year, ranging from 1989 to 2018. We treat $t = 1989$ as the baseline to avoid perfect multicollinearity. X_{it}^g represents other control variables including individual education level, permanent residence (1 for urban, otherwise 0) and data source (1 for data from CFPS, otherwise 0). We estimate the regressions separately for men and women.

The coefficients α_j^g of interest in this paper measure the effect of other event time dummy variables on the outcome variables compared with the year before the first childbirth. The coefficients β_k^g and γ_y^g estimate the effects of individual ages and time trends on the outcome variables, respectively. The coefficients δ^g estimate the effect of other control variables on the outcome variables.

To convert the effect of having a child from absolute value ($\hat{\alpha}_\tau^g$) to a proportion P_τ^g , we apply the following formula: $P_\tau^g = \hat{\alpha}_\tau^g / E[\tilde{Y}_{it\tau}^g | \tau]$, where $\tilde{Y}_{it\tau}^g$ is the counter-factual outcome if he/she did not become a parent at time τ . We then define an index of child penalty to measure the gap between men and women as a result of parenthood by $P_\tau = (\hat{\alpha}_\tau^m - \hat{\alpha}_\tau^f) / E[\tilde{Y}_{it\tau}^f | \tau]$ for each τ .

We have one possible concern for the identification strategy. There may exist some unobserved factor that affects both fertility and labor outcomes, which will generate a biased result. For instance, some literature shows that the outbreak of COVID-19 affected both fertility decisions and heir income (Aassve et al., 2020; Dang & Nguyen, 2021). As pointed by Berniell et al. (2021), such concerns only occur when fertility is perfectly under control (Berniell et al., 2021). However, research show that people cannot perfectly control their fertility. For example, Sedgh et al. (2014) showed that about 37% of pregnancies in eastern Asia in 2012 were unintended.

We also use the difference-in-differences (DID) approach to estimate the child penalties separately for men and women. The regression model is as follows:

$$Y_{it}^g = \lambda^g \delta_i^g + \mu^g D_{it}^g + \varphi^g W_{it}^g + \epsilon_{it}^g \quad (2)$$

where i denotes an individual identifier and t denotes year. Y_{it}^g represents the outcome variables, including individual earnings, labor force participation and wage rate, for individual i of gender g in year t . δ_i^g are individual fixed effects with time-invariant parameter λ^g . D_{it}^g is the treatment indicator, set as 1 after having a child and otherwise 0. μ^g is our main coefficient of interest, which estimates the effect of the treatment. W_{it}^g represents control variables including a set of age and year dummy variables, individual education level, and whether permanent residence is urban or rural. We estimate the regressions separately for men and women.

We use a fixed-effects (FE) model to test the effect of informal employment and job promotion on individual income. The specific regression model is as follows:

$$Y_{it} = \beta A_{it} + \alpha W_{it} + \delta_i + \varepsilon_{it} \quad (3)$$

where Y_{it} is the individual earnings and A_{it} represent informal employment and job promotion. All other specifications on the right side are the same as those in equation (2).

5. Results

5.1 Motherhood impacts on labor market outcomes

Figure 1 presents the gender-specific effects of parenthood on individual earnings, labor supply and wage rate over a 12-year period around the first child's birth. As defined in equation 1, these coefficients indicate outcomes at event time 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 27% in individual

earnings after the first childbirth. The decline in women's earnings continued for 7 years, although there is a little recovery after the second year following the first childbirth. However, the patterns differ for men. The individual earnings of men showed a slightly increase with the first child arrival, and two years later, it returned to the level of pre-birth. The average child penalty on the earnings of women relative to men is equal to 31.2% over 7 years following the first childbirth.

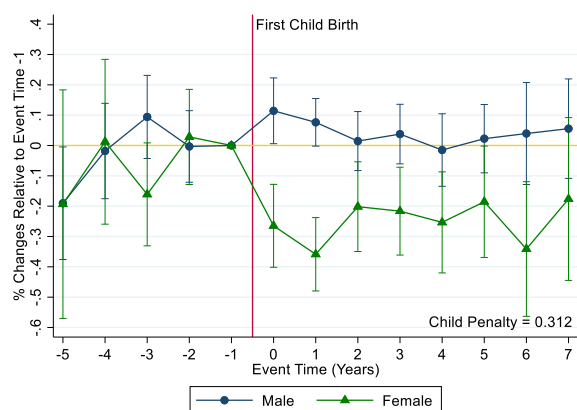
Three margins can be served as contributions to these earnings impacts, which are labor force participation, working hours, and wage rate. Panels B–D display these marginal results, which are all in play. Panel B presents the estimation results on the parenthood effects on labor force participation. We find similar trends as individual earnings. The trajectories of men and women are almost exactly parallel before the arrival of the first child. This indicates that men and women had similar labor force participation trends before having a child. However, women experience a sharp decline of 25% in labor supply after the first childbirth relative to the year before childbirth. Despite a substantial rebound two years later, women's labor supply shows no sign to recover to their previous level. The average child penalty of labor force participation is 18.3% over the first seven post-child years.

Panel C presents the estimates on the parenthood effects on working hours. Results shows that there is a parallel trend in working hours for men and women before childbirth. Right after the first child birth, women's working hours fell dramatically, by 25% compared with the level one year before childbirth, while the change for men is negligible. After two years of childbirth, women's working hours began to converge, and three years later, it shows no significant effect

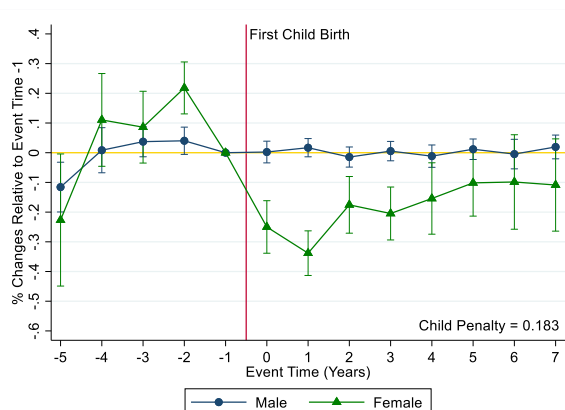
of motherhood on working hours. The average child penalty in working hours for women in comparison with men is about 22.8% over 7 years since the first child.

