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## Motherhood Penalties and Living Arrangements in China

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### Abstract

Past research on the “motherhood wage penalty” has all been based on data from nuclear families, leaving open the possibility that the motherhood wage penalty may be lower or even absent in multi-generational families. In this paper, the wage gap between mothers and non-mothers is examined in both nuclear and multi-generational families in the context of contemporary China, which has a long tradition of patriarchal families. Using 1993–2006 China Health and Nutrition Survey data, the magnitude and variation of motherhood penalty is explored with fixed effects models among 1,058 women. It is found that each additional child lowers hourly wages by about 12 percent. In addition, the results show that the motherhood penalty is largest for women living with husband’s parents, smaller for women not living with parents, and nil for women living with their own parents.

### Keywords

child care; grandparents; gender roles; intergenerational relationships; motherhood; work-family issues

### Introduction

Over the past half century, women’s movement into the labor market has been one of the most significant social changes worldwide. While women have steadily gained relative to men or even surpassed them in education in many societies, a substantial and persistent wage gap remains between men and women. Studies that incorporate human capital factors (e.g. education, on-the-job training, and work experience) and structural factors (e.g. occupational sex segregation and industrial sectors) explain no more than two thirds of the observed gender wage gap (Bibb & Form, 1977; Blau & Kahn, 2016; England et al., 1988; Roos, 1981; Weichselbaumer & Winter-Ebmer, 2005).

In the last two decades, scholars have gradually shifted their attention to the family sphere in explaining gender earnings inequality and have found that the conflict between family responsibilities and work plays an important role in gender inequality in labor market outcomes in both developed and developing countries (Anderson, Binder, & Krause, 2003;

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Avellar & Smock, 2003; Budig & England, 2001; England, 2005; Lundberg & Rose, 2000; Waldfogel, 1997). Becoming a mother is the most prominent factor that creates such a “family gap” in earnings. Past studies have found that mothers earn lower hourly wages than women without children in the United States and other industrialized countries, although the magnitude of the motherhood wage penalty varies with social context factors, such as welfare policies, for instance (Fuchs, 1988; Waldfogel, 1998a, 1998b; Budig & England, 2001).

To better understand the source of the motherhood wage penalty, scholars have considered various aspects of heterogeneity among mothers. For example, past research has found that the motherhood wage penalty varies with the timing of mother’s return to the labor force, the skills and effort required by the job, and other work-related factors (Anderson, Binder, & Krause, 2002; Anderson, Binder, & Krause, 2003; Budig & England, 2001). In addition, family-related characteristics such as marital status and time spent in domestic labor are also found to influence the wage gap between mothers and non-mothers. However, past research on the motherhood wage penalty has all been based on data from nuclear families, and the relationship between women’s childbearing and wages has not been considered in multi-generational families. In other words, variation in the motherhood penalty across living arrangements has hitherto received little attention in the literature. We know that East Asian societies have a long tradition of adult children coresiding with their parents even after marriage and childbearing (Thornton & Lin, 1994; Raymo et al., 2015; Whyte, 2004; Whyte & Xu, 2003). Previous studies have demonstrated that in such multigenerational families, exchange of services is bilateral. While adult children are supposed to care for their elderly parents, elderly parents may also provide help with housework and raising grandchildren (Chen, 2004; Chen, 2005; Chen, Liu, & Mair, 2011; Chen, Short, & Entwisle, 2000; Chu, Xie, & Yu, 2011; Xie & Zhu, 2009; Zeng & Xie, 2014). In light of this background, we expect that the motherhood penalty would vary by living arrangement, although this factor’s importance has not been explored in the previous research.

In this study, we situate our empirical work in China, where we examine the wage gap between mothers and non-mothers, paying close attention to the variation in motherhood penalty by living arrangement. Capitalizing on longitudinal data from the Chinese Health and Nutrition Survey (CHNS), our study has two concrete aims. First, we evaluate the magnitude of the motherhood wage penalty in China, a socialist country undergoing the economic transformation. Because past studies have mainly focused on the motherhood penalty in countries with mature market economies like the U.S., knowledge about the existence and magnitude of a motherhood wage penalty in a transforming country is quite limited. Thus, we contribute to the literature on the motherhood penalty by situating women’s labor market performance in post-reform China, a society where the transformation from planned to market economy may have disadvantaged women relative to men in earnings (Shu & Bian, 2003; Zhang & Hannum, 2015). Second, we explore the variation in motherhood penalty across different forms of living arrangement. Differences in motherhood penalty by living arrangement may provide more insight into how the family context in general influences women’s labor market outcomes.

## Theoretical Issues

### Explanations of the Motherhood Penalty

Numerous studies have found evidence for the motherhood wage penalty: women with young children suffered a wage disadvantage ranging between 5 percent and 20 percent in the U.S., U.K., and some other OECD countries (Harkness & Waldfogel, 2003; Joshi, Paci, & Waldfogel, 1999; Killewald & Gough, 2013; Lundberg & Rose, 2000; Neumark & Korenman, 1994; Waldfogel, 1997, 1998a, 1998b). While it is widely accepted that having children is associated with women's lower wages, theoretical explanations for this phenomenon are diverse. The explanations can be broadly grouped into two categories: (1) supply-side explanations involving human capital investment, job performance, and occupational characteristics; and (2) demand-side explanations focusing on discrimination.

The most commonly applied theoretical explanation for the wage effects of children on women's wages is based on human capital theory, developed by Becker (1964) and Mincer (1974). According to this theory, work experience has a positive impact on wages, because on-the-job training and skill development improve a worker's productivity. Mothers accumulate less work experience and on-the-job training compared to non-mothers through three concrete mechanisms. First, mothers may temporarily withdraw from the labor force to care for young children and thus stop accumulating human capital. Second, even when they are employed, mothers may spend less time at work than non-mothers. Third, work experience accumulated prior to the birth of a child may depreciate in value if mothers stop updating knowledge and skills required for their jobs, especially when pursuing professional careers (Polachek, 1979, 1981, 1984, 1985). The extent to which work experience can actually explain the motherhood wage penalty, however, is continually under debate. Some scholars have found that the wage gap between mothers and non-mothers no longer exists after experience and tenure are controlled for (Hill, 1979; Korenman & Neumark, 1992). However, more recent studies have found that work experience explains only part of the observed motherhood penalty (e.g., Budig & England, 2001; Gangl & Ziefle, 2009; Neumark & Korenman, 1994).

