Educational Assortative Mating and Motherhood Penalty in China

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This is the accepted version of the following article:

Cheng, C., & Zhou, Y. (2024). Educational assortative mating and motherhood penalty in China. *Research in Social Stratification and Mobility, 89,* 100873.

, which has been published in final form at https://doi.org/10.1016/j.rssm.2023.100873

Abstract

Mothers earn less than comparable childless women, and such motherhood penalty differs in magnitude by women's socioeconomic and demographic characteristics. Prior research, however, has rarely considered how the effect of parenthood on women's income may also depend on the characteristics of their partners. Using data from the China Family Panel Studies 2010–2018, we examine how the effects of motherhood on women's earnings and within-couple income inequality vary by couples' educational pairings in China. A large educational gap between spouses–hypergamy or hypogamy–exacerbates the motherhood penalty on a woman's individual income and her share of the couple's combined income. However, when the educational gap between spouses is moderate, hypergamy lessens the motherhood penalty on women's individual income, whereas hypogamy mitigates the penalty on their share of couples' combined earnings. In the context of China's declining fertility, narrowing gender gap in education, and widening gender pay gap, these findings provide descriptive empirical evidence on how the motherhood penalty varies by educational assortative mating and underscore the significance of considering couple dynamics in understanding the motherhood penalty.

Keywords

Motherhood Penalty; Educational Assortative Mating; Gender; Income; China.

Highlights

• The motherhood penalty varies by couples' educational pairings in China.

• Two-level heterogamy–hypergamy or hypogamy–exacerbates the motherhood penalty.

• One-level hypergamy lessens the motherhood penalty on women's individual income.

• One-level hypogamy mitigates the motherhood penalty on women's share of income.

1. Introduction

Studies in many societies, including China, have consistently shown evidence of the "motherhood penalty," i.e., mothers earning less than comparable childless women (de Linde Leonard & Stanley, 2020; Yu & Xie, 2018; Zhao, 2018). Existing research also suggests that the degree of the motherhood penalty differs by women's education. Highly educated mothers may face a larger penalty, as the loss of experience is more costly for them (England et al., 2016). On the other hand, they might also secure jobs with better work-family balance and have the means to outsource housework, thereby reducing the penalty (Amuedo-Dorantes & Kimmel, 2005; Killewald, 2011). In the context of China, prior research also shows variations in the motherhood penalty by women's education (Shen, 2022; Yu & Xie, 2014).

However, few studies have considered how the effect of parenthood on a woman's income may depend on not only her own education but also whom she marries. Decisions around parenthood and divisions of labor often involve both partners (Killewald & García-Manglano, 2016), and work-family arrangements tend to differ depending on spousal differences in education (Van Bavel et al., 2018). Therefore, the motherhood penalty may vary in magnitude by couples' educational pairings. Using longitudinal data from the China Family Panel Studies (CFPS), we examine how the motherhood penalty differs by educational assortative mating in China, where the gender gap in education has declined, but the gender wage gap has widened.

We conceptualize the economic consequences of motherhood in two dimensions, a woman's absolute income, i.e., her individual earnings, and relative income, i.e., her share of the couple's combined income. The few existing studies that have considered educational pairings examine the effect of motherhood on women's relative income in Europe (Dotti Sani, 2015; Klesment & Van Bavel, 2017; Nylin et al., 2021; Van Bavel & Klesment, 2017). However, how motherhood penalties vary by educational pairings may differ for absolute and relative income. Absolute income entails labor market performance, capturing potential motherhood effects on wage, employment, occupation, and work hours (Dribe & Nystedt, 2013). On the other hand, relative income indicates within-couple inequality, reflecting relative status and power differentials between spouses (Musick et al., 2020). Together, our study provides insight into the implications of educational assortative mating for mothers' earnings and within-couple income inequality and highlights the significance of couple dynamics in understanding the motherhood penalty.

China offers a particularly interesting context for this study. First, marriage and childbearing are nearly universal in China, with a short gap between the time of marriage and the time of first birth. Non-marital childbearing is extremely rare (Yu & Xie, 2021). The strong linkage between marriage and childbearing in China underscores the necessity to consider spousal dynamics in understanding the effect of parenthood. Second, the progress toward gender equality has been uneven in China. While the gender gap in education has been closing in recent decades and has even reversed in urban China among recent birth cohorts (Wu & Zhang, 2010), gender inequality has increased in many other aspects (Ji et al., 2017). In the public sphere, female labor force participation has declined, the gender pay gap has widened, and gender-based occupational segregation has increased (He & Wu, 2017). Meanwhile, in the private sphere, women still shoulder the majority of domestic responsibilities, and few couples would regard the gender division of labor as unfair (Zuo & Bian, 2001). Partly due to the unequal division of household

labor, married women and mothers face significant disadvantages in labor market outcomes (Zhang et al., 2008). The motherhood wage penalty has been increasing over the past three decades (Shen, 2022; Zhang & Hannum, 2015). Despite the transition from the previous anti-natalist family planning policy to the current universal three-child policy, China's total fertility rate remains low and continues to decline, suggesting the persistent challenges Chinese women face in achieving work-family balance. The motherhood penalty is especially large for women living with their husbands' parents (Yu & Xie, 2018) and when they have very young children (Zhao, 2018). However, how motherhood affects within-couple income inequality and how the motherhood penalty varies by educational assortative mating remain unknown. Finally, educational homogamy has significantly increased over the past century in China (Dong & Xie, 2023). In tandem with the rapid improvement in women's education (Treiman, 2013), educational hypogamy (wives more educated than husbands) has also gradually increased among recent marriage cohorts (Han, 2010). However, couples' preference for status hypergamy (women marrying men of higher status) persists (Mu & Xie, 2014). Our study contributes to understanding the implications of educational assortative mating patterns for the motherhood effect on women's individual earnings and within-couple income inequality.

2. Theoretical framework

In this section, we discuss theoretical accounts of how educational assortative mating may moderate the effect of motherhood on women's income. We argue that how motherhood penalties vary by educational pairings may differ for absolute and relative income.

First, in terms of relative income, educational hypergamy (wives less educated than husbands) may exacerbate the motherhood penalty, while educational hypogamy (wives more educated than husbands) may mitigate it. Educational pairing reflects spousal differences in bargaining resources (Blood & Wolfe, 1960; Cheng & Xie, 2023). According to relative resources theory, spouse with more resources relative to the other has more bargaining power to negotiate for desired outcomes. Therefore, women in hypogamy may have more resources to bargain for a more egalitarian division of labor (Van Bavel et al., 2018; Yu & Xie, 2011). Conversely, women in hypergamy are more dependent on their husbands and perform more unpaid domestic labor in exchange for their partner's economic resources (Brines, 1994). Thus, relative resources theory would predict that women in hypergamy may experience a larger penalty, given a more gendered division of labor where she focuses more on domestic work (Klesment & Van Bavel, 2017). In contrast, women in hypogamy may experience a smaller penalty, especially on their relative income, as they often contribute a substantial proportion of family income (Hannum et al., 2013; Van Bavel et al., 2018). Consistent with these predictions, existing research in Europe shows that women in hypogamy experience a smaller motherhood penalty on relative earnings (Klesment & Van Bavel, 2017; Nylin et al., 2021; Van Bavel & Klesment, 2017). Prior research in China has found evidence in support of relative resource bargaining in the division of household labor (Kan & He, 2018; Yu, 2014). Therefore, we hypothesize that in China, compared to homogamy, women experience a smaller motherhood penalty on relative income in hypogamy but a larger penalty in hypergamy.