Panel D presents the estimation results on the parenthood effects on wage rate. Although men and women have similar wage trajectories before childbirth, those women who are employed after childbirth suffer a drop-in wage rate of 19% relative to the pre-child year. Unlike women, there is no visible change for men after childbirth. This diverging trend in wage rates for males and females continues even seven years after the first childbirth. The average child penalty in wage rate over seven years after childbirth is 18.9% for women relative to men. It should be noted that, when estimating the child penalty on wage rate, we restrict the sample to working individuals; that may underestimate the real impact of the first child on wage rate outcomes (Berniell et al., 2021).

Panel A: Individual earnings (unconditional)



Panel B: Labor force participation



Panel C: Working hours (unconditional)

Panel D: Wage rate (conditional)

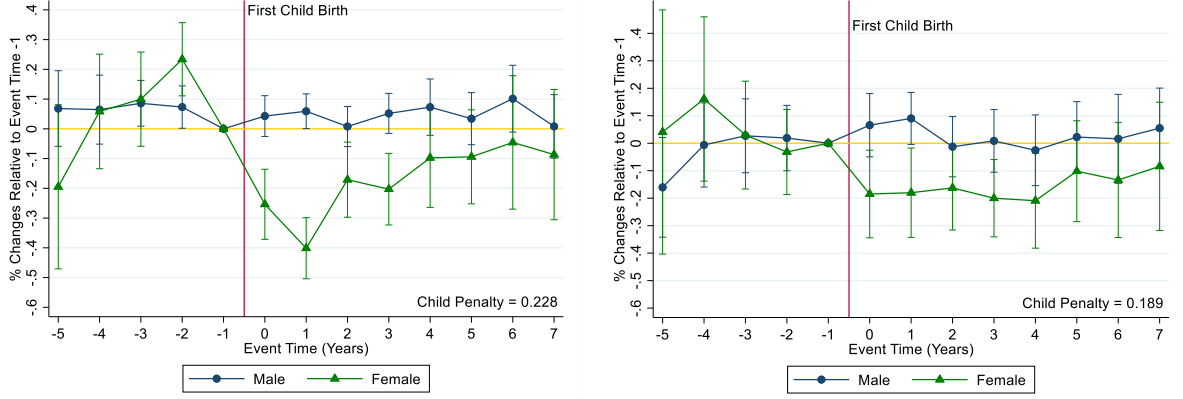


Figure 1. Impacts of children on labor outcomes

Note: This figure shows the percent change of labor market outcomes relative to one year before the first child birth, as calculated by $P_{\tau}^g = \hat{\alpha}_{\tau}^g / E[Y_{it\tau}^g | \tau]$ for men and women. 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 $P_{\tau} = (\hat{\alpha}_{\tau}^m - \hat{\alpha}_{\tau}^w) / E[Y_{it\tau}^g | \tau]$. The control variables include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size, as in equation (1). The event year refers to when first child was born ($\tau = 0$). The years before (after) the first child born was index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth.

To check the robustness of the results, we also run placebo tests by replacing the birth year with a set of random numbers ranging from 2011-2017 and conduct a regression following equation (1). The results suggest that 1) fertility has no significant impact on those labor market outcomes, and 2) parenthood effects on labor market outcomes are very similar for fathers and mothers under placebo tests (Figure S2 in the appendix). These results verify that the changes in our labor market outcomes are a result of childbirth rather than other factors.

We also run a DID model for a robustness check and the results are consistent with our basic results (Table S1 and Table S2 in the appendix). Specifically, after having a first child, females' individual earnings show a reduction of 7,211 RMB; females' labor force

participation is 3.61% lower; and their wage rate is 2.5 RMB per hour lower. However, for males, there is no obvious effect on these outcomes.

Considering that a portion of women may endogenously choose the time of childbirth, we divided our samples into endogenous and exogenous types to test the robustness. To distinguish whether women are endogenous or exogenous, variables that reflect women's personality characteristics, such as risk preference, long-term consideration or short-sightedness, can play a role (Jia & Gan, 2013). Given the availability of the data, we selected two variables as identification, that are, informal profession as well as risk and rigor preference. For simplicity, we only model women based on the barley no effect on fathers observed in our case. Women in formal jobs may be more planning and long-term, while women in informal jobs may be more short-sighted. Besides, women who are rigorous and risk averse are more likely to choose to avoid risk, while those who are not rigorous and risk preference are not. According to this, we classified the samples engaged in formal jobs, rigorous and risk averse as endogenous type, and the samples engaged in informal work, less rigorous and risk averse as exogenous type. Results are presented in Figure S3, which show that women of endogenous type also have similar penalty to those of exogenous type, which proves the robustness of the model.

5.2 Gender difference on career choices

We then explore two potential mechanisms which may drive the labor market impact. One possibility is career choices. Females, once they become mothers, are more likely to make critical career adjustments than men due to their preference for family amenities rather than pecuniary rewards or discrimination by employers' due to less productive (Goldin, 2014;

Correll & Benard, 2007). We provide evidence from two aspects, which are informal employment and job promotion. We focus on the parents who participated in the labor force. Before we identify these mechanisms, the connections between individual earnings and informal employment as well as job promotion should be clarified. The results shown in Table S3 indicates that formal jobs and job promotion associated with higher individual earnings, which is in line with our expectation.