Another possible explanation for the motherhood wage penalty is that women's family responsibilities interfere with their work effort or productivity and thus result in lower wages. According to Becker's "new home economics" (1985), women contribute more to the family and take more responsibility for housework and child-rearing after becoming wives and mothers. As individuals' energy is limited, increased housework and childcare demands consume large amounts of mothers' energy that may otherwise be spent on paid work. In addition, mothers may worry about their children during their workdays and be unable to concentrate on their jobs. Thus, even when mothers have no career break after having children, they may become less productive at work because they are tired from domestic labor and distracted by their children. Due to difficulty in measuring productivity directly, scholars usually examine such hypothesized effects indirectly. Some studies have found that the wage gap between mothers and non-mothers is reduced significantly after accounting for factors such as the amount of physical strength demanded by the job (Budig & England, 2001). Other scholars, however, demonstrated that family constraints hampered

mothers' career progress (Baxter, 1992; Coverman, 1983; Kühhirt & Ludwig, 2012; Noonan, 2001; Shirley & Wallace, 2004).

A third possible explanation for the motherhood penalty from the supply side involves the concept of "compensating differentials." According to neoclassical economic theory, the "compensating differentials" hypothesis means that although the wages for some jobs are lower than those for others, lower wages may sometimes be offset by non-pecuniary advantages, such as lesser skill demands, more pleasant working conditions, higher starting wages, or lower risk of depreciation (England, 2005; Filer, 1985; Kilbourne et al., 1994; Killingsworth, 1985; Smith, 1979). Mothers may seek "mother-friendly" jobs with higher compensating differentials, such as flexible working hours and reduced demands on their energy. Since "mother-friendly" jobs offer more non-pecuniary amenities, wages for them are usually lower than those for "mother-unfriendly" jobs (Bergmann, 1974, 1986). When young women prepare to have children, they may consider both the pecuniary and the non-pecuniary features of a job. As long as they think the utility of non-pecuniary compensation in "mother-friendly" jobs is large enough to offset lower wages, they may choose those jobs which are more compatible with the role of mother. Thus, it is argued that the different types of job selected by mothers and non-mothers account for the observed wage gap.

The part of the motherhood penalty explained by observed job characteristics, however, is quite small. One job aspect often studied in this literature is whether a job is part-time or full-time. Several studies found that controlling for part-time employment reduces the motherhood penalty by 5 to 20 percent (Anderson, Binder, & Krause, 2003; Budig & England, 2001; Davies & Pierre, 2005; Joshi, Paci, & Waldfogel, 1999; Waldfogel, 1997). Analyzing data including information on several pecuniary and non-pecuniary job characteristics in Germany, Felfe (2006) concluded that some part of the motherhood wage penalty could be accounted for by compensating differentials.

Demand-side explanations of the wage gap between mothers and non-mothers focus on employers' discrimination. "Statistical discrimination" and "taste" are the two major sources of employers' discrimination against mothers. Statistical discrimination is associated with what economists call imperfect information about the productivity of workers (Arrow, 1972, 1973; Phelps, 1972). This theory maintains that employers, finding it expensive or difficult to measure each worker's productivity, save money by relying on indicators about different groups of workers to make predictions about individuals' productivity. If mothers are, on the average, less productive than non-mothers, then employers may have an incentive to pay mothers lower wages. According to this economic theory, the wage gap between mothers and non-mothers mainly reflects average productivity differences. Most studies citing statistical discrimination in explaining the wage gap, however, are theoretical in nature, since productivity is difficult to measure. Psychological studies on stereotyping indirectly revealed statistical discrimination in human cognition, showing how some employers observed real differences, exaggerated them, and thus produced an artificial average pay gap between groups larger than actual average group differences in productivity (Benard & Correll, 2010; Correll, Benard, & Paik, 2007; Cuddy, Fiske, & Glick, 2004; Fuegen et al., 2004; Halpert, Wilson, & Hickman, 1993).

The second source of discrimination is “taste,” which is simple prejudice on the part of one group towards another (Becker, 1971). Unlike employers practicing statistical discrimination, those practicing taste discriminations make no assumptions about mothers’ vs. non-mothers’ productivity, but simply prefer not to hire women with children. In empirical studies, it is common for scholars to treat the residual wage gap (i.e. the wage gap that remains after comprehensively controlling relevant factors) as evidence of employers’ taste discrimination. Obviously, this approach suffers from the problem of potential confounding of unmeasured factors that may be associated with motherhood but also affect earnings.

### Heterogeneity in the Motherhood Penalty

While scholars now accept that mothers usually earn less than non-mothers, recent studies have shifted attention from estimating the overall difference between non-mothers and mothers to exploring the heterogeneity in the motherhood penalty. The first mechanism by which women might suffer different penalties for having children operates with job characteristics. Several studies have observed that the motherhood wage penalty varies considerably by education level (Amuedo-Dorantes & Kimmel, 2005; Anderson, Binder, & Krause, 2002). Some scholars have shown that women with higher levels of education suffer more from the motherhood penalty, since interrupting the accumulation of work experience after having children imposes larger opportunity costs on higher-skilled workers (Anderson, Binder, & Krause, 2002; England et al., 2016; Yu & Xie, 2014). Using a selection model to correct for the endogeneity of women’s choice to work and have children, however, Amuedo-Dorantes and Kimmel (2005) have observed a motherhood wage boost instead of loss for college-educated women. They attribute this wage boost to the college-educated women’s search for family-friendly work environments that offer better opportunities for advancement. Similarly, Budig and Hodges (2010) found that among white women in the U.S., having children inflicts the largest penalty on low-wage women. In addition, motherhood wage penalties may vary with workplace characteristics. A recent study in Finland reported that motherhood wage penalties are lower in female-dominated industries than in male-dominated industries, supporting the “compensating differential” hypothesis (Napari, 2010).