Second, in terms of absolute income, hypogamy may exacerbate the motherhood penalty, while hypergamy may mitigate it. Different from relative income, which signifies within-couple

inequality, absolute income more directly mirrors labor market performance. While relative resources theory sheds light on within-couple division of labor and relative earnings, social capital theory provides a useful framework for understanding how educational assortative mating may moderate the motherhood penalty on absolute income. Social capital theory underscores the significance of social networks for one's career trajectories (Lin et al., 1981), and the spouse is part of one's social capital (Komter et al., 2012). A partner more educated than oneself can provide one with access to information and social networks conducive to career development (Dribe & Nystedt, 2013), which may bear more on one's labor market performance and thus absolute income. A more educated partner can also augment one's productivity by transmitting knowledge and skills and providing guidance and emotional support (Brynin & Francesconi, 2004). Research in Sweden suggests that women's absolute income grows slower in hypogamy, partly due to less access to spousal resources (Dribe & Nystedt, 2013). In China, social connections (*guanxi*) play a crucial role in job searches and career advancement (Bian, 1994). Spouses serve as essential bridges between job seekers and their ultimate helpers (Bian, 1997). Prior research in China has shown that higher levels of husbands' education can boost their wives' earnings (Huang et al., 2009). Thus, in terms of absolute income, we hypothesize that women experience a larger penalty in hypogamy but a smaller penalty in hypergamy where they have better access to career-facilitating spousal resources.

Finally, there may be heterogeneity depending on the size of educational differences between spouses. When the educational difference between spouses is large—at least two levels different—both hypergamy and hypogamy may exacerbate the motherhood penalty on absolute and relative income. In the case of hypergamy where the wife's education is at least two levels lower than her husband's, spousal networks are likely to be less relevant for her career due to gender specialization. Thus, hypergamy of large educational gaps may exacerbate the motherhood penalty on both absolute and relative income. In the case of hypogamy where the wife's education significantly surpasses her husband's, she may engage in "gender display" to compensate for the deviance from the norm of hypergamy (Brines, 1994). She may perform more housework to display her femininity and refrain from outearning her husband (Bertrand et al., 2015; Van Bavel et al., 2018). In such cases, gender norms, rather than relative resources, determine the household division of labor (Bittman et al., 2003). Prior research has found evidence of gender display in rural China where gender norms are more traditional (Kan & He, 2018; Yu & Xie, 2011). Thus, in contrast to relative resources theory, gender theory would argue that women in hypogamy may experience a larger penalty on their income through the gender display of housework performance (Dribe & Nystedt, 2013). As gender display is more pronounced at higher ends of spousal differences in socioeconomic status, we hypothesize that women experience a larger motherhood penalty in hypogamy where their education level significantly surpasses that of their husbands.

In summary, based on relative resources theory, social capital theory, and gender theory, we derive the following theoretical expectations. Compared to homogamy:

Hypothesis 1 Hypogamy mitigates the penalty on women's relative income, given more relative resources, but exacerbates the penalty on absolute income, given limited spousal resources.

Hypothesis 2 Hypergamy mitigates the penalty on women's absolute income, given more access to spousal resources, but exacerbates the penalty on relative income, given lower relative resources.

Hypothesis 3: When the educational difference between spouses is large, both hypergamy and hypogamy exacerbate the motherhood penalty on absolute and relative income, given gender display in hypogamy and the traditional division of labor in hypergamy.

3. Methods

3.1. Data and sample

Data are from the China Family Panel Studies (CFPS), a nationally representative longitudinal biennial survey of Chinese households and their individual members since 2010 (Xie & Hu, 2014). We limited our analysis to 2010, 2012, 2014, and 2018 surveys in which personal income was consistently measured. The analytic sample consisted of women interviewed in at least two waves; data were organized into person-waves. We imposed the following restrictions to construct our analytic sample. First, we restricted to waves where women were aged 20–49 because most women would have finished their education by the age of 20 and completed childbearing by the age of 49. Second, we restricted to waves where women were married and living with their husbands and where both women and their husbands were interviewed, which were necessary conditions for a couple's combined income to be observed. The few women who changed partners were excluded so that educational assortative mating was predetermined during the observation window and not subject to change due to remarriages. Third, we restricted to waves where the combined income of a woman and her husband was not zero to study within-couple income inequality. Waves, where a woman earned zero income, were included as long as her husband earned some income because an income drop to zero following parenthood may be considered as a form of the motherhood penalty. Finally, we excluded women who remained childless during the entire study period and waves where a woman's first-born child was over 15 years old to examine changes in women's income over motherhood stages where work-family conflicts were more intense. The final analytic sample consisted of 6,767 person-year observations from 2,713 women.

3.2. Measurement

We examined two income outcomes. Absolute income was measured by a woman's annual individual income after tax[1]. All values were logged and CPI-adjusted in constant 2009 *yuan*. Absolute income captures possible motherhood effects on wages, work hour adjustments, job changes, and employment status transitions. To examine within-couple income inequality, we further examined relative income, measured by a woman's share of the couple's combined income, i.e., her income divided by the sum of her and his income and multiplied by a hundred. We tested two forms of motherhood effect. The number of children measured the effect of additional births and included three categories, no child (reference group), one child, and two or more children.

[1] For women with zero income, their logged income was the log of 0.1 cents.

Time from first birth allowed us to examine how the motherhood effect unfolded over time. We measured time from first birth as years since the birth of the first child: <0 (before the birth of the first-born, reference group), 0–3, 4–6, 7–9, 10–12, and 13–15.

Educational assortative mating was measured as educational pairings of the couple. Each spouse's education included three levels, elementary school or less (*Low*), middle school (*Med*), and high school or above (*High*). We combined individuals with a high school education and those with a university education or above given the sample distribution, so that there were sufficient cases in each educational pairing. Thus, there were nine possible educational pairings:

(1) *Wife Low – Husband Low* (low-education homogamy),
(2) *Wife Low – Husband Med* (one-level hypergamy),
(3) *Wife Low – Husband High* (two-level hypergamy),
(4) *Wife Med – Husband Low* (one-level hypogamy),
(5) *Wife Med – Husband Med* (medium-education homogamy),
(6) *Wife Med – Husband High* (one-level hypergamy),
(7) *Wife High – Husband Low* (two-level hypogamy),
(8) *Wife High – Husband Med* (one-level hypogamy),
(9) *Wife High – Husband High* (high-education homogamy).