Panel A shows the existence of gender differences in the probability of engaging in informal work. Conditional on being employed, women start to have more informal jobs than men after childbirth, while they had similar trends in the probability of engaging in informal work before child birth. The positive effect on increasing female's informal jobs increases over time. Women have a 31% higher likelihood than men of engaging in informal work over seven years after parenthood. Our results are similar with Berniell et al. (2021), who found an increase of 38% on average in labor informality among working women over the first decade after becoming mothers.

Panel B presents the effects of childbearing on the probability of job promotion relative to a year before first childbirth. Results show that the rates of job promotion for both men and women dropped dramatically in the first years after childbirth. However, men's promotion rate has a quick recovery to the pre-birth levels, while the female rate never recovers. The probability of promotion for women relative to men is reduced by 53% on average over seven years after having children. Our result was supported by Correll et al. (2007), who showed that

motherhood has a significant and negative effect on hiring, promotion, and training for management.

Panel A: Informality Professions (conditional)

Panel B: Job Promotion (conditional)

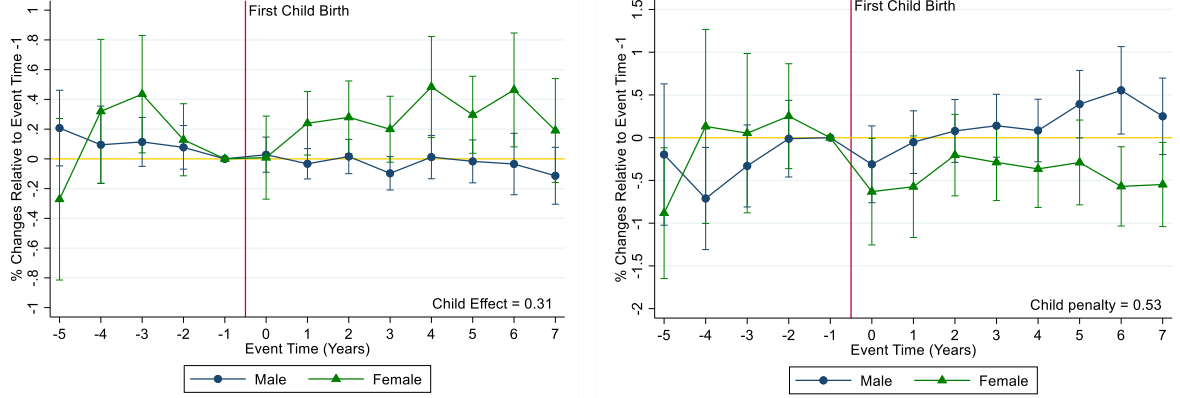


Figure 2. Impacts of children on career development

Note: This figure shows the percent change of informality professions (Panel A) and job promotion (Panel B) relative to one year before the first child birth for men and women, as calculated by $P_{\tau}^g = \hat{\alpha}_{\tau}^g / E[Y_{it\tau}^g | \tau]$. The 95% confidence intervals of the impact are also reported. The effects are estimated using samples that are currently employed (i.e. conditional). Jobs unsuitable for promotion are treated as missing data. 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 $P_{\tau} = (\hat{\alpha}_{\tau}^m - \hat{\alpha}_{\tau}^w) / E[Y_{it\tau}^g | \tau]$. The control variables include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size, as described in equation (1). The event year refers to when first child was born ($\tau = 0$). The years before (after) the first child born was index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth.

5.3 Social norms and household division

Besides the external labor market factors, social norms toward gender roles can also affect gender differences. Social norms like “men managing external affairs, women internal” is deeply rooted. To identify whether social norms can explain the gender gaps in labor market, we divide our selected sample into two groups: strong gender stereotype and weak gender stereotype. Results are presented in Panel A, Figure 3, which plots the child penalty in

individual earnings in different gender norms groups. We also present the motherhood impacts measured by percentage change in Panel A, Figure S4 in the appendix. Specifically, women with strong stereotypes face an average child penalty of about 50 percent relative to men over seven years after childbirth. Women with weak stereotypes encounter a child penalty of about 10 percent on average and there is no evidence that the child penalty persists in the long run. These findings indicate that social attitudes toward "traditional" gender roles can restrain female's labor market performance.

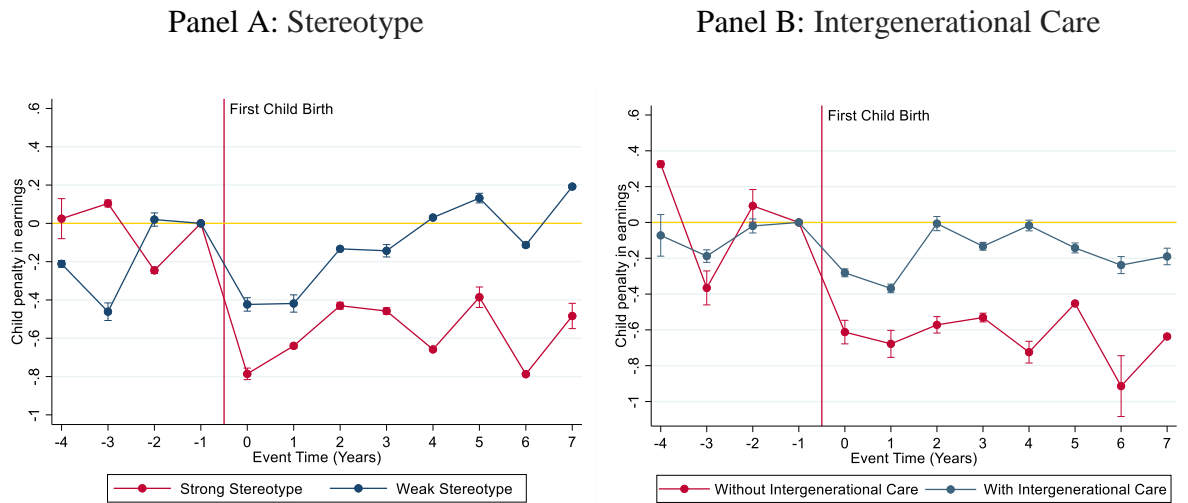


Figure 3. Impacts of children in different situations

Note: This figure shows the child penalty, as calculated by $P_{\tau} = (\hat{\alpha}_{\tau}^m - \hat{\alpha}_{\tau}^w)/E[Y_{it\tau}^g|\tau]$, in individual earnings for different groups: weak or strong stereotype (Panel A) and with or without intergenerational care (Panel B). The 95 percent confidence intervals are also reported. The control variables include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size, as shown in equation (2). The event year refers to when first child was born ($\tau = 0$). The years before (after) the first child born was index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth.

