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USING PERSONNEL DATA:  
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WIDEN THE GENDER PAY GAP**

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# Unpacking the Child Penalty Using Personnel Data: How Promotion Practices Widen the Gender Pay Gap\*

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## Abstract

We estimate the child penalty using detailed personnel records that allow decomposition into distinct pay components. The penalty initially arises from reductions in time-based pay after childbirth. Over time, job-rank-based pay becomes increasingly significant. These effects are interconnected: reduced working hours lead to lower performance evaluations, which subsequently limit promotion opportunities. Our model demonstrates that current promotion practices, which reward extended hours at entry-level positions, can generate production inefficiency. This finding suggests that addressing promotion practices could simultaneously reduce gender inequality and improve talent allocation, making a business case for organizational reform.

**Keywords:** Child penalty, promotion, career progression, broken rung, management practice, personnel economics, internal labor markets, gender pay gap

**JEL Codes:** J13, J16, J24, J31, M51

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# 1 Introduction

Despite women’s increasing educational qualifications and growing presence in high-paying occupations, substantial gender pay gaps persist across advanced economies (Goldin, 2014). A rapidly growing literature demonstrates that these disparities are fundamentally driven by the differential impacts of parenthood on career trajectories — the so-called “child penalty” — which has emerged as the primary driver of modern gender inequalities (Kleven et al., 2019a).<sup>1</sup> Research across diverse contexts consistently documents substantial and persistent earnings penalties for mothers that compound over time, while fathers experience minimal or even positive effects.<sup>2</sup> This universal pattern suggests that parenthood interacts with fundamental features of labor market structure in ways that systematically disadvantage women across developed economies.

Recent evidence shows that expansions of family policies have not necessarily eliminated the long-run earnings losses associated with motherhood (Dahl and Loken, 2024; Kleven et al., 2024; Diallo et al., 2025). This persistence indicates that the sources of the child penalty lie beyond statutory leave and childcare provisions. Goldin (2014) argues that the organization of work, including how hours, availability, and promotions are rewarded, is a central mechanism that sustains gender inequality. In this context, firm-level practices become decisive for mothers’ career progression. A particularly visible manifestation is the “broken rung” phenomenon: women face systematically lower promotion rates from entry-level to first managerial positions, which are critical for establishing an upward career trajectory (Haeghele, 2024a).<sup>3</sup> Yet despite the potential importance of these organizational mechanisms, systematic evidence on how personnel practices shape the child penalty remains scarce.

We examine these organizational mechanisms using comprehensive personnel records from a Japanese manufacturing firm. A unique aspect of this dataset is its comprehensive breakdown of payroll data, which is provided on a monthly basis and categorized by various pay components. This allows us to decompose earnings into different pay categories and analyze how each contributes to the child penalty. The personnel records also track monthly working hours, job assignments, promotions, leave-taking, annual evaluations, and employee surveys, enabling us to investigate the mechanisms driving these earnings patterns. The firm’s low annual turnover rate of 4% allows long-term observation of career trajectories with minimal sample attrition concerns. The firm offers generous

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<sup>1</sup>For evidence on talent misallocation, see Hsieh et al. (2019); Sevilla (2020); Bandiera et al. (2020).

<sup>2</sup>See Bertrand et al. (2010); Angelov et al. (2016); Kleven (2026); Cortés and Pan (2023) for cross-country evidence.

<sup>3</sup>McKinsey and LeanIn (2019) introduced the term *broken rung*, referring to lower promotion rates for women from entry-level to first managerial roles, which affects female representation in leadership pipelines. This contrasts with the *glass ceiling* (low representation in top executive roles) and *leaky pipeline* (higher exit rates at various career stages), by focusing specifically on early-career promotion barriers within corporate contexts.

family support packages that exceed Japan's already substantial mandates for paid parental leave and subsidized daycare, lending our findings relevance to organizational mechanisms operating in other advanced economies with comparable family policy frameworks.

To quantify the impact of childbirth on monthly earnings trajectories, we employ a matched-control event study design to identify and estimate the child penalty several years after childbirth. Workers who had children during the observation period are treated units, while those who did not are pure control units. Using coarsened exact matching, we match the distributions of marital status, birth cohort, education level, and tenure of the control units with those of the treated units. Worker characteristics not used for matching, such as performance evaluation scores and hours worked, are balanced between the treatment and control groups, indicating that these workers follow similar career paths until childbirth.

Using this matched sample, we perform an event study regression on several outcomes, including both total monthly earnings and its components. Specifically, we categorize the firm's 27 distinct pay items into four main components: (i) age-based pay, which increases with age; (ii) time-based pay, which encompasses overtime, night shift, and weekend shift compensation; (iii) job-rank-based pay, which rises with higher positions and includes managerial compensation; and (iv) other allowances unrelated to the above categories. We confirm that the parallel pre-trend assumption holds for each outcome in the period leading up to childbirth. We also implement alternative event study designs without matched controls for robustness checks.

The event study estimates that, averaged over the first ten years after childbirth, the motherhood penalty — the earnings decline following the first childbirth relative to the counterfactual without a child — is 47%, while fathers see a small premium of 7.4%. Combining the two, the ten-year child penalty amounts to 54.5%. These magnitudes align with existing estimates for Japan, suggesting the patterns documented here are not unique to this firm. We further show that nearly 90% of the penalty arises from time-based pay immediately after childbirth. Its contribution then declines, while job-rank-based pay grows in importance and becomes the dominant factor by year 15. In effect, the long-run penalty would have been roughly half as large in the absence of the promotion gap. This decomposition is possible only because the personnel records capture pay components that standard administrative data do not.

Rich internal data allow us to trace how the sources of the child penalty are not merely sequential but deeply intertwined. Our data suggest that reduced work hours lower evaluation scores at the lowest job rank. These lower evaluations limit promotion opportunities. The importance of work hours, however, is significant only at the entry level. As workers climb the promotion ladder, the link between hours worked and evaluation scores is faded. In other words, long working hours are

crucial for initially securing a path to promotion, but become less important as employees progress in their careers. Importantly, our data do not present strong evidence that the career return to long hours reflects productivity; rather, it stems from the value placed on availability and, to some extent, workplace competition. This lingering career cost of reducing hours is particularly relevant to most new parents because they are at the lowest job rank. As a result, childbirth reduces mothers' earnings in two key ways: their monthly pay decreases immediately due to parental leave and reduced hours, and their future earnings are hampered by diminished promotion prospects due to these reduced hours. The latter represents the true essence of the term *child penalty*, highlighting systemic repercussions of parenthood.

To interpret these empirical findings and investigate welfare implications for human resource (HR) management practices, we investigate a theoretical model of internal promotion building upon [Gibbons and Waldman \(1999\)](#). The model incorporates three key features. First, workers differ in their time-invariant abilities and in the marginal cost of work due to childcare responsibilities. Second, reflecting the promotion system of the firm, workers face the same promotion thresholds and are promoted step-by-step without skipping any job rank. Third, consistent with our empirical finding, long working hours improve promotion prospects only at the lowest job rank. We show that this promotion system incentivizes workers with lower abilities but fewer time constraints to work excessively long hours to secure a promotion path. Consequently, even in a simple model with full information and no discrimination or bias, these promotion practices can generate production inefficiency.<sup>4</sup> This inefficiency stems from talent misallocation that disadvantages high-ability workers who face high time costs.<sup>5</sup>

The model offers a framework for interpreting our empirical patterns. In our institutional context, mothers typically face substantial time constraints due to childcare responsibilities, while fathers experience minimal changes to their time availability. The theoretical analysis suggests that within the current promotion system, high-ability mothers systematically face greater barriers to advancement beyond entry-level positions compared to equally or less capable fathers who retain temporal flexibility. These promotion dynamics amplify the child penalty over time. Moreover, this mechanism can generate production inefficiency, as capable women remain in lower-ranked positions despite their underlying productivity. Our analysis indicates that redesigning promotion and evaluation practices can help mitigate the long-term child penalty while improving overall organizational productivity. Alternatively, reorganizing work to increase productivity per hour, thereby making shorter working hours the norm, could also achieve both.

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<sup>4</sup>The latter result holds in our model because of the assumption that workers are paid at their own productivity.

<sup>5</sup>[Bronson and Thoursie \(2021\)](#) also analyze a model with multiple promotion opportunities, focusing on parental leave and subsequent gender differences in wage growth. Our model differs by highlighting how existing promotion systems can distort production efficiency, especially on employees with childcare responsibilities.

**Contribution to Literature** To our knowledge, this study is one of the first to use pay records to decompose the child penalty and examine how HR management practices influence its magnitude and evolution. Both analyses are made possible by detailed firm-level personnel data.<sup>6</sup> In doing so, we contribute to three strands of literature.

First, we uncover *within-firm* mechanisms driving the long-run child penalty. Although the child penalty, defined as the decline in earnings that mothers experience after childbirth, is well-documented (Waldfoegel, 1997; Lundberg and Rose, 2000; Ejrnaes and Kunze, 2013; Angelov et al., 2016; Lundborg et al., 2017; Kleven et al., 2019b), its underlying mechanisms remain actively debated (Lundborg et al., 2024; Adams-Prassl et al., 2024c). While childbirth is undoubtedly physically demanding for women, evidence indicates that the primary drivers of the child penalty lie more in societal gender norms than in biological needs (Kleven et al., 2021). Gendered expectations surrounding caregiving roles partly explain both cross-country variation in the magnitude of the child penalty (Kleven, 2026) and differences observed between heterosexual and same-sex couples (Moberg, 2016; Nix and Andresen, 2019). Having these gendered caregiving responsibilities in the background, women often exit the labor market or transition into positions offering shorter hours, greater flexibility, or higher substitutability, typically part-time or lower-paid roles (Manning and Petrongolo, 2008; Fernández-Kranz et al., 2013; Goldin, 2014; Goldin and Katz, 2016; Adda et al., 2017; Kleven et al., 2019b; Casarico and Lattanzio, 2021; Azmat et al., 2022). Such *between-firm* mobility emerges as an important mechanism behind the child penalty.

In contrast, our study sheds light on *within-firm* processes driving differential earnings growth between men and women after childbirth. We demonstrate how internal human resource management practices, specifically reward systems that disproportionately value long working hours, generate substantial child penalties within firms, even in the absence of differential skill growth or explicit discrimination. Using rich personnel data, we identify how these organizational practices shape earnings trajectories, resulting in women’s stagnating career progression compared to their male counterparts. Our findings suggest that firms’ reward structures significantly contribute to

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<sup>6</sup>A recent study by Healy and Heissel (2024) uses personnel data to examine child penalty. Analyzing internal records in the US Marine Corps, they estimate the negative impacts of childbirth on Marine women’s physical fitness performance, on-the-job training assignments, and promotions up to two years post-birth. Marine men also experience a decline in physical fitness, though for a shorter period. These findings emphasize that parenthood, particularly for women, is physically demanding, which can affect workplace performance and hinder promotion prospects. Their study highlights the important policy issue of providing reasonable accommodations for workers’ birth-related medical conditions, particularly for new parents in physically demanding jobs. This is especially crucial in a context where parental leave is short (6-18 weeks at the US Marine Corps). In contrast, our study examines a context where maternal and parental leave is generous (up to 52 weeks), so the physical fitness channel is less likely to be at play. Complementing their study, our research illuminates mothers’ and fathers’ working hours and their *long-term* career consequences, using comprehensive personnel records that contain detailed pay records, as well as performance evaluation and promotion records.

the financial repercussions of motherhood. Consequently, adjusting these internal practices provides a promising avenue for reducing the child penalty, complementing existing public policies designed to support work-family balance and gender-neutral caregiving, policies that, despite their intentions, have thus far demonstrated limited effectiveness (Kleven et al., 2020; Nix and Andresen, 2024; Dahl and Loken, 2024).

Second, beyond the child penalty, we contribute to the broader literature on the gender pay gap by tracing the within-firm *pay-growth* gap using comprehensive personnel records. A growing literature documents that the gender earnings gap widens substantially over the life cycle and that much of this divergence occurs within firms and establishments rather than through differential sorting across employers (Frederiksen et al., 2016; Barth et al., 2021; Bronson and Thoursie, 2021). Related static decompositions find that both sorting and within-firm pay-setting contribute to the cross-sectional gap, with the relative importance varying across settings (Card et al., 2016; Casarico and Lattanzio, 2022). Our data allow us to pinpoint the organizational mechanisms behind this within-firm divergence. Detailed records on earnings, hours, evaluations, and employee attitudes reveal that internal policies and promotion practices systematically generate divergent career trajectories for men and women after childbirth.

Third, we contribute to the literature on the gender promotion gap, particularly the early-career gap known as the *broken rung* phenomenon. While the gender promotion gap has long been documented in personnel economics (Lazear and Rosen, 1990; Blau and Devaro, 2007), its causes remain under active study. Prior research points to multiple mechanisms: gender differences in promotion aspirations across professions such as law (Azmat and Ferrer, 2017; Ganguli et al., 2021; Azmat et al., 2024), central banking (Hospido et al., 2022), and global corporations (Haegle, 2024a); managerial bias in subjective evaluations (Haegle, 2024b; Benson et al., 2024); and discrimination against mothers (Bronson and Thoursie, 2021). Our study instead emphasizes organizational architecture, showing that personnel policies and promotion criteria can generate large gender disparities even without explicit bias. Promotion systems that reward long work hours create structural barriers for women with childcare responsibilities, effectively producing a broken rung in the career ladder even in the absence of discrimination or lower aspirations.

**Organization of the Paper** The remainder of this paper is organized as follows. Section 2 provides a brief background on the firm we investigate, and describe our data. Section 3 documents the evolution of child penalty. Section 4 investigates promotion dynamics in the firm. Section 5 discusses our empirical results. Section 6 presents an illustrative model of internal promotion that aligns with our empirical findings, and discusses the welfare implication of the personnel policies

and practices in the firm. Section 7 concludes.

## 2 Background and Data

### 2.1 The firm

This study examines a major Japanese manufacturing firm. It is one of the market leaders in consumer nondurable goods and has been in business for over a century.<sup>7</sup> As of 2013, the firm employed approximately 4,000 regular workers and operated within Japan's manufacturing sector, which accounts for about 20 percent of GDP and 16 % of total employment. This context offers three key features that make it particularly well-suited for studying how childbirth affects gender disparities in career trajectories within a firm.

First, the firm has a low annual quit rate of 4% for both men and women (see Section 2.3.2 for details). Such low turnover is typical of large Japanese companies that offer competitive compensation packages. Among 546 listed and major unlisted firms with more than 1,000 employees, the average annual quit rate in 2022 was 4.12%.<sup>8</sup> High employee retention enables us to track individual career trajectories over long periods, particularly around key life events such as childbirth. This feature provides a crucial advantage for analyzing how gender gaps evolve within a single firm over time.

Second, the firm is representative of gender disparities in Japan, a country with one of the largest gender gaps in the OECD. Its gender pay gap as of 2024 is 32%, which is close to the national average of 25% and the average for large manufacturing firms of 26.1%.<sup>9</sup> Women hold 7.1% of managerial positions, below the national average of 17.1% but close to the large firm manufacturing average of 6%. These patterns indicate that our results are informative for understanding broader gender gaps, particularly in male dominated sectors. Appendix A.12 documents the gender pay gap and female representation by industry and firm size across Japan to situate the firm within the broader context.

Third, our context allows us to examine gender gaps in an environment where both government and firm-level policies support the reconciliation of work and family responsibilities. In such a

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<sup>7</sup>In Japan, century-old firms are far from rare. According to Teikoku Databank, which provides financial research and support services, there were 45,284 firms that had been in business for over a century as of September 2024. Moreover, the world's century-old firms are highly concentrated in Japan.

<sup>8</sup>Toyoko Keizai Inc., a leading Japanese market database provider, reports this figure in its CSR database.

<sup>9</sup>Ministry of Health, Labour and Welfare, January 2024.

setting, the lack of formal support is unlikely to explain persistent gender disparities. Japan provides generous parental leave: mothers can take 58 weeks of paid leave and fathers 52 weeks, with wage replacement rates of about 60%, exempt from social security contributions.<sup>10</sup> Public childcare is also widely available and affordable.<sup>11</sup> The firm offers additional family-friendly workplace policies, including reduced working hours until a child turns 12, in-house childcare facilities, and flexible work-from-home arrangements. Such provisions are common among large manufacturing firms; about 65% offer similar policies (Table 17 in Appendix A.12). Studying career dynamics in this policy-rich environment highlights why gender pay gaps persist even when both public and workplace policies strongly support working parents. Our findings suggest that family-friendly policies, although important, are insufficient to eliminate long-standing disparities.

## 2.2 Sample and Variable Definitions

We restrict our sample to permanently contracted employees under 60, the current default retirement age at the firm. Our sample does not include temporary workers. All personnel records are observed for all employees in our sample and linked using anonymized employee identification numbers. Table 6 in Appendix A summarizes our data sources, detailing the frequency of observations, the periods covered, and the sample coverage.

**Job Title, Division Assignment, and Promotion** The personnel record provides us with each worker’s job assignment every month between September 2013 and January 2024. During this period, we also have complementary records of the exact dates of job assignment change. Within the firm, jobs are differentiated both horizontally and vertically. Horizontally, roles are divided into three divisions: manufacturing, sales, and back-office functions such as finance and HR. The production division is the largest, with 58% of employees. 19% of employees work in the sales division, while the remaining employees work in back office. Most horizontal job sorting occurs at the entry stage and is rare later in one’s career, although not precluded by the employment contract.

Within each division, jobs are vertically differentiated by rank, with compensation increasing as employees advance. We define promotion as an upward progression from one rank to another. Our data record the precise date of each rank change, eliminating potential subjectivity in identifying promotions from wage growth. The first three ranks (*staff member*, *team leader*, and *senior team leader*) are classified as non-managerial positions. Positions above *senior team leader* are

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<sup>10</sup>The total leave translates to a full-rate equivalent of 31.1 weeks for fathers, the most generous among OECD countries. See Yamaguchi (2019).

<sup>11</sup>See Yamaguchi et al. (2018).

designated as managerial according to firm policy. The promotion structure is strictly sequential: employees must advance through consecutive ranks without skipping levels. While the employment contract permits downward mobility, demotion occurs rarely in practice.

**Hours Worked** Monthly payroll data between September 2013 and January 2024 provide a comprehensive view of both the amount and timing of work hours for non-managerial employees. Specifically, we have monthly data on each worker's contracted hours and actual hours worked. Actual hours are further categorized into regular hours, overtime, irregular hours (including night, weekend, and holiday shifts), and reduced hours for childcare. Employees with children under 12 can choose to work 30 hours per week (75% of full-time) with a proportional pay reduction.. Note that the data do not record the actual hours worked by managers, as they have discretion over their working hours and are exempt from overtime compensation. Therefore, our analysis of hours worked and hourly pay is limited to non-managerial employees.

**Monthly Pay by Item** The firm employs a structured compensation system that determines monthly earnings through a combination of base pay adjustments and various supplemental components. The base pay, determined by age and job rank, represents the wage rate for standard full-time work. This base amount is then adjusted according to actual hours worked, with overtime hours receiving a premium and reduced hours resulting in proportional reductions. During parental leave, salaries fall to zero as leave benefits are administered through employment insurance rather than the firm.

Given this institutional structure, we decompose monthly earnings into four components using detailed payroll records. The firm's monthly payroll data itemizes 27 distinct pay categories, which we aggregate into: (1) time-based pay, (2) job-rank-based pay, (3) age-based pay, and (4) allowances. This decomposition enables us to analyze how different institutional channels contribute to earnings growth throughout an employee's career at the firm.

1. The time-based pay component reflects adjustments to base pay based on deviations from standard full-time hours. This includes positive adjustments for overtime, night, and holiday shifts, as well as negative adjustments when employees work reduced hours. During parental leave, this component becomes negative enough to reduce total earnings to zero.
2. The job-rank-based pay component is tied to an employee's job rank. Each rank has a narrow pay band, within which individual pay is determined by performance evaluations from immediate supervisors and those two ranks above. Additionally, managers receive a fixed

amount of managerial compensation. An increase in job-rank-based pay is directly linked to a promotion within the firm's organizational hierarchy.

3. The age-based pay component is determined by both educational qualifications and age. Entry-level base pay increases with employees' educational qualifications. As employees age, this component automatically increases by a modest amount. It is not influenced by hours worked or job ranks.
4. Allowances include various supplemental payments: family allowance for household heads, professional license/certification premiums (e.g., for boiler operators), and training supplements. Most allowances apply to a small subset of workers and involve modest or infrequent payments. The family allowance is the notable exception: it provides substantial additional compensation to household heads, defined as employees with dependent children and a spouse earning below \$10,400 annually. While this allowance is formally gender-neutral, in practice it creates systematic gender differences in pay since male employees typically qualify as household heads while female employees rarely do.<sup>12</sup>

Each pay component is calculated according to a pre-determined formula. Individual pay negotiation cannot directly influence specific salary items. To increase her pay, an employee must negotiate for a higher evaluation and promotion to a higher job rank. Alternatively, the labor union can negotiate changes to the pay formula on behalf of all non-managerial employees. Consequently, conditional on observed employee characteristics such as age and job rank, the gender pay gap in this setting does not arise from differences between men and women in willingness or ability to negotiate.<sup>13</sup> Furthermore, the employer does not have the scope to exercise monopsonistic power by setting differential wages for men and women who are otherwise identical, a mechanism increasingly recognized in recent research as another contributor to unexplained gender pay gaps.<sup>14</sup>

The proposed decomposition offers an analytical advantage for studying how parenthood affects earnings trajectories. Specifically, this categorization maps directly onto the firm's personnel policies and promotion practices, enabling us to identify specific organizational mechanisms that

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<sup>12</sup>Family allowances, originating from social welfare policies, first introduced in Europe during the early 20th century. During World War II, the Japanese government, as part of its warfare strategy, regulated company wage scales and mandated family allowances to alleviate poverty. This practice, although no longer required, has continued to influence pay structures in firms long after World War II ended. According to a 2020 survey from the Ministry of Health, Labour, and Welfare, about 70% of firms with more than 30 employees offer family allowances. Recently, family allowances have faced increasing criticism. Critics argue that it perpetuates the outdated family model of "a working husband and a stay-at-home wife," despite the growing diversity in family structures in Japan.

<sup>13</sup>Babcock and Laschevar (2003).

<sup>14</sup>Hirsch (2010).

generate earnings disparities between men and women following childbirth. In addition, by separating rank-based from age-based components, we can distinguish career advancement effects from mechanical wage growth. While alternative approaches might express earnings simply as the product of hours worked and wage rates, our decomposition better serves our goal of understanding how different institutional channels contribute to the child penalty over time.<sup>15</sup>

**Personnel Evaluation Score** The firm employs a 5-point performance rating scale for its annual evaluations, ranging from 1 (lowest) to 5 (highest). These ratings are retrospective, based on a set of demonstrable criteria evaluated by immediate supervisors and subsequently approved by higher-level supervisors. The evaluation criteria assess both individual performance and teamwork skills over the past year.

**Employee Demographics** Finally, we collect data on employees' sex, age, tenure, highest degree attained, marital status, number of children, and the birth year and month of both the employees and their children.

## 2.3 Summary Statistics

### 2.3.1 Employee Demographics

Table 1 presents summary statistics as of September 2013 for our entire sample in Column 1, as well as male employees in Column 2 and female employees in Column 3. Female employees account for 20% of the sample. On average, they are younger (27.85 years old) than their male counterparts (39.7 years old). Consequently, women have shorter tenure. Men and women have similar educational backgrounds, with 34% of men and 28.4% of women having graduated from some college or above.

There is a noticeable gender difference in the distribution of job ranks. 96.3% of female employees are at the entry-level job rank, whereas the figure for men is 59.2%. This disparity is partly due to differences in tenure between genders. However, it also suggests the presence of a broken rung phenomenon, where women in entry-level positions are promoted to managerial positions at much

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<sup>15</sup>An alternative approach would be to express earnings as the product of hours worked and wage rates and analyze changes in log earnings. However, such an approach cannot handle zero-earnings periods during parental leave without arbitrary adjustments. In addition, it is hard to further decompose wage rates into detailed components such as a job-rank-based component. Our decomposition avoids this issue while maintaining the ability to separate hours-based adjustments from changes in wage rates.