This categorization allows us to make several important distinctions. First, in line with prior research on how the motherhood penalty varies by women's own education, we are able to compare women in homogamy of low education to those in homogamy of high education. Second, to further consider how the effect of parenthood on women's income depends on the relative education between spouses, we draw distinctions between homogamy, hypergamy, and hypogamy. Finally, to test the hypotheses derived from relative resources, gender display, and social capital theories, we consider heterogeneity depending on the size of educational differences between spouses. Specifically, we distinguish women whose education differs from their husbands by one level (one-level hypergamy/hypogamy) from women whose education differs from their husbands by two levels or more (two-level hypergamy/hypogamy).

We adjusted for several time-varying control variables that may be associated with motherhood status and income outcomes based on a review of the motherhood penalty literature in China (Shen, 2022; Yu & Xie, 2018; Zhang et al., 2008; Zhao, 2018) and Western societies (Cukrowska-Torzewska & Matysiak, 2020; Gough & Noonan, 2013). First, we controlled for women's potential work experience and its squared term. Potential work experience, commonly used to approximate exact experience, was a function of a woman's age and years of education. Second, we accounted for women's and their husbands' respective employment status, including whether one was employed, whether one was employed in the public sector, whether one was non-farm employed, and whether one was self-employed. Third, we adjusted for several household characteristics, including whether women lived with their own parents, whether women lived with their parents-in-law, urbanicity of residence, and the province of residence. The descriptive statistics and the model results for these time-varying controls are available in Tables A1–A3 in the Appendix.

3.3. Analytic strategy

We employed fixed effects models to examine how the number of children and time from first birth affect women's absolute and relative income. Fixed effects models accounted for all time-invariant characteristics associated with motherhood status, educational pairings, and income outcomes. For each income measure (*Y*) of woman *i* at wave *t*, we tested two models: the effect of number of children (*N*) by educational pairings (*E*), as expressed in Eq. (1), and the effect of time from first birth (*T*) by educational pairings, as expressed in Eq. (2). All models adjusted for the time-varying covariates (*X*). The model testing the effect of time from first birth (Eq. (2)) also controlled for the number of children. The reference category for educational pairings is homogamy of low education (*Wife Low – Husband Low*). Thus, in Eq. (1), β_1 is the effect of births, given homogamy of low education (reference group); β_2 is the additional effect of births for other types of educational pairing. Similarly, in Eq. (2), γ_1 is the effect of time from first birth, given homogamy of low education; γ_2 is the additional effect of time from first birth for other types of educational pairing.

$$Y_{\mathrm{it}} = \beta_0 + \beta_1 N_{it} + \beta_2 N_{it} \times E_i + \beta_3 X_{it} + \alpha_i + \mu_{it} \quad (1)$$

$$Y_{\mathrm{it}} = \gamma_0 + \gamma_1 T_{it} + \gamma_2 T_{it} \times E_i + \gamma_3 X_{it} + \gamma_4 N_{it} + \delta_i + \varepsilon_{it} \quad (2)$$

4. Results

4.1. Descriptive statistics

Table 1 shows the descriptive statistics of women's income, motherhood status, and educational assortative mating patterns. On average, women contributed 30.82% of couples' combined income. Across all person-waves, 5.6% of the sample had no child, and 36% had two or more children. At the baseline interview in 2010, about 10% of the sample was childless; by the time of the last interview in 2018, about 54% had at least two children (results not shown). Homogamy was the predominant form of educational pairing, especially among high-school graduates. Hypergamy was more prevalent than hypogamy. Heterogamy with large educational gaps between spouses was the least common.

[Table 1 about here]

4.2. Regression results

Tables 2 and 3 present the fixed effects model results on the effect of the number of children and time from first birth, respectively. To visualize and facilitate the interpretation of how the motherhood effects vary by educational assortative mating, we plotted predicted changes in women's logged income and income share by motherhood and educational pairing in Fig. 1 and Fig. 2, based on the results in Table 2 and Table 3, respectively. Fig. 1 illustrates the effects of additional births on a woman's logged income and her share of the couple's income and how these effects vary by educational assortative mating. Fig. 2 shows how the effects of motherhood on

women's absolute and relative income unfold over time and by educational assortative mating. The line type represents the type of educational assortative mating, with homogamy in solid lines, hypergamy in dotted lines, and hypogamy in dashed lines. In particular, the loose-dashed lines denote hypogamy of large educational gaps where the husband's education is at least two levels lower than the wife's. The loose-dotted lines denote hypergamy of large educational differences where the husband's education is at least two levels higher than the wife's. The line color represents the level of the wife's education, with low education in orange, medium education in red, and high education in black.

[Fig. 1 and Fig. 2 about here]

The results reveal three major findings. First, among women in homogamy, the motherhood penalty declined with education. As shown in Table 2 and Table 3, the interaction terms for homogamy of high education (*Wife High – Husband High*) were positive and significant in all models. In other words, the motherhood effect was significantly smaller for women in homogamy of high education than for women in homogamy of low education (*Wife Low – Husband Low*). Fig. 1 illustrates this difference visually: Women in homogamy of high education (solid black line, *Wife High – Husband High*) experienced smaller penalties on both absolute and relative income at additional births than women in homogamy of low education (solid orange line, *Wife Low – Husband Low*). This finding aligns with existing research that shows a mitigating effect of women's own education on the motherhood penalty (Shen, 2022). Moreover, the gap between homogamy of high education and homogamy of low education widened over time. As shown in Fig. 2, while high-educated women in homogamy started to recover from the motherhood penalty over the years, the motherhood penalty on low-educated women in homogamy persisted and even aggravated, perhaps due to cumulative disadvantages over time. High-educated women, except for those married to low-educated men (loose-dashed black line, *Wife High – Husband Low*), experienced minimal penalties on both absolute and relative income over time. This is evident whether they were married to equally high-educated men (solid black line, *Wife High – Husband High*) or to men with middle school education (dashed black line, *Wife High – Husband Med*).

Second, when the educational difference between spouses was large, women in both hypergamy and hypogamy experienced large motherhood penalties on absolute and relative income, consistent with *Hypothesis 3*. As shown in Table 2 and Table 3, the interaction terms for two-level hypogamy (*Wife High – Husband Low*) and two-level hypergamy (*Wife Low – Husband High*) were not significant in all models. In other words, the motherhood effect for women in two-level heterogamy was just as substantial as that for women in homogamy of low education (*Wife Low – Husband Low)*. Fig. 1 illustrates these patterns visually: Women in heterogamy where their husbands' education was two levels higher (loose-dotted orange line, *Wife Low – Husband High*) or two levels lower (loose-dashed black line, *Wife High – Husband Low*) experienced the largest motherhood penalties on both absolute and relative income at additional births. These disadvantages also persisted over time, as shown in Fig. 2.