Social norms towards gender roles can lead to the recognition of women as the main childcare and housework providers within the household, although the economic roles of men and women in society today are converging. We thus explore gender inequality on time

distribution to help us understand the role of social norms. The results on the effects of parenthood on time allocated to housework and leisure activities are presented in Figure 4. Panels A-B present the separate trajectories of housework hours and family & leisure hours across the event time for both males and females.

Panel A shows that the two trajectories for men and women are very similar in housework hours despite a slight shock until the first child was born, at which point two trajectories begin to separate. Women's housework hours increase 18% and men's almost unchanged relative to the pre-child year. One year after the childbirth, women's housework time still remains high level, while men's begins to decline. Although women's housework hours occasionally fluctuate greatly, they sustain a higher rate than that of men for a long time. The average child effect for women compared to men is 26.4% over the seven years after childbirth.

Panel B shows that, though the two trajectories are almost perfectly parallel before the first childbirth, women's family & leisure hours rise sharply after the arrival of the first child, while men are nearly unaffected. During the first two years of having a child, women's family & leisure hours increased by around 20% on average relative to the pre-child level. Then the two trajectories converge again three years after the first childbirth. The average child effect in leisure hours of women relative to men is equal to 5.7% over the post-child period.

Figure S5 presents the effects of parenthood on leisure hours trajectories of women and men. From these results we can see that there's no evidence that female's leisure hours increased, on the contrary, it dropped rapidly right after the birth of the first child, while male's increased slightly. One year after the childbirth, the trajectories of men and women coincide

again. These results above verify that women indeed devote more hours to family responsibilities after having a child.

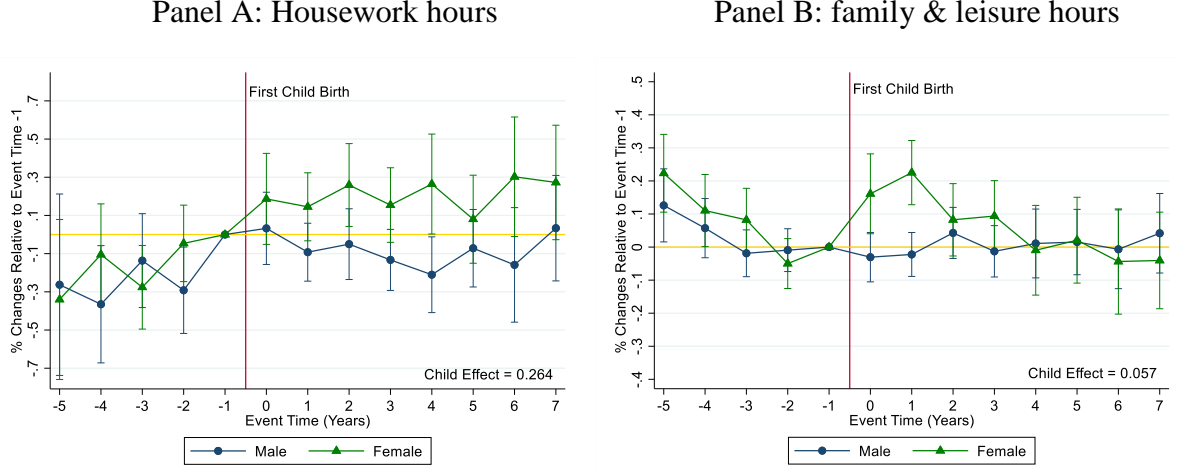


Figure 4. Impacts of children on time allocation

Note: This figure shows the percent change of time allocation relative to one year before the first child birth for men and women, as calculated by $P_{\tau}^g = \hat{\alpha}_{\tau}^g / E[Y_{it\tau}^g | \tau]$. The 95% confidence intervals of the impact are also reported. Panels A and B present the parenthood impacts on housework hours and family care and leisure hours, respectively. 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 $P_{\tau} = (\hat{\alpha}_{\tau}^m - \hat{\alpha}_{\tau}^w) / E[Y_{it\tau}^g | \tau]$. The control variables include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size, as described in equation (1). The event year refers to when first child was born ($\tau = 0$). The years before (after) the first child born was index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth.

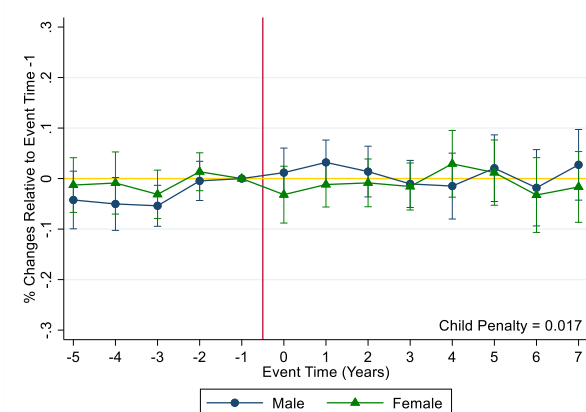
From another perspective, influenced by traditional culture, it is common for Chinese grandparents to take care of grandchildren and it appear to be regard as a social norm. This may reduce some of the burden on women. Panel B compares the motherhood penalty for women with or without intergenerational care. It reveals that the child penalty of those without intergenerational care is larger (about 48 percent on average over seven years) and persistent. For those with intergenerational care, the child penalty is 15 percent over seven years. Our result was supported by a series of literatures, which empirically confirmed that

intergenerational care could significantly increase mothers' labor supply (Posadas & Vidal-Fernandez, 2013; Arpino et.al., 2014; Morrissey, 2017).