The motherhood wage penalty has also been shown to vary with race and family characteristics. While most studies have found that in the U.S. whites pay a larger motherhood penalty than African and Hispanic Americans, scholars have sought different explanations for this pattern (Budig & England, 2001; Glauber, 2007; Neumark & Korenman, 1994; Waldfogel, 1997). Some scholars argued that African American women are less economically dependent on their partners than whites, and thus motherhood might increase their motivation for or productivity at their paid work (Hill, 1979; Waldfogel, 1997). The other explanation related to wage distribution by race (Glauber, 2007). Minority women were more likely to occupy low-paying jobs in the economy, and the minimum wage put a floor on the penalties that are possible (Budig & England, 2001). Also for the U.S., research has shown that the motherhood penalty was larger for married women than for single or divorced women (Budig & England, 2001; Glauber, 2007). It is argued in this literature that husbands can provide financial resources that allow married mothers to focus

more on children than single women can, and that sex division of labor in marriage leads to the observed larger penalties for married mothers. Moreover, mother's wage penalty may change over time. Anderson et al. (2003) reported that younger children impose a higher penalty than older children on mothers in the U.S., as younger children require more care from mothers. Scholars have observed a similar pattern in Spain—that the wage penalty declines over time—and that it takes nine years for mothers to return to their pre-birth levels (Fernández-Kranz, Lacuesta, & Rodríguez-Planas, 2013).

However, past studies have not yet taken the family living arrangement into consideration, overlooking the possibility that a woman's wage reduction due to childbearing might be different due to coresidence with her parents or parents-in-law. In nuclear families with no more than two adults, the mother usually shouldered most of the burden of childcare (Yavorsky et al., 2015). In multi-generational families, however, grandparents may provide childcare. Most past studies of the motherhood penalty have focused on Western societies, in which it is rare for married adult children to coreside with parents. For this reason, how living arrangement—an important family context variable—affects the motherhood penalty is not a major issue. However, we know that multigenerational coresidence is quite common in East Asian societies (Chu, Xie, & Yu, 2011; Parish & Willis, 1993, 1994; Thornton & Lin, 1994). Scholars have demonstrated the influence of living arrangements on various family processes, such as monetary and non-monetary intergenerational transfers, elderly parents' care, and child-rearing, which were closely related to women's labor being devoted to the family (Chu, Xie, & Yu, 2011; Xie & Zhu, 2009; Zeng & Xie, 2014). Therefore, given the context of this study in contemporary China, we will examine the motherhood penalty in both nuclear and multigenerational families in order to advance our understanding of the role of family context for women's performance in the labor market.

## Living Arrangements in China

In the Chinese tradition, the ideal family form is an extended, joint household with multiple generations coresiding together (Chu, Xie, & Yu, 2011; Greenhalgh, 1985; Parish & Willis, 1993, 1994; Thornton & Lin, 1994). Before industrialization, multi-generational coresidence facilitated collective labor of family members for agricultural production. Aided by the Confucian ideology of filial piety, it was also an efficient way for the family to take care of the elderly (Fei, 2013). The traditional Chinese family was patriarchal, with authority, inheritance, and coresidence running along male offspring. Therefore, patrilocal multi-generational coresidence was the dominant living arrangement in traditional Chinese society (Yang, 2008).

This normative form of living arraignment has been changed by economic, social and cultural transformations since the founding of the People's Republic of China, especially in the economic reform era that began in 1978. Rapid industrialization and urbanization have significantly weakened the economic function of the extended family, with the availability of the pension system in urban areas making the elderly economically independent of their adult children (Xie and Zhu 2009; Zhang & Goza, 2006). Large-scale migration has resulted in physical separation between many parents and their adult children. Culturally influenced by individualism (Yan, 2009), young couples now value private space and prefer to live

independently (Chen et al. 2011). Data from the 2010 China Census showed that about 60 percent of Chinese families were nuclear families, while only 23 percent were extended families (Wang, 2013). Modernization has also reduced gender asymmetry so that daughters may have close ties with parents even after marriage. For example, some studies observed that daughters tended to give more money to their elderly parents in today's urban China (Xie & Zhu, 2009; Xu, 2013; Ma & Wen, 2016). In addition, fertility below replacement level, in large part attributable to the government's strict family planning policy, means that a certain proportion of families only have daughters, so that the traditional coresidence pattern is no longer applicable to them. As a result, matrilocal coresidence, living with the wife's parents, has emerged in recent decades (Bian et al., 1997; Chu, Xie, & Yu, 2011; Logan & Bian, 1999; Logan, Bian, & Bian, 1998; Pimentel & Liu, 2004; Whyte & Xu, 2003; Xie & Zhu, 2009). In 2000, only 2.51 percent of married couples lived with the wife's parents in China (Wu & Guo, 2010). According to a recent study, the proportion of matrilocal coresidence families increased to 11.5 percent in 2010, and such living arrangements were more prevalent among younger cohorts and couples in more developed regions (Xu, 2013). In summary, there are three major living arrangements among married couples in contemporary China: a married couple and their children living independently as a nuclear family, an extended family living with the husband's parents, and an extended family living with the wife's parents.

Although the traditional family form has been weakened in China due to social changes such as modernization and migration, multigenerational coresidence remains an important residential form practiced by many families (Chu, Xie, & Yu, 2011; Raymo et al., 2015; Rosenzweig & Zhang, 2014; Yasuda et al., 2011; Zeng & Xie, 2014). The percentage of multigenerational households is five times as high in China as it is in the United States: 23.5 percent versus 4 percent, respectively (Zeng & Wang, 2004). In addition, as Zeng and Xie (2014) observed, in contrast with the U.S. pattern, in which grandparents tended to substitute for parents, Chinese grandparents tended to supplement parental presence. We know that in China, married women's labor force participation rate is almost universal (Maurer-Fazio et al., 2011). Thus, the need for grandparents' childcare may provide strong motivation for a married couple to coreside with one spouse's parents (Chen et al. 2011).