Table 1: Summary Statistics (As of September 2013)

	<b>Overall (n = 3871)</b>	<b>Men (n = 3132)</b>	<b>Women (n = 739)</b>
Age (Year)			
Mean	37.43	39.70	27.85
Education			
4-Yr College (%)	31.2%	33.0%	23.7%
Some college (%)	1.7%	1.0%	4.7%
High school (%)	67.1%	66.0%	71.6%
Missing (%)	0.0%	0.0%	0.0%
Sex			
Men (%)	80.9%	100.0%	0.0%
Women (%)	19.1%	0.0%	100.0%
Tenure (Year)			
Mean	16.13	18.13	7.64
Monthly Wage			
Total (USD)			
Mean	3,884	4,157	2,729
Time (USD)			
Mean	693	753	441
Rank (USD)			
Mean	1,878	2,020	1,276
Age (USD)			
Mean	1,028	1,054	915
Family Allowance and Others (USD)			
Mean	286	330	97
Job rank			
Staff Member (%)	66.3%	59.2%	96.3%
Team Leader (%)	12.3%	15.0%	0.8%
Senior Team Leader (%)	12.0%	14.2%	2.4%
Manager (%)	9.4%	11.6%	0.4%
Division			
Manufacturing (%)	64.0%	64.9%	60.1%
Sales (%)	14.1%	15.2%	9.5%
Back (%)	20.6%	18.4%	30.2%
Secondment (%)	1.2%	1.5%	0.3%
% with marriage	48.3%	55.2%	18.9%
% with child	35.0%	41.1%	9.3%
# of children			
Mean	0.68	0.81	0.14
Age of the youngest child (Year)			
Mean	10.90	11.15	6.26

*Notes:* All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY, which was the average exchange rate in September 2013, the starting point of our payroll data.

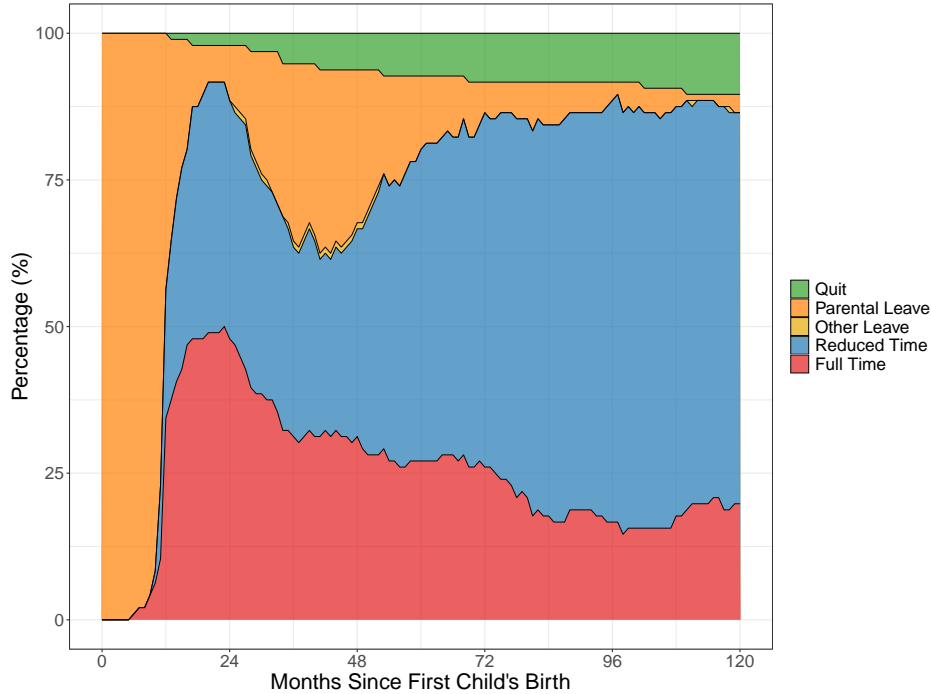


Figure 1: Women's Post Birth Employment Status

*Notes:* This figure presents a monthly breakdown of female employee outcomes up to 120 months after the birth of their first child. It shows the proportion of employees who quit the firm, took parental leave, opted for reduced working hours, or continued to work full-time. Due to data availability on the birth year and month of the first child for workers who left the firm, this figure is limited to 120 months due to data availability and available for mothers only.

lower rates than their male counterparts. We will discuss a possible broken rung in connection to the child penalty on promotion in Section 4.

### 2.3.2 Employee Turnover and Post-Childbirth Employment Status

The firm's low employee quit rate offers an ideal setting for studying within-firm earnings dynamics, as it minimizes concerns about sample attrition. The overall annual quit rate across all ages is approximately 4%, declining as employees age and stabilizing in their 30s (see Appendix A Figure 12). This figure presents the average annual quit rate by age and gender, calculated by dividing the total number of voluntary quits in a given year by the number of employees of the corresponding age and gender at the start of the year. Women's quit rates are slightly higher than men's until age 25, after which there is no statistically significant difference between genders.

Notably, the low quit rate extends even to female employees following their first childbirth, a subgroup conventionally considered at high risk of exiting the labor force. Figure 1 illustrates the changing proportions of mothers who continue working full-time, reduce their hours, take parental

leave, or leave their jobs.<sup>16</sup> The average annual quit rate over the 10 years post-birth is 1.1%, which is significantly lower than the firm’s overall voluntary quit rate of 4.0%. This suggests that childbirth does not increase quit rates.

The high firm attachment of mothers is likely attributed to the company’s generous family-friendly policies. Nearly 80% of mothers choose to reduce their work hours at some point, using the option to work as few as 30 hours per week (75% of full-time) while their children are under 12.<sup>17</sup> These mothers typically work around 30 hours per week. Interestingly, the proportion opting for reduced hours increases, rather than decreases, as their first child ages. This trend likely reflects the growing caregiving responsibilities mothers face, as many need to leave work early to care for school-age children after school.

### 2.3.3 Within-Firm Earnings Trajectory

Finally, we use detailed pay items from the payroll data to document the sources of the gender earnings gap. In cross section, male employees earn \$4,157 per month, while female employees earn \$2,729 per month on average. This results in an unconditional, within-firm gender pay gap of 34%. The primary driver of this gap is job-rank-based pay, accounting for 52% (\$744) of the pay gap. An additional 22% (\$312) is attributed to the gender gap in time-based pay, while allowances explain 16%. The remaining 10% (\$139) is attributed to age-based pay, reflecting differences in age between male and female employees.

Dynamically, the gender pay gap widens over the career. Figure 2 shows the average monthly earnings for men and women, broken down into four pay components. Between ages 25 and 50, the gender gap more than doubles, increasing from 11% to 26%. At age 25, nearly 95% of the pay gap comes from differences in time-based pay. By age 50, time-based pay accounts for less than 30%. In contrast, job-rank-based pay explains over 50% of the gap. Women’s pay growth within the firm falls short of men’s largely due to the lack of growth in rank-based pay.

Women’s pay growth significantly correlates with the presence of children. Figure 14 in Appendix A shows the trajectory of monthly earnings for those with children and without children.

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<sup>16</sup>We extract data on employee turnover, parental leave uptake, and reduced working hours for mothers from internal personnel records. The sample is a balanced panel of women who had their first child before September 2013. For women who subsequently left the firm, children’s birth dates are not recorded; we therefore infer the timing of childbirth from the start date of the mandatory post-birth maternity leave. We validate this inference against data from current employees whose family characteristics are known. Because identification relies on maternity leave records, the figure is available for mothers only. Since fathers do not necessarily take parental leave, birth timing cannot be recovered for fathers who later left the firm.

<sup>17</sup>The share of female workers who have ever opted for reduced work hours is 78%, whereas it is only 0.4% for male workers.

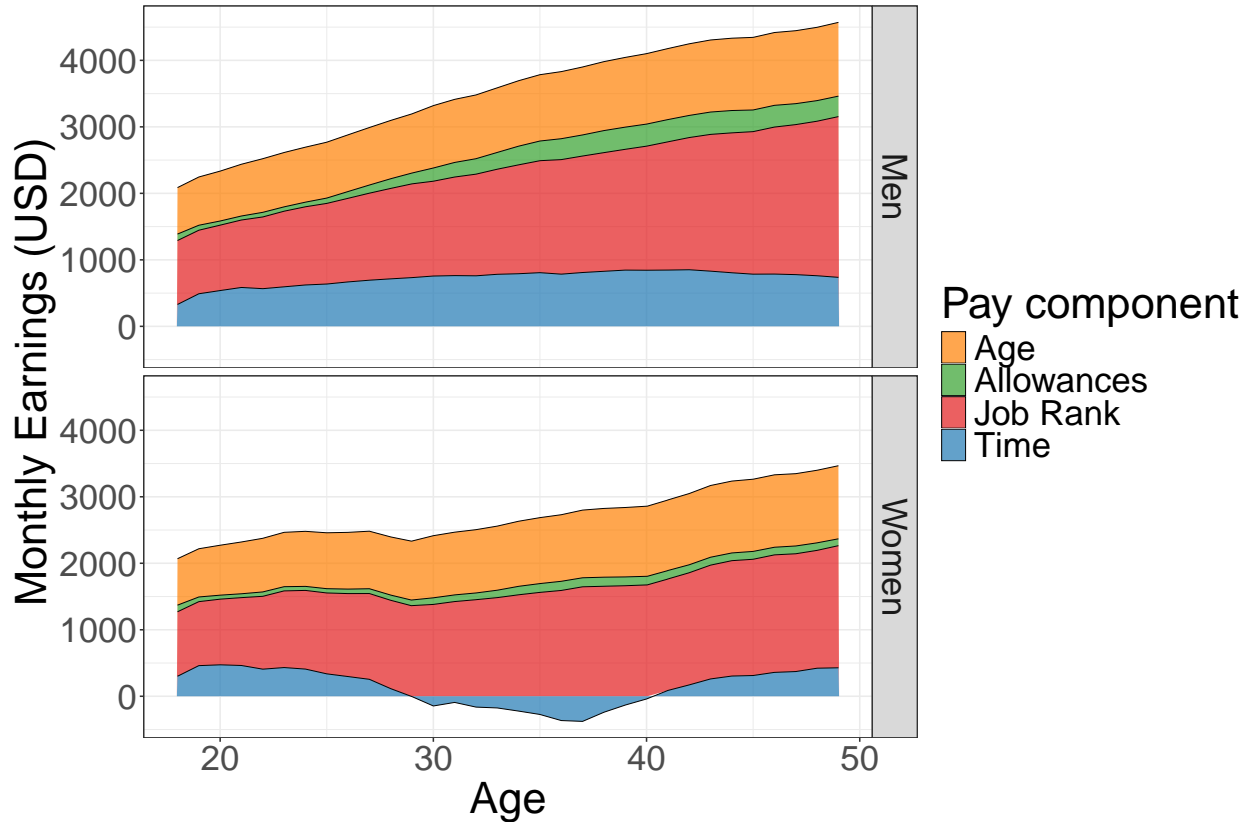


Figure 2: Decomposition of Average Monthly Earnings

*Notes:* This figure displays the average monthly earnings for age and gender groups, broken down into four pay components. The sample is restricted to male and female employees aged 59 or below who have worked for at least one year at domestic office between September 2013 and January 2024. The upper panel shows All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY.

For women’s with children, their time-base pay goes negative during childbearing ages, and pay growth stalls. From age 25 and 50, monthly earnings grow by 30%. In contrast, pay for women without children grows continuously over the career. From age 25 and 50, monthly earnings grow by 36%. These patterns align with previous research, which identifies the gendered effects of childbirth as a major contributor to the overall gender pay gap (Bertrand et al., 2010; Kleven et al., 2021; Bertrand, 2020; Cortés and Pan, 2023). In the following sections, we examine in detail how and why childbirth impacts the earnings trajectories of men and women.

### 3 Child Penalty

As shown in the earlier section, parenthood is a key factor correlating with women’s slower pay growth compared to men within the firm. This section expands on these observations by quantifying

the impact of childbirth on total monthly earnings. We explore how the child penalty evolves over time, and decompose it into key pay components: age-based, time-based, job-rank-based pay, and allowances. This analysis sheds light on the evolving nature of the child penalty, thereby offering a comprehensive understanding of the mechanisms.

### 3.1 Empirical Strategy

We employ a matched-control event study design to quantify the impact of childbirth on monthly earnings from this firm and each pay component.<sup>18</sup> The treated units are workers whose first child was born after September 2013. Figure 3 displays the raw average monthly earnings and their composition before and after the first childbirth.<sup>19</sup> Women experience a sharp and sustained drop in earnings following childbirth, while men’s earnings remain largely unaffected, except for a brief dip in the first month. This divergence widens the father-mother pay gap. To isolate the causal effect of childbirth, we use the event study design to control for other factors that may influence earnings trajectories.

The pool of control units consists of employees who are married but have no children throughout the study period.<sup>20</sup> Childless, married people constitute a suitable candidate for control group because they are similarly at risk of having a child. This approach is particularly relevant in Japan, where 97.6% of children are born within marriage,<sup>21</sup> and 96.5% of married couples express a desire to have a child.<sup>22</sup>

For each treated individual  $i$ , we use coarsened exact matching (Iacus et al., 2012) to select a control individual based on education, birth year, and hiring type. Control units are weighted so that the distribution of covariates matches that of the treated group prior to treatment. We assign weights as  $W = 1$  for treated units and  $W = (N_C/N_T)(N_T^s/N_C^s)$  for controls, where  $N_C$  and  $N_T$  are the total number of treated and control units, and  $N_T^s$  and  $N_C^s$  are their counts within stratum  $s$ . This ensures comparability in the joint distribution of observable baseline characteristics. Each control is assigned a placebo childbirth month, randomly drawn from the same stratum to match

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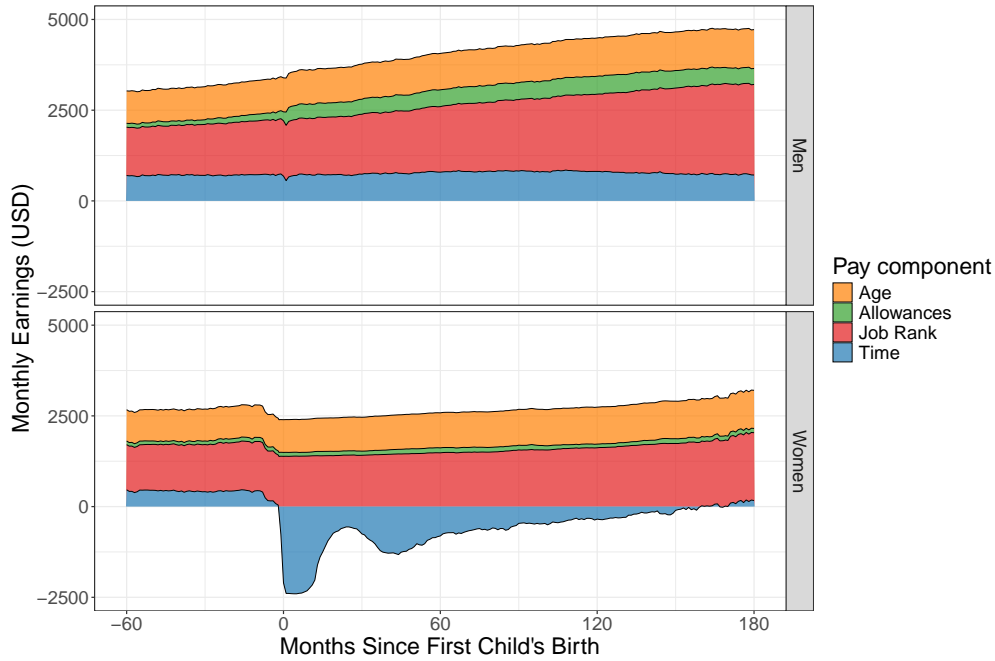
<sup>18</sup>Recent studies using a matched-control event study design include Goldschmidt and Schmieder (2017); Aneja and Xu (2022); Adams-Prassl et al. (2024a,b); Healy and Heissel (2024). Our regression specification closely follows that of Adams-Prassl et al. (2024b).

<sup>19</sup>As Figure 3a shows, the decline in women’s time-based pay occurs twice: first immediately after their first childbirth and then again around three years later. This pattern aligns with the fact that most parents, both men and women, have more than one child. Appendix A Figure 15 presents a similar figure by the number of children, showing that the second dip does not occur for women with only one child.

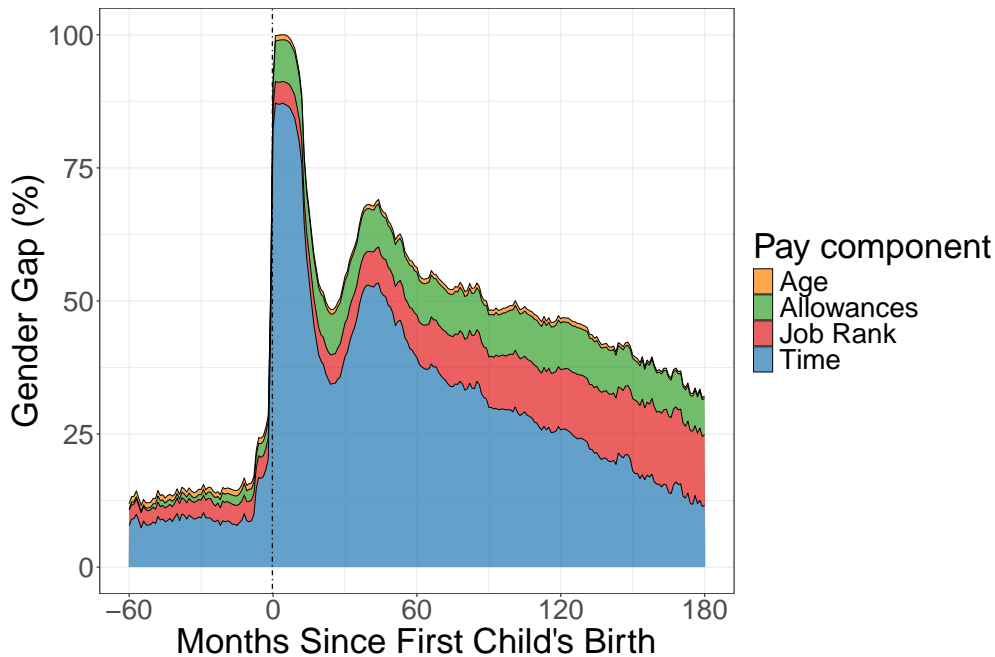
<sup>20</sup>See Kleven et al. (2019a) online Appendix B.2 for a discussion of employing pure controls.

<sup>21</sup>See Vital Statistics 2020.

<sup>22</sup>See Annual Population and Social Security Surveys 2015.



(a) Monthly earnings by items and gender



(b) Father-mother gap

Figure 3: Average Monthly Earnings Around the Time of the First Childbirth

*Notes:* Figure 3a displays the accounting decomposition of average monthly earnings 60 months before and 180 months after the first childbirth. Figure 3b shows the gender pay gap, measured as the difference in average earnings between male and female employees, expressed as a fraction of male earnings. The sample is restricted to employees aged 59 or below who have worked for at least one year at domestic office and have had the first child between September 2013 and January 2024. All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY, which was the average exchange rate in September 2013.

the timing of their treated counterpart. The control group thus captures earnings trajectories in the absence of childbirth.

We estimate the following weighted event-study regression:

$$Y_{it}^g = \sum_{e \neq -10} \alpha_e^g D_{it}^e + \sum_s \sum_k \beta_{k,s}^g Age_{it}^k Educ_i^s + \gamma_i + \delta_t^g + \epsilon_{it}^g, \quad (1)$$

where  $Y_{it}^g$  is the outcome of interest, such as monthly earnings, measured in levels to retain zero values during leave-taking. Let  $E_i$  denote the year and month of employee  $i$ 's first childbirth, and define event-time dummies  $D_{it}^e = 1_{[t-E_i=e]} \times Treat_i$ , where  $Treat_i = 1$  for treated and 0 for control employees. The coefficients  $\alpha_e^g$  capture the dynamic effects of first childbirth, i.e., the child penalty.

We include interactions of age dummies  $Age_{it}^k = 1_{[k=age_{it}]}$  and education dummies  $Educ_i^s = 1_{[s=educ_i]}$  to allow for gender- and education-specific age-earnings profiles. Together with individual fixed effects  $\gamma_i$  and gender-specific calendar time fixed effects  $\delta_t^g$ , these controls help mitigate residual imbalances in covariates that may remain after the coarsened matching procedure. The event-study window spans 60 months (5 years) before childbirth or placebo childbirth to 180 months (15 years) after, with  $e = -10$  (conception) as the reference month ( $e = [60, \dots, 180]$ ).

Relative to the conventional event-study approach in [Kleven et al. \(2019a\)](#), which does not account for education-specific age-earnings profiles, our specification follows the recommendation of [Adams-Prassl et al. \(2024c\)](#) to allow for systematic differences in fertility and parental leave across education groups. We include education-specific age-earnings profiles but omit time-since-graduation controls because of strong collinearity with age in our sample.

Our parameter of interest,  $\alpha_e^g$ , measures the effect of first childbirth on monthly earnings relative to ten months before childbirth for employees who remain with the firm at event time  $e$ . A causal interpretation relies on the parallel-trends assumption: in the absence of childbirth, treated employees' earnings trajectories would have evolved in parallel with those of their matched controls. Because our earnings measure excludes parental leave benefits—leavers have zero earnings— $\alpha_e^g$  captures the reduction in earned income from productive work at the firm.<sup>23</sup>

We use the matched-control event-study design as our main specification to quantify the long-run child penalty. Unlike [Kleven et al. \(2019b\)](#), who rely on an event-study design with not-yet-treated workers as controls, our approach matches treated employees to similar workers who never have children. The not-yet-treated design identifies short-run effects under the assumption that the

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<sup>23</sup>[Adams-Prassl et al. \(2024c\)](#) show that child-penalty estimates differ markedly depending on whether parental leave benefits are counted as earnings.

Table 2: Balance of Pre-Event Characteristics

	Men			Women		
	Treated	Matched Control	Gap	Treated	Matched Control	Gap
4-Yr College Ratio	0.48	0.48	0	0.52	0.52	0
Age (t = 0)	31.02	30.03	0.99 (p = 0.091)	28.96	27.62	1.34 (p = 0.016)
Tenure (t = 0)	9.3	8.38	0.92 (p = 0.123)	7.87	6.63	1.24 (p = 0.012)
Staff Member Ratio (t = 0)	0.62	0.6	0.02 (p = 0.776)	0.92	0.97	-0.05 (p = 0.106)
Monthly Hours Worked (A year prior to the event)	191.1	192.86	-1.76 (p = 0.286)	174.7	168.85	5.85 (p = 0.384)
Performance Evaluation (A year prior to the event)	3.72	3.68	0.04 (p = 0.503)	3.73	3.75	-0.02 (p = 0.779)
Monthly Earnings (t = -12)	3306.22	3161.15	145.07 (p = 0.062)	2752.63	2646.97	105.66 (p = 0.33)
N	740	510		275	207	

Notes: This table presents the mean pre-event characteristics: monthly hours worked, performance evaluations, and monthly earnings, all measured one year before (placebo) birth. Columns 1 and 2 compare treated men and their matched controls, while Columns 4 and 5 compare treated women and their matched controls. Columns 3 and 6 shows the difference in means, with p-values in parentheses.

timing of childbirth is as-good-as-random. To ensure our findings are not sensitive to the choice of design, we replicate the analysis using not-yet-treated workers as controls, with results reported in Section 3.3.

Following Kleven (2026), we further convert the estimated level effects into percentages using the formula  $P_e^g = \alpha_e^g / E[\tilde{Y}_{it}^g | e, Treat_i = 1]$ , where  $\tilde{Y}_{it}^g$  represents the counterfactual outcome in the absence of childbirth's impact at event time  $e$ , i.e.,

$$\tilde{Y}_{it}^g = \sum_s \sum_k \tilde{\beta}_{k,s}^g Age_{it}^k Educ_i^s + \tilde{\gamma}_i + \tilde{\delta}_t^g \quad (2)$$

Finally, we compute the child penalty at event time  $e$  as

$$\text{Child Penalty}(\bar{e}) \equiv E[P_e^{Men} | 0 \leq e \leq \bar{e}] - E[P_e^{Women} | 0 \leq e \leq \bar{e}]. \quad (3)$$

The first term represents the percentage effect on men's earnings averaged over  $\bar{e}$  months post birth. We refer to it as the fatherhood premium if positive, or the fatherhood penalty if negative. The second term represents the average effects on women's earnings, referred to as the motherhood penalty. The child penalty is then defined as the difference between the fatherhood premium (or penalty) and the motherhood penalty.