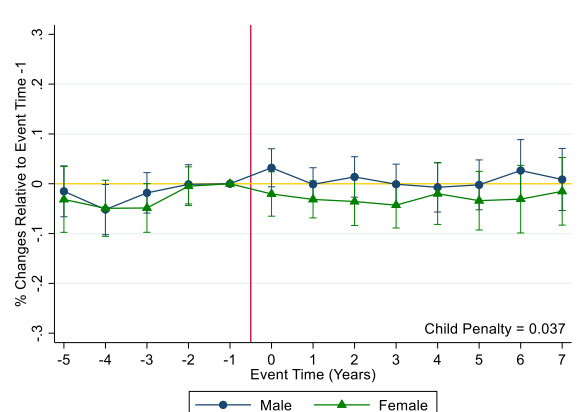
5.4 Motherhood impacts on subjective well-being

As we discussed above, female encounter persistent large penalty in terms of labor market outcomes. However, the reduction of labor market welfare does not imply the decrease of overall welfare. To verify whether fertility can affect overall welfare, we plot the parenthood effect on the welfare variables trajectories for men and women separately, which is reported in Figure 6. Here, we use self-rated life satisfaction, happiness and social status to represent the overall welfare. Results in Panel A-B show that, there is barely gender difference in the impact of fertility on both life satisfaction and happiness. Panel C shows that two trajectories evolve similarly before the first child coming, while female's social status significantly increases after childbirth, and males essentially unchanged. This phenomenon appears to last for seven years, creating an average child effect of 7.4% over seven years.

Panel A: Happiness



Panel B: Life satisfaction



Panel C: Social status

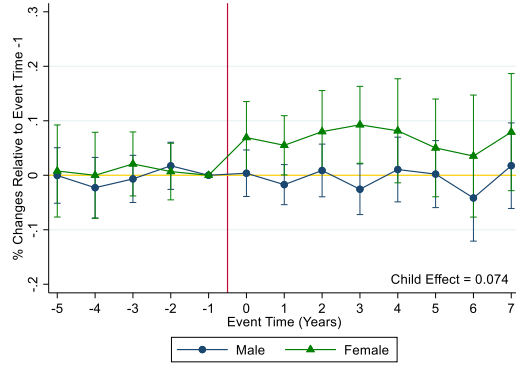


Figure 5. Impacts of children on well-being

Note: This figure shows the percent change of subjective well-being relative to one year before the first child birth for men and women, as calculated by $P_{\tau}^g = \hat{\alpha}_{\tau}^g / E[Y_{it\tau}^g | \tau]$. The 95% confidence intervals of the impact are also reported. Panels A, B, C present the parenthood impacts on happiness, life satisfaction and social status, respectively. 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 $P_{\tau} = (\hat{\alpha}_{\tau}^m - \hat{\alpha}_{\tau}^w) / E[Y_{it\tau}^g | \tau]$. The control variables include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size, as described in equation (1). The event year refers to when first child was born ($\tau = 0$). The years before (after) the first child born was index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth.

6. Conclusion and discussion

Gender inequality still exists in labor markets in many countries, although it has been mitigated in many aspects. Motherhood is shown to be a significant cause of these gender gaps. However, previous literature identifying the effects of children on gender inequality in labor markets has concentrated on developed countries, except for one study in Chile (Berniell et al., 2021). There also exists a lack of literature on child and gender inequality from the perspective of time allocation and career development. This paper is the first to comprehensively study the causal effect of the first child on gender inequality in the labor market in developing countries.

Using a comprehensive individual panel dataset in China and an event study method following Kleven et al. (2019), we examined the effects of having a child on gender inequality

in China from the perspectives of labor market outcomes, career development and time allocation. We have four main findings. First, we provide evidence that having a child dramatically increases gender gaps in labor market outcomes. Our results allow us to compare the child effect on gender inequality between developing countries and developed countries. Specifically, the average child penalties on female's individual earnings in China (23.8%) are lower than in most developed countries, such as Sweden, the US, the UK and Finland (around 40%) as well as Austria and Germany (around 65%). Furthermore, the child penalties on females in China are smaller than those in Chile (around 28%), a developing country. Our results are close to those in Denmark and Spain (around 24%). In terms of labor force participation, we find that child penalties in China (14.9%) are still smaller than in most other countries, e.g. 29% in Israel, Italy, Portugal and Spain, around 40% in France, Ireland, the US, the UK, Austria and Germany, and 22% in Chile. However, our results are larger than those in Denmark (12%) and Sweden (8%). Moreover, the child penalty on the wage rate in China (13.8%) is slightly larger than that in other countries, e.g., 11% in Denmark and nearly no effect in Chile. These results echo China's efforts in achieving gender equality.

Second, we have found two potential mechanisms to explain gender inequality in the labor market, which are career choice and social norms. From the perspective of career choice, we find that the motherhood penalty can be attributed to women's higher rates of informal employment and – if formally employed – decreasing possibility of obtaining a promotion after childbirth. These results reveal that many working women, once they become mothers, are forced to sacrifice their careers. Some women choose to engage in informal jobs to better

balance work and family and buffer against the child penalty on female labor force participation. However, employees in informal jobs usually receive low pay and are unable to accumulate human capital. Moreover, motherhood may hinder women's career development (Metz, 2005; Schultheiss, 2009) because mothers are considered less committed to paid work. These reasons may explain the gender gap of the wage rate for working parents. This paper is among the few studies that explores the child penalty on career choice.