However, the implications of living arrangements may be quite different for wives, especially between patrilocal coresidence and matrilocal coresidence (Chu, Xie, & Yu, 2011). In the traditional Chinese family system, marriage means that a woman has joined her husband's extended family, where older and male family members have power over younger and female members. In this system, when parents become old, they receive care and financial support from their coresidential offspring. The responsibility for caring for elderly parents, however, falls primarily on daughters-in-law in extended families (Cong & Silverstein, 2008; Cooney & Di, 1999; Whyte, 2004; Whyte & Xu, 2003; Zhan & Montgomery, 2003). Therefore, when women living in these traditional, multigenerational families become mothers, they face dual pressures in caring for both children and elderly parents-in-law. If a mother's energy is heavily consumed by family responsibilities, her performance in the labor market is negatively affected, and her earnings may suffer as a result.

The situation may be different for wives living with their own parents. In a non-traditional coresidence pattern, a couple may live with the wife's parents for practical reasons, especially the need for childcare (Chu, Xie, & Yu, 2011; Xu, 2013). In that case, there is no prescribed traditional cultural norm according to which the woman, the adult married daughter or her mother, should assume major household responsibilities. A recent study of housework division showed that in China, living with her own mother reduced a woman's housework time by about 3 hours per week, in contrast with an approximately 1-hour reduction when living with her husband's mother (Yu, 2014). Thus, couples living with wives' parents may receive more help with childcare and household chores than those living with husbands' parents. With household burden alleviated by her own parents, a mother living in a matrilocal coresidence family is better situated than a mother living in a nuclear family to handle competing demands of work and family, deliver a good performance at work, and thus receive good earnings. As for couples living independently in nuclear families, they neither receive domestic help directly from parents nor provide immediate elder care for parents. Such couples typically provide care for their children themselves, as in Western societies.

Taken together, we expect that the motherhood penalty in China should vary by living arrangement.

- Hypothesis 1** Women living with their husband's parents suffer larger motherhood penalties than those in other situations.
- Hypothesis 2** Women living with their own parents experience smaller motherhood penalties than those in other situations.
- Hypothesis 3** The motherhood penalty for mothers in nuclear families is moderate, falling between the penalties for the two types of multigenerational coresidential couples.

## Data and Measure

### Data

Our empirical analysis is based on panel data from the China Health and Nutrition Survey (<http://www.cpc.unc.edu/projects/china>). The China Health and Nutrition Survey (CHNS) is a longitudinal study starting from 1989. Capitalizing on the longitudinal nature of the CHNS, we apply the fixed effects model to eliminate the unobserved person-specific time-invariant attributes. The sample covers rural and urban areas from nine provinces--Liaoning, Heilongjiang, Shandong, Henan, Jiangsu, Hubei, Hunan, Guizhou, and Guangxi--which vary substantially in geography, economic development, and public resources. A multistage, stratified random cluster sampling method was used. Within each province, counties were stratified by income, and a Probability-to-Population-Size (PPS) sampling method was used to randomly select four counties. Finally, villages and townships within the counties were selected randomly. Although not truly nationally representative, the survey covers nine diverse provinces and can be interpreted to represent China overall. Detailed information on education, occupation, income, family, and other domains was collected from household members. The CHNS has thus far conducted eight waves (1989, 1991, 1993, 1997, 1999,



2000, 2004, 2006 and 2009). However, because information on some key variables is inconsistent or missing for the 1989, 1991 and 2009 waves, we restrict our analysis to five waves (1993, 1997, 2000, 2004 and 2006) that contain detailed fertility histories of married women. Our analysis is based on women between ages 18 and 50 in each wave. We further confine our sample to women who had positive wages and had been tracked at least twice in the study. Note that due to the sample adjustment of CHNS, respondents began participation at different times. After we deleted observations with missing values, the final sample consisted of 2,743 person-year observations from 1,058 women, and 431 women have been interviewed at least 3 three times. At the time of first interview, 29.6 percent are non-mothers, and in the final time of interview, mothers account for 17.6 percent of the final sample.

## Variables

**Dependent and key explanatory variables**—The dependent variable is the logarithm of a woman’s wage rate from her primary job, adjusted to 2006 price levels using the Consumer Price Index. We constructed this variable by dividing the respondent’s monthly wage by her monthly working hours. The key explanatory variable is a woman’s total number of children by the interview date. The CHNS collected information only on ever-married women’s fertility histories, from which we constructed the childbirth variable. For unmarried women, we assume fertility of 0. We acknowledge that such treatment may miss children born to unmarried women. However, due to traditional norms and government fertility regulations in China, out-of-wedlock childbirth is extremely rare (Raymo et al., 2015). The “Law of Population and Family Planning of P. R. China” stipulates that mothers pay large social compensation fees for out-of-wedlock births. For instance, in Beijing, the social compensation fee is usually 1 to 3 times the per capita yearly disposable income. Thus, it is reasonable to assume no births for unmarried women. Living arrangement is measured by a three-category variable: living independently, living with wife’s parents, or living with husband’s parents.

**Controls**—To explore which factors account for the motherhood penalty, we estimate full regression models that include additional explanatory variables. We use education and work experience to measure human capital. Education is measured categorically: primary school or below (reference group), middle school, high school, or college and above. Due to the lack of work history, we impute years of work experience as follows (Mincer 1974): work experience = age - schooling years - 7. We measure job characteristics with several variables. A dummy variable denotes whether the respondent’s current job is part time. Occupation consists of five broad categories: (1) professional or manager (2) clerk, service worker or commercial staff, (3) agriculture-related worker (reference group), (4) industry worker, and (5) other. The ownership of the respondent’s work unit is divided into three categories: market sector, collective sector, and state sector. To capture time availability, we include time spent on jobs other than the main wage job. Marital status is measured in four categories: “never married” (the reference category), married, divorced, and widowed. Housework is theoretically important, because it captures how women’s household burdens may impede their labor force outcomes. We measure it with two variables: daily housework hours and a dummy indicating whether the woman took care of elders in the family in the

past week. In the random effects model, we add regional variables to control for large regional variability in economic development: east coastal region (reference group), middle region, and southwest region.