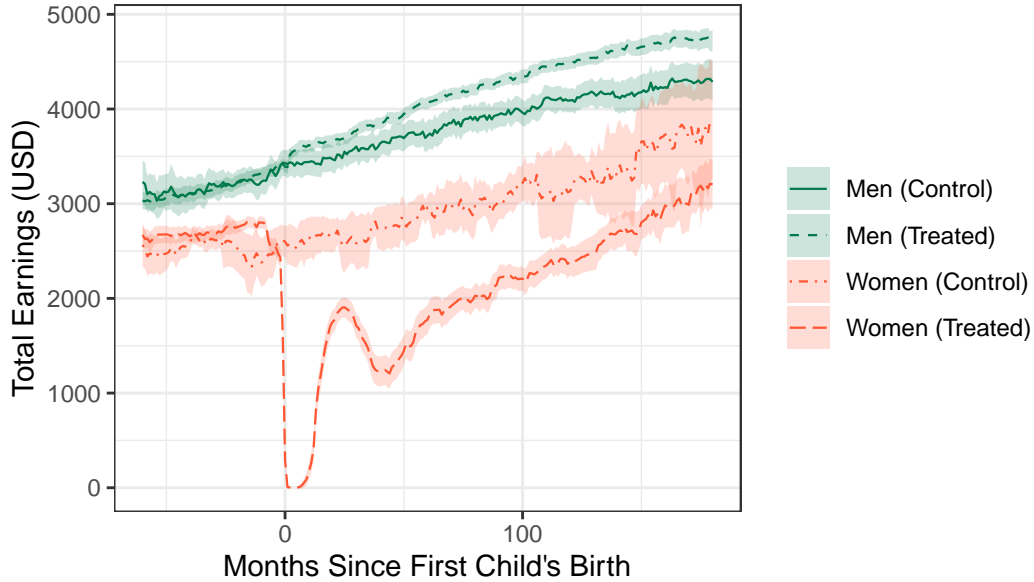


Figure 4: Average Monthly Earnings of Treated and Matched Control Groups

*Notes:* This figure displays the mean monthly earnings, along with 95% confidence intervals, for men and women with children and their respective matched control groups. All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY.

### 3.2 Estimation Results

**Balance of Covariates Before Childbirth** Table 2 reports the balance of pre-event characteristics between treated and control units, using the weights defined in Section 3.1. We match on education, birth year, and hiring type. Columns 1–2 compare treated men with their matched controls, and Columns 4–5 report the same for women. Education is exactly matched by construction. Age is coarsely matched: treated men are similar in age to their controls, whereas treated women are on average about one year older, which also results in roughly one additional year of tenure. These small differences are addressed by the regression adjustment in equation (1).

The remaining variables—share of entry-level positions (staff member), monthly hours worked, performance evaluations, and monthly earnings—are measured one year before the actual or placebo birth and are not used in matching. Differences between treated and control groups are statistically insignificant, indicating that both groups followed similar career trajectories before childbirth. This balance alleviates concerns about selection into fertility.

**Event Study Estimates** Figure 4 illustrates the mean total monthly earnings for women and men with children (treated group) in our sample, alongside their respective control groups as defined

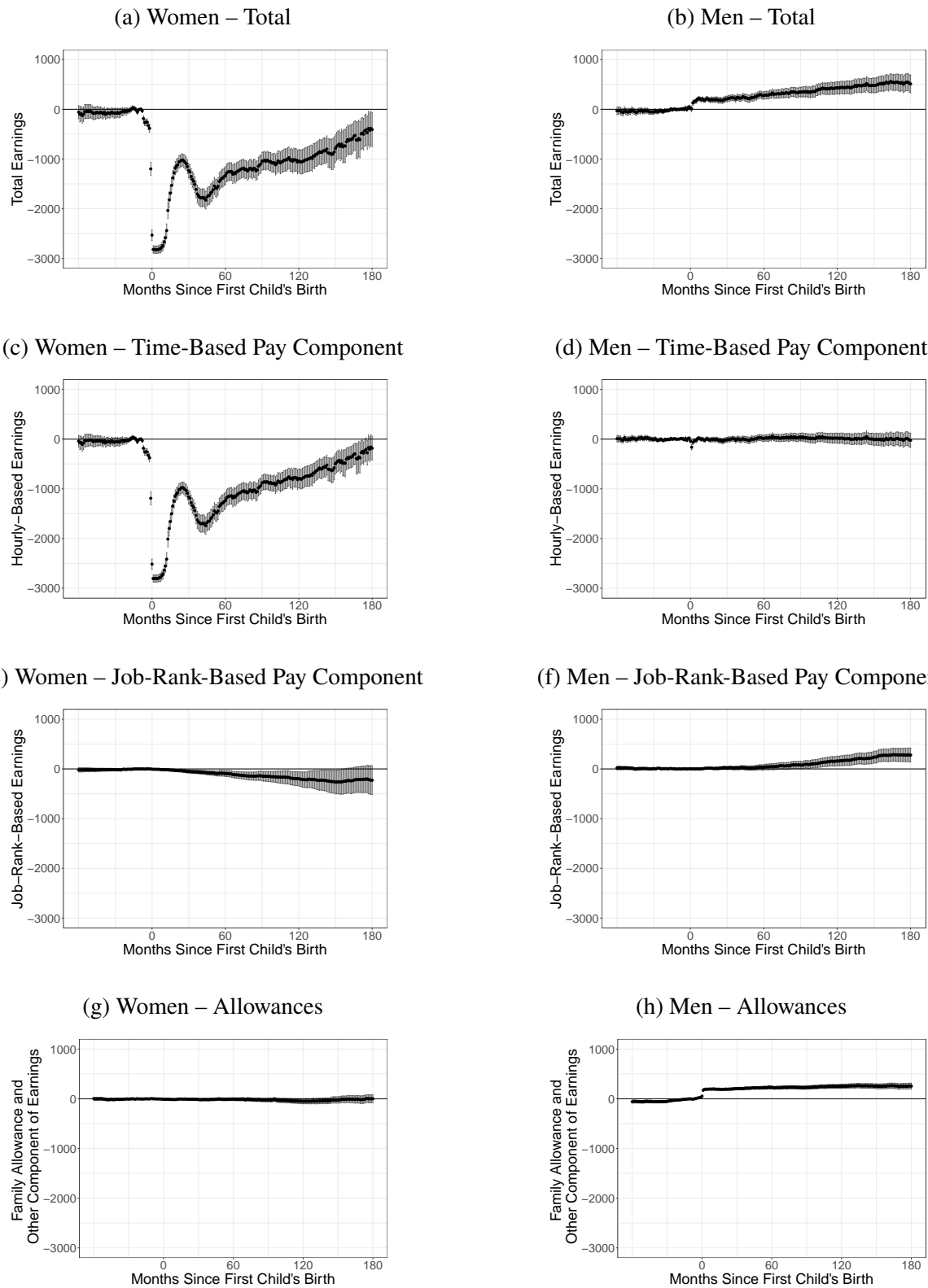


Figure 5: Event Study Estimates by Pay Component

*Notes:* This figure shows the event study estimates and 95% confidence intervals for the impact of childbirth on monthly earnings by pay component, based on the regression specified in equation (1). The reference month is set at the time of conception ( $e = -10$ ). All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY.

in Section 3.1. Before child conception, the earnings trajectories of the treated and control groups align closely, with no statistically significant differences observed. In contrast, after childbirth, the trajectories diverge, showing the impact of childbirth on earnings: positive for men and negative for women.

Figure 5 presents the event study estimates of the motherhood penalty and fatherhood premium. At the top row, Figure 5a displays the effect on women’s total earnings while Figure 5b shows men’s total earnings while. In both cases, there is no significant pretrend found, which supports the parallel trend assumption. Averaged over the first ten years after childbirth, the long-run motherhood penalty is 47% while for fathers there is a small premium of 7.4%. Combining the two, the long-run child penalty defined in equation (3) is 54.5%.

Our data can further quantify the impact of childbirth on each pay component as shown in the second to the fourth rows of Figure 5. Specifically, 5c and Figures 5d present the event-study estimates for the impact on time-based pay for women and men, respectively. Figures 5e and 5f display the effects on job-rank-based pay, while Figures 5g and 5h illustrate the impact on allowances. No significant pre-trend is observed for any pay component except for allowances for men,<sup>24</sup> further supporting our identification strategy. These estimates help us to breakdown the fatherhood premium and motherhood penalty.

The sources of the motherhood penalty change over time. As shown in Figure 5c, time-based pay declines sharply after childbirth, initially accounting for nearly the entire motherhood penalty. Because our payroll data is recorded monthly, we capture the steep earnings drop when mothers take parental leave. While earnings gradually recover within two years, they dip again, likely due to about half of the mothers having a second child.<sup>25</sup> Data on parental leave and reduced hours usage, as shown in Figure 1, together with the event-study estimates of the effects of childbirth on hours worked reported in Appendix A.5, support this pattern. After 60 months, the reduction in time-based pay begins to steadily diminish. Meanwhile, job-rank-based pay experiences a smaller but noticeable decline immediately after childbirth, which grows steadily over time. This pattern contrasts with findings from previous studies using registry data, which report an immediate and significant drop in occupational rank and promotion opportunities following childbirth (Kleven et al., 2019b; Bronson and Thoursie, 2021).

In contrast to mothers, fathers’ earnings gains stem from pay rules that are formally neutral but

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<sup>24</sup>The small pre-trend observed a year before conception arises from a higher proportion of treated men getting married during this period, which increases the amount of family allowance. We are unable to match treated and control groups by the year of marriage because data on the exact year of marriage are not available for all individuals.

<sup>25</sup>Figure 13 in Appendix A.2 shows the distribution of the number of children among male and female workers at the firm.

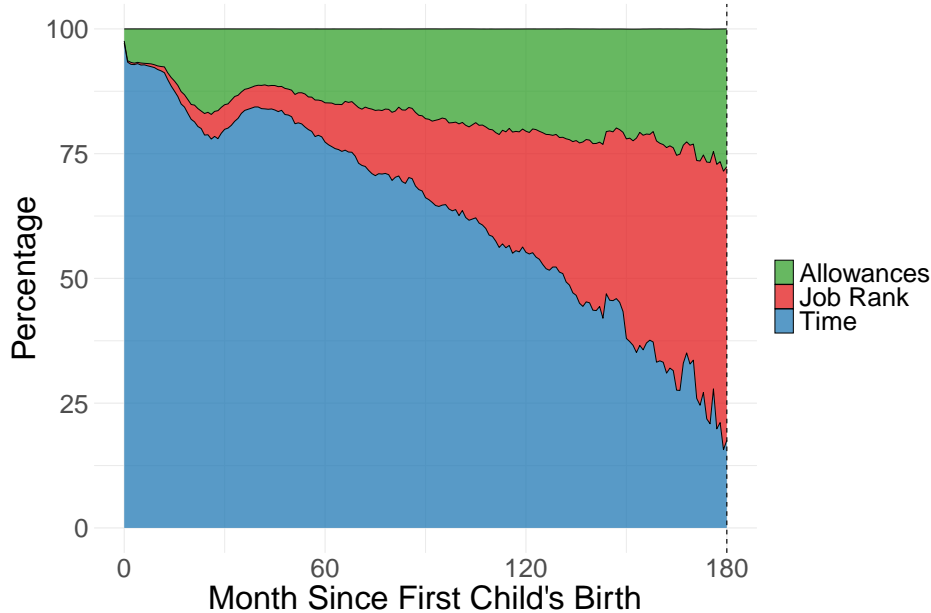


Figure 6: Sources of Child Penalty

Notes: This figure shows the relative contributions of pay components, time, rank and allowances, to the child penalty. The estimates are derived from the regression specified in equation (1).

operate along gendered lines. Figure 5h shows an immediate, significant, and persistent positive impact on allowances at the time of childbirth. This increase is mostly automatic, driven by the family allowance, which is common in Japanese firms. The allowance provides additional compensation to household heads, with the amount increasing as family size grows. As discussed in Section 2.2, while the family allowance is *de jure* (by law) gender-neutral, it is *de facto* (in practice) gendered, as male employees are almost always considered household heads. As shown in 5d, the arrival of a child has little effect on time-based pay, except for a small but noticeable drop in the first few months after childbirth, unlike findings from studies in the US (Lundberg and Rose, 2000). As shown in Figure 5f, job-rank-based pay shows no short-term effect, but positive impacts emerge in the long run.

Combining the motherhood penalty and the fatherhood premium reveals which components of pay drive the widening gender earnings gap after childbirth. Figure 6 illustrates the changing shares of the sources of the child penalty, extending up to 15 years after childbirth. Time-based pay initially accounts for nearly 90% of the penalty, consistent with women’s leave-taking patterns (Section 2.3.2). This coincides with increased family care responsibilities: employee surveys reveal a 70-percentage point rise in female employees needing work accommodations after their first childbirth (detailed in Appendix A.6). However, the relative importance of these factors shifts over time. By year 10, time-based pay’s contribution decreases to 60%, while job-rank-based pay steadily grows to

17%. Beyond this point, the impact of rank-based pay increases significantly, becoming the largest contributor to the penalty by year 15. This evolution suggests that understanding the long-term child penalty requires examining the mechanisms behind the growing rank component, particularly promotions and job evaluations, which we address in the next section.

### 3.3 Robustness

**Alternative Event Study Specification** As we discussed in Section 3.1, we implement an alternative event study design without matched controls, following the empirical approach used in previous studies on the child penalty, such as [Kleven et al. \(2019b\)](#). Detailed results are reported in Appendix A.3. Overall, the estimates from our main event study and the alternative design are similar, suggesting that our findings are not driven by the specific choice of event study design.

**Possibility of Spillover Effects** Studies have shown that parental leave absences can influence coworkers and overall workplace dynamics ([Gallen, 2019](#); [Ginja et al., 2023](#); [Brenøe et al., 2023](#); [Huebener et al., 2025](#)). This raises the concern that our matched control group, composed of individuals who never had children, may have been indirectly affected by their coworkers' parental leave during their careers. However, as discussed in Appendix A.4, we do not find compelling evidence for this concern in our data. Although workplace responses to parental leave are an important topic, we do not consider them a major confounding factor in our estimates of the child penalty.

## 4 Mechanisms Linking Childbirth to Career Penalties

The child penalty is driven by slower promotion in the long-run: missed rank advances accumulate into a growing gap in job-rank-based pay. To understand this process, we trace the chain from promotions to their underlying determinants. We first document the gender gap in promotions, then examine how promotions depend on evaluation scores, and finally show that evaluations at the entry rank are highly sensitive to working hours. This sequence links childbirth to persistent career penalties for mothers.

Table 3: Unconditional Promotion Rate by Gender

Promotion	Men	Women	Gender Gap	p-value	Relative rate
Staff Member to Team Leader	0.05	0.02	0.04	0.00	0.35
Team Leader to Senior Team Leader	0.08	0.09	-0.01	0.75	1.09
Senior Team Leader to Manager	0.07	0.05	0.02	0.19	0.72

*Notes:* This table reports the unconditional, annual promotion hazard by sex at each job rank. Relative rate is defined as women’s promotion rate divided by men’s rate.

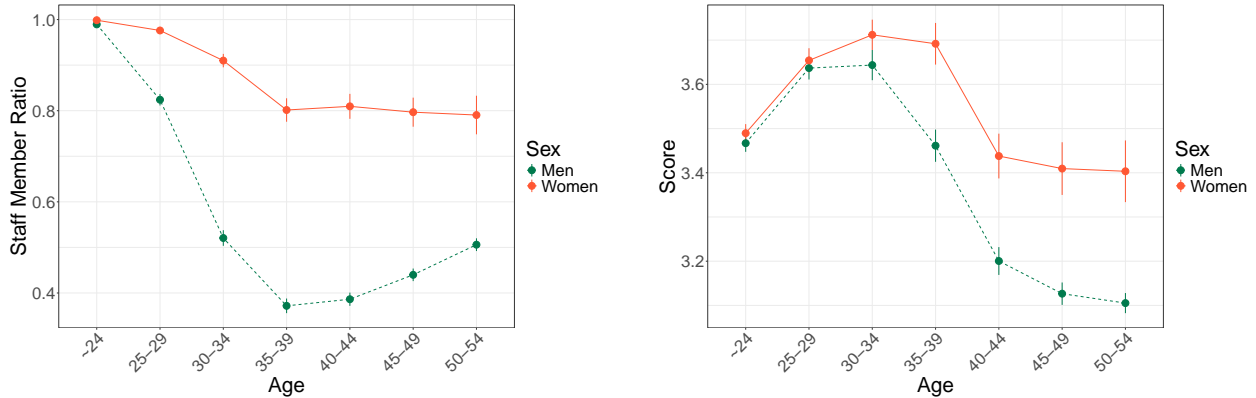


Figure 7: Dynamics of Promotion and Evaluation Scores at the Lowest Rank

*Notes:* The left panel shows the share of individuals who remain in the lowest-ranked position, disaggregated by gender and age group. The right panel presents the average annual evaluation scores among these lowest-ranked workers, also by gender and age group.

## 4.1 Gender Promotion Gaps

Promotions are the first step in the chain linking childbirth to long-term earnings losses. Table 3 shows that women are promoted from staff member to team leader at less than half the rate of men, creating an early “broken rung” on the career ladder. Although the gap narrows at higher ranks, women remain underrepresented in managerial positions.

Figure 7 provides further evidence. The left panel shows that women remain concentrated in the lowest rank well into their 30s and 40s, while many men advance. The right panel reveals that women who remain at the bottom often have equal or higher evaluation scores than their male peers. This suggests that the initial promotion barrier is not explained by lower measured performance, motivating our next step: examining how promotions are determined within the firm.

## 4.2 Determinants of Promotion

To understand why women advance more slowly, we examine how promotions are determined within the firm. Supervisors recommend employees for promotion based on annual evaluation scores, which reflect performance, teamwork, and leadership potential and are approved two levels up in the hierarchy. Although the firm does not formally consider working hours, interviews with HR suggest that long hours and availability may informally influence these evaluations, especially at the entry rank.

To understand how these evaluations translate into promotion decisions, we examine the relationship between performance scores and promotion rates. Figure 8 shows the average annual promotion rate by performance evaluation score from the previous year. For each job rank, the promotion rate increases with performance scores. Achieving the highest score (5) increases the likelihood of promotion by a factor of three to five compared to the second-highest score (4). These statistics indicate that the current promotion system assigns higher performers to higher ranks, confirming the HR department's explanation.

While performance scores play a crucial role in promotions, we also examined the potential influence of working hours. The HR department notes that working hours are not officially considered in promotion decisions, as the ability to work longer is not a prioritized quality. Figure 9 presents the distribution of weekly hours worked across three non-managerial positions: staff member, team leader, and unit leader. Although team and unit leaders on average work longer hours than staff members, these leaders do not necessarily work beyond 50 hours per week. In fact, some leaders work less than 40 hours per week. However, HR reports that supervisors often informally favor employees who work longer hours or take on unconventional shifts, such as night shifts. The extent to which this unofficial preference influences internal promotions, however, remains unclear.

To empirically assess the influences of performance evaluation scores and hours of work, as well as other demographic characteristics, we run a regression model for promotion. This model examines the factors affecting an employee's likelihood of moving up by one rank, as described in Section 2.2. Specifically, for employee  $i$  at the rank  $r$  in the division  $s$  in year  $t$ ,

$$promote_{i,r,s,t+1} = \sum_j \beta_j^r \cdot \mathbf{D}_{i,t}^j + \sum_h \lambda_h^r \cdot \mathbf{D}_{i,t}^h + \theta_p^r \mathbf{D}_i^{female} + \tau_t^r + \delta_s^r + x'_{i,s,t} \gamma^r + \epsilon_{i,r,s,t} \quad (4)$$

where  $promote_{i,r,s,t+1}$  is an indicator of promotion from rank  $r$  to  $r + 1$  for worker  $i$  at division  $s$  in year  $t + 1$ . The variable  $\mathbf{D}_{i,t}^j$  ( $j = 1, 2, 4, 5$ ) is a dummy variable indicating whether an employee's evaluation score, rounded to the nearest integer, is  $j = 1, 2, 4, \text{ or } 5$ . Score 3 is the omitted category.

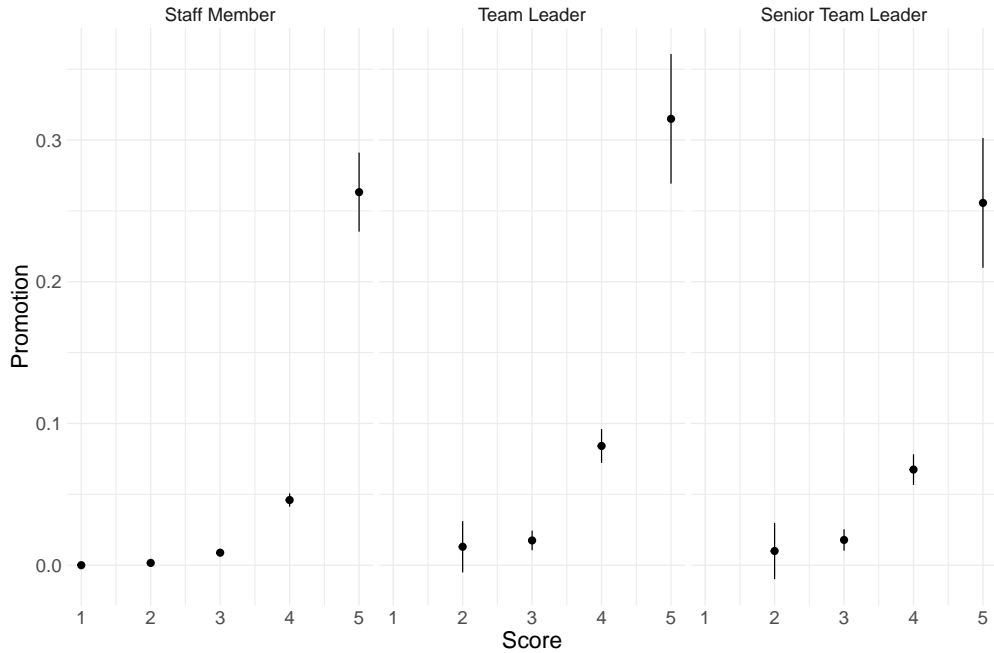


Figure 8: Promotion Rate by Evaluation Score and Job Rank

*Notes:* This figure shows the average annual promotion rate by evaluation score and job rank, based on data from 2013 to 2023. The sample includes employees who worked for at least one year in domestic offices during these years.

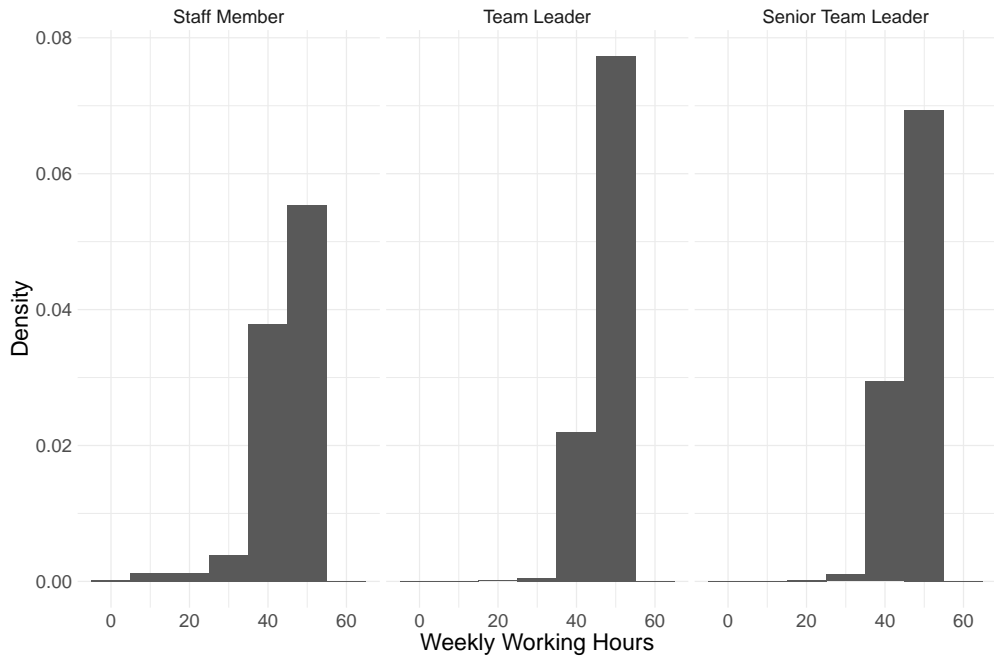


Figure 9: Distribution of Weekly Hours Worked by Job Rank

*Notes:* This figure shows the distribution of average weekly hours worked by job rank, based on pooled data from 2013 to 2023. The sample includes employees who worked for at least one year in domestic offices during this period.

The variable  $D_{i,t}^h$  is a dummy variable indicating whether an employee works shorter hours (less than 40 hours per week) or longer hours (more than 50 hours per week). Regular working hours (40-50 hours per week) serve as the reference category. The variable  $D_i^{female}$  is a female dummy,  $\tau_t^r$  is a time fixed effect,  $\delta_s^r$  is a division fixed effect, and  $x_{i,s,t}$  is a vector of  $i$ 's other characteristics including educational attainment, age, and recruitment channels through which  $i$  was hired. The last term  $\epsilon_{i,r,s,t}$  is an error term uncorrelated with all other variables.

Table 4 reports the results.<sup>26</sup> At each step of promotion, there is a significant, positive, non-linear relationship between the evaluation score and the promotion rate. Column 1 shows that compared to score 3, achieving the highest score (i.e., 5) increases the chance of promotion from staff member to team leader by 24 percentage points. Similarly, Column 2 shows that it increases the chance of promotion from team leader to unit leader by 29 percentage points, while Column 3 indicates a 26 percentage point increase for promotion from senior team leader to section manager. Consistent with HR's description, hours worked have no impact on promotion probability when evaluation score is given, except for a small negative effect of short working hours at the entry rank.