When it comes to social norms, our results show that the mothers who hold less to the stereotype of "men managing external affairs, women internal" suffer a lower child penalty, which indicates that social norms could explain part of the observed gender gap in labor force market. A core view of gender essentialism (the belief that males and females are born with distinctively different natures, determined biologically rather than culturally) holds that women are instinctively good at domestic work and childcare (Ridgeway & Correll 2004; Weeden et al., 2016). Such stereotypes make people take it for granted that mothers, rather than fathers, should spend more time and energy taking care of their children. As a result, mothers, voluntarily or involuntarily, devote a lot of time to family activities and curtail their paid work hours. Such point is also confirmed in our research. We find that women's housework hours are significantly increased after having a child. Moreover, during the first two years of childbirth, females' time devoted to family care and leisure activities increased remarkable, while females' leisure time (roughly calculated) is reduced, which indicates that females assigned more time to look after their families (mainly childcare). Unlike women, time spent by men on family activities do not change significantly before and after childbirth. These

findings suggest that inside the household, due to the traditional social norms, females are still mainly responsible for childcare as well as a large share of domestic tasks. Outside the household, however, such norms and labor division of household generate discrimination against women and even severe occupational segregation in the job markets. (Ridgeway & Correll 2004; Xiao & Asadullah 2020). To the best of our knowledge, this paper is among the few to examine the child effect from the perspective of gender norms and time allocation.

We also investigate how intergenerational care, which links to social norms, affects gender gap in labor market. Our results show that motherhood penalty is much smaller in the group with intergenerational care than without, which indicates that intergenerational care can help to reduce gender gap caused by child. As CBD reported, grandparents nowadays share nearly half of the childcare responsibilities for mothers with two- and three-year-old child (CBD, 2019). Intergenerational care makes women more able to commit to labor force participation (Yu & Xie, 2018). This is an important reason why China is one of the countries with the highest rates of female in the workforce in the world (CBD, 2019).

Third, we explored how childbirth affects subjective well-being of parents. Our results reveal that fertility does not significantly affect happiness and life satisfaction of men or women, while it can increase women's social status. Albeit women experience changes in labor force outcomes and other aspects like marital quality, leisure time and health, which decreases their job and life satisfaction, child is an important source of happiness, and after a first birth, parents can enjoy the joys provided by the baby (Georgellis et.al., 2012; Myrskylä & Margolis, 2014). These two effects may counteract each other, leading to our results not significant. In terms of

social status, the social status of modern women has experienced a process of dynamic improvement (Wu et.al., 2014). After giving birth, females, who have to give up their self-worth for the family, are considered great and will be protected and valued by the society and their families. Moreover, mothers spend more time engaged with their child, so they could occupy the most essential position in the child's heart. The attention of the child can also improve the mother's self-evaluation status.

These results provide some important implications for closing the gender gap in labor markets. First, the gender gap in labor markets in developing countries should be paid more attention. Second, governments should further improve relevant laws and regulations to protect women's reproductive rights and interests. Improving maternity leave and maternity insurance, and prohibiting hidden gender discrimination in the job market, are two examples. Third, some other measures should be put in practice. In some countries, fathers are encouraged to spend more time on housework and child care, especially in families where the mother is also employed full-time. Better child care institutions could be another measure to relieve mothers' childbearing burden. Finally, improving women's own attitudes toward gender equality can also help realize gender equality.

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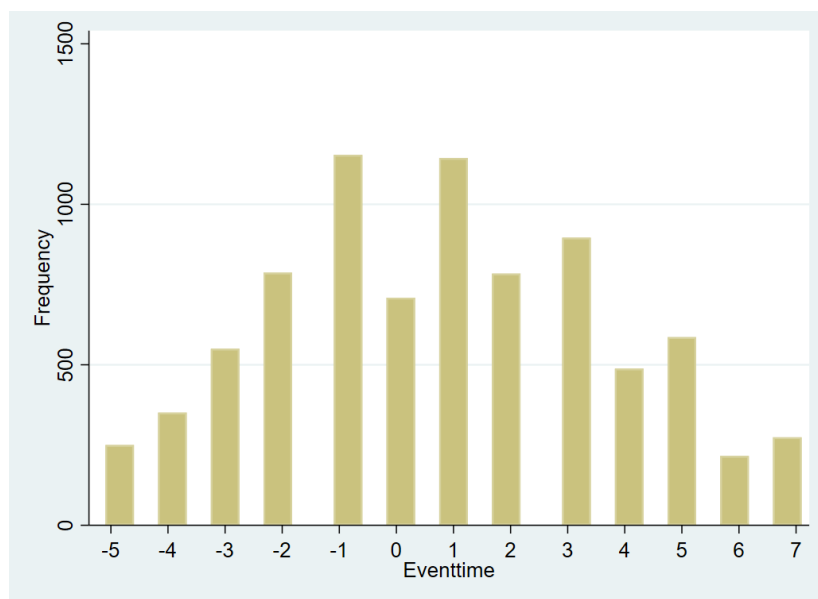
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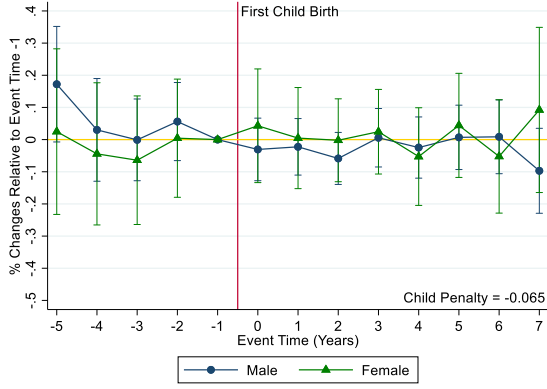
Appendix



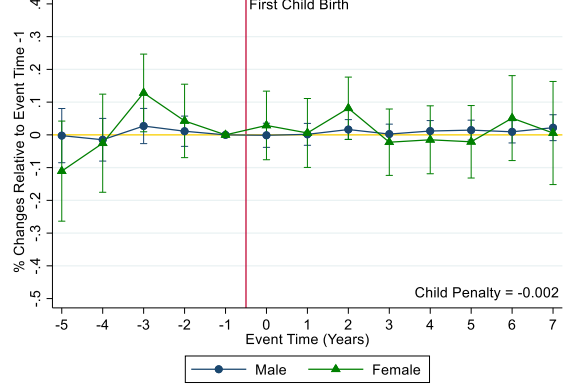
Appendix Figure S1 Sample distribution

Note: This figure describes the distributions of samples before and after the event. The event year refers to the year when first child was born ($\tau=0$). The years before (after) the first child born are indexed by negative (positive) numbers. We limit the sample to the parents observed at least one year before and after first child birth.