Third, when the educational difference between spouses was moderate, the effect of motherhood differed for absolute and relative income. Consistent with *Hypothesis 2*, women in hypergamy, where their husbands' education was one level higher, experienced smaller penalties on their absolute income. Fig. 1 depicts this finding visually: Women with elementary education married

to middle-school-educated men (dotted orange line, *Wife Low – Husband Med*) and women with middle school education married to high-school-educated men (dotted red line, *Wife Med – Husband High*) experienced smaller penalties on absolute income at second births compared to women in homogamy. In addition, Fig. 2 further reveals that the motherhood penalty on absolute income lessened over time among middle-school-educated women married to high-school-educated men (dotted red line, *Wife Med – Husband High*). This observation resonates with social capital theory, suggesting that access to the resources of their high-school-educated partners may have helped middle-school-educated mothers recover from childbearing-related work disruptions, especially after their children started to enter school.

While middle-school-educated women married to high-school-educated men experienced smaller penalties on absolute income, middle-school-educated women married to low-educated men experienced smaller penalties on relative income, which lends support to *Hypothesis 1*. Women with middle school education married to men with elementary school education or less (dashed red line, *Wife Med – Husband Low*) experienced smaller penalties on relative income at first birth, as shown in Fig. 1, especially in early childhood, as shown in Fig. 2.

[Tables 2 and 3 about here]

5. Discussion

Consistent with prior research (Yu & Xie, 2018; Zhao, 2018), we find that the motherhood penalty on women's income persists over the life course in China. However, the magnitude of the motherhood penalty depends on women's and their partners' education. Prior research suggests that while highly educated women have higher opportunity costs, they may also hold jobs that provide better work-family balance and promotion opportunities and possess greater economic resources to outsource domestic labor. Our results suggest that women in homogamy at low levels of education experience larger penalties than women in homogamy of high education levels.

While most prior research examines how the degree of the motherhood penalty varies by women's own education, our study further considers the impact of couple dynamics and examines how motherhood penalties vary by couples' educational pairings. Our results suggest that the motherhood penalty depends on not only a woman's own education but also whom she marries. Heterogamy, with large educational differences between spouses, tends to exacerbate motherhood penalties on both absolute and relative income. Women in hypergamy, where their husbands' education was two levels higher, experience large motherhood penalties, given lower relative resources and a more gendered division of labor. Meanwhile, women in hypogamy, where their husbands' education was two levels lower, also experience large motherhood penalties, given limited spousal resources and gender display.

When spousal differences in education are moderate, hypergamy lessens the motherhood penalty on women's *absolute* income, whereas hypogamy mitigates the penalty on women's *relative* income. Hypergamy allows better access to spousal resources, which can facilitate career development and has more bearings on absolute income, an indicator of labor market performance. In contrast, women in hypogamy have higher relative earnings potential and opportunity costs,

which are more consequential for within-couple division of labor and have larger impacts on relative income, an indicator of within-couple income inequality.

Our study provides descriptive empirical evidence on how the motherhood penalty varies by educational assortative mating in China. Based on the existing literature, we discussed several theoretical mechanisms of how educational pairings may moderate the motherhood effects through relative resource bargaining and gender display of domestic labor and access to career-facilitating spousal networks. Limited by the data, we could not further empirically test these mediating mechanisms. In addition, couples may self-select into certain types of marriage based on their preferences for marriage and childbearing, labor force participation, and involvement in housework and childcare. Women with lower earnings potential may choose hypergamy, taking on more family responsibilities in exchange for spousal income (Hannum et al., 2013). On the other hand, women who seek more egalitarian divisions of labor may enter hypogamy where they tend to have more bargaining power. These selection mechanisms, consistent with the theoretical mechanisms we discussed previously, reflect how educational assortative mating may be associated with household divisions of labor, which in term affects the parenthood effect on individual income and within-couple income inequality. Future research with appropriate data may further explore these underlying mechanisms.

Our study points to several other directions for future research. First, we measured income by annual individual income, capturing possible motherhood effects on wages, work hour adjustments, job changes, and employment status transitions. Future research may expand on how educational assortative mating moderates the motherhood effect on each specific dimension, such as labor input and labor supply. In the U.S., White women are more likely to work part-time or drop out of the labor force after childbirth compared to Asian American women (Greenman, 2011). However, in China, most women remain in the labor force after giving birth (Yu & Xie, 2014). The level of female labor supply recovers in about four years after childbirth, and women with higher levels of education experience smaller penalties on their labor supply (Yang & He, 2022).

Second, although we analyzed variations in the motherhood penalty by time from first birth, it is important to note that these trends are still relatively short-term. Future studies may explore longer-term outcomes, delving into aspects such as the couple's respective income trajectory over the life course. Additionally, it may be fruitful to examine the differential effects of motherhood on family-level economic well-being in the long run, such as family income (Hannum et al., 2013; Kim & Sakamoto, 2017) and wealth (Cheng & Zhou, 2022).

Third, our study focuses on variations in the motherhood penalty by educational assortative mating. However, couples may sort on various characteristics beyond educational attainment and exchange different traits, which can influence couple dynamics and in turn affect the level of motherhood penalty. Future studies can examine how other dimensions of assortative mating can moderate the motherhood penalty.

Finally, in the Chinese context, temporal and spatial variations in the motherhood penalty are worth exploring. Macro-level changes in the education system, labor market, and gender ideology associated with market transition can affect the level of motherhood penalty over time (Shen, 2022; Zhang & Hannum, 2015). The motherhood penalty may also differ in rural and urban areas, given

rural-urban differences in economic development and gender norms (Yu & Xie, 2011). Prior research also finds that the motherhood penalty varies by intergenerational living arrangements (Yu & Xie, 2018). Unpacking how spousal dynamics interact with familial and societal factors in shaping women's labor market outcomes around parenthood would further extend our understanding of the heterogeneity in the motherhood penalty.

Together, our study shows that educational assortative mating has important implications for both women's personal earnings and within-couple income inequality. Decisions around parenthood, including the quantum and timing of fertility, division of market and household labor, and resource exchange, are negotiated at the couple level (Musick et al., 2020; Van Bavel & Klesment, 2017). Taking into account of spousal dynamics when studying the effect of parenthood is especially relevant to the context of East Asia, given the strong linkage between marriage and childbearing in these societies (Raymo et al., 2015). With the large increase in educational homogamy in contemporary China (Dong & Xie, 2023) and the persistent challenges Chinese women face in achieving work-family balance (Ji et al., 2017), our study underscores the significance of considering couple dynamics in understanding motherhood penalties.

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Tables and Figures

Table 1. Descriptive statistics of women's income, motherhood status, and educational assortative mating patterns.