We note that, regardless of parenthood status,<sup>27</sup> being female reduces the likelihood of promotion from staff member to team leader by 4 percentage points. This gender gap is equivalent to the impact of a reduction in evaluation scores from 4 to 3, indicating a potential unexplained barrier for women in the promotion process. While this study focuses on the child penalty within the firm, our findings do not rule out the possibility that factors beyond the child penalty also contribute to the overall gender gap within the organization.

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<sup>26</sup>In Appendix A.7, we present the results from running the regression separately for each division.

<sup>27</sup>Appendix A.9 Table 14 presents the regression results controlling for parenthood status. Being female is associated with a 4 percentage-point lower likelihood of promotion from staff member to team leader, and this gap persists even after controlling for parenthood status. Among women, parenthood (coefficient on Child;  $0.02 - 0.03 = -0.01$ ) does not significantly affect promotion chances. In contrast, among men, having children appears to increase the likelihood of promotion compared to childless men. However, the magnitude is only one-tenth the size of the effect of increasing evaluation scores from 4 to 5. High evaluation scores remain the primary driver of promotion probability.

Table 4: Determinants of Promotions

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	-0.04 (0.00)	-0.04 (0.00)	-0.02 (0.02)	-0.03 (0.02)	-0.02 (0.02)	-0.03 (0.02)
<b>Evaluation score (ref. 3)</b>						
5	0.24 (0.01)	0.24 (0.01)	0.29 (0.02)	0.28 (0.02)	0.26 (0.02)	0.26 (0.03)
4	0.04 (0.00)	0.04 (0.00)	0.07 (0.01)	0.07 (0.01)	0.06 (0.01)	0.05 (0.01)
2	-0.01 (0.00)	-0.01 (0.00)	-0.01 (0.01)	0.00 (0.01)	-0.02 (0.01)	-0.01 (0.01)
1	0.00 (0.01)	0.00 (0.01)				
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>						
$\geq 50$ hours	-0.00 (0.01)	-0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	-0.00 (0.01)	-0.01 (0.01)
$< 40$ hours	-0.01 (0.00)	-0.01 (0.00)	0.03 (0.03)	0.04 (0.04)	0.04 (0.02)	0.02 (0.03)
Top		0.01 (0.01)		0.00 (0.01)		0.00 (0.01)
<b>Education (ref. High school)</b>						
4-Yr College	0.00 (0.00)	0.00 (0.00)	0.04 (0.01)	0.03 (0.01)	0.02 (0.01)	0.02 (0.01)
Some College	0.00 (0.01)	-0.01 (0.01)	0.09 (0.04)	0.08 (0.06)	0.03 (0.02)	0.03 (0.03)
Mid Carrer	-0.01 (0.00)	-0.01 (0.00)	-0.02 (0.01)	-0.02 (0.01)	-0.04 (0.01)	-0.04 (0.01)
Age	0.01 (0.00)	0.01 (0.00)	0.04 (0.00)	0.04 (0.00)	0.07 (0.01)	0.08 (0.01)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	0.04	0.04	0.08	0.08	0.07	0.06
Num.Obs.	18 349	17 819	4020	3504	3660	3081
R2 Adj.	0.114	0.111	0.117	0.110	0.092	0.100
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Division	X	X	X	X	X	X
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results from regressing promotion incidence on worker characteristics, as specified in regression equation (4). The regressions are run with and without an indicator variable identifying whether a worker has the longest tenure in their work unit. The sample includes workers from all divisions combined. The first two columns report results for all staff members, the next two focus on team leaders, and the final two on senior team leaders. All specifications include division and year fixed effects. Standard errors, clustered at the worker level, are shown in parentheses.

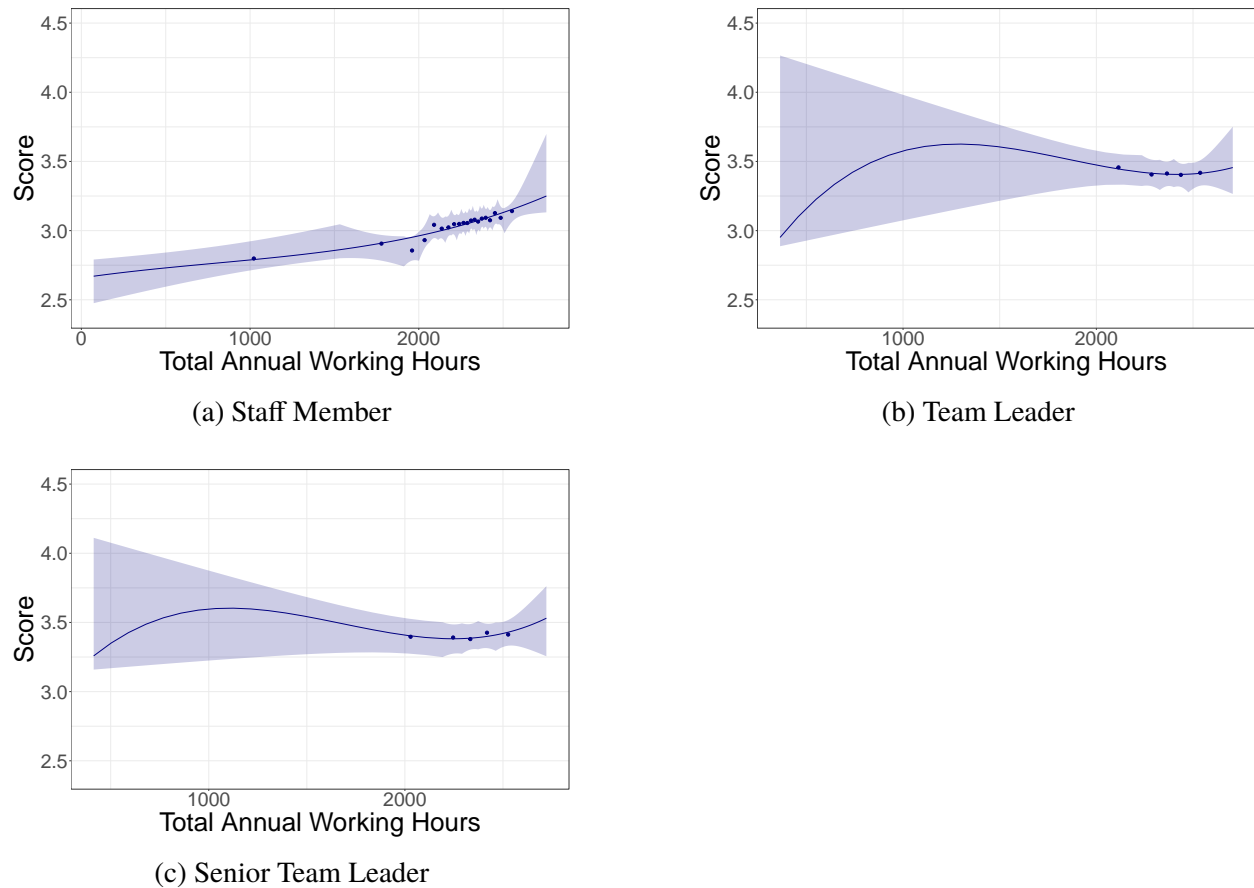


Figure 10: Hours Worked and Evaluation Scores

*Notes:* This binscatter plot illustrates the relationship between annual hours worked (x-axis) and annual evaluation scores (y-axis), following the methodology of Cattaneo et al. (2024). The optimal number of bins is determined by minimizing the integrated mean square error (IMSE), using the default settings in the *binsreg* package. The blue line represents a third-order polynomial fit, with shaded regions indicating 95% confidence intervals. All estimates control for division fixed effects.

### 4.3 Determinants of Performance Evaluation

Given that performance evaluations are crucial for promotion, as evidenced by our previous analysis, we next examine the determinants of evaluation scores. In particular, we are interested in understanding how working hours are associated with these scores, especially because our interviews with HR suggested that long hours are informally favored. This analysis will help us further unpack the mechanisms behind the promotion patterns we observe.

To see how hours of work is associated with evaluation scores in a simple framework, we apply the binscatter method proposed by Cattaneo et al. (2024). Here, we control for division fixed effects because evaluation criteria differ substantially by divisions, according to HR. As shown in Figure 10a, hours worked and evaluation scores are positively correlated at the lowest job rank (staff

member). This association, however, disappears at the higher ranks (see Figures 10b and 10c).

We also run the following regression model for performance evaluation with more control variables. Specifically, for employee  $i$  at the rank  $r$  in the division  $s$  in year  $t$ ,

$$eval_{i,r,s,t} = \sum_h \lambda_h^r \cdot \mathbf{D}_{i,t}^h + \theta_p^r \mathbf{D}_i^{female} + \tau_t^r + \delta_s^r + x'_{i,s,t} \gamma^r + \epsilon_{i,r,s,t} \quad (5)$$

where  $eval_{i,r,s,t}$  is  $i$ 's evaluation score in year  $t$ . The variable  $\mathbf{D}_{i,t}^h$  is a dummy variable indicating whether an employee works shorter hours (less than 40 hours per week) or longer hours (more than 50 hours per week). Regular working hours (40-50 hours per week) serve as the reference category. The variable  $\mathbf{D}_i^{female}$  is a female dummy,  $\tau_t^r$  is a time fixed effect,  $\delta_s^r$  is a division fixed effect, and  $x_{i,s,t}$  is a vector of  $i$ 's characteristics including educational attainment, age, and recruitment channels through which  $i$  was hired. The last term  $\epsilon_{i,r,s,t}$  is an error term uncorrelated with all other variables.

Table 5 presents the results.<sup>28</sup> At the lowest rank (staff member), there is a significant, positive, and non-linear relationship between hours worked and evaluation scores. Column 1 shows that long working hours are associated with a 0.07 point higher evaluation score than regular working hours. Conversely, short working hours are associated with a 0.20 point lower score than regular working hours. Interestingly, for team leaders (Column 2) and senior team leaders (Column 3), hours worked no longer show a statistically significant association with evaluation scores. Finally, the coefficient for the female dummy is positive and statistically significant, indicating that women perform better than men with the same work hours at the same hierarchical level, even though women's higher scores do not necessarily lead to more promotions, as we have shown in the previous subsection.

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<sup>28</sup>In Appendix A.8, we present the results from running the regression separately for each division.

Table 5: Determinants of Evaluation Scores

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	0.05 (0.02)	0.06 (0.02)	0.02 (0.07)	-0.05 (0.07)	-0.04 (0.06)	-0.06 (0.06)
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>						
$\geq 50$ hours	0.07 (0.02)	0.06 (0.02)	0.03 (0.04)	0.04 (0.04)	0.03 (0.04)	0.00 (0.04)
$< 40$ hours	-0.20 (0.02)	-0.19 (0.02)	0.11 (0.08)	0.08 (0.09)	0.00 (0.05)	-0.04 (0.06)
Top		0.07 (0.02)		-0.01 (0.02)		0.04 (0.03)
<b>Education (ref. High school)</b>						
4-Yr College	0.13 (0.02)	0.12 (0.02)	0.09 (0.04)	0.09 (0.04)	0.05 (0.04)	0.05 (0.04)
Some College	0.16 (0.06)	0.15 (0.06)	0.01 (0.12)	-0.09 (0.11)	0.04 (0.10)	0.03 (0.10)
Mid Carrer	0.04 (0.02)	0.04 (0.02)	0.15 (0.05)	0.16 (0.05)	0.10 (0.05)	0.11 (0.05)
Age	-0.00 (0.01)	-0.00 (0.01)	0.05 (0.02)	0.05 (0.02)	0.01 (0.03)	0.02 (0.04)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	3.38	3.37	3.63	3.62	3.67	3.65
Num.Obs.	18 349	17 819	4020	3504	3660	3081
R2 Adj.	0.201	0.196	0.097	0.085	0.146	0.137
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Division	X	X	X	X	X	X
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results of regressions analyzing annual evaluation scores based on worker characteristics, as specified in regression equation (5). The regressions are run with and without an indicator variable identifying whether a worker has the longest tenure in their work unit. The sample includes workers from all divisions combined. The first two columns report results for all staff members, the next two focus on team leaders, and the final two on senior team leaders. All specifications include division and year fixed effects. Standard errors, clustered at the worker level, are shown in parentheses.

## 5 Discussion

Our analysis in Section 4 identifies working hours as a critical pathway through which childbirth affects promotion prospects: increased caregiving responsibilities following childbirth constrain mothers' time allocation at work, which subsequently impacts their career progression. This finding raises three questions. First, we investigate why working hours are so crucial for career advancement in our setting (Section 5.1). Our evidence points to dynamic pay premiums for long working hours as the primary mechanism, while showing that tournament incentives might play a complementary role. We find limited support for alternative explanations based on signaling or human capital accumulation. Second, we consider whether mechanisms beyond the hours-evaluation-promotion channel might explain the child penalty (Section 5.2). We find limited empirical support for explanations based on managerial bias against mothers or changes in women's career aspirations following childbirth. These findings suggest that gendered time constraints after childbirth, rather than a priori bias or changes in aspirations, drive the motherhood penalty identified in Section 3.2. Third, we discuss the external validity of our empirical findings (Section 5.3).

### 5.1 Extended Hours and Career Advancement

Our analysis in Section 4 suggests an association between working hours and career advancement within the firm. This pattern, while documented in our single-firm setting, reflects a broader phenomenon observed across various contexts, from the United States (Bell and Freeman, 2001; Goldin, 2014) and Germany (Bell and Freeman, 2001) to Denmark (Frederiksen et al., 2024).<sup>29</sup> The widespread nature of this relationship suggests that our findings may have broader relevance. Below, we examine four potential mechanisms that could explain how long hours translate into career success. Our evidence points to dynamic pay premiums for long hours as the primary mechanism, while providing limited support for alternative explanations based on tournament incentives, signaling, or human capital accumulation.

The primary mechanism supported by our evidence is dynamic pay premiums for long working hours, or dynamic compensating differentials (Rosen, 1986a; Goldin and Katz, 2011; Goldin,

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<sup>29</sup>Using Danish registry data, Frederiksen et al. (2024) document population-wide evidence of a positive association between work hours and career success in Denmark. They examine the mechanisms linking hours to career outcomes. Their data support multiple explanations: tournament theory, asymmetric information about workers' costs of long hours, and human capital accumulation. They also find that long working hours matter for career progression only within the same firm, not when switching firms. Compared to Frederiksen et al. (2024), we use internal records including production outputs, detailed job ranks beyond the manager/non-manager distinction, work hours, evaluations, and qualitative interviews with the HR department. These data allow us to further narrow down the potential mechanisms linking long hours to career progression.

2014), that are premiums paid to workers who maintain extended availability and in-person presence (presenteeism), particularly at entry-level positions. This requirement stems from the need to address time-sensitive situations: sales staff must respond to urgent client requests involving perishable products, while manufacturing workers address unexpected demand surges or mechanical problems. While such events are infrequent, their potential costs make employee preparedness particularly valuable. Notably, these contingency responsibilities primarily affect entry-level positions rather than team leaders, whose main role is staff supervision. The firm addresses this technological constraint through two compensation channels: direct overtime pay and, more importantly, the promise of higher future earnings through better evaluation scores and promotion prospects.

While the dynamic compensating differentials explanation aligns well with our empirical patterns and institutional context, we systematically examine alternative explanations for two reasons. First, it helps validate our interpretation that the hours-evaluation link reflects technological constraints rather than other factors. Second, different mechanisms could have distinct implications for both the efficiency of current practices and potential policy interventions. We consider three alternative explanations.

The first alternative mechanism operates through human capital accumulation: longer working hours could build skills through learning-by-doing, leading to higher future productivity (Shaw, 1989; Imai and Keane, 2004). This mechanism has been documented in certain occupations, such as the gig economy (e.g., ride-share drivers) (Cook et al., 2021) and physically demanding jobs like the Marine Corps (Healy and Heissel, 2024), where it has been argued to contribute to the gender pay gap. In our context, however, the data do not support the human capital accumulation mechanism. If learning-by-doing explained our findings, we would expect employees who work longer hours to become more productive over time, which would, in turn, justify their higher evaluation scores. While we cannot directly observe individual productivity, we test this hypothesis using team-level data. Specifically, we examine whether teams whose non-managerial employees worked longer hours in year  $t - 1$  produce higher hourly output in year  $t$ , controlling for year and workplace fixed effects. Our analysis, detailed in Appendix A.11, finds no significant relationship between past working hours and current productivity. A likely explanation is that per-hour productivity is constrained by the available capital (e.g., machines), limiting the potential for productivity enhancement through additional working hours. This evidence suggests that productivity gains from learning-by-doing are unlikely to explain the observed relationship between working hours and evaluation scores.

Signaling theory (Spence, 1973) and career concern models (Holmström, 1999) suggest that early-career employees might use long working hours to signal their ability and leadership potential.

According to this explanation, evaluators would interpret extended hours as a proxy for leadership qualities, rewarding these workers with better evaluations. However, our evidence is not consistent with the signaling mechanism: we find that working hours do not correlate with performance evaluations at upper ranks (Section 4.3). This lack of correlation suggests that the ability to work long hours does not predict leadership effectiveness, making it unlikely that working hours serve as a meaningful signal of worker quality in our context.

Our evidence also supports a complementary role for tournament incentives. Tournament theory suggests that promotion and reward systems operate as rank-order tournaments where workers compete based on relative rather than absolute performance or hours worked (Lazear and Rosen, 1981; Rosen, 1986b). Recent evidence from Norway shows that tournaments based on hours worked can operate implicitly or informally, even when employers do not explicitly establish competitive incentives (Johnsen et al., 2024). This insight is relevant to our context. If implicit tournament dynamics are the primary driver of our findings, relative working hours among peers would predict evaluation scores more strongly than absolute working hours. To test this prediction, we modify regression (5) to include an indicator for whether an employee works the longest hours within their peer group (defined as those at the same job rank under the same supervisor). Our analysis shows that while being the longest-hours worker carries a significant additional premium in evaluation scores, the baseline relationship between absolute hours and evaluations remains the same (see Table 5). These results suggest tournament incentives may complement rather than replace our primary mechanism. That is, evaluators appear to reward both absolute effort and relative performance. This complementarity aligns with HR’s observation that the firm faces scarcity of talent for high-ranked positions.

In summary, our evidence suggests that dynamic compensating differentials, or the need to handle time-sensitive contingencies, creates fundamental demands for extended availability, particularly at entry-level positions. The firm addresses this technological constraint by rewarding availability through both evaluation scores and promotion decisions. This mechanism helps explain why reduced working hours following childbirth disproportionately affect early-career advancement: the ability to maintain extended presence is most valuable precisely when women face increased family demands.

## 5.2 Alternative Explanations for the Child Penalty

Our analysis shows that reduced working hours are the primary pathway linking childbirth to slower promotion. We next examine two alternative explanations for the child penalty: potential

discrimination against mothers and declining career aspirations after childbirth.

We first test whether supervisors hold explicit or implicit bias against mothers. In regressions of evaluation scores including a child indicator (Appendix A.9), we find no evidence that motherhood lowers performance assessments. Although women face lower promotion rates conditional on their score, this gap is unchanged after childbirth,<sup>30</sup> indicating that discrimination against mothers does not explain the penalty.

We corroborate this finding using employee survey data on sex-based unfair treatment (Appendix A.10). We compare the share of married women with and without children who report ever experiencing: (i) being excessively questioned about private life (e.g., marital status or childbearing), (ii) being looked down upon because of their sex, or (iii) being treated differently because of their sex. None of these differences are statistically significant. Together, the regression and survey evidence provide little support for the hypothesis that the child penalty arises from discrimination against mothers.

A second possibility is that childbirth reduces women’s career ambition, leading them to step back voluntarily from advancement opportunities. However, employee survey responses (Appendix A.6) show no significant change in stated career aspirations after childbirth.

Overall, these analyses indicate that the within-firm child penalty stems from gendered time constraints rather than bias or declining aspirations. Organizational practices that link early-career advancement to long working hours thus generate persistent gender gaps even without explicit discrimination. This insight motivates the theoretical analysis in the next section, which examines the efficiency implications of such promotion practices.

### 5.3 External Validity

Finally, we assess the generalizability of our empirical findings, considering both their relevance beyond Japan, as well as their applicability to the broader Japanese context.

To place our findings in an international context, we note that since fathers experience near-zero earnings effects following childbirth in most countries, the cross-country child penalty is effectively a comparison of motherhood penalties. Comparing our motherhood penalty directly (47%), our estimates remain larger than in the Nordic countries (21% in Denmark and 26% in Sweden) and the US (31%), comparable to the UK (44%), and smaller than in Austria (51%) and Germany (61%)

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<sup>30</sup>The sum of the coefficients on *child* and *child*×*female*, reported in Table 14, is not statistically different from zero.

(Kleven et al., 2019b). This is not surprising, given the relatively high proportion of people in Japan who believe mothers should stay at home. In the 2012 ISSP survey, 68.7% of respondents agreed with the statement that women should stay at home when there is a child under school age, similar to attitudes in other countries with a large child penalty. While cross-country cultural norms clearly influence the magnitude of the penalty, the underlying mechanism we identify, that is the career return to long working hours, is commonly observed across contexts, as discussed in Section 5.1. Our findings thus contribute to understanding the micro-level drivers of the long-run child penalty beyond the Japanese case.

Turning to the representativeness of our child penalty estimate within Japan, direct comparison is constrained by the fact that firm-level child penalty estimates do not exist for other firms, a data limitation that motivates our contribution in the first place. Two pieces of indirect evidence nonetheless suggest our estimates are relevant beyond this firm. First, the magnitude of our estimates aligns with the population-level estimate using administrative data: Fukai and Kondo (2025), using local tax records from 16 municipalities that cover about 39,000 men and women between 2018 and 2022, estimate a short-run earnings penalty at the four-year mark of approximately 50%, consistent with our estimate over a comparable window (64.5 %).<sup>31</sup> Second, since 2022, firms with over 300 employees have been required to disclose their gender pay gap, providing a basis for cross-firm comparison. As documented in Section 2.1 and Appendix A.12, this firm's gender pay gap is close to both the national average and the average for large manufacturing firms. To the extent that the cross-sectional gender pay gap reflects the cumulative within-firm gap in pay growth, of which the child penalty is a key driver, this comparability suggests our estimates are informative for Japanese manufacturing and for large Japanese firms more broadly.

The small positive fatherhood premium we document is also not specific to this firm. Two population-level studies for Japan, Fukai and Kondo (2025) using administrative tax records and Kikuchi (2026) using representative household survey data, consistently document a small but immediate and persistent post-birth earnings gain for fathers. Although neither study permits decomposing the source of this gain, the family allowance is a plausible contributor: as noted in Section 2.1, the allowance is de jure gender-neutral but de facto gendered, and more than 70% of Japanese firms with over 30 employees offer it.

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<sup>31</sup>It is likely that many mothers take parental leave for a second child within two to four years of the first birth, which would increase our estimate relative to theirs, as their measure includes parental leave benefits while ours does not.

## 6 Theoretical Exploration

Building on our empirical findings, we now investigate a theoretical model to explore the efficiency implications of the firm's current evaluation and promotion practices. Our analysis in the previous section revealed the following key patterns:

1. Promotions are mainly based on performance evaluation scores.
2. At the entry level, longer working hours are associated with higher evaluation scores. The association between hours worked and evaluations diminishes at higher ranks.

These patterns suggest that while working long hours may not be crucial for career advancement in the long run, it appears to be essential for getting started on the promotion track. In this section, we analyze an illustrative model of internal promotion that incorporates these empirical patterns. By modifying the model of [Gibbons and Waldman \(1999\)](#) to step-by-step promotion opportunities, we demonstrate that even in a simple model under full information and no taste-based or other a priori gender bias, these evaluation and promotion practices themselves can cause production inefficiency. We then discuss implications to the long-run child penalty by focusing on gender differences in post-childbirth time constraints.

Consider a model with a unit mass of female workers and a unit mass of male workers in a firm. Each worker has two traits: *utility cost of working*  $\beta_i > 0$  which is potentially gender-specific as we discuss later, and *innate ability*  $\theta_i$  drawn from a uniform distribution over  $[\underline{\theta}, \bar{\theta}]$  where  $\bar{\theta} > \underline{\theta} > 0$ . For simplicity and to solely highlight the implications from a promotion policy, we assume that  $\theta_i$  is independently distributed across gender and observable to all parties.

There are three periods following childbirth,  $t = 1, 2, 3$ . A firm consists of three-rank job ladders,  $j = 1, 2, 3$ . If worker  $i$  is assigned to job rank  $j$  in period  $t$ , then the worker produces outputs  $y_{i,t} = d_j + c_j \eta_{i,t}$ , where  $d_j$  and  $c_j$  are parameters and known to all parties. We assume that  $d_1 \geq d_2 \geq d_3 \geq 0$  and  $c_3 \geq c_2 \geq c_1 \geq 0$ .<sup>32</sup> We also assume that workers are paid at their own productivity (evaluated by the firm), i.e.,  $w_{i,j,t} = d_j + c_j \eta_{i,t}$  where  $\eta_{i,t}$  represents worker  $i$ 's human capital (evaluated by the firm) in period  $t$ , as defined in the next paragraph.