### Statistical Models

We mainly apply an across-person, fixed effects regression model to estimate the effect of motherhood on women's wage rates. Compared to the ordinary least-squared (OLS) model, the fixed effects model has the advantage of overcoming potential biases caused by person-specific differences, unmeasured personal characteristics that may affect both motherhood and earnings (Budig & England, 2001; Korenman & Neumark, 1992; Waldfogel, 1997). In other words, by applying the fixed effects model, we are able to control for all invariant unobserved characteristics—i.e., intelligence, diligence, career ambition, family background, and personality traits. The fixed effects model is as follows. For the  $i$ th individual at time  $t$ , we specify:

$$\log(\text{wage rate})_{it} = \beta_0 + \beta_1(\text{birth})_{it} + \beta_2(\text{human capital controls})_{it} + \beta_3(\text{job controls})_{it} + \beta_4(\text{family controls})_{it} + e_{it};$$

$$e_{it} = \alpha_i + \mu_{it}$$

where  $e$  is an error term that contains two parts:  $\alpha_i$  denotes the person-fixed component, i.e., unobserved time-invariant characteristics, and  $\mu_{it}$  is the person-varying and time-varying component.  $\beta_0$  is the intercept, and  $\beta_1$  measures the effect of fertility on women's wages.  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$  capture the effects of human capital, job characteristics and family constraints on women's wages, respectively. We start with the bivariate baseline model with births = number of children. We then sequentially add three sets of variables to the model: human capital, job characteristics, and family constraints.

One shortcoming of the fixed effects model is that it uses up many degrees of freedom. Another is the requirement that a woman be in the labor force both before and after she gives birth. For comparison, we also estimate the random effects regression model, knowing that random effects models may suffer from biases due to unobserved but invariant characteristics. We note that women with the largest motherhood penalties are most likely to quit the labor market, and thus our fixed effects models may underestimate the average motherhood penalty.

To explore the heterogeneity in motherhood penalty by living arrangement, we run fixed effects models on three subsamples of women: living independently, living with wife's parents, and living with husband's parents. We compare the coefficient of number of children across the different models for the three subsamples, and use a Hausman test to determine whether the differences in motherhood penalty by living arrangement are statistically significant across the three subsamples.

## Results

### The Motherhood Wage Penalty in China

Table 1 shows the descriptive statistics of the variables by motherhood status. The first two columns are based on person-year observations, and the last two columns on the respondent's last observation. We observe that in our sample, wages were higher for mothers than for non-mothers. Such results, however, are due mainly to the differences in work experience between these two groups, as the average years of work experience was about 21 for mothers and 10 for non-mothers at the last observation. With respect to time use, mothers' average working hours were less than those of non-mothers, suggesting that mothers spend more time doing housework instead of paid work than non-mothers. Mothers and non-mothers had similar distributions for education and occupation.

In Table 2, we present our estimated effects of having children on women's logged wage rates using both the fixed effects and random effects models for comparison. The Hausman test indicated that fixed effects models were preferred over the random effects models. We first included only motherhood status and age to estimate the gross effect of children on women's wage rates. The results from the fixed effects model indicate that the mothers had a 20.4 percent lower wages than non-mothers. The larger effect of having children in the random effects model suggested negative selectivity into having children on unmeasured earnings-related, person-invariant characteristics. For instance, women with career ambitions tended to have both low fertility and higher earnings; without controlling for such unobserved, time-invariant personal traits, the negative effect of childbearing was overestimated. In the full model controlling for human capital factors, job characteristics, and family constraints, the motherhood penalty estimate was reduced to 15.8 percent in the fixed effects model and to 14.0 percent in the random effects model. The sizable penalty estimate that remained, however, suggests that supply-side factors could only account for a limited proportion of wage gap between mother and non-mothers.

In addition to the fertility effect, we observe the effects of some other determinants of women's wages, and we interpret those effects based on full models in Table 2. Education is included only in random effects models, as it rarely changes in women's childbearing years. Since almost all of education change after entering the labor market is due to adult education (Lai, 2014), which is closely related to promotion and salary raise in the Chinese context, coefficients of education in the fixed effects model will not represent the real effect of schooling. In the random effects model, we observe a significant positive effect of education on wage rate. Work experience played an important role in determining women's wages in both the fix-effects and random effects models. Regarding job characteristics variables, women with part-time jobs earned 18.4 percent lower wages than those with full-time jobs in the fixed effects model. Time spent in domestic labor would significantly lower women's wage rates. According to the random effects model, women living with their own parents would have significantly higher wages compared to women living with their husbands' parents and women in nuclear families, and taking care of elderly had a significant positive effect on women's wage rates. However, with unmeasured person-invariant factors controlled, living arrangements and elder-care responsibilities did not significantly influence

women's wages. We also observe a regional variation in women's wage rates in the random effects model: wage rate was highest in the Eastern Coastal area and lowest in the Southwest area.

In the preceding analysis, we have observed a significant wage gap between mothers and non-mothers. We now proceed to estimate the magnitude of wage loss for each child. Since the effect of each child on women's wages may be non-linear, we used both continuous and categorical specifications for the number of children in the fixed effects model, as shown in Table 3. The results from the continuous specification indicate that the wage penalty for each child was 16.7 percent. According to the categorical specification, compared with having no children, having first child significantly lowered women's wage rates by 13.9 percent, and having two children lowered women's wage rates by 24.0 percent. This suggests only a slight non-linearity in the effect of children, as the second child had a smaller negative effect (i.e., 10.1 percent) on mothers than the first child.

### **Motherhood Penalty and Living Arrangement**

To better understand the heterogeneity of the motherhood penalty, we show the effect of having children on women's wages separately by living arrangement in Table 4. For couples living independently, each additional child lowered the wife's wages by 14.5 percent. For couples living with the husbands' parents, the wife suffered a much larger wage penalty, 28.9 percent for each child. For couples living with the wife's parents, however, having children did not have a significant effect on the wife's wages, and thus mothers bore no wage penalty in such a living arrangement. To test whether the differences across three types of living arrangements are statistically significant, we present paired comparison results of the key explanatory variables from the Hausman test in the right columns in Table 4. The comparison results reveal that the effects of children on women's wage rates varied significantly across nuclear family, matrilineal coresidence, and patrilineal coresidence, supporting Hypotheses 1, 2 and 3.