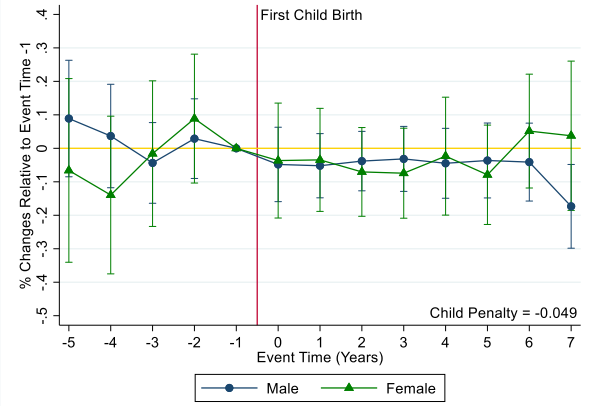
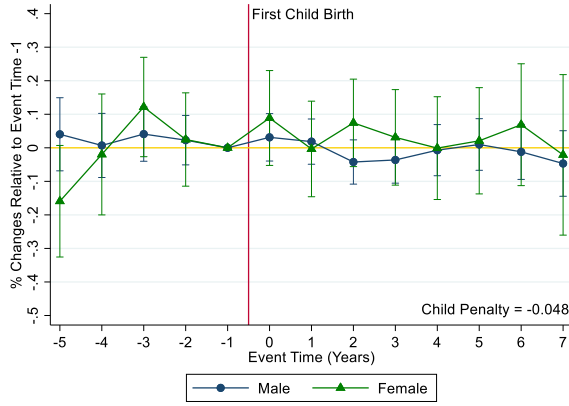
Panel A: Individual earnings (unconditional)



Panel B: Labor force participation



Panel C: Wage rate (conditional)



Appendix Figure S2. Placebo tests

Note: This figure shows the results of placebo tests corresponding to Figure 1. All the settings are the same as Figure 1, except using a random year to replace the first childbirth year. The figures show the percent change of labor market outcomes relative to a random year (instead of one year before the first child birth), as calculated by $P_{\tau}^g = \hat{\alpha}_{\tau}^g / E[Y_{it\tau}^g | \tau]$ for men and women. 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 $P_{\tau} = (\hat{\alpha}_{\tau}^m - \hat{\alpha}_{\tau}^w) / E[Y_{it\tau}^g | \tau]$. The control variables include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size, as in equation (1). The event year refers to when first child was born ($\tau = 0$). The years before (after) the first child born was index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth.

Appendix Table S1: DID estimates on the effects of having a child for female

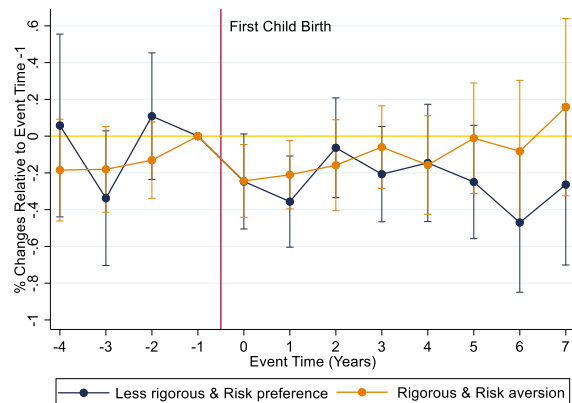
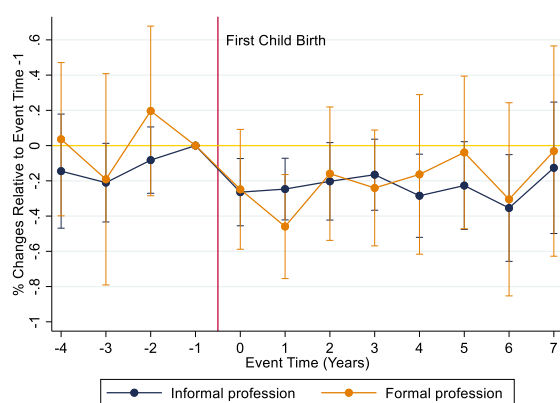
Dependent variable	Individual earnings	Labor force participation	Working hours	Wage rate
Treatment	-7,211*** (1,290)	-0.361*** (0.0290)	-85.00*** (8.757)	-2.497*** (0.724)
Individual fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Observations	3,156	3,230	2,905	1,891
R ² (within)	0.170	0.106	0.081	0.190
Number of pid	855	855	854	792

Note: This table shows the DID estimates on the effects of having a child for female. The treatment indicator takes as 1 after parents having a child and otherwise 0. The control variables include a set of age and year dummy variables, individual education level, permanent residence, health status and family size. The sample restricts parents that are in their age of 16 to 60, with their first child born after age 18 and before 50 years old. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) the first child birth.