Each worker  $i$  is endowed with the initial productivity  $\eta_{i,1} = \theta_i$  and assigned to job 1 (entry rank) at the beginning of period 1. Given  $\eta_{i,t}$  and period- $t$  job rank denoted by  $j(t)$ , each worker

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<sup>32</sup>For the solution of the utility maximization (which is introduced later) to be well-defined, we also assume that  $\beta_i > 2c_1$ ,  $\beta_i(\beta_i - c_1) > 2c_2^2$ , and  $\beta_i^2 > c_2^2 + c_3^2$ .

chooses hours worked  $h_{i,t} \geq 0$ . Then, worker  $i$ 's (cumulative) evaluation score on the job according to one's own ability and hours worked in period  $t$  is updated to:

$$\eta_{i,t+1} = \eta_{i,t} + \theta_i + \mathbf{1}_{j(t)=1} h_{i,t}.$$

Because all workers are assigned to job 1 at the beginning of period 1,  $\eta_{i,2} = 2\theta_i + h_{i,1}$  for any  $i$ . The firm's promotion rule at the end of period  $t = 1, 2$  is to assign worker  $i$  from job 1 to job 2 (team leader) if and only if  $\eta_{i,t+1} \geq \eta_1$ , and to assign worker  $i$  from job 2 to job 3 (senior team leader) if and only if  $\eta_{i,t+1} \geq \eta_2$ , where  $\eta_1$  and  $\eta_2$  are exogenously-given thresholds with  $\eta_2 > \eta_1 > \bar{\theta}$ .<sup>33</sup>

Four remarks are in order. First, consistent with Fact 1, worker  $i$ 's productivity is increasing in one's own ability. Second, reflecting Fact 2 that long working hours are appreciated only for the lowest-rank job, worker  $i$ 's evaluation score is increasing in one's own labor input only for  $j = 1$ . Third, if a worker is not promoted in period 1, then the worker cannot be promoted to the highest rank ( $j = 3$ ). Fourth, because each worker's wage is assumed to be paid at her/his production, each worker receives all of the production surplus. Hence, production efficiency (together with each worker's utility maximization, as defined in the next paragraph) implies Pareto efficiency in our model.

We assume that worker  $i$ 's utility takes the following form:

$$U(\theta_i, \beta_i) = \left( w_{i,j(1),1} h_{i,1} - \frac{1}{2} \beta_i h_{i,1}^2 \right) + \left( w_{i,j(2),2} h_{i,2} - \frac{1}{2} \beta_i h_{i,2}^2 \right) + \left( w_{i,j(3),3} h_{i,3} - \frac{1}{2} \beta_i h_{i,3}^2 \right).$$

Each worker chooses their labor inputs  $(h_{i,1}, h_{i,2}, h_{i,3})$  to maximize their own utility. Note that if each  $\eta_{i,t}$  were exogenously fixed, the optimal labor input would be characterized by the first-order condition  $h_{i,t} = w_{i,j,t} / \beta_i = (d_j + c_j \eta_{i,t}) / \beta_i$ , which we call effective productivity of worker  $i$ .

In Appendix B, we derive the worker's optimal decision by solving the maximization problem and provide the proofs of the following propositions. Figure 11 illustrates the optimal household behavior depending on  $\theta_i$  and  $\beta_i$ . Note that the worker is more likely to be promoted to a higher job rank, as one's ability ( $\theta_i$ ) increases or the marginal disutility of labor ( $\beta_i$ ) decreases.

Now, we focus on a situation in which female workers bear higher marginal cost of working than male workers due to higher childcare responsibilities, i.e.,  $\beta_{female} > \beta_{male}$  (consistent with

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<sup>33</sup>Different from existing models such as Gibbons and Waldman (1999), Gicheva (2013), Kato et al. (2017), and Bronson and Thoursie (2021), there is a friction on promotion steps: each worker faces the same promotion thresholds and cannot be promoted from job 1 to job 3 within one period. For this friction, we assume that workers can neither negotiate with a company nor find an outside position with a higher-ranked job. Consistent with this assumption, there is essentially no wage negotiation in these (non-top) job ranks in the firm. Furthermore, hiring a worker for a middle or high-rank position is exceptional.

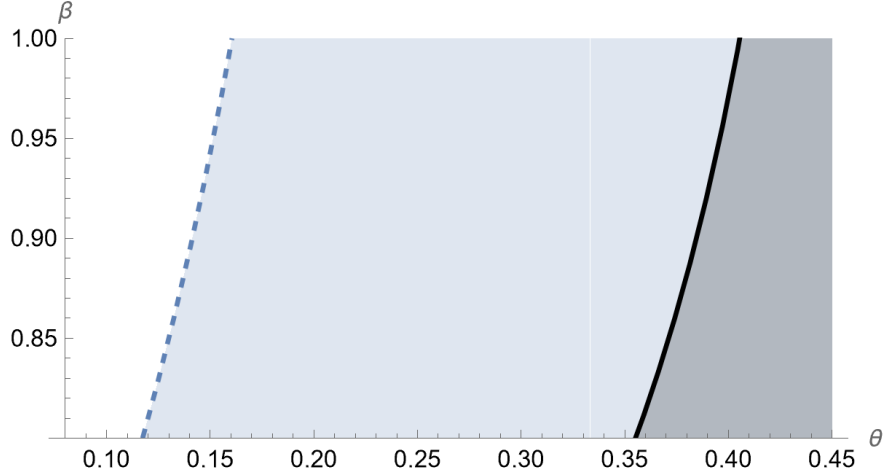


Figure 11: Illustration of Household Behavior

*Notes:* This figure illustrates the optimal household decisions when  $c = 0.3$ ,  $d = 0.05$ ,  $\eta_1 = 1$ , and  $\eta_2 = 1.5$ . In the last period ( $t = 3$ ), the worker's job rank is  $j = 1$  if the worker is in the left area of the dashed curve;  $j = 2$  if the worker is in the area between the dashed curve and the thick curve, and  $j = 3$  if the worker is in the right area of the thick curve.

the fact shown in Figure 22a). Then, we obtain the following theoretical results:

**Proposition 1** Female workers' unconditional promotion rate from  $j = 1$  to  $j = 2$  is lower than male workers'.

**Proposition 2** It is possible that female workers' unconditional promotion rate from  $j = 2$  to  $j = 3$  is higher than male workers'.

Propositions 1 and 2 align with empirical findings in Table 3. Namely, male workers' annual promotion rate from staff member to team leader is significantly higher than the female workers' rate. However, at higher ranks, the promotion rates for male workers are not necessarily higher than those for female workers.<sup>34</sup> Note that our model is also consistent with the motherhood penalty reported in Section 3.2: the presence of childcare responsibilities increases the marginal disutility of labor ( $\beta_i$ ), which results in reduced hours worked and subsequently lower promotion rates.

**Proposition 3** It is possible that a female worker who is not promoted to  $j = 3$  has higher innate ability ( $\theta_i$ ), human capital ( $\eta_{i,3}$ ), and effective productivity at  $j = 3$  ( $\frac{d_3 + c_3 \eta_{i,3}}{\beta_i}$ ) than a male worker who is promoted to  $j = 3$ .

<sup>34</sup>It is possible that female workers' unconditional promotion rate is lower than male workers' one in Proposition 2. For example, if  $\eta_2$  is sufficiently large, only male workers who have both low  $\beta_i$  and high  $\theta_i$  can be promoted to  $j = 3$ .

Proposition 3 highlights a possibility of production inefficiency. This result comes from the firm’s promotion and evaluation systems. To understand the intuition behind Proposition 3, consider first a female worker with high  $\theta_i$  and high  $\beta_i$ . Suppose that the female worker does not work long in  $t = 1$  and hence does not get promoted to  $j = 2$  at the end of  $t = 1$ . Consider next a male worker with lower  $\theta_i$  and  $\beta_i$  than the female worker. The male worker may work very long in  $t = 1$  so that he can get promoted at the end of both periods. By comparing these two workers, it is possible in  $t = 3$  that the female worker has higher innate ability ( $\theta_i$ ), human capital ( $\eta_{i,3}$ ), and effective productivity  $\left(\frac{d_3 + c_3 \eta_{i,3}}{\beta_i}\right)$  than the male worker. In this case, production (and Pareto) inefficiency occurs, as productive efficiency would improve if the female worker (rather than the male worker) were assigned to  $j = 3$  in  $t = 3$ . As illuminated in the proof, this result is particularly relevant when the first promotion step is substantially harder than later ones, a feature that appears in our data.

Table 3 and Figure 7 show empirical patterns consistent with the above result. Women experience much lower promotion rates at the first step of the career ladder, and those who remain at the entry rank often receive higher evaluation scores than their male counterparts. This pattern suggests talent misallocation: high-performing but time-constrained women are promoted more slowly than lower-performing men, reflecting the promotion dynamics described in our model.

Note that the talent misallocation identified in Proposition 3 can occur even when long working hours at the entry level directly and persistently increase human capital. If long working hours contributed nothing to human capital accumulation yet still resulted in higher evaluation scores, the case for misallocation would be straightforward: the firm would be promoting less qualified workers based on an unproductive signal.

Building on but beyond the discussions in the literature, Proposition 3 theoretically highlights that job-assignment inefficiency can occur through the combination of the firm’s step-by-step promotion policy and the evaluation of long working hours at entry-level positions. That is, even under full information and no taste-based or other a priori gender bias, a firm’s seemingly gender-neutral HR management policies themselves can lead to production (and Pareto) inefficiency, thereby systematically disadvantaging employees with childcare responsibilities. Given that step-by-step promotion policies are widespread across industries, we briefly discuss possible evaluation and promotion reforms in the concluding section.

## 7 Concluding Remarks

Using detailed personnel data, we decompose the child penalty into distinct pay components, revealing a substantial child penalty of 54.5%. The sources of this penalty follow a clear intertemporal pattern: while time-based pay drives the initial impact immediately following childbirth, job-rank-based pay gradually becomes the dominant factor, accounting for the majority of the child penalty by the 15-year mark. This evolution reflects an interconnected mechanism: reduced working hours following childbirth lead to lower performance evaluations, which subsequently constrain promotion opportunities. Our analysis reveals that long working hours serve as a critical factor for advancement within the firm, while our theoretical model highlights that such promotion practices can generate production inefficiencies.

Our findings highlight that while current promotion practices may appear merit-based in isolation, their gendered implications emerge when considered within the broader social context. In a society where women disproportionately bear caregiving responsibilities, these practices systematically limit advancement opportunities for capable women with children compared to equally qualified men who face fewer time constraints, leading to a broken rung phenomenon. Furthermore, as demonstrated in our theoretical model, these promotion practices can cause production inefficiency.

One avenue for addressing this issue is to develop evaluation processes that emphasize potential for managerial performance rather than easily measurable inputs such as hours worked. When managerial roles require substantially different skills than entry-level positions, promotion decisions should place less weight on current job performance metrics like hours worked. Our theoretical analysis suggests that production inefficiency would not arise if hours worked influenced only current compensation rather than promotion prospects. Critically, such reforms remain feasible even when firms face legitimate demands for extended availability. The key is to compensate employees for meeting these demands through wage premiums rather than embedding availability requirements into career advancement criteria.

Our study has some limitations that suggest avenues for future research. Most notably, we do not address why the firm continues to maintain potentially inefficient human resource practices or what prevents changes from being made. We hypothesize that these practices are remnants of a time when the male-sole-breadwinner model was the norm, and the workforce was homogenous, predominantly male, and had ample disposable time due to stay-at-home female partners. In that context, rewarding long working hours did not result in efficiency losses. Additionally, changing internal practices can be costly, and those in higher leadership positions, who advanced under the

current system, may have little incentive to push for change. Understanding why firms adopt and maintain certain human resource management practices would provide valuable insights into why the gender gap in the labor market persists and why progress toward closing it is slow.

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Unpacking the Child Penalty Using Personnel Data:  
How Promotion Practices Widen the Gender Pay Gap  
Appendices

## A Data Appendix

### A.1 Data Sources

Table 6: Data sources

Data source	period	frequency
Payroll data	September 2013 to January 2024	monthly
Job assignment records	September 2013 to January 2024	monthly
Employee demographics	For all employees in data	
Leave taking records	For all employees in data	
Employee performance evaluation	2014 to 2023	annual
Performance review questionnaire	2016 to 2024	annual

## A.2 Summary Statistics

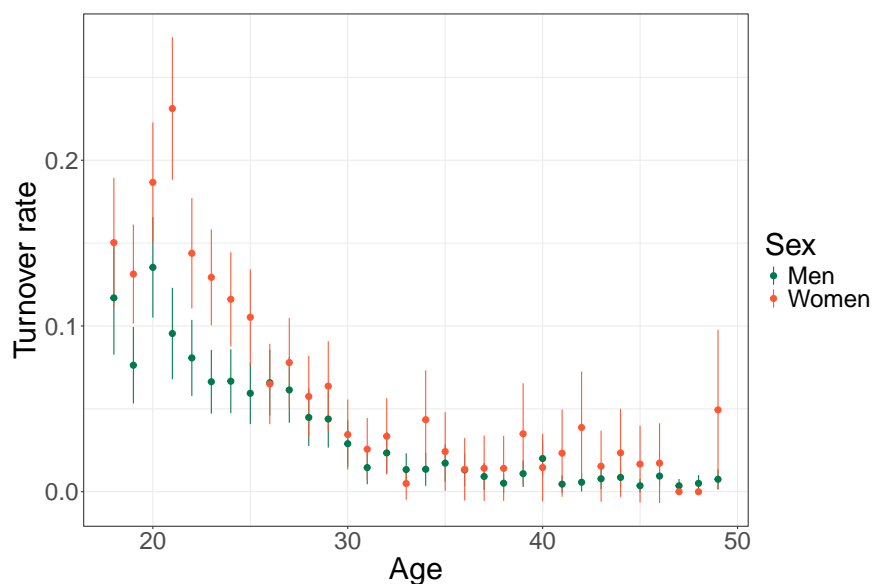


Figure 12: Annual Quit Rate by Age and Gender

*Notes:* This figure displays the annual share and 95% confidence intervals of employees who quit the firm, calculated separately for age and gender groups, based on internal personnel records from 2013 to 2023.

Figure 12 shows the average annual quit rate by age and gender, calculated as the total number of voluntary quits in a given year divided by the number of employees of the corresponding age and gender at the start of the year. The overall average quit rate across all ages is approximately 4%, with the rate decreasing as employees age. Women's quit rates are slightly higher than men's until the age of 25. However, after 25, there is no statistically significant difference in quit rates between men and women.

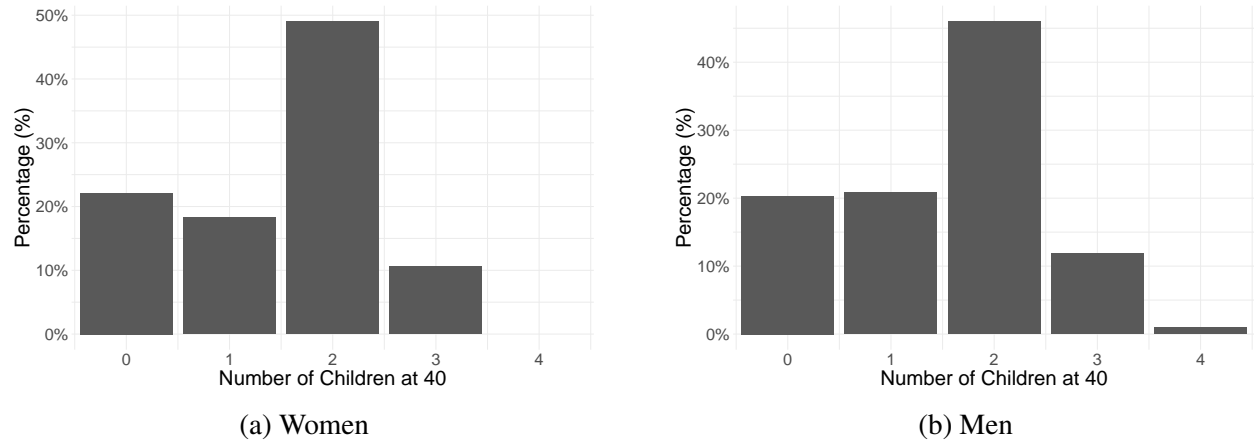


Figure 13: The percentage distribution of the number of children mothered (on the left) or fathered (on the right) by the employees at the age of 40. The sample is limited to employees born in 1983 or earlier who are currently employed at the firm as of September 2022.

Figure 13 displays the percentage distribution of the number of children mothered (left) and fathered (right) by age 40. For both men and women, nearly 45% have two children, while approximately 25% have none.

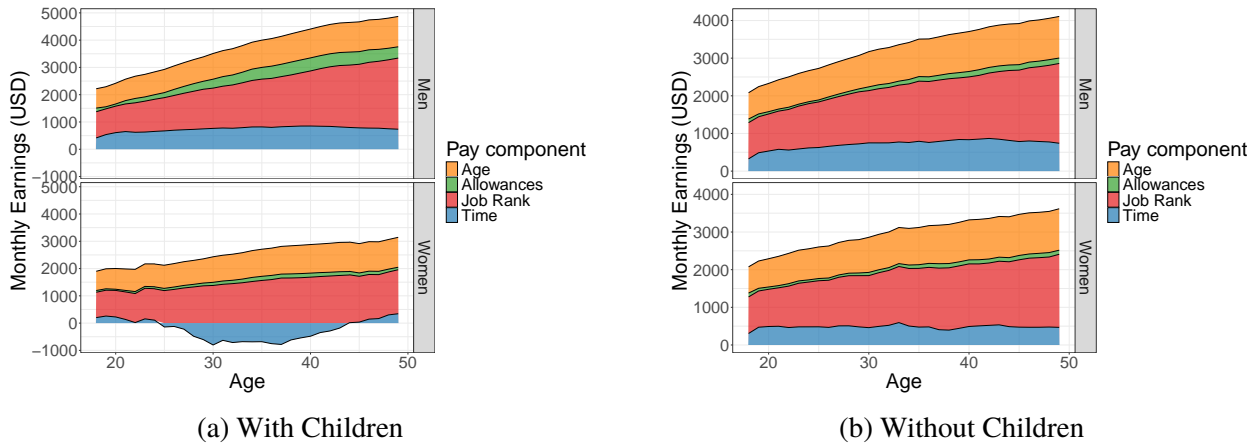


Figure 14: Decomposition of Average Monthly Earnings

*Notes:* This figure presents the average monthly earnings by age, gender, and family status groups, broken down into four pay components. Figure 14a displays the one for workers with children while Figure 14b displays the one for those without children. In both figures, the sample is restricted to employees aged 59 or below who have worked for at least one year at domestic office and have had the first child between September 2013 and January 2024. All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY.

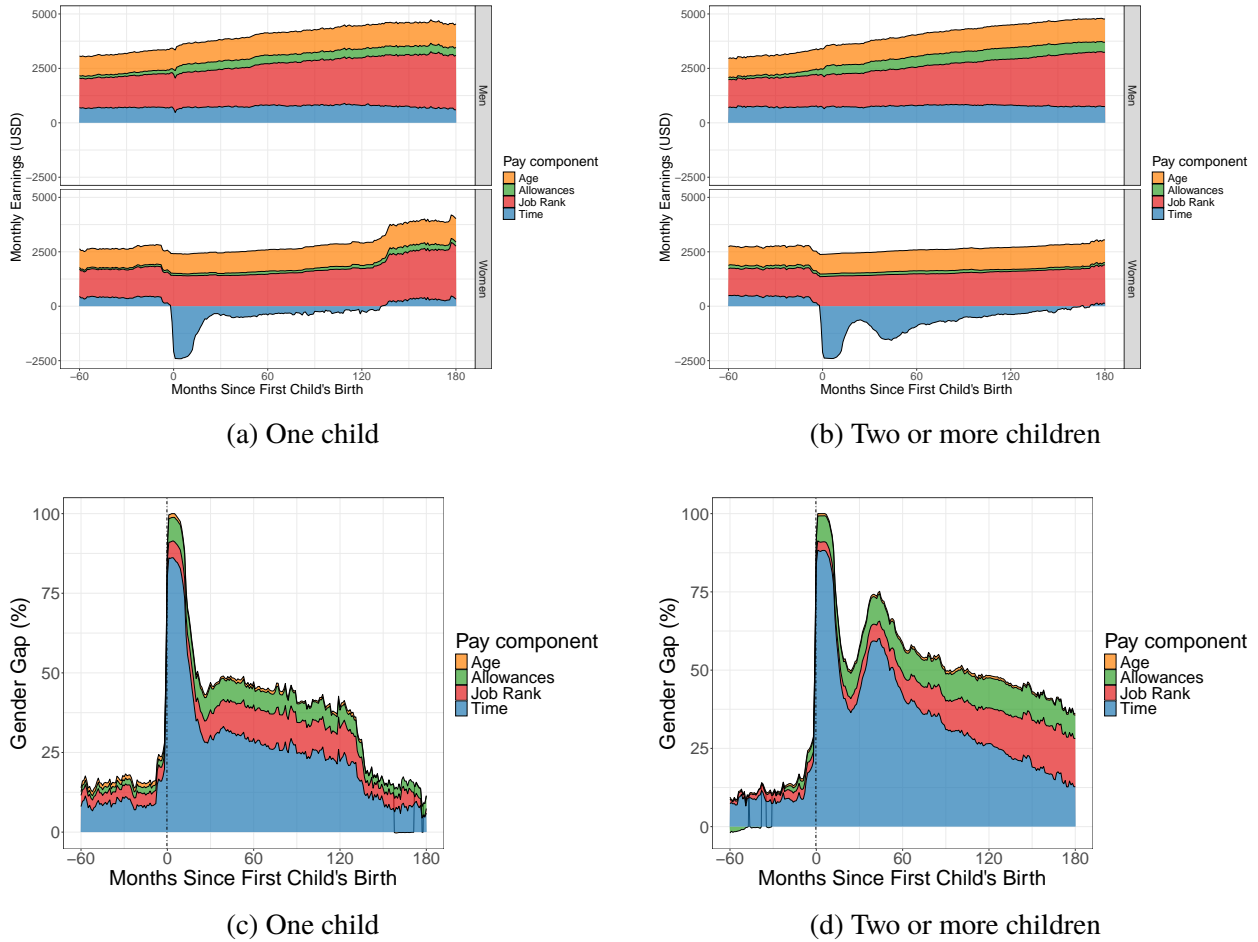


Figure 15: Monthly Earnings Around the Time of the First Childbirth by No. of Children

*Notes:* Figure 15a and Figure 15b display the accounting decomposition of average monthly earnings 60 months before and 180 months after the first childbirth, by the number of children. Figure 15c and Figure 15d display the earnings difference between male and female employees, by the number of children. The sample is restricted to employees aged 59 or below who have worked for at least one year at domestic office and have had the first child between September 2013 and January 2024. All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY, which was the average exchange rate in September 2013.

### A.3 Using Future Parents as Control

Table 7: Event Study Estimates Under Different Event Study Designs

		Matched Control	Future Parents as Control
Men	Total Earnings	280.50	315.30
	Time-Based Pay Component	9.30	-2.10
	Job-Rank-Based Pay Component	52.50	63.00
	Allowances	218.50	254.00
Women	Total Earnings	-1438.30	-1341.40
	Time-Based Pay Component	-1323.40	-1266.40
	Job-Rank-Based Pay Component	-96.90	-62.00
	Allowances	-18.10	-13.20
Child Penalty		54.60	53.60

*Notes:* This table presents a comparison of event study estimates on the impact of childbirth on monthly earnings by pay component, based on two different event-study designs. Column 1 reports estimates from the regression specified in equation (1), using matched controls. Column 2 reports estimates from the regression specified in equation (6), using future parents as controls. The reported estimates are averaged over the 10 years following childbirth. The reference month is set at the time of conception ( $e = -10$ ). All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY.

Earlier studies on the child penalty, such as [Kleven et al. \(2019b\)](#), use an event study design where the control group consists of not-yet-treated workers (i.e., future parents) rather than matched controls. To test the robustness of our main findings to the choice of control group, we conduct an alternative event study using future parents as controls and estimate the child penalty. Specifically, we estimate the following regressions on workers who had their first child during the study period:

$$Y_{it}^g = \sum_{e \neq -10} \alpha_e^g D_{it}^e + \sum_s \sum_k \beta_{k,s}^g Age_{it}^k Educ_i^s + \delta_t^g + \epsilon_{it}^g \quad (6)$$

where  $Y_{it}^g$  is monthly earnings.  $D_{it}^e = 1_{[t-E_i=e]}$  are event time dummies for treated unites. The coefficients  $\alpha_e^g$  capture the dynamic effects of the birth of the first child (i.e., the child penalty). We have interactions of age dummies,  $Age_{it}^k = 1_{[k=age_{it}]}$ , and education dummies,  $Educ_i^s = 1_{[s=Educ_i]}$ . Following [Kleven et al. \(2019b\)](#), we do not include individual fixed effects. Following [Adams-Prassl et al. \(2024c\)](#)'s recommendation, we allow for different age-earnings profiles by education and gender but, unlike theirs, we do not include time-since-graduation due to the high degree of collinearity between age and time-since-graduation.  $\delta_t^g$  is gender-specific calendar time fixed effects. The study window spans from 60 months (5 years) before childbirth (or placebo childbirth) to 120 months (10 years) after ( $e = [60, \dots, 180]$ ), with the timing of conception,  $e = -10$ , serving as the reference month.