As we discussed earlier, the key to understanding the heterogeneity in the motherhood penalty by living arrangement is to know whether the wife is a caregiver or a care receiver in a multigenerational coresidence. To address this question, in Table 5 we present descriptive statistics of variables relevant to this discussion by living arrangement and motherhood for mothers younger than 35 years old, whose children are usually very young and in need of care. Among wives living with husbands' parents, 9 percent had taken care of elderly people in the last week, compared to 4 percent of wives living with their own parents and 7 percent of wives living in nuclear families. We also present the average housework time (not including taking care of children) by living arrangement in Table 5. For wives living with husbands' parents, the average amount of housework time per day was 1.80 hours, compared with 1.36 hours for wives living with their own parents. The average amount of time spent taking care of children during the last week was also quite different depending on living arrangement, with 5.38 hours per week and 4.06 hours per week respectively for wives living with their husbands' parents vs. wives living with their own parents. These disparities suggest that family burdens, including elder care, domestic labor, and child care, are much lower for wives living with their own parents than for those living with their husbands'

parents. Hence, wives living with their own parents can devote more energy to their jobs than wives living with their husbands' parents or wives living independently, and this pattern in wives' household work may explain the variation in the motherhood penalty by living arrangement.

### Robustness Check

Our results are based on observed data and thus are subject to the possibility that a mother's number of children may be endogenous, affecting living arrangements. While we cannot eliminate the potential selection bias, we can examine whether motherhood effects differ by living arrangement in our data. We present the results of this exercise in Table 6. Among the women who have only one child, the pattern of motherhood penalty by living arrangement is similar to that in Table 4. Yet among women who have two or more children, only those women in nuclear families suffered a significant wage loss. The nonsignificant coefficients in Model 2 and Model 3 in Table 6 are largely due to the small number of women with two or more children living in a multigenerational coresidence family.

In addition, since some respondents in our sample changed their living arrangement during the survey, we did a robustness check in Table 7 to rule out the possibility that variation in the motherhood penalty by living arrangement is driven by those who changed the living arrangement in the data. We constructed a subsample excluding the respondents who had changed living arrangement. During the survey, 81 women changed to not living with parents, 24 women changed to living with their own parents, and 60 women changed to living with their husbands' parents. Based on the restricted subsample excluding those who changed living arrangement, we repeated the analysis and report the results in Table 7, which are almost the same as those in Table 4. Among women not living with parents and living with husband's parents, each child lowered the wage rate by 12.5 percent and 30.1 percent respectively. And there was still no significant negative effect of having children on the wage rate for women living with own parents.

### Conclusion and Discussion

Does motherhood affect a woman's wages in China? Using the fixed effects model to account for potential omitted-variable biases in estimating women's wages, we found a motherhood penalty of about 12 percent per child. The magnitude of motherhood penalty is slightly lower than that reported in a previous study using the same dataset but a different sample restriction. (Jia & Dong, 2013). Not much of this estimated penalty can be explained by either the human capital theory, the compensating differentials perspective, or the family constraints perspective. Thus, we are left to speculate that this penalty is likely attributable to an unmeasured productivity gap and/or employer's discrimination, the two remaining sources of the motherhood wage penalty.

Our study further compared the motherhood penalty in nuclear families to that in multigenerational families in the context of China, where multigenerational coresidence is still commonly practiced. We proposed that in multigenerational families, the existence of a motherhood penalty depends on whether a couple lives with husbands' or wife's own parents. Our results show that the motherhood wage penalty was 28.9 percent for women

living with their husbands' parents, compared with 14.5 percent for those living in nuclear families. However, women living with their own parents did not suffer a significant wage penalty. These results are consistent with our expectations. Women living in nuclear families typically bear the major responsibility of providing care for their children themselves. Compared with non-mothers, such an extra family burden of childcare may reduce job productivity and thus produce a motherhood penalty. The patrilocal coresidence is a traditional extended family model in which wives are expected to respect and care for their husbands' parents. Along with childcare, women in these traditional arrangements suffer a larger penalty due to the additional family responsibility of caring for elderly. One likely explanation is that the extra energy devoted to family responsibilities reduces those women's work productivity and thus their wage rates. Compared with living in a nuclear family or patrilocal coresidence, matrilocal coresidence is an emerging and unconventional living arrangement for women in China. Such a coresidence pattern is usually adopted for practical reasons such as the need for childcare. We found that women in matrilocal coresidence do not experience a significant wage penalty, most likely because their parents provide help with childcare and domestic labor. Our auxiliary analysis of mothers' time spent in childcare and domestic labor by living arrangement provides some support to our interpretation. With the family burden alleviated by the wife's parents, mothers are able to perform as well as non-mothers in their jobs and thus avoid the motherhood penalty.

Why do paternal grandparents only burden mothers, while maternal grandparents help them? We do not have a firm answer but wish to mention biological bonding as a possibility, as maternal grandparents, being the mother's biological parents, may be willing to make personal sacrifices to help their daughters, whereas paternal grandparents tend to follow tradition in exploiting their daughters-in-law (Pashos, 2000). Coresidence enables maternal grandparents to provide help to the mother. This is analogous to Killewald's (2013) argument that only married men living with their biological children experience the fatherhood premium.

Of course, alternative explanations are possible. For example, daughters who live with their parents after marriage may be selective in unobserved attributes – e.g., enjoying higher socioeconomic status than their husbands or having nontraditional values (Chu, Xie, & Yu, 2011; Xie & Zhu, 2009) – that may also affect their labor force outcomes so that they do not suffer motherhood penalties. The most we can claim in this paper, however, is that motherhood penalty varies by residential patterns involving extended families in China. Our findings suggest that future research on the relationship between family constraints and women's performance in the labor market should not be limited to the bargaining or specialization between husband and wife, given potential complexities being introduced by multigenerational relationships involving extended family members, especially in terms of childcare and elder care. For societies with a patriarchal culture, gender relations differ by patrilocal versus matrilocal coresidence. While this study presents, for the first time, evidence on the variation in motherhood penalty by living arrangement, we welcome future research to determine whether similar variations exist in other societies and to explore causal mechanisms for such variations.