Appendix Table S2: DID estimates on the effects of having a child for male

Dependent variable	Individual earnings	Labor force participation	Working hours	Wage rate
Treatment	1,769 (1,374)	-0.0201 (0.0149)	-1.279 (6.076)	-0.249 (0.540)
Individual fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Observations	4,600	4,759	3,999	3,435
R ² (within)	0.305	0.129	0.070	0.207
Number of pid	1,291	1,293	1,288	1,256

Note. This table shows the DID estimates on the effects of having a child for female. The treatment indicator takes as 1 after parents having a child and otherwise 0. The control variables include a set of age and year dummy variables, individual education level, permanent residence, health status and family size. The sample restricts parents that are in their age of 16 to 60, with their first child born after age 18 and before 50 years old. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) the first child birth.



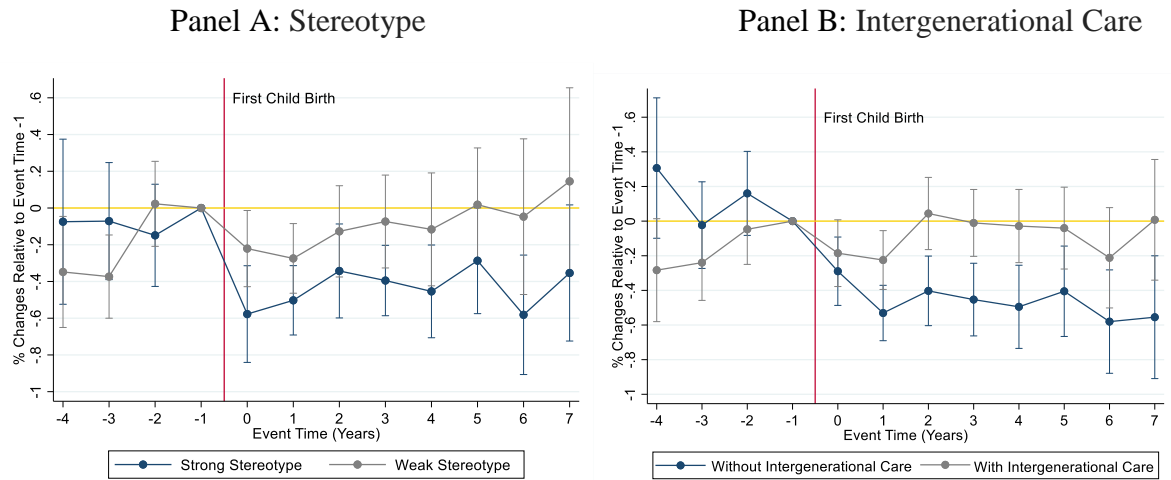
Appendix Figure S3. Impacts of children in different situations

Note: This figure shows event time coefficients estimated of the impacts of child on mothers in different situations: informal profession or formal profession (Panel A), less rigorous and risk preference or rigorous and risk aversion (Panel B). Each panel shows 95 percent confidence intervals around the event coefficients based on robust standard errors. The full set of controls include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size. The regression clusters at the individual level. Data cover the period 1989–2018. The sample restricts parents that are in their age of 16 to 60, with their first child born after age 18 and before 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 index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -4$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth. Calculations based on the China Family Panel Studies (CFPS).

Appendix Table S3: FE estimates on the effects of career development on individual earnings

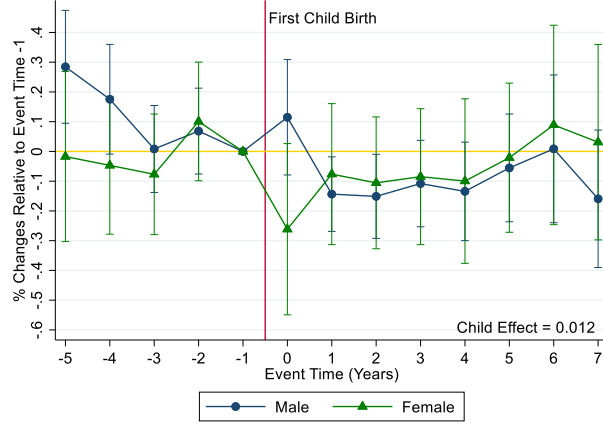
Dependent variable	Individual earnings	Individual earnings
Informal profession	-3,321*** (919.9)	
Job promotion		14,651*** (1,977)
Individual fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Control variables	Yes	Yes
Observations	6,025	3,856
R ² (within)	0.282	0.327
Number of pid	2,047	1,869

Note. This table shows the FE estimates on the effects of career development on individual earnings. The treatment indicator takes as 1 after parents having a child and otherwise 0. The control variables include a set of age and year dummy variables, individual education level, permanent residence, health status and family size. The sample restricts parents that are in their age of 16 to 60, with their first child born after age 18 and before 50 years old. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) the first child birth.



Appendix Figure S4. Impacts of children in different situations

Note: This figure shows event time coefficients estimated of the impacts of child on mothers in different situations: weak or strong stereotype (Panel A), with or without intergenerational care (Panel B). Each panel shows 95 percent confidence intervals around the event coefficients based on robust standard errors. The full set of controls include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size. The regression clusters at the individual level. Data cover the period 1989–2018. The sample restricts parents that are in their age of 16 to 60, with their first child born after age 18 and before 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 index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -4$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth. Calculations based on the China Family Panel Studies (CFPS).



Appendix Figure S5. Heterogeneity impacts

Note: This figure shows the percent change of leisure hours (roughly measured) relative to one year before the first child birth for men and women, as calculated by $P_t^g = \hat{\alpha}_t^g / E[Y_{it\tau}^g | \tau]$. The 95% confidence intervals of the impact 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 $P_t = (\hat{\alpha}_t^m - \hat{\alpha}_t^w) / E[Y_{it\tau}^g | \tau]$. The control variables include calendar year, age dummies and other variables contain education level, permanent residence, health status and family size, as described in equation (1). The event year refers to when first child was born ($\tau = 0$). The years before (after) the first child born was index by negative (positive) numbers. The sample includes parents observed between five years before ($\tau = -5$) and seven years after ($\tau = 7$) their first child birth. We limit the sample to the parents observed at least one year before and after first child birth.