The parameter of interest,  $\alpha_e^g$ , represents the impact of childbirth on monthly earnings, relative to ten months before the first childbirth, for individuals who remain with the same firm at event time  $e$ . A key assumption for the causal interpretation of  $\alpha_e^g$  is a parallel trend assumption: this means

that, had they not had children, the trajectory of monthly earnings for employees with children would have been parallel to that of employees without children.

Figure 16 presents event study estimates for each month before and after the birth of the first child, based on equation (6). Table 7 compares event study estimates of earnings components and child penalty effects using matched controls versus future parents as controls. Overall, the estimates from the two event study designs are comparable, suggesting that our findings are not driven by the specific choice of event-study design.

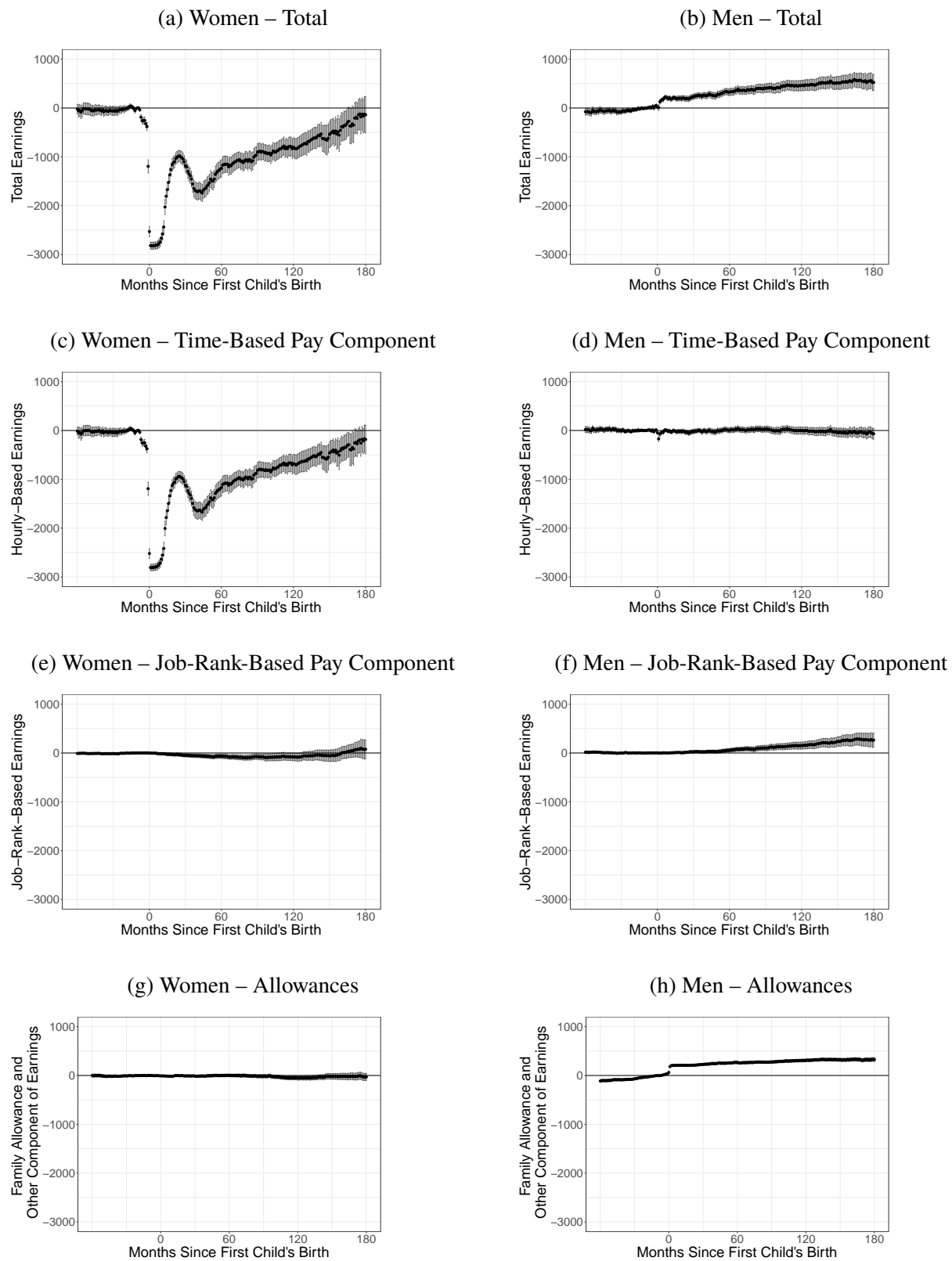


Figure 16: Event Study Estimates Using Future Parents as Control

Notes: This figure shows the event study estimates and 95% confidence intervals for the impact of childbirth on monthly earnings by pay component, based on the regression specified in equation (6). The reference month is set at the time of conception ( $e = -10$ ). All amounts in Japanese yen are converted to U.S. dollars using an exchange rate of 1 USD = 99 JPY. 19

## A.4 Spillover Effects of Parental Leave Absences

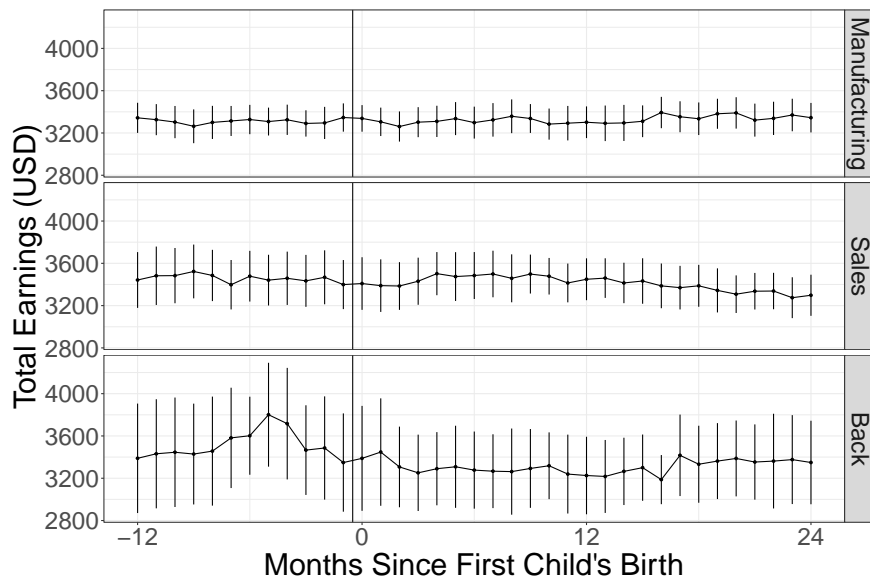


Figure 17: Monthly Earnings Around the Time of a Co-worker's First Childbirth

*Notes:* This figure shows the average monthly earnings of individuals whose female co-workers experienced their first childbirth, broken down by division. Event time is defined as the month in which the female co-worker gave birth. Team affiliation is measured and fixed one year before the event. The whiskers represent 95% confidence intervals.

Studies have shown that parental leave absences can affect coworkers and workplace dynamics more broadly (Gallen, 2019; Ginja et al., 2023; Brenøe et al., 2023; Huebener et al., 2025). This raises the question of whether our matched control group, consisting of individuals who never had children, may have been indirectly affected by their coworkers' parental leave at some point in their careers. For instance, they may have temporarily increased their labor supply to cover for absent colleagues, which could lead to an upward bias in the counterfactual earnings profile.

However, there is no strong indication of such an effect in our data. Figure 17 plots the raw average monthly earnings for individuals whose female co-workers have had their first child. The data show no clear changes in earnings before or after the event, suggesting that work hours or job responsibilities did not increase in response to coworkers' absences.

There are several possible explanations for why our findings differ from previous studies that document significant coworker effects. First, those studies often exploit unexpected or retroactively applied changes in parental leave policies, which cause substantial labor supply shocks. In our case, no such unanticipated policy changes occurred. Second, the firm we study is large and can rely on internal labor reallocation to adjust for absences. In contrast, many of the firms examined in the existing literature are small or medium-sized and have more limited capacity for internal

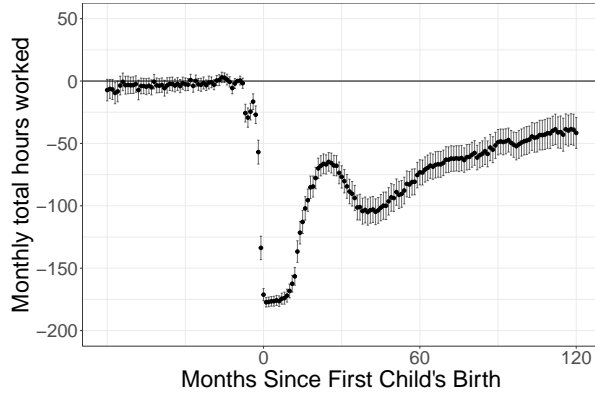
adjustment.

Although understanding how workplaces respond to parental leave absences is an important research question in its own right, we do not consider coworker spillover effects to be a major concern in interpreting our estimates of the child penalty.

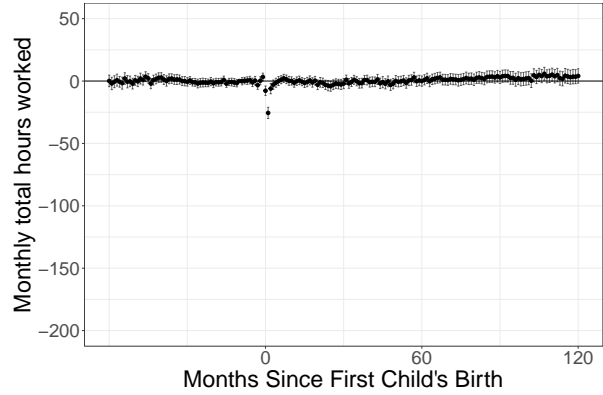
## A.5 Hours Worked

Figures 18 and 19 show event-study estimates of the effects of childbirth on hours worked and on the take-up of reduced-hours arrangements, based on the regression in equation (1). The patterns are consistent with the effects on the time-based pay component shown in Figure 5, which reassures that changes in the time-based pay component capture changes in hours worked.

Additionally, Figures 20 and 21 show the effects of childbirth on women's hours worked and on the take-up of reduced-hours arrangements, separately by the number of children. The goal is to assess whether the number of children matters for the child penalty at the ten-year mark. The dynamics differ between mothers with one child and those with two or more children. For mothers with two or more children, hours worked falls twice: once immediately after the first birth and again around the three-year mark, which likely corresponds to the timing of the second birth. In contrast, mothers with one child experience only a single decline. Despite these differences in the short- and medium-run dynamics, the long-run effect at the ten-year mark does not differ statistically between the two groups. This suggests that mothers adjust their hours over a long period after childbirth, and that caring for one child is not substantially less time-intensive than caring for two or more children, at least as measured by foregone work hours.



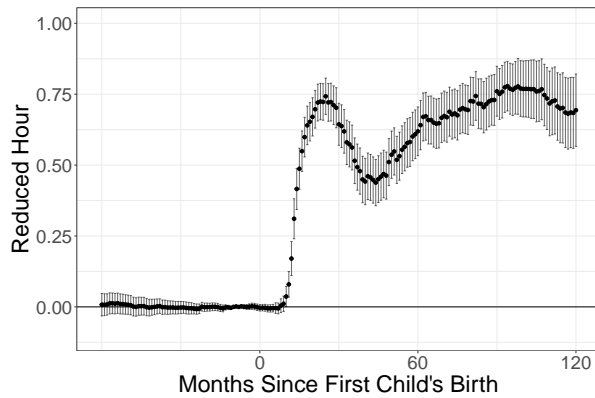
(a) Women



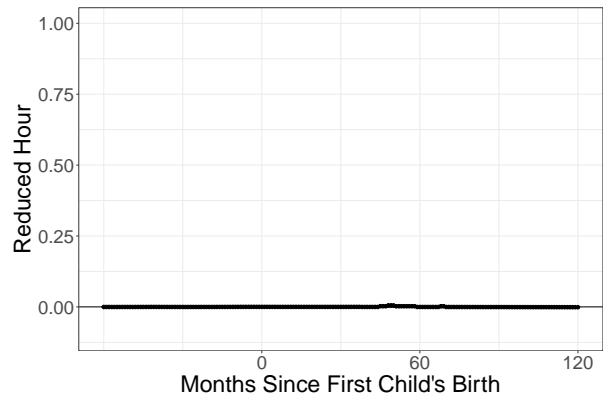
(b) Men

Figure 18: Childbirth Effects on Monthly Hours Worked

*Notes:* This figure presents event-study estimates of the effect of childbirth on monthly hours worked, with 95% confidence intervals, based on the regression in equation (1). The reference month is the month of conception ( $e = -10$ ). Hours are observed only for non-managers (staff members, team leaders, and section leaders); managers are therefore excluded from the regression.



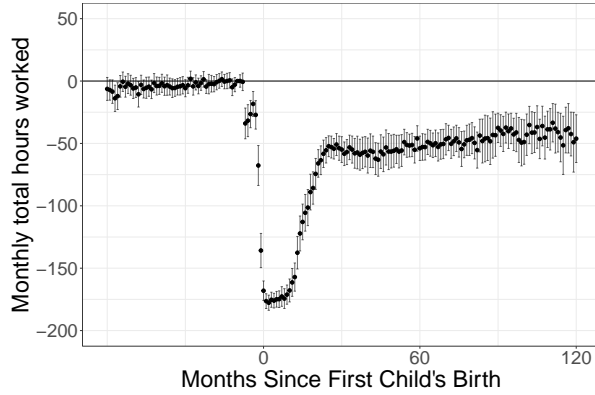
(a) Women



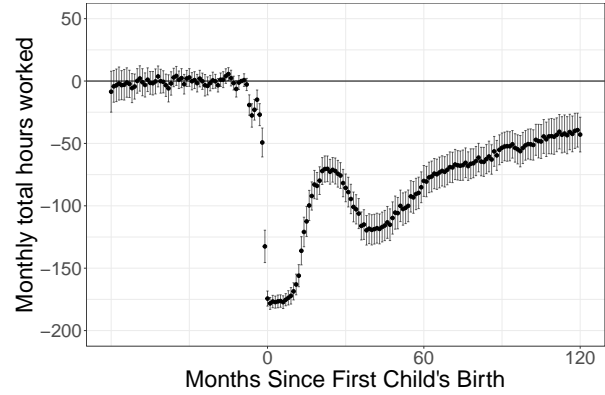
(b) Men

Figure 19: Effects of Childbirth on Reduced-Hours Take-Up

*Notes:* This figure presents event-study estimates of the effect of childbirth on the take-up of reduced-hours arrangements for parenting, with 95% confidence intervals, based on the regression in equation (1). The reference month is the month of conception ( $e = -10$ ). Hours are observed only for non-managers (staff members, team leaders, and section leaders); managers are therefore excluded from the regression.



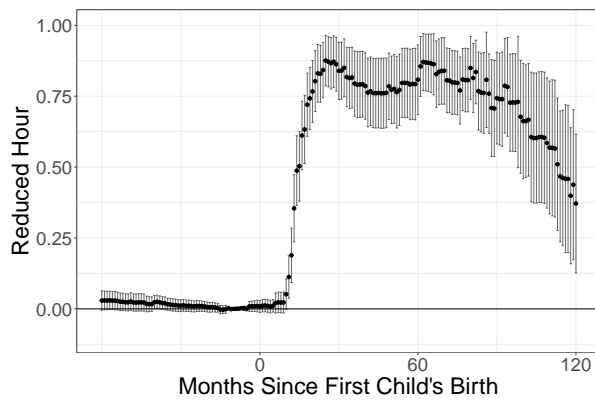
(a) One Child



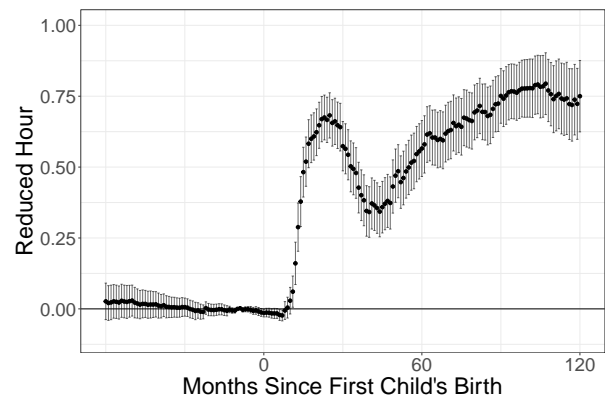
(b) Two or More

Figure 20: Childbirth Effects on Women’s Monthly Hours Worked by the Number of Children

*Notes:* This figure presents event-study estimates of the effect of childbirth on women’s monthly hours worked by the number of children, with 95% confidence intervals, based on the regression in equation (1). The reference month is the month of conception ( $e = -10$ ). Hours are observed only for non-managers (staff members, team leaders, and section leaders); managers are therefore excluded from the regression.



(a) One Child



(b) Two or More

Figure 21: Effects of Childbirth on Women’s Reduced-Hours Take-Up by the Number of Children

*Notes:* This figure presents event-study estimates of the effect of childbirth on women’s take-up of reduced-hours arrangements for parenting by the number of children, with 95% confidence intervals, based on the regression in equation (1). The reference month is the month of conception ( $e = -10$ ). Hours are observed only for non-managers (staff members, team leaders, and section leaders); managers are therefore excluded from the regression.

## A.6 Promotion Aspirations and Work-Family Conflicts

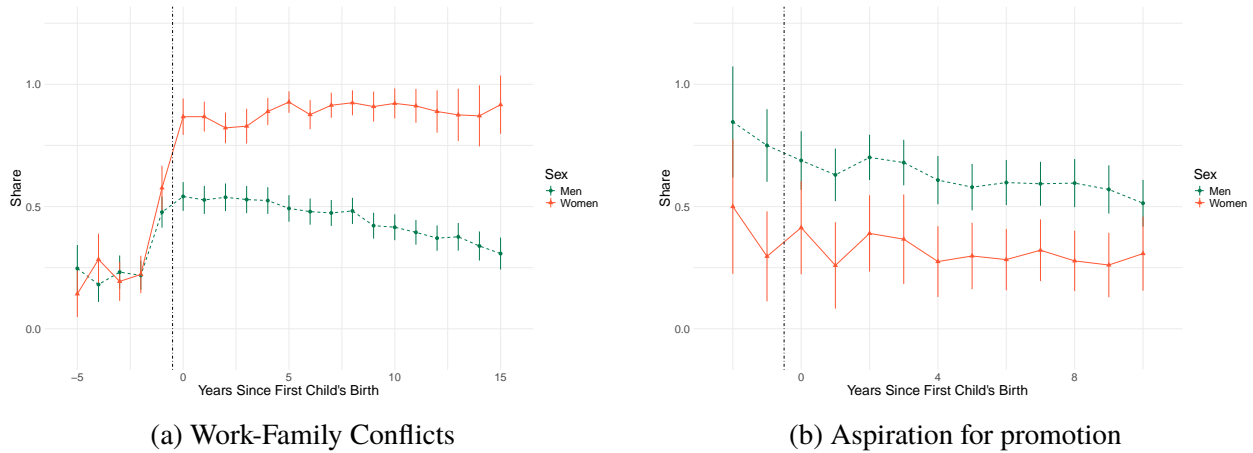


Figure 22: Employee Survey Responses Around the Time of Childbirth

*Notes:* Figure 22a shows the share and 95% confidential intervals of employees who expressed needs for work accommodations due to family care responsibilities before and after the birth of the first child. Figure 22b shows the share and 95% confidential intervals of employees who expressed their aspiration for promotion before and after the birth of the first child.

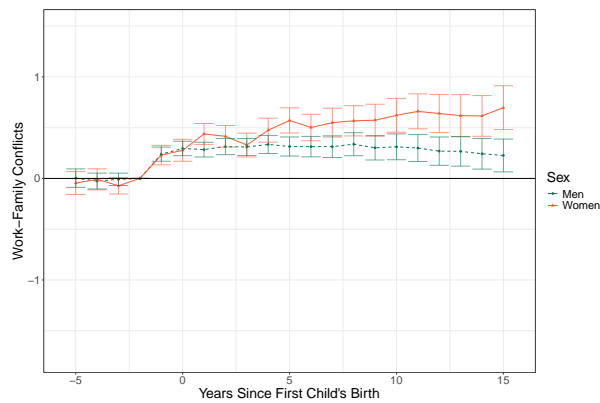
In addition to the impacts on monthly earnings presented in Section 3, we also examine the effects of first childbirth on promotion aspirations and work-family conflicts using data from the annual internal employee survey. As described in Section 2, the firm conducts a brief survey during the annual review meeting between supervisors and subordinates, collecting information on employees' work and personal situations for personnel planning purposes. In this analysis, we focus on two key areas: *work-family conflicts* and *promotion aspirations*. Work-family conflicts refer to whether an employee is experiencing personal challenges related to family care and has expressed needs for work accommodations. Promotion aspirations indicate whether an employee seeks advancement to the next rank.

The impact of childbirth on work-family conflict is sharp and immediate. Figure 23a shows the event study estimates on the share of male and female employees reporting work-family conflict in annual surveys. We observe no pre-trend and, as shown in Figure 22, no gender gap in responses prior to childbirth. However, a significant disparity emerges immediately after childbirth, with mothers experiencing a 70-percentage-point increase — more than double the rate observed for new fathers. This substantial mother-father gap persists and continues to widen over time.

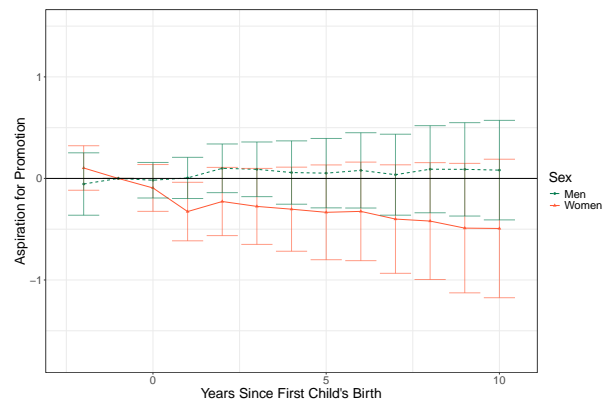
This diverging pattern of work-family conflicts aligns with the leave-taking and hours worked of mothers and fathers. While 93.2% of women take parental leave with an average duration of 366 days, only 4.4% of men do so following the birth of their first child, with an average leave duration

of just 29 days (conditional on uptake). Moreover, as discussed in Section 3.2, 78.1% of women opt for reduced work hours, compared to only 0.4% of men. The gender gap is striking but not surprising given the broader context. As discussed in Section 2, women spend about five times more time on household duties than men, the largest gender gap among OECD countries.

Meanwhile, the impact on promotion aspirations do not present a clear picture. Figure 22b displays the share and 95% confidential intervals of employees who expressed their aspiration for promotion before and after the birth of the first child. The data shows that a statistically significant gender gap in promotion aspirations already exists before birth. This pattern aligns with previous research (e.g., Azmat et al., 2024; Hospido et al., 2022), which highlights the gender gap in aspirations as a potential factor in the promotion gap. Post-birth, however, both men's and women's aspirations trend downward without a sharp decline immediately following childbirth. Figure 23b shows the event study estimates of the first childbirth on the percentage of employees who expressed a desire for promotion in annual surveys. Due to more limited panel availability for this outcome, the figure covers a shorter window than the main analysis. The point estimates show a gradual decline for women and a gradual increase for men although none are statistically significant. Thus we cannot conclusively say that aspirations are the primary mechanism behind the diverging outcomes between fathers and mothers, especially compared to the stark effects of work-family conflicts. Our findings do not completely contradict the idea that aspirations are not fixed and may be shaped by earlier experiences either, potentially amplifying the gender gap in career progression (e.g., Azmat et al., 2024).



(a) Work-Family Conflicts



(b) Aspiration for promotion

Figure 23: Impact of First Childbirth on Employee Survey Responses

*Notes:* This figure shows the event study estimates and 95% confidence intervals for the impact of childbirth on annual employee survey questions, based on the regression specified in equation (1). The reference year is set two years prior to the year of childbirth. In Figure 23a, the outcome is the share of employees who expressed needs for work accommodations due to family care responsibilities before and after the birth of the first child. In Figure 23b, the outcome is the share of employees who expressed their aspiration for promotion before and after the birth of the first child. The row means of the respective outcomes for the treated units are shown in Appendix A.3 Figure 22.