	Mean/%	SD
Income Outcomes		
Logged Income	3.85	7.72
Income Share (%)	30.82	31.68
Motherhood Status		
Number of Children (%)		
0	5.59	
1	58.39	
2+	36.03	
Time from First Birth (%)		
< 0	3.66	
0–3	20.88	
4–6	19.52	
7–9	19.65	
10–12	19.88	
13–15	16.40	
Educational Assortative Mating (%)		
Wife Low – Husband Low	16.85	
Wife Low – Husband Med	11.26	
Wife Low – Husband High	3.04	
Wife Med – Husband Low	8.20	
Wife Med – Husband Med	18.80	
Wife Med – Husband High	8.98	
Wife High – Husband Low	2.20	
Wife High – Husband Med	6.61	
Wife High – Husband High	24.06	
N (person)	2,713	
N (person-year)	6,767	

Note: Descriptive statistics of time-varying control variables are available in Table A1 in the Appendix.

Table 2. Fixed effects models of women's income by number of children and educational assortative mating.

	Model 1 Logged Income		Model 2 Income Share	
	B	(SE)	B	(SE)
Number of Children (ref. = 0)				
1	–5.19***	(1.47)	–16.02**	(6.06)
2+	–8.97***	(1.60)	–24.85***	(6.63)
Number of Children × Educational Assortative Mating (ref. = Wife Low – Husband Low)				
One Child × Wife Low – Husband Med	2.57	(2.17)	1.72	(9.00)
One Child × Wife Low – Husband High	–0.39	(3.78)	–3.07	(15.63)
One Child × Wife Med – Husband Low	1.31	(2.09)	18.44*	(8.66)
One Child × Wife Med – Husband Med	1.54	(1.83)	11.07	(7.57)
One Child × Wife Med – Husband High	1.42	(2.01)	9.06	(8.32)
One Child × Wife High – Husband Low	–0.39	(2.71)	–5.84	(11.22)
One Child × Wife High – Husband Med	1.49	(2.15)	2.53	(8.92)
One Child × Wife High – Husband High	3.68*	(1.62)	11.18†	(6.72)
Two+ Children × Wife Low – Husband Med	4.87*	(2.38)	11.67	(9.84)
Two+ Children × Wife Low – Husband High	1.41	(3.66)	1.38	(15.17)
Two+ Children × Wife Med – Husband Low	3.36	(2.33)	17.82†	(9.63)
Two+ Children × Wife Med – Husband Med	2.83	(1.98)	15.61†	(8.21)
Two+ Children × Wife Med – Husband High	6.71**	(2.25)	15.45†	(9.30)
Two+ Children × Wife High – Husband Low	0.16	(3.26)	–2.33	(13.48)
Two+ Children × Wife High – Husband Med	5.64*	(2.41)	8.18	(9.96)
Two+ Children × Wife High – Husband High	6.84***	(1.85)	13.74†	(7.64)
Time-Varying Controls	Yes		Yes	
N (person)	2,713		2,713	
N (person-year)	6,767		6,767	

Notes: All models controlled for women's potential work experience and its squared term, women's and their husbands' respective employment status (whether one was employed, whether one was employed in the public sector, whether one was non-farm employed, and whether one was self-employed), whether women lived with their own parents, whether women lived with their parents-in-law, urbanicity of residence, and the province of residence. Full model results are available in Table A2 in the Appendix.
†p <.1; *p<.05; **p<.01; ***p<.001.

Table 3. Fixed effects models of women's income by time from first birth and educational assortative mating.

	Model 3 Logged Income		Model 4 Income Share	
	B	(SE)	B	(SE)
Time from Birth (ref. = <0)				
0–3	–6.80***	(1.99)	–23.86**	(8.28)
4–6	–8.23***	(2.19)	–25.80**	(9.13)
7–9	–7.68***	(2.30)	–24.06*	(9.55)
10–12	–8.95***	(2.45)	–30.54**	(10.21)
13–15	–11.78***	(2.61)	–33.87**	(10.85)
Time from First Birth × Educational Assortative Mating (ref. = Wife Low – Husband Low)				
0–3 × Wife Low – Husband Med	6.14*	(2.83)	9.20	(11.77)
0–3 × Wife Low – Husband High	–5.22	(6.56)	–12.97	(27.27)
0–3 × Wife Med – Husband Low	3.41	(2.78)	28.96*	(11.58)
0–3 × Wife Med – Husband Med	3.92†	(2.35)	15.18	(9.79)
0–3 × Wife Med – Husband High	5.79*	(2.52)	21.40*	(10.50)
0–3 × Wife High – Husband Low	2.22	(3.28)	–0.60	(13.64)
0–3 × Wife High – Husband Med	6.70*	(3.00)	24.01†	(12.47)
0–3 × Wife High – Husband High	6.69**	(2.11)	21.25*	(8.79)
4–6 × Wife Low – Husband Med	7.17*	(3.01)	11.03	(12.54)
4–6 × Wife Low – Husband High	–2.64	(6.34)	–12.12	(26.36)
4–6 × Wife Med – Husband Low	3.21	(2.99)	20.04	(12.42)
4–6 × Wife Med – Husband Med	5.79*	(2.51)	18.45†	(10.44)
4–6 × Wife Med – Husband High	9.93***	(2.72)	24.13*	(11.31)
4–6 × Wife High – Husband Low	1.52	(3.64)	–9.05	(15.13)
4–6 × Wife High – Husband Med	8.18**	(3.15)	21.88†	(13.11)
4–6 × Wife High – Husband High	9.45***	(2.29)	21.73*	(9.52)
7–9 × Wife Low – Husband Med	5.60†	(3.05)	5.24	(12.68)
7–9 × Wife Low – Husband High	–1.32	(6.57)	–7.87	(27.33)
7–9 × Wife Med – Husband Low	4.74	(3.06)	24.03†	(12.71)
7–9 × Wife Med – Husband Med	5.52*	(2.54)	19.99†	(10.58)
7–9 × Wife Med – Husband High	9.09**	(2.77)	26.35*	(11.51)
7–9 × Wife High – Husband Low	4.52	(3.81)	–1.35	(15.83)
7–9 × Wife High – Husband Med	9.50**	(3.24)	22.92†	(13.47)
7–9 × Wife High – Husband High	9.28***	(2.33)	18.84†	(9.71)