Our study has some limitations, the most prominent being the endogeneity of living arrangement. For example, we cannot rule out the possibility of reverse causality in that mothers with wages less prone to the motherhood penalty are more likely to coreside with their own parents. In addition, the most recent wave of data is 2006, which is more than 10 years ago. In the past decade, women's education and work productivity in China have been improving significantly (Ji et al., 2017; Wu, 2014). The One-Child Policy has been relaxed since 2013. Motherhood penalty in today's China may be influenced by such social changes. In future analyses, we wish to use more recent longitudinal data with more family-related information such as the China Family Panel Study to gain more insight into the relation between childbearing and women's wage rates. Finally, deeper investigation using qualitative methods may also be useful for understanding complicated interactions and bargaining processes involving extended family members in multigenerational coresidence arrangements. For instance, aside from the proposed explanations above, wife's psychosocial stress of living with parents-in-law may also lower their job performance in the labor market. Qualitative interviews could capture subtler mental activities of women. We welcome future research further exploring this topic.

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**Table 1**

## Descriptive Statistics for Mothers and Non-mothers

	Pooled cross-sectional		Last observation per woman	
	Mothers	Non-Mothers	Mothers	Non-Mothers
Mean				
Hourly wage <sup>a</sup> (yuan/hour)	4.31 (4.63) <sup>b</sup>	3.77 (3.72)	5.45 (6.00)	4.64 (3.67)
Monthly wage (yuan)	717.53 (719.48)	636.73 (584.61)	895.24 (886.75)	777.59 (575.48)
Monthly working hour	177.31 (42.97)	180.47 (42.63)	177.69 (47.08)	179.87 (49.17)
Age	37.77 (6.23)	26.98 (6.39)	40.20 (6.27)	28.14 (6.19)
Work experience (year)	21.13 (7.14)	10.22 (6.85)	23.43 (7.37)	11.19 (6.93)
Housework hour per day	3.01 (4.84)	1.76 (4.07)	2.16 (3.61)	1.11 (3.02)
Time spent in other work (hour)	0.56 (2.01)	0.6 (1.57)	0.55 (1.96)	0.27 (1.45)
Number of children	1.23 (0.49)		1.25 (0.51)	
Percentage				
Number of children				
One child	79.50		77.96	
Two children	18.01		19.29	
Three children	2.16		2.30	
Three and above	0.32		0.46	
Marital status				
Unmarried	0.00	47.62	0.00	48.13
Married	96.69	50.79	96.21	50.80
Divorced	1.15	0.88	1.49	0.53
Widowed	2.16	0.71	2.30	0.53
Occupation				
Agriculture related	1.88	1.76	1.95	2.67
Worker	34.56	41.62	31.46	40.11
Clerk, sales and service	30.88	32.28	35.13	33.16
Manager and professional	29.18	19.22	27.21	19.25
Other	3.49	5.11	4.25	4.81
Work sector				
Market sector	18.93	34.04	26.41	47.59
State sector	49.72	40.92	51.66	36.62
Collective sector	25.60	25.04	21.93	19.79
Work type				
Full-time	93.11	88.01	89.90	80.21
Part-time	6.89	11.99	10.10	19.79
Living arrangement				
Living independently	69.85	25.93	67.26	16.58
Living with own parents	4.78	62.79	6.31	78.07
Living with husband's parents	25.37	11.29	26.43	5.35
Caring for elderly people in last week	8.90	1.79	11.14	1.07

	Pooled cross-sectional		Last observation per woman	
	Mothers	Non-Mothers	Mothers	Non-Mothers
Observations	2176	567	871	187

*Note:* Hourly wage and monthly wage are inflated by the CPI in 2006.

Numbers in parentheses are standard deviations.

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**Table 2**

Effects of Having a Child on Women's Ln Hourly Wage in Fixed Effects Models and Random Effects Models

	Fixed effects model		Random effects model	
	Net effect of fertility	Full model	Net effect of fertility	Full model
Being a mother (yes=1)	-0.204 *** (0.048)	-0.158 *** (0.054)	-0.224 *** (0.042)	-0.140 *** (0.045)
Age	0.109 *** (0.003)		0.046 *** (0.002)	
Education (reference group: primary school and below)				
Middle school				0.025 (0.041)
High school				0.198 *** (0.043)
College				0.819 *** (0.059)
Work experience		0.086 *** (0.010)		0.049 *** (0.008)
Work experience <sup>2</sup> (unit=100)		0.001 (0.024)		-0.025 (0.018)
Part time work (yes=1)		-0.184 ** (0.059)		-0.111 * (0.049)
Occupation (reference group: agriculture related)				
Worker		0.121 (0.116)		-0.012 (0.097)
Clerk, sales and service		0.109 (0.118)		-0.017 (0.098)
Manager and professional		0.186 (0.123)		0.118 (0.101)
Other		0.214 (0.134)		0.044 (0.115)
Work unit (reference group: market sector)				
State sector		-0.040 (0.049)		-0.213 *** (0.038)
Collective sector		-0.064 (0.049)		-0.328 *** (0.039)
Time spent in other work		-0.104 (0.084)		-0.267 *** (0.069)
Marital status (reference group: unmarried)				
Married		0.233 ** (0.083)		0.243 *** (0.065)
Divorced		0.162 (0.176)		0.128 (0.139)
Widowed		0.541 *** (0.157)		0.515 *** (0.119)
Housework hour per day		-0.008 *** (0.002)		-0.017 *** (0.002)
Living arrangement (reference group: living independently)				
Living with wife's parents		0.104 (0.125)		0.382 *** (0.056)
Living with husband's parents		-0.030 (0.058)		0.111 ** (0.037)
Caring for elderly people in last week (yes=1)		0.086 (0.048)		0.126 ** (0.043)
Region (reference group: north east)				
Eastern Coastal region				0.106 * (0.052)
Middle region				-0.122 * (0.049)
South west region				-0.165 *** (0.055)
Constant	-2.576 *** (0.107)	-0.644 *** (0.165)	-0.327 *** (0.075)	0.242 (0.139)

	Fixed effects model		Random effects model	
	Net effect of fertility	Full model	Net effect of fertility	Full model
Observations	2,743	2,743	2,743	2,743

*Note:* Numbers in parentheses are standard errors.