## A.7 Determinants of Promotion by Division

Table 8: Determinants of Promotions: Manufacturing Division

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	-0.04 (0.00)	-0.04 (0.00)	-0.00 (0.02)	-0.00 (0.02)	0.29 (0.02)	0.29 (0.03)
<b>Evaluation score (ref. 3)</b>						
5	0.27 (0.02)	0.27 (0.02)	0.28 (0.02)	0.28 (0.02)	0.29 (0.04)	0.29 (0.04)
4	0.04 (0.00)	0.04 (0.00)	0.06 (0.01)	0.06 (0.01)	0.06 (0.01)	0.06 (0.01)
2	-0.00 (0.00)	-0.00 (0.00)	-0.01 (0.01)	-0.01 (0.01)	-0.02 (0.01)	-0.02 (0.01)
1	-0.00 (0.00)	-0.00 (0.00)				
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>						
$\geq 50$ hours	-0.00 (0.01)	-0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)
$< 40$ hours	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.04)	-0.03 (0.03)	-0.11 (0.03)	-0.10 (0.03)
Top		0.01 (0.01)		-0.00 (0.01)		-0.00 (0.01)
<b>Education (ref. High school)</b>						
4-Yr College	0.01 (0.00)	0.01 (0.00)	0.04 (0.01)	0.03 (0.01)	0.00 (0.01)	0.00 (0.01)
Some College	-0.01 (0.01)	-0.01 (0.01)	0.09 (0.08)	0.09 (0.08)	0.10 (0.07)	0.19 (0.07)
Mid Carrer	-0.01 (0.00)	-0.01 (0.00)	-0.02 (0.01)	-0.02 (0.01)	-0.05 (0.01)	-0.05 (0.01)
Age	0.01 (0.00)	0.01 (0.00)	0.04 (0.00)	0.04 (0.00)	0.08 (0.01)	0.08 (0.01)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	0.03	0.03	0.07	0.07	0.05	0.05
Num.Obs.	13 254	13 249	3059	3021	1596	1576
R2 Adj.	0.115	0.116	0.110	0.111	0.106	0.110
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results from regressing promotion incidence on worker characteristics, as specified in regression equation (4). The sample is restricted to workers in the manufacturing division. Column 1 reports results for all staff members, Column 2 focuses on team leaders, and Column 3 on senior team leaders. Each specification includes division and year fixed effects. Standard errors are clustered at the worker level and are reported in parentheses.

Table 9: Determinants of Promotions: Sales Division

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	-0.08 (0.01)	-0.07 (0.02)	-0.08 (0.04)	-0.13 (0.03)	-0.05 (0.07)	-0.08 (0.04)
<b>Evaluation score (ref. 3)</b>						
5	0.36 (0.04)	0.34 (0.05)	0.37 (0.05)	0.36 (0.07)	0.28 (0.05)	0.36 (0.07)
4	0.06 (0.01)	0.06 (0.02)	0.11 (0.02)	0.16 (0.03)	0.08 (0.03)	0.06 (0.03)
2	-0.02 (0.02)	-0.01 (0.02)	-0.00 (0.05)	0.07 (0.10)	-0.05 (0.03)	-0.03 (0.03)
1	0.01 (0.02)	0.02 (0.02)				
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>						
$\geq 50$ hours	0.06 (0.16)	0.05 (0.16)	-0.05 (0.04)	-0.05 (0.04)	-0.10 (0.04)	-0.10 (0.06)
$< 40$ hours	-0.03 (0.02)	-0.03 (0.02)	0.17 (0.09)	0.37 (0.11)	0.07 (0.10)	0.02 (0.08)
Top		0.02 (0.01)		0.04 (0.03)		-0.00 (0.03)
<b>Education (ref. High school)</b>						
4-Yr College	0.04 (0.02)	0.04 (0.02)	0.04 (0.02)	-0.00 (0.03)	0.05 (0.02)	0.07 (0.03)
Some College	-0.01 (0.04)	-0.01 (0.04)	0.08 (0.03)	0.07 (0.06)	-0.03 (0.05)	0.03 (0.04)
Mid Carrer	0.04 (0.02)	0.04 (0.02)	0.02 (0.05)	-0.02 (0.07)	-0.01 (0.05)	-0.07 (0.03)
Age	0.06 (0.01)	0.06 (0.01)	0.05 (0.02)	0.05 (0.03)	0.12 (0.02)	0.13 (0.03)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	0.09	0.08	0.12	0.12	0.10	0.08
Num.Obs.	1631	1447	853	442	664	464
R2 Adj.	0.176	0.158	0.120	0.120	0.080	0.151
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results from regressing promotion incidence on worker characteristics, as specified in regression equation (4). The sample is restricted to workers in the sales division. Column 1 reports results for all staff members, Column 2 focuses on team leaders, and Column 3 on senior team leaders. Each specification includes division and year fixed effects. Standard errors are clustered at the worker level and are reported in parentheses.

Table 10: Determinants of Promotions: Back Office

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	-0.04 (0.01)	-0.03 (0.01)	0.05 (0.12)	-0.27 (0.26)	-0.03 (0.02)	-0.03 (0.02)
<b>Evaluation score (ref. 3)</b>						
5	0.16 (0.02)	0.16 (0.02)	0.31 (0.15)	0.87 (0.16)	0.24 (0.03)	0.20 (0.03)
4	0.02 (0.01)	0.02 (0.01)	0.16 (0.08)	0.32 (0.16)	0.06 (0.01)	0.04 (0.01)
2	-0.01 (0.01)	-0.01 (0.01)	0.09 (0.15)		0.01 (0.03)	0.01 (0.04)
1	0.09 (0.03)	0.09 (0.03)				
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>						
$\geq 50$ hours	-0.07 (0.01)	-0.08 (0.01)	0.09 (0.11)		0.03 (0.03)	0.02 (0.03)
$< 40$ hours	-0.03 (0.01)	-0.02 (0.01)	-0.19 (0.09)	-0.73 (0.20)	0.05 (0.02)	0.04 (0.03)
Top		0.01 (0.01)		-0.23 (0.10)		0.02 (0.01)
<b>Education (ref. High school)</b>						
4-Yr College	0.00 (0.01)	0.00 (0.01)	0.13 (0.10)	-0.07 (0.19)	0.03 (0.01)	0.03 (0.02)
Some College	0.01 (0.01)	-0.00 (0.01)	0.22 (0.08)		0.05 (0.03)	0.02 (0.03)
Mid Carrer	-0.02 (0.01)	-0.02 (0.01)	0.05 (0.11)	0.16 (0.20)	-0.03 (0.02)	-0.04 (0.02)
Age	0.03 (0.00)	0.03 (0.00)	0.05 (0.04)	0.12 (0.08)	0.06 (0.01)	0.07 (0.01)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	0.05	0.05	0.15	0.17	0.06	0.06
Num.Obs.	3464	3123	108	41	1400	1041
R2 Adj.	0.091	0.090	0.052	0.298	0.086	0.077
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results from regressing promotion incidence on worker characteristics, as specified in regression equation (4). The sample is restricted to back office workers. Column 1 reports results for all staff members, Column 2 focuses on team leaders, and Column 3 on senior team leaders. Each specification includes division and year fixed effects. Standard errors are clustered at the worker level and are reported in parentheses.

## A.8 Determinants of Evaluation Scores by Division

Table 11: Determinants of Evaluation Scores: Manufacturing Division

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	0.07 (0.02)	0.07 (0.02)	-0.03 (0.10)	-0.03 (0.10)	-0.21 (0.22)	-0.21 (0.22)
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>						
≥ 50 hours	0.06 (0.02)	0.05 (0.02)	0.03 (0.04)	0.03 (0.04)	-0.04 (0.05)	-0.05 (0.05)
< 40 hours	-0.20 (0.03)	-0.19 (0.03)	0.13 (0.09)	0.11 (0.10)	0.14 (0.18)	0.13 (0.19)
Top		0.07 (0.02)		-0.02 (0.03)		0.02 (0.04)
<b>Education (ref. High school)</b>						
4-Yr College	0.09 (0.03)	0.09 (0.03)	0.11 (0.05)	0.10 (0.05)	0.06 (0.05)	0.06 (0.06)
Some College	0.16 (0.08)	0.15 (0.08)	-0.14 (0.12)	-0.14 (0.12)	0.41 (0.09)	0.24 (0.08)
Mid Carrer	0.06 (0.03)	0.06 (0.03)	0.16 (0.05)	0.16 (0.05)	0.15 (0.05)	0.15 (0.05)
Age	-0.01 (0.01)	-0.01 (0.01)	0.05 (0.02)	0.05 (0.02)	-0.01 (0.05)	-0.01 (0.05)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	3.28	3.28	3.61	3.62	3.56	3.55
Num.Obs.	13 254	13 249	3059	3021	1596	1576
R2 Adj.	0.141	0.142	0.082	0.082	0.086	0.082
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results from regressing annual evaluation scores on worker characteristics, as specified in regression equation (5). The sample is restricted to workers in the manufacturing division. Column 1 reports results for all staff members, Column 2 focuses on team leaders, and Column 3 on senior team leaders. Each specification includes division and year fixed effects. Standard errors are clustered at the worker level and are reported in parentheses.

Table 12: Determinants of Evaluation Scores: Sales Division

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	-0.11 (0.05)	-0.08 (0.05)	0.00 (0.07)	-0.16 (0.07)	-0.13 (0.14)	-0.19 (0.13)
<b>Weekly Hours Worked (ref. 40 ≤ hours &lt; 50)</b>						
≥ 50 hours	0.02 (0.20)	0.02 (0.20)	-0.05 (0.10)	-0.07 (0.08)	0.06 (0.12)	0.14 (0.14)
< 40 hours	-0.16 (0.07)	-0.16 (0.07)	0.07 (0.15)	0.19 (0.18)	-0.07 (0.20)	0.10 (0.24)
Top		0.05 (0.04)		0.06 (0.06)		0.00 (0.06)
<b>Education (ref. High school)</b>						
4-Yr College	-0.00 (0.06)	0.02 (0.06)	0.02 (0.07)	-0.02 (0.08)	0.08 (0.08)	0.08 (0.09)
Some College	0.21 (0.17)	0.22 (0.17)	0.07 (0.18)	-0.05 (0.22)	-0.54 (0.15)	-0.53 (0.15)
Mid Carrer	0.07 (0.06)	0.07 (0.07)	0.15 (0.11)	-0.01 (0.13)	-0.25 (0.11)	-0.22 (0.15)
Age	-0.01 (0.02)	-0.02 (0.02)	0.01 (0.04)	-0.05 (0.06)	0.04 (0.08)	0.02 (0.09)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	3.55	3.54	3.68	3.66	3.77	3.72
Num.Obs.	1631	1447	853	442	664	464
R2 Adj.	0.249	0.249	0.154	0.132	0.244	0.264
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results from regressing annual evaluation scores on worker characteristics, as specified in regression equation (5). The sample is restricted to workers in the sales division. Column 1 reports results for all staff members, Column 2 focuses on team leaders, and Column 3 on senior team leaders. Each specification includes division and year fixed effects. Standard errors are clustered at the worker level and are reported in parentheses.

Table 13: Determinants of Evaluation Scores: Back Office

	Staff Member		Team Leader		Senior Team Leader	
	(1)	(2)	(1)	(2)	(1)	(2)
Female	0.05 (0.04)	0.04 (0.04)	0.38 (0.23)	0.52 (0.16)	0.00 (0.07)	-0.03 (0.07)
<b>Weekly Hours Worked (ref. 40 ≤ hours &lt; 50)</b>						
≥ 50 hours	0.20 (0.09)	0.19 (0.09)	-0.58 (0.14)		0.22 (0.08)	0.14 (0.08)
< 40 hours	-0.20 (0.03)	-0.19 (0.04)	-0.08 (0.22)	0.17 (0.13)	-0.03 (0.06)	-0.08 (0.06)
Top		0.06 (0.03)		-0.14 (0.12)		0.09 (0.04)
<b>Education (ref. High school)</b>						
4-Yr College	0.18 (0.04)	0.16 (0.04)	-0.10 (0.16)	-0.07 (0.13)	0.01 (0.06)	0.01 (0.07)
Some College	0.14 (0.09)	0.13 (0.09)	0.19 (0.16)		0.07 (0.13)	0.11 (0.13)
Mid Carrer	-0.04 (0.06)	-0.06 (0.06)	-0.32 (0.26)	-0.12 (0.12)	0.05 (0.09)	-0.00 (0.10)
Age	0.08 (0.01)	0.09 (0.01)	0.09 (0.08)	0.13 (0.08)	0.01 (0.05)	0.06 (0.06)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	3.68	3.68	3.72	3.73	3.75	3.76
Num.Obs.	3464	3123	108	41	1400	1041
R2 Adj.	0.174	0.175	0.240	0.467	0.151	0.140
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id
FE: Period	X	X	X	X	X	X

*Notes:* This table presents the results from regressing annual evaluation scores on worker characteristics, as specified in regression equation (5). The sample is restricted to back office workers. Column 1 reports results for all staff members, Column 2 focuses on team leaders, and Column 3 on senior team leaders. Each specification includes division and year fixed effects. Standard errors are clustered at the worker level and are reported in parentheses.

## A.9 Additional Analyses on Promotion and Evaluation Dynamics

Table 14: Determinants of Promotions

	Staff Member			Team Leader			Senior Team Leader		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Female	-0.04 (0.00)	-0.04 (0.00)	-0.04 (0.00)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	0.01 (0.02)
<b>Evaluation score (ref. 3)</b>									
5	0.24 (0.01)	0.24 (0.01)	0.24 (0.01)	0.29 (0.02)	0.29 (0.02)	0.29 (0.02)	0.26 (0.02)	0.26 (0.02)	0.26 (0.02)
4	0.04 (0.00)	0.04 (0.00)	0.04 (0.00)	0.07 (0.01)	0.07 (0.01)	0.07 (0.01)	0.06 (0.01)	0.06 (0.01)	0.06 (0.01)
2	-0.01 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.02 (0.01)	-0.02 (0.01)	-0.02 (0.01)
1	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)						
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>									
$\geq 50$ hours	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)
< 40 hours	-0.01 (0.00)	-0.02 (0.00)	-0.01 (0.00)	0.03 (0.03)	0.02 (0.03)	0.02 (0.04)	0.04 (0.02)	0.04 (0.02)	0.05 (0.02)
<b>Education (ref. High school)</b>									
4-Yr College	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.04 (0.01)	0.04 (0.01)	0.04 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Some College	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.09 (0.04)	0.09 (0.04)	0.09 (0.04)	0.03 (0.02)	0.03 (0.02)	0.03 (0.02)
Mid Carrer	-0.01 (0.00)	-0.01 (0.00)	-0.01 (0.00)	-0.02 (0.01)	-0.02 (0.01)	-0.02 (0.01)	-0.04 (0.01)	-0.04 (0.01)	-0.04 (0.01)
Child		0.02 (0.00)	0.02 (0.00)		0.01 (0.01)	0.01 (0.01)		0.01 (0.01)	0.02 (0.01)
Female*Child			-0.03 (0.01)			0.02 (0.04)			-0.09 (0.03)
Age	0.01 (0.00)	0.01 (0.00)	0.01 (0.00)	0.04 (0.00)	0.04 (0.00)	0.04 (0.00)	0.07 (0.01)	0.07 (0.01)	0.07 (0.01)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	0.04	0.04	0.04	0.08	0.08	0.08	0.07	0.07	0.07
Num.Obs.	18 349	18 349	18 349	4020	4020	4020	3660	3660	3660
R2 Adj.	0.114	0.115	0.116	0.117	0.117	0.117	0.092	0.092	0.094
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id	by: id	by: id	by: id
FE: Division	X	X	X	X	X	X	X	X	X
FE: Period	X	X	X	X	X	X	X	X	X

*Notes:* This table presents regression results examining promotion incidence based on worker characteristics, as specified in regression equation (4). The regressions include an indicator variable for whether a worker has children and its interaction with a female dummy variable, with and without these controls. The sample comprises workers from all divisions combined. The first three columns show results for all staff members, the next three focus on team leaders, and the final three on senior team leaders. All regressions include division and year fixed effects. Standard errors, clustered at the worker level, are reported in parentheses.

Table 15: Determinants of Evaluation Scores

	Staff Member			Team Leader			Senior Team Leader		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Female	0.05 (0.02)	0.06 (0.02)	0.06 (0.02)	0.02 (0.07)	0.06 (0.07)	0.05 (0.08)	-0.04 (0.06)	0.00 (0.06)	-0.03 (0.07)
<b>Weekly Hours Worked (ref. <math>40 \leq \text{hours} &lt; 50</math>)</b>									
$\geq 50$ hours	0.07 (0.02)	0.07 (0.02)	0.07 (0.02)	0.03 (0.04)	0.03 (0.04)	0.03 (0.04)	0.03 (0.04)	0.03 (0.04)	0.03 (0.04)
$< 40$ hours	-0.20 (0.02)	-0.26 (0.02)	-0.26 (0.02)	0.11 (0.08)	0.08 (0.08)	0.08 (0.08)	0.00 (0.05)	-0.02 (0.05)	-0.03 (0.05)
<b>Education (ref. High school)</b>									
4-Yr College	0.13 (0.02)	0.13 (0.02)	0.13 (0.02)	0.09 (0.04)	0.10 (0.04)	0.10 (0.04)	0.05 (0.04)	0.05 (0.04)	0.05 (0.04)
Some College	0.16 (0.06)	0.15 (0.06)	0.15 (0.06)	0.01 (0.12)	-0.02 (0.12)	-0.02 (0.12)	0.04 (0.10)	0.05 (0.10)	0.06 (0.10)
Mid Carrer	0.04 (0.02)	0.04 (0.02)	0.04 (0.02)	0.15 (0.05)	0.14 (0.05)	0.14 (0.05)	0.10 (0.05)	0.09 (0.04)	0.09 (0.04)
Child		0.20 (0.02)	0.20 (0.02)		0.11 (0.03)	0.11 (0.03)		0.12 (0.03)	0.11 (0.03)
Female*Child			0.00 (0.04)			0.03 (0.13)			0.09 (0.11)
Age	-0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.05 (0.02)	0.04 (0.02)	0.04 (0.02)	0.01 (0.03)	0.00 (0.03)	0.00 (0.03)
Age Squared	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Mean Outcome	3.38	3.38	3.38	3.63	3.63	3.63	3.67	3.67	3.67
Num.Obs.	18 349	18 349	18 349	4020	4020	4020	3660	3660	3660
R2 Adj.	0.201	0.215	0.215	0.097	0.104	0.103	0.146	0.153	0.154
Std.Errors	by: id	by: id	by: id	by: id	by: id	by: id	by: id	by: id	by: id
FE: Division	X	X	X	X	X	X	X	X	X
FE: Period	X	X	X	X	X	X	X	X	X

*Notes:* This table presents the results of regressions analyzing annual evaluation scores based on worker characteristics, as specified in regression equation (5). The regressions include an indicator variable for whether a worker has children and its interaction with a female dummy variable, with and without these controls. The sample comprises workers from all divisions combined. The first three columns show results for all staff members, the next three focus on team leaders, and the final three on senior team leaders. All regressions include division and year fixed effects. Standard errors, clustered at the worker level, are reported in parentheses.

## A.10 Workplace Experiences as Women by Parental Status

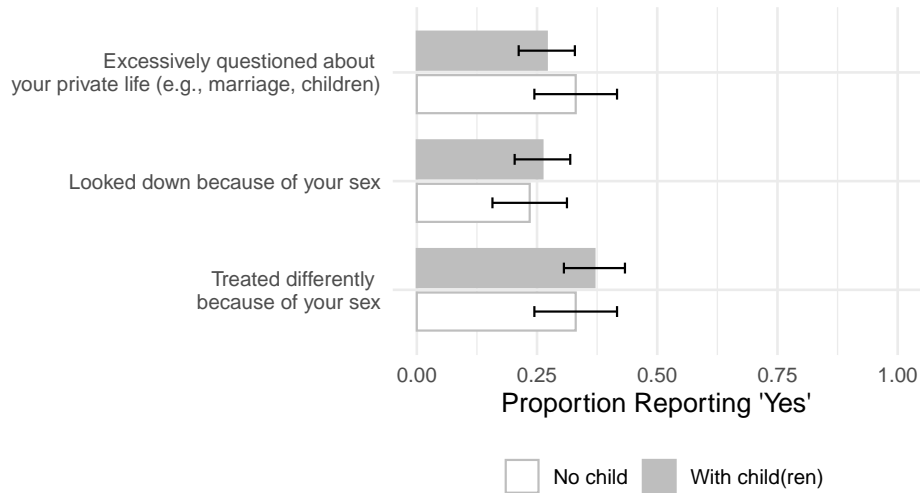


Figure 24: Workplace Experiences by Parental Status

*Notes:* This figure shows the proportion of married women who have ever experienced each stated form of workplace behavior, comparing those with and without children. The three items are adapted from Folke et al. (2020). Respondents rated each item on a five-point Likert scale (1 = Never, 2 = Once, 3 = Sometimes, 4 = Often, 5 = Very often). The survey was conducted as part of the work environment survey administered by HR in August 2024. Affirmative responses are defined as selecting any option from 2 (Once) to 5 (Very often). Whiskers indicate 95% confidence intervals.

Are women with children treated differently at work compared to those without children? Figure 24 presents the proportion of married women who report having ever experienced each of the following workplace behaviors, disaggregated by parental status: being excessively questioned or drawn into conversations about their private life (e.g., marital status or childbearing), being looked down upon because of their sex, and being treated differently because of their sex. Respondents evaluated each item using a five-point Likert scale (1 = Never, 2 = Once, 3 = Sometimes, 4 = Often, 5 = Very often). Responses from 2 (Once) to 5 (Very often) are classified as affirmative.

Across these items, between 25% and 35% of respondents reported experiencing the behavior at least once in the past. However, the differences between women with and without children are not statistically significant. These findings indicate that such experiences are present in the workplace, but there is no evidence that their occurrence is associated with parental status.

## A.11 Hours Worked and Observed Productivity

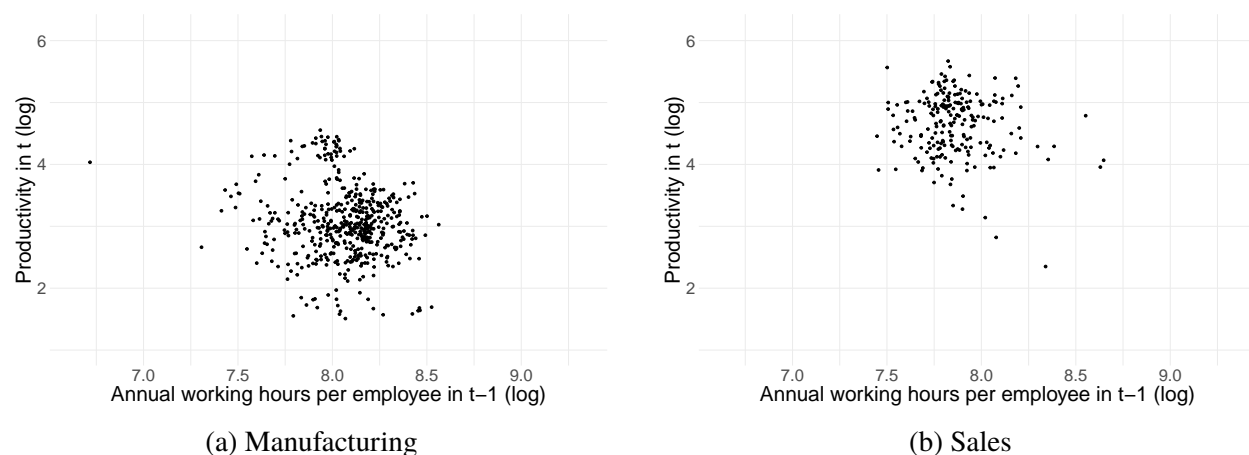


Figure 25: Past Hours Worked and Current Observed Productivity

*Notes:* This figure illustrates the relationship between average annual hours worked in year  $t$  and average production output per hour in the following year, by division (manufacturing and sales). Output is measured as gross revenue from non-durable consumer goods for manufacturing teams and gross sales for sales teams. Since output data is available only at the team level, we calculate per-worker measures by dividing team output by the number of non-managerial workers and averaging annual hours worked at the team level.

One key hypothesis for why longer working hours lead to better career outcomes is human capital accumulation - the idea that additional work hours build skills through learning-by-doing (see [Shaw, 1989](#); [Imai and Keane, 2004](#)). If this mechanism explains our findings, we would expect employees who work longer hours to become more productive over time, justifying their higher evaluation scores.

To test this hypothesis, we examine team-level data on annual hours worked and production outputs. We measure outputs using gross revenue from non-durable consumer goods for manufacturing teams and gross sales for sales teams. Since output data is only available at the team level, we construct per-worker measures by dividing team outputs by the number of non-managerial workers and averaging annual hours worked at the team level.