10–12 × Wife Low – Husband Med	7.52*	(3.14)	12.87	(13.06)
10–12 × Wife Low – Husband High	0.80	(6.67)	0.27	(27.73)
10–12 × Wife Med – Husband Low	5.77†	(3.15)	28.80*	(13.10)
10–12 × Wife Med – Husband Med	6.29*	(2.64)	20.77†	(10.97)
10–12 × Wife Med – Husband High	12.42***	(2.92)	26.48*	(12.14)
10–12 × Wife High – Husband Low	4.46	(4.07)	2.56	(16.93)
10–12 × Wife High – Husband Med	11.32***	(3.39)	30.04*	(14.10)
10–12 × Wife High – Husband High	10.94***	(2.44)	22.07*	(10.15)
13–15 × Wife Low – Husband Med	8.22*	(3.23)	13.32	(13.44)
13–15 × Wife Low – Husband High	4.49	(6.74)	5.12	(28.06)
13–15 × Wife Med – Husband Low	8.77**	(3.28)	33.74*	(13.63)
13–15 × Wife Med – Husband Med	8.53**	(2.70)	25.87*	(11.22)
13–15 × Wife Med – Husband High	15.26***	(3.01)	31.61*	(12.51)
13–15 × Wife High – Husband Low	5.47	(4.56)	–4.91	(18.97)
13–15 × Wife High – Husband Med	12.86***	(3.48)	30.17*	(14.49)
13–15 × Wife High – Husband High	14.39***	(2.52)	25.30*	(10.47)
Time-Varying Controls	Yes		Yes	
N (person)	2,713		2,713	
N (person–year)	6,767		6,767	

Notes: All models controlled for the number of children, women's potential work experience and its squared term, women's and their husbands' respective employment status (whether one was employed, whether one was employed in the public sector, whether one was non-farm employed, and whether one was self-employed), whether women lived with their own parents, whether women lived with their parents-in-law, urbanicity of residence, and the province of residence. Full model results are available in Table A3 in the Appendix.
†p <.1; *p<.05; **p<.01; ***p<.001.

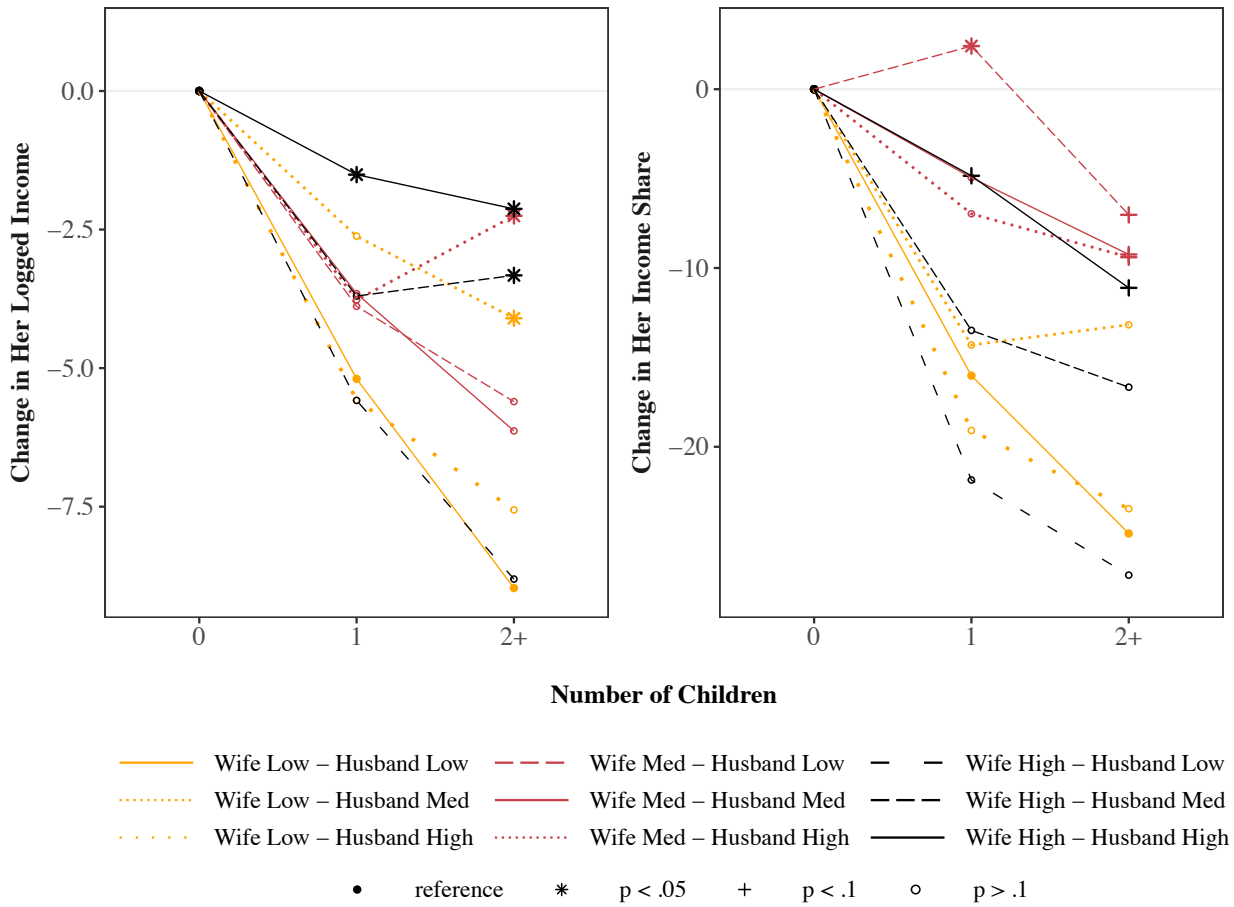

Fig. 1 Predicted change in wife's logged income and income share by number of children and educational pairing. *Note.* Predictions are derived from fixed effects models shown in Table 2. Each spouse's education includes three levels, elementary school or less (Low), middle school (Med), and high school or more (High). Statistical significance refers to whether the difference in the effect of number of children between homogamy of elementary school or less (Wife Low – Husband Low) and each of the remaining eight educational pairings is statistically significant. In other words, for each of the remaining eight educational pairings, statistical significance refers to the p-value of the corresponding interaction term between that educational pairing and number of children.