\*  $p < 0.05$ ,

\*\*  $p < 0.01$ ,

\*\*\*  $p < 0.001$ ,

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**Table 3**

Effects of Total Number of Children on Women's Ln Hourly Wage in Fixed Effects Models and Random Effects Model

	Continuous measure		Categorical measure	
	Net effect of fertility	Full model	Net effect of fertility	Full model
Number of children	-0.167 *** (0.037)	-0.122 ** (0.040)		
Total number of births (reference group: no child)				
One child			-0.174 *** (0.051)	-0.139 * (0.056)
Two children			-0.346 ** (0.089)	-0.240 * (0.097)
Three or more children			-0.372 (0.299)	-0.297 (0.322)
Age	0.110 *** (0.003)		0.110 *** (0.003)	
Work experience		0.085 *** (0.010)		0.086 *** (0.010)
Work experience <sup>2</sup> (unit=100)		0.236 (2.376)		0.001 (0.023)
Part time work (yes=1)		-0.184 ** (0.059)		-0.184 ** (0.059)
Occupation (reference group: agriculture related)				
Worker		0.126 (0.115)		0.124 (0.116)
Clerk, sales and service		0.112 (0.118)		0.110 (0.118)
Manager and professional		0.191 (0.123)		0.189 (0.123)
Other		0.211 (0.134)		0.210 (0.135)
Work unit (reference group: market sector)				
State sector		-0.038 (0.049)		-0.038 (0.050)
Collective sector		-0.062 (0.049)		-0.062 (0.049)
Time spent in other work		-0.109 (0.084)		-0.108 (0.084)
Marital status (reference group: unmarried)				
Married		0.222 ** (0.083)		0.226 ** (0.084)
Divorced		0.147 (0.176)		0.152 (0.176)
Widowed		0.520 *** (0.156)		0.526 *** (0.157)
Housework per day		-0.008 *** (0.002)		-0.008 *** (0.002)
Living arrangement (reference group: living independently)				
Living with wife's parents		0.091 (0.125)		0.094 (0.125)
Living with husband's parents		-0.030 (0.058)		-0.028 (0.058)
Caring for elderly people in last week		0.086 (0.048)		0.086 (0.048)
Region (reference group: north east)				
Eastern Coastal region				
Middle region				
South west region				
Constant	-2.586 *** (0.107)	-0.640 *** (0.165)	-2.589 *** (0.108)	-0.641 *** (0.165)
Observations	2,743	2,743	2,743	2,743

Note: Numbers in parentheses are standard errors.



\*  
 $p < 0.05,$

\*\*  
 $p < 0.01,$

\*\*\*  
 $p < 0.001,$

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**Table 4**  
Effects of Total Number of Children on Women's Ln Hourly Wage from Fixed Effects Models by Living Arrangement

	Living with husband's parents		
	Model 1	Model 2	Model 3
Number of children	-0.145*** (0.055)	0.204 (0.125)	-0.289** (0.097)
Other variables included			
Observations	1,667	460	616
Individuals	699	215	299

  

	Model 1 vs. Model 2	Model 1 vs. Model 3	Model 2 vs. Model 3
	-0.348** (0.111)	-0.144 <sup>†</sup> (0.080)	0.492*** (0.077)

Note: Numbers in parentheses are standard errors.

<sup>†</sup>  $p < 0.1$ ,

\*  $p < 0.05$ ,

\*\*  $p < 0.01$ ,

\*\*\*  $p < 0.001$ .

We control for all variables in Table 2 except for living arrangements.

**Table 5**

Descriptive Statistics for Selected Variables by Living Arrangement for Mothers Younger than 35 Years Old

	Living independently	Living with wife's parents	Living with husband's parents
Caring for elderly people in last week	0.07 (0.26)	0.04 (0.21)	0.09 (0.29)
Housework time per day (hour)	1.92 (1.87)	1.36 (1.85)	1.80 (2.03)
Time spent taking care of children under 6 years old last week (hour)	3.07 (12.69)	4.06 (9.97)	5.38 (13.94)
Observations	388	63	295

*Note:* Numbers in parentheses are standard deviations.

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**Table 6**  
Effects of Total Number of Children on Women's Ln Hourly Wage from Fixed Effects Models by Living Arrangement

	Not living with parents			Living with wife's parents			Living with husband's parents		
	Model 1	Model 2	Model 3	Model 1 vs. Model 2	Model 1 vs. Model 3	Model 2 vs. Model 3			
Total number of births (reference group: no child)									
One child	-0.140* (0.0841)	0.145 (0.142)	-0.338*** (0.114)	-0.285* (0.115)	-0.198** (0.077)	0.483*** (0.085)			
Two children	-0.316*** (0.121)	0.783 (0.506)	-0.300 (0.349)	1.099* (0.491)	0.016 (0.326)	1.083*** (0.366)			
Three or more children	-0.306 (0.456)		-0.961 (0.698)		-0.655 (0.528)				
Other variables included									
Observations	1,667	460	616						
Individuals	699	215	299						

Note: Numbers in parentheses are standard errors.

\*  $p < 0.05$ ,

\*\*  $p < 0.01$ ,

\*\*\*  $p < 0.001$ .

We control for all variables in Table 2 except for living arrangements.

**Table 7**

Effects of Total Number of Children on Women's Ln Hourly Wage from Fixed Effects Models by Living Arrangement (Excluding Shifters)

	Living with husband's parents		
	Model 1	Model 2	Model 3
Number of children	-0.125* (0.0575)	0.258 (0.134)	-0.301** (0.105)
Other variables included			
Observations	1,537	429	505
Individuals	618	191	239

  

	Model 1 vs. Model 3	Model 2 vs. Model 3
Number of children	-0.375** (0.121)	-0.175* (0.087)
Other variables included		
Observations		
Individuals		

Note: Numbers in parentheses are standard errors.

\*  $p < 0.05$ ,

\*\*  $p < 0.01$ ,

\*\*\*  $p < 0.001$ .

We control for all variables in Table 6 except for living arrangements.