Visual evidence provides little support for the human capital accumulation hypothesis. Figure 25 shows no apparent correlation between log average per-worker outputs in year  $t$  and log per-worker annual hours worked in year  $t-1$ .

Statistical tests confirm this pattern. Table 16 presents regressions of log productivity measures in year  $t$  on log annual hours worked in  $t-1$ . The coefficient on lagged hours worked is negative in the baseline specification (Column 1) and remains insignificant when we add year and team fixed effects (Column 2), control for current year hours (Column 3), or include all controls (Column 4).

Table 16: Hours Worked and Productivity

Panel a: Manufacturing Division

	(1)	(2)	(3)	(4)
Annual working hours per employee in t - 1 (log)	-0.43 (0.11)	0.04 (0.06)	-0.33 (0.17)	0.05 (0.06)
Annual working hours per employee in t (log)			-0.14 (0.20)	-0.03 (0.06)
Mean Outcome	3.05	3.05	3.05	3.05
Num.Obs.	497	497	497	497
R2 Adj.	0.023	0.974	0.022	0.974
Std.Errors	Heteroskedasticity-robust		Heteroskedasticity-robust	
FE: Period		by: Team X		by: Team X
FE: Team		X		X

Panel b: Sales Division

	(1)	(2)	(3)	(4)
Annual working hours per employee in t - 1 (log)	-0.36 (0.21)	-0.52 (0.19)	-0.21 (0.30)	-0.59 (0.18)
Annual working hours per employee in t (log)			-0.27 (0.31)	0.14 (0.17)
Mean Outcome	4.64	4.64	4.64	4.64
Num.Obs.	217	217	217	217
R2 Adj.	0.014	0.914	0.014	0.914
Std.Errors	Heteroskedasticity-robust		Heteroskedasticity-robust	
FE: Period		by: Team X		by: Team X
FE: Team		X		X

*Notes:* This table presents the results of regressions analyzing the relationship between workers' productivity (log productivity) in year t and their annual working hours (log hours) in the previous year (t-1). The top panel presents results for workers in the Manufacturing Division, while the bottom panel focuses on those in the Sales Division. In each panel, Column 1 reports the baseline results. Columns 2 to 4 add more controls: year and team fixed effects (Column 2), controls for current year hours (Column 3), and all controls together (Column 4). Standard errors, clustered at the team level, are shown in parentheses.

This pattern holds for both manufacturing and sales divisions.

Together, these results provide little support for human capital accumulation as the primary mechanism linking working hours to career advancement in our setting.

## A.12 Within-Firm Gender Pay Gap and Family-Friendly Workplace Practices (FFWP)

In this section, we document the within-firm gender pay differences and the firm-level FFWP provision and using newly available data from the Ministry of Health, Labour, and Welfare of Japan. Since 2022, firms with over 300 employees have been required to disclose their gender pay gap in the ministry's database, which is updated daily. Firms also report, albeit voluntarily, their FFWP policies and other gender diversity metrics, such as the share of women in managerial and board positions. The database is designed to help job seekers compare firms based on workplace policies and workforce diversity. For our analysis, we use data from January 6, 2025 (the first business day of the year). We exclude firms with fewer than 300 employees, as their disclosures are voluntary and may be subject to selection bias.

We define FFWP as firms' voluntary provisions of non-wage amenities that offer temporal and spatial flexibility beyond national mandates: (i) flexible work schedules, (ii) reduced work hours, and (iii) the option to work from home. We construct an FFWP index ranging from 0 to 3, assigning one point for each policy a firm adopts. While prior research has also considered other amenities preferred by women than men, such as firm-provided child care and workplace proximity ([Le Barbanchon et al., 2020](#)), our data do not allow us to include these factors. The gender pay gap is measured as the median pay of female regular workers as a percentage of the median pay of male regular workers, without adjusting for occupations or job ranks. Part-time and temporary workers are excluded from this calculation.

Table 17 presents summary statistics for all firms, large firms (5,000 or more employees), manufacturing firms, manufacturing firms with 1,000 to 5,000 employees, and manufacturing firms with over 5,000 employees. The firm we study falls into the last category. Overall, reduced working hours are the most commonly offered family-friendly workplace policy (FFWP), followed by remote work. The provision of FFWPs is positively correlated with both firm size and industry: larger firms are more likely to offer such policies, and manufacturing firms tend to provide more FFWPs than the national average. Among large manufacturing firms with over 5,000 employees, the majority offer generous FFWPs, with approximately 65 percent providing each type of policy.

Table 17: Firm-level gender pay gap and family friendly workplace practices (FFWP)

	All firms mean [std.dev.]	All industries > 5,000 mean [std.dev.]	Manufacturing mean [std.dev.]	Manufacturing 1,000-5,000 mean [std.dev.]	Manufacturing > 5,000 mean [std.dev.]
<i>Firm Size (N. of employees)</i>					
301 - 500	0.41 [0.49]	–	0.41 [0.49]	–	–
501 - 1000	0.32 [0.47]	–	0.32 [0.47]	–	–
1001 - 5000	0.23 [0.42]	–	0.23 [0.42]	1.00 [0.00]	–
> 5000	0.04 [0.20]	1.00 [0.00]	0.04 [0.19]	–	1.00 [0.00]
<i>Industry (Japan Standard Industrial Classification)</i>					
Agriculture and forestry	0.00 [0.04]	–	–	–	–
Fisheries	0.00 [0.01]	–	–	–	–
Mining and quarrying of stone and gravel	0.00 [0.02]	–	–	–	–
Construction	0.04 [0.18]	0.03 [0.17]	–	–	–
Manufacturing	0.24 [0.43]	0.23 [0.42]	1.00 [0.00]	1.00 [0.00]	1.00 [0.00]
Electricity, gas, heat supply, and water	0.00 [0.07]	0.02 [0.14]	–	–	–
Information and communication	0.06 [0.23]	0.06 [0.24]	–	–	–
Transport and postal activities	0.06 [0.23]	0.06 [0.25]	–	–	–
Wholesale and retail trade	0.16 [0.37]	0.23 [0.42]	–	–	–
Finance and insurance	0.03 [0.17]	0.07 [0.26]	–	–	–
Real estate and goods rental and leasing	0.02 [0.13]	0.01 [0.07]	–	–	–
Scientific research, professional and technical services	0.01 [0.11]	0.01 [0.08]	–	–	–
Accommodations, eating, and drinking services	0.04 [0.20]	0.09 [0.29]	–	–	–
Living-related and personal services and amusement services	0.01 [0.11]	0.01 [0.12]	–	–	–
Education, and learning support	0.02 [0.15]	0.02 [0.15]	–	–	–
Medical, health care, and welfare	0.14 [0.35]	0.04 [0.20]	–	–	–
Compound services	0.01 [0.12]	0.00 [0.04]	–	–	–
Services, N.E.C.	0.15 [0.36]	0.10 [0.31]	–	–	–
Government, except elsewhere classified	0.00 [0.04]	0.00 [0.04]	–	–	–
Industries unable to classify	0.01 [0.09]	0.01 [0.07]	–	–	–
<i>Gender Gap</i>					
Gender pay gap (regular workers)	25.01 [12.75]	26.89 [10.21]	26.13 [8.86]	27.20 [7.78]	26.11 [7.48]
Gender pay gap (non-regular workers)	19.85 [35.23]	17.32 [27.05]	27.45 [20.76]	28.80 [18.79]	25.74 [15.86]
Female manager share	17.11 [19.27]	12.69 [13.34]	6.66 [8.52]	6.24 [6.99]	5.97 [5.00]
<i>Family Friendly Workplace Practices (FFWP)</i>					
Option to reduce working hours	0.34 [0.47]	0.48 [0.50]	0.42 [0.49]	0.52 [0.50]	0.65 [0.48]
Option for flexible work schedule	0.17 [0.37]	0.32 [0.47]	0.28 [0.45]	0.42 [0.49]	0.62 [0.49]
Option to work from home	0.23 [0.42]	0.42 [0.49]	0.33 [0.47]	0.47 [0.50]	0.65 [0.48]
FFWP index (max value = 3)	0.74 [1.10]	1.22 [1.34]	1.03 [1.25]	1.42 [1.37]	1.91 [1.42]
<i>Sample Size</i>					
N	13826	554	3283	759	127

Notes: This table presents the industrial composition, firm size distribution, mean gender pay gap, and provision of family-friendly workplace practices (FFWP) for all firms in our baseline dataset (Column 1), firms with more than 1,000 employees (Column 2), manufacturing firms (Column 3), and large manufacturing firms (Column 4). Standard deviations are reported in square brackets. Firms with fewer than 300 employees are excluded from the baseline sample. The gender pay gap is calculated as the difference between the mean pay of female workers and the mean pay of male workers, expressed as a percentage of the mean pay of male workers. The FFWP index ranges from 0 to 3, with firms receiving one point for each of the following policies: (i) reduced working hours for parenting, (ii) flexible work schedules, and (iii) remote work options for parents. Data: The Ministry of Health, Labour, and Welfare of Japan (January 2025).

## B Proofs of Propositions

We first characterize the the worker's optimal decision in our model of promotion. Note that

$$\begin{aligned}
 U(\theta_i, \beta_i) = & [d_1 + c_1\theta_i]h_{i,1} - \frac{1}{2}\beta_i h_{i,1}^2 \\
 & + [d_j + c_j(2\theta_i + h_{i,1})]h_{i,2} - \frac{1}{2}\beta_i h_{i,2}^2 \\
 & + [d_j + c_j(3\theta_i + h_{i,1} + \mathbf{1}_{j(2)=1}h_{i,2})]h_{i,3} - \frac{1}{2}\beta_i h_{i,3}^2.
 \end{aligned}$$

By solving out this maximization problem, we obtain the following three cases:

(i) Worker  $i$  is never promoted, i.e.,  $j(1) = j(2) = j(3) = 1$ . In this case,

$$\begin{aligned}
 h_{i,1}^{np} &= \frac{1}{\beta_i + c_1} \left( d_1 + c_1\theta_i + c_1 \frac{3d_1 + 6c_1\theta_i}{\beta_i - 2c_1} \right), \\
 h_{i,2}^{np} &= \frac{1}{\beta_i + c_1} \left( d_1 + 2c_1\theta_i + c_1 \frac{3d_1 + 6c_1\theta_i}{\beta_i - 2c_1} \right), \\
 h_{i,3}^{np} &= \frac{1}{\beta_i + c_1} \left( d_1 + 3c_1\theta_i + c_1 \frac{3d_1 + 6c_1\theta_i}{\beta_i - 2c_1} \right),
 \end{aligned}$$

where  $h_{i,1}^{np} + h_{i,2}^{np} < \eta_1 - 3\theta_i$ . Let  $U^{np}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

(ii) Worker  $i$  is promoted to  $j = 2$  at the end of period 2, i.e.,  $j(1) = j(2) = 1$  and  $j(3) = 2$ . In this case, if  $i$  works more than the promotion cutoff (i.e.,  $h_{i,1} + h_{i,2} > \eta_1 - 3\theta_i$ ), then

$$\begin{aligned}
 h_{i,1}^{sp1} &= \frac{c_1[\beta_i(\beta_i\theta_i + d_1) + c_2d_2 + 4c_2^2\theta_i] + \beta_i(\beta_id_1 + c_2d_2 + 3c_2^2\theta_i) + 2\beta_ic_1^2\theta_i}{(\beta_i + c_1)[(\beta_i - c_1)\beta_i - 2c_2^2]}, \\
 h_{i,2}^{sp1} &= \frac{c_1[\beta_i(2\beta_i\theta_i + d_1) + c_2d_2 + 2c_2^2\theta_i] + \beta_i(\beta_id_1 + c_2d_2 + 3c_2^2\theta_i) + \beta_ic_1^2\theta_i}{(\beta_i + c_1)[(\beta_i - c_1)\beta_i - 2c_2^2]}, \\
 h_{i,3}^{sp1} &= \frac{(\beta_i - c_1)d_2 + c_2(2d_1 + 3\beta_i\theta_i)}{(\beta_i - c_1)\beta_i - 2c_2^2}.
 \end{aligned}$$

where  $h_{i,1}^{sp1} < \eta_1 - 2\theta_i$ . Let  $U^{sp1}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

If  $i$  works just enough to be promoted (i.e.,  $h_{i,1} + h_{i,2} = \eta_1 - 3\theta_i$ ), then

$$h_{i,1}^{sp2} = \frac{\eta_1}{2} - \frac{4c_1 + 3\beta_i}{2c_1 + 2\beta_i}\theta_i, \quad h_{i,2}^{sp2} = \frac{\eta_1}{2} - \frac{2c_1 + 3\beta_i}{2c_1 + 2\beta_i}\theta_i, \quad h_{i,3}^{sp2} = \frac{d_2 + c_2\eta_1}{\beta_i}.$$

Let  $U^{sp2}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

(iii) Worker  $i$  is promoted to  $j = 2$  at the end of period 1 but not promoted at the end of period 2, i.e.,  $j(1) = 1$  and  $j(2) = j(3) = 2$ . In this case, if  $i$  works more than the promotion cutoff (i.e.,  $h_{i,1} > \eta_1 - 2\theta_i$ ), then

$$\begin{aligned} h_{i,1}^{fp1} &= \frac{c_1\beta_i\theta_i + \beta_id_1 + 2c_2d_2 + 5c_2^2\theta_i}{\beta_i^2 - 2c_2^2}, \\ h_{i,2}^{fp1} &= \frac{\beta_i^2d_2 + \beta_ic_2(2\beta_i\theta_i + c_1\theta_i + d_1) + c_2^3\theta_i}{\beta_i^3 - 2\beta_ic_2^2}, \\ h_{i,3}^{fp1} &= \frac{\beta_i^2d_2 + \beta_ic_2(3\beta_i\theta_i + c_1\theta_i + d_1) - c_2^3\theta_i}{\beta_i^3 - 2\beta_ic_2^2}, \end{aligned}$$

where  $h_{i,1}^{fp1} < \eta_2 - 3\theta_i$ . Let  $U^{fp1}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

If  $i$  works just enough to be promoted to  $j = 2$  at the end of  $t = 1$  (i.e.,  $h_{i,1} = \eta_1 - 2\theta_i$ ), then

$$h_{i,1}^{fp2} = \eta_1 - 2\theta_i, \quad h_{i,2}^{fp2} = \frac{d_2 + c_2\eta_1}{\beta_i}, \quad h_{i,3}^{fp2} = \frac{d_2 + c_2(\eta_1 + \theta_i)}{\beta_i},$$

where  $h_{i,1}^{fp2} < \eta_2 - 3\theta_i$ . Let  $U^{fp2}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

(iv) Worker  $i$  is promoted in both periods, i.e.,  $j(1) = 1$ ,  $j(2) = 2$ , and  $j(3) = 3$ . In this case, if works more than the promotion cutoff (i.e.,  $h_{i,1} > \eta_2 - 3\theta_i$ ), then

$$\begin{aligned} h_{i,1}^{bp1} &= \frac{c_1\beta_i\theta_i + \beta_id_1 + c_2d_2 + c_3d_3 + 2c_2^2\theta_i + 3c_3^2\theta_i}{\beta_i^2 - c_2^2 - c_3^2}, \\ h_{i,2}^{bp1} &= \frac{d_2(\beta_i^2 - c_3^2) + c_2[c_1\beta_i\theta_i + \beta_i(2\beta_i\theta_i + d_1) + c_3d_3 + c_3^2\theta_i]}{\beta_i(\beta_i^2 - c_2^2 - c_3^2)}, \\ h_{i,3}^{bp1} &= \frac{d_3(\beta_i^2 - c_2^2) + c_3[c_1\beta_i\theta_i + \beta_i(3\beta_i\theta_i + d_1) + c_2d_2 - c_2^2\theta_i]}{\beta_i(\beta_i^2 - c_2^2 - c_3^2)}, \end{aligned}$$

where  $h_{i,1}^{bp1} > \eta_2 - 3\theta_i$ . Let  $U^{bp1}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

If  $i$  works just enough to be promoted to  $j = 3$  and promotion to  $j = 3$  is the bottleneck (i.e.,  $h_{i,1} = \eta_2 - 3\theta_i$  and  $\eta_1 + \theta_i \leq \eta_2$ ), then

$$h_{i,1}^{bp2} = \eta_2 - 3\theta_i, \quad h_{i,2}^{bp2} = \frac{d_2 + c_2(\eta_2 - \theta_i)}{\beta_i}, \quad h_{i,3}^{bp2} = \frac{d_3 + c_3\eta_2}{\beta_i}.$$

Let  $U^{bp2}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

If  $i$  works just enough to be promoted to  $j = 3$  and promotion to  $j = 2$  is the bottleneck (i.e.,  $h_{i,1} = \eta_2 - 3\theta_i$  and  $\eta_1 + \theta_i > \eta_2$ ; in this case, worker  $i$  always gets promoted to  $j = 3$  once he is

promoted at the end of  $t = 1$ ), then

$$h_{i,1}^{bp3} = \eta_1 - 2\theta_i, \quad h_{i,2}^{bp3} = \frac{d_2 + c_2\eta_1}{\beta_i}, \quad h_{i,3}^{bp3} = \frac{d_3 + c_3(\eta_1 + \theta_i)}{\beta_i}.$$

Let  $U^{bp3}(\theta_i, \beta_i)$  denote the indirect utility of worker  $i$  in this case.

## B.1 Proof of Proposition 1.

Note that by the envelop theorem, the change of the indirect utility with respect to  $\beta_i$  is:

$$\frac{\partial U^z(\theta_i, \beta_i)}{\partial \beta_i} = -\frac{1}{2} [(h_{i,1}^z)^2 + (h_{i,2}^z)^2 + (h_{i,3}^z)^2].$$

for  $z = np, sp1, fp1, bp1$ . Because  $h_{i,1}^{np} + h_{i,2}^{np} < \eta_1 - 3\theta_i < h_{i,1}^{sp1} + h_{i,2}^{sp1}$ ,  $\eta_1 - 2\theta_i < h_{i,1}^{fp1} < h_{i,1}^{bp1}$ , and  $0 < c_1 < c_2 < c_3$ , it is straightforward to check that

$$\frac{\partial U^z(\theta_i, \beta_i)}{\partial \beta_i} < \frac{\partial U^{np}(\theta_i, \beta_i)}{\partial \beta_i} < 0,$$

for  $z = sp1, fp1, bp1$ . Hence, as  $\beta_i$  increases, worker  $i$  becomes more likely to prefer  $np$  to  $fp1$ ,  $sp1$ , or  $bp1$ .

It remains to compare the indirect utility under  $np$  with the one under  $bp3, bp2, fp2, sp2$ . First, we compare the indirect utilities under  $np$  and  $bp3$ . Note that

$$\begin{aligned} U^{bp3}(\theta_i, \beta_i) &= [d_1 + c_1\theta_i](\eta_1 - 2\theta_i) - \frac{1}{2}\beta_i(\eta_1 - 2\theta_i)^2 \\ &\quad + [d_2 + c_2\eta_1]h_{i,2}^{bp3} - \frac{1}{2}\beta_i(h_{i,2}^{bp3})^2 \\ &\quad + [d_3 + c_3(\eta_1 + \theta_i)]h_{i,3}^{bp3} - \frac{1}{2}\beta_i(h_{i,3}^{bp3})^2. \end{aligned}$$

By taking the derivative with respect to  $\beta_i$  and re-arrange the terms, we have

$$\frac{\partial U^{bp3}(\theta_i, \beta_i)}{\partial \beta_i} = -\frac{1}{2} [(h_{i,1}^{bp3})^2 + (h_{i,2}^{bp3})^2 + (h_{i,3}^{bp3})^2].$$

Hence, it is straightforward to check that

$$\frac{\partial U^{bp3}(\theta_i, \beta_i)}{\partial \beta_i} < \frac{\partial U^{np}(\theta_i, \beta_i)}{\partial \beta_i} < 0.$$

Second, we compare the indirect utilities under  $np$  and  $bp2$ . Note that

$$\begin{aligned} U^{bp2}(\theta_i, \beta_i) &= [d_1 + c_1\theta_i](\eta_2 - 3\theta_i) - \frac{1}{2}\beta_i(\eta_2 - 3\theta_i)^2 \\ &\quad + [d_2 + c_2(\eta_2 - \theta_i)]h_{i,2}^{bp2} - \frac{1}{2}\beta_i(h_{i,2}^{bp2})^2 \\ &\quad + [d_3 + c_3\eta_3]h_{i,3}^{bp2} - \frac{1}{2}\beta_i(h_{i,3}^{bp2})^2. \end{aligned}$$

By taking the derivative with respect to  $\beta_i$  and re-arrange the terms, we have

$$\frac{\partial U^{bp2}(\theta_i, \beta_i)}{\partial \beta_i} = -\frac{1}{2} \left[ (h_{i,1}^{bp2})^2 + (h_{i,2}^{bp2})^2 + (h_{i,3}^{bp2})^2 \right].$$

Hence, it is straightforward to check that

$$\frac{\partial U^{bp2}(\theta_i, \beta_i)}{\partial \beta_i} < \frac{\partial U^{np}(\theta_i, \beta_i)}{\partial \beta_i} < 0.$$

Third, we compare the indirect utilities under  $np$  and  $fp2$ . Note that

$$\begin{aligned} U^{fp2}(\theta_i, \beta_i) &= [d_1 + c_1\theta_i](\eta_1 - 2\theta_i) - \frac{1}{2}\beta_i(\eta_1 - 2\theta_i)^2 \\ &\quad + [d_2 + c_2\eta_1]h_{i,2}^{fp2} - \frac{1}{2}\beta_i(h_{i,2}^{fp2})^2 \\ &\quad + [d_2 + c_2(\eta_1 + \theta_i)]h_{i,3}^{fp2} - \frac{1}{2}\beta_i(h_{i,3}^{fp2})^2. \end{aligned}$$

By taking the derivative with respect to  $\beta_i$  and re-arrange the terms, we have

$$\frac{\partial U^{fp2}(\theta_i, \beta_i)}{\partial \beta_i} = -\frac{1}{2} \left[ (h_{i,1}^{fp2})^2 + (h_{i,2}^{fp2})^2 + (h_{i,3}^{fp2})^2 \right].$$

Hence, it is straightforward to check that

$$\frac{\partial U^{fp2}(\theta_i, \beta_i)}{\partial \beta_i} < \frac{\partial U^{np}(\theta_i, \beta_i)}{\partial \beta_i} < 0.$$

Lastly, we compare the indirect utilities under  $np$  and  $sp2$ . Note that

$$\begin{aligned}
U^{sp2}(\theta_i, \beta_i) &= [d_1 + c_1\theta_i]h_{i,1}^{sp2} - \frac{1}{2}\beta_i(h_{i,1}^{sp2})^2 \\
&\quad + [d_1 + c_1(2\theta_i + h_{i,1}^{sp2})]h_{i,2}^{sp2} - \frac{1}{2}\beta_i(h_{i,2}^{sp2})^2 \\
&\quad + [d_2 + c_2\eta_1]h_{i,3}^{sp2} - \frac{1}{2}\beta_i(h_{i,3}^{sp2})^2 \\
&= [d_1 + c_1\theta_i](\eta_1 - 3\theta_i) + [d_2 + c_2\eta_1]h_{i,3}^{sp2} - \frac{1}{2}\beta_i(h_{i,3}^{sp2})^2 \\
&\quad + c_1(\theta_i + h_{i,1}^{sp2})h_{i,2}^{sp2} - \frac{1}{2}\beta_i(h_{i,1}^{sp2})^2 - \frac{1}{2}\beta_i(h_{i,2}^{sp2})^2.
\end{aligned}$$

By taking the derivative with respect to  $\beta_i$  with using  $\frac{\partial h_{i,1}^{sp2}}{\partial \beta_i} = \frac{2c_1\theta_i}{(2c_1+2\beta_i)^2} = -\frac{\partial h_{i,2}^{sp2}}{\partial \beta_i}$ , we have

$$\begin{aligned}
\frac{\partial U^{sp2}(\theta_i, \beta_i)}{\partial \beta_i} &= -\frac{1}{2} [(h_{i,1}^{sp2})^2 + (h_{i,2}^{sp2})^2 + (h_{i,3}^{sp2})^2] \\
&\quad + c_1\theta_i \frac{\partial h_{i,2}^{sp2}}{\partial \beta_i} + c_1 \frac{\partial h_{i,1}^{sp2}}{\partial \beta_i} h_{i,2}^{sp2} + c_1 h_{i,1}^{sp2} \frac{\partial h_{i,2}^{sp2}}{\partial \beta_i} - \beta_i \frac{\partial h_{i,1}^{sp2}}{\partial \beta_i} h_{i,1}^{sp2} - \beta_i \frac{\partial h_{i,2}^{sp2}}{\partial \beta_i} h_{i,2}^{sp2} \\
&= -\frac{1}{2} [(h_{i,1}^{sp2})^2 + (h_{i,2}^{sp2})^2 + (h_{i,3}^{sp2})^2] \\
&\quad + \frac{\partial h_{i,1}^{sp2}