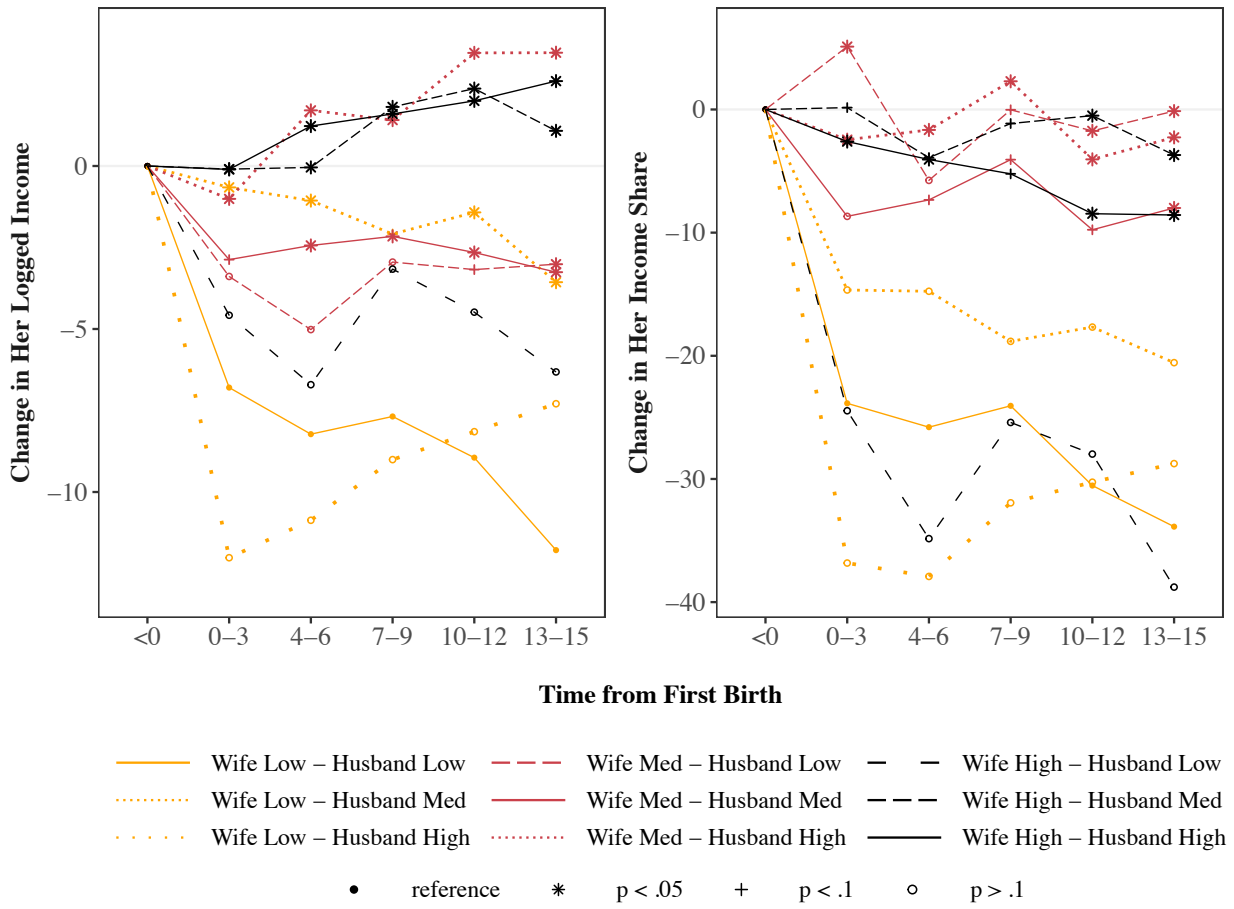

Fig. 2 Predicted change in logged income and income share by time from first birth and educational pairing. *Note.* Predictions are derived from fixed effects models shown in Table 3. Each spouse's education includes three levels, elementary school or less (Low), middle school (Med), and high school or more (High). Statistical significance refers to whether the difference in the effect of time from first birth between homogamy of elementary school or less (Wife Low – Husband Low) and each of the remaining eight educational pairings is statistically significant. In other words, for each of the remaining eight educational pairings, statistical significance refers to the p-value of the corresponding interaction term between that educational pairing and time from first birth.

Appendix

Table A1. Descriptive statistics of time-varying controls

	Mean/%	SD
Number of children	1.36	0.69
Wife's potential work experience	14.65	5.76
Wife's potential work experience's squared term	247.90	178.66
Wife's work characteristics		
Wife is employed (%)	70.33	
Wife is employed in the public sector (%)	13.37	
Wife is non-farm employed (%)	19.46	
Wife is self-employed (%)	5.44	
Husband's work characteristics		
Husband is employed (%)	88.77	
Husband is employed in the public sector (%)	20.30	
Husband is non-farm employed (%)	18.92	
Husband is self-employed (%)	9.52	
Coresidence with wife's parents (%)	7.18	
Coresidence with husband's parents (%)	52.80	
Household is in an urban area (%)	55.09	
N (person)	2,713	
N (person-year)	6,767	

Note: Province of household residence is not shown.

Table A2. Fixed effects models of women's income by number of children and educational assortative mating.

	Model 1 Logged Income		Model 2 Income Share	
	B	(SE)	B	(SE)
Number of Children (ref. = 0)				
1	–5.19***	(1.47)	–16.02**	(6.06)
2+	–8.97***	(1.60)	–24.85***	(6.63)
Number of Children × Educational Assortative Mating (ref. = Wife Low – Husband Low)				
One Child × Wife Low – Husband Med	2.57	(2.17)	1.72	(9.00)
One Child × Wife Low – Husband High	–0.39	(3.78)	–3.07	(15.63)
One Child × Wife Med – Husband Low	1.31	(2.09)	18.44*	(8.66)
One Child × Wife Med – Husband Med	1.54	(1.83)	11.07	(7.57)
One Child × Wife Med – Husband High	1.42	(2.01)	9.06	(8.32)
One Child × Wife High – Husband Low	–0.39	(2.71)	–5.84	(11.22)
One Child × Wife High – Husband Med	1.49	(2.15)	2.53	(8.92)
One Child × Wife High – Husband High	3.68*	(1.62)	11.18†	(6.72)
Two+ Children × Wife Low – Husband Med	4.87*	(2.38)	11.67	(9.84)
Two+ Children × Wife Low – Husband High	1.41	(3.66)	1.38	(15.17)
Two+ Children × Wife Med – Husband Low	3.36	(2.33)	17.82†	(9.63)
Two+ Children × Wife Med – Husband Med	2.83	(1.98)	15.61†	(8.21)
Two+ Children × Wife Med – Husband High	6.71**	(2.25)	15.45†	(9.30)
Two+ Children × Wife High – Husband Low	0.16	(3.26)	–2.33	(13.48)
Two+ Children × Wife High – Husband Med	5.64*	(2.41)	8.18	(9.96)
Two+ Children × Wife High – Husband High	6.84***	(1.85)	13.74†	(7.64)
Time-Varying Controls				
Wife's potential work experience	0.58***	(0.13)	1.94***	(0.53)
Wife's potential work experience's squared term	–0.02***	(0.00)	–0.03†	(0.02)
Wife's work characteristics				
Wife is employed	6.39***	(0.29)	21.18***	(1.20)
Wife is employed in the public sector	2.01***	(0.49)	5.15*	(2.01)
Wife is non-farm employed	–5.51***	(0.38)	–17.49***	(1.55)
Wife is self-employed	–7.64***	(0.51)	–22.39***	(2.12)
Husband's work characteristics				
Husband is employed	–2.00***	(0.36)	–12.42***	(1.47)
Husband is employed in the public sector	–1.11**	(0.41)	–6.99***	(1.70)
Husband is non-farm employed	0.85**	(0.32)	9.40***	(1.31)
Husband is self-employed	1.75***	(0.41)	26.24***	(1.72)

Coresidence with wife's parents	1.36	(0.94)	6.61†	(3.88)
Coresidence with husband's parents	–0.04	(0.42)	1.03	(1.72)
Household is in an urban area	–0.13	(0.52)	–2.50	(2.16)
Province	Yes		Yes	
Constant	2.67	(3.65)	15.13	(15.11)
Sigma_u	6.64		26.70	
Sigma_e	5.99		24.79	
Rho	0.55		0.54	
Within R2	0.18		0.17	
Between R2	0.18		0.10	
Overall R2	0.16		0.11	
N (person)	2,713		2,713	
N (person-year)	6,767		6,767	

Note: †p <.1; *p<.05; **p<.01; ***p<.001.

Table A3. Fixed effects models of women's income by time from first birth and educational assortative mating.

	Model 3 Logged Income		Model 4 Income Share	
	B	(SE)	B	(SE)
Time from Birth (ref. = <0)				
0–3	–6.80***	(1.99)	–23.86**	(8.28)
4–6	–8.23***	(2.19)	–25.80**	(9.13)
7–9	–7.68***	(2.30)	–24.06*	(9.55)
10–12	–8.95***	(2.45)	–30.54**	(10.21)
13–15	–11.78***	(2.61)	–33.87**	(10.85)
Time from First Birth × Educational Assortative Mating (ref. = Wife Low – Husband Low)				
0–3 × Wife Low – Husband Med	6.14*	(2.83)	9.20	(11.77)
0–3 × Wife Low – Husband High	–5.22	(6.56)	–12.97	(27.27)
0–3 × Wife Med – Husband Low	3.41	(2.78)	28.96*	(11.58)
0–3 × Wife Med – Husband Med	3.92†	(2.35)	15.18	(9.79)
0–3 × Wife Med – Husband High	5.79*	(2.52)	21.40*	(10.50)
0–3 × Wife High – Husband Low	2.22	(3.28)	–0.60	(13.64)
0–3 × Wife High – Husband Med	6.70*	(3.00)	24.01†	(12.47)
0–3 × Wife High – Husband High	6.69**	(2.11)	21.25*	(8.79)
4–6 × Wife Low – Husband Med	7.17*	(3.01)	11.03	(12.54)
4–6 × Wife Low – Husband High	–2.64	(6.34)	–12.12	(26.36)
4–6 × Wife Med – Husband Low	3.21	(2.99)	20.04	(12.42)
4–6 × Wife Med – Husband Med	5.79*	(2.51)	18.45†	(10.44)
4–6 × Wife Med – Husband High	9.93***	(2.72)	24.13*	(11.31)
4–6 × Wife High – Husband Low	1.52	(3.64)	–9.05	(15.13)
4–6 × Wife High – Husband Med	8.18**	(3.15)	21.88†	(13.11)
4–6 × Wife High – Husband High	9.45***	(2.29)	21.73*	(9.52)
7–9 × Wife Low – Husband Med	5.60†	(3.05)	5.24	(12.68)
7–9 × Wife Low – Husband High	–1.32	(6.57)	–7.87	(27.33)
7–9 × Wife Med – Husband Low	4.74	(3.06)	24.03†	(12.71)
7–9 × Wife Med – Husband Med	5.52*	(2.54)	19.99†	(10.58)
7–9 × Wife Med – Husband High	9.09**	(2.77)	26.35*	(11.51)
7–9 × Wife High – Husband Low	4.52	(3.81)	–1.35	(15.83)
7–9 × Wife High – Husband Med	9.50**	(3.24)	22.92†	(13.47)
7–9 × Wife High – Husband High	9.28***	(2.33)	18.84†	(9.71)

10–12 × Wife Low – Husband Med	7.52*	(3.14)	12.87	(13.06)
10–12 × Wife Low – Husband High	0.80	(6.67)	0.27	(27.73)
10–12 × Wife Med – Husband Low	5.77†	(3.15)	28.80*	(13.10)
10–12 × Wife Med – Husband Med	6.29*	(2.64)	20.77†	(10.97)
10–12 × Wife Med – Husband High	12.42***	(2.92)	26.48*	(12.14)
10–12 × Wife High – Husband Low	4.46	(4.07)	2.56	(16.93)
10–12 × Wife High – Husband Med	11.32***	(3.39)	30.04*	(14.10)
10–12 × Wife High – Husband High	10.94***	(2.44)	22.07*	(10.15)
13–15 × Wife Low – Husband Med	8.22*	(3.23)	13.32	(13.44)
13–15 × Wife Low – Husband High	4.49	(6.74)	5.12	(28.06)
13–15 × Wife Med – Husband Low	8.77**	(3.28)	33.74*	(13.63)
13–15 × Wife Med – Husband Med	8.53**	(2.70)	25.87*	(11.22)
13–15 × Wife Med – Husband High	15.26***	(3.01)	31.61*	(12.51)
13–15 × Wife High – Husband Low	5.47	(4.56)	–4.91	(18.97)
13–15 × Wife High – Husband Med	12.86***	(3.48)	30.17*	(14.49)
13–15 × Wife High – Husband High	14.39***	(2.52)	25.30*	(10.47)
Time-Varying Controls				
Number of children	–1.53***	(0.30)	–4.70***	(1.25)
Wife's potential work experience	0.33†	(0.18)	2.21**	(0.73)
Wife's potential work experience's squared term	–0.01**	(0.00)	–0.03	(0.02)
Wife's work characteristics				
Wife is employed	6.26***	(0.29)	20.63***	(1.21)
Wife is employed in the public sector	1.92***	(0.49)	5.20*	(2.02)
Wife is non-farm employed	–5.42***	(0.37)	–17.20***	(1.56)
Wife is self-employed	–7.61***	(0.51)	–22.43***	(2.13)
Husband's work characteristics				
Husband is employed	–1.81***	(0.36)	–12.40***	(1.48)
Husband is employed in the public sector	–1.10**	(0.41)	–6.72***	(1.70)
Husband is non-farm employed	0.77*	(0.32)	9.38***	(1.32)
Husband is self-employed	1.56***	(0.41)	26.01***	(1.72)
Coresidence with wife's parents	1.89*	(0.94)	7.48†	(3.89)
Coresidence with husband's parents	–0.04	(0.41)	1.11	(1.72)
Household is in an urban area	0.01	(0.52)	–2.55	(2.17)
Province	Yes		Yes	
Constant	2.76	(3.76)	12.17	(15.62)
Sigma_u	7.98		26.89	
Sigma_e	5.96		24.77	
Rho	0.64		0.54	
Within R2	0.20		0.18	

Between R2	0.16	0.12
Overall R2	0.14	0.12
N (person)	2,713	2,713
N (person–year)	6,767	6,767

Note: †p <.1; *p<.05; **p<.01; ***p<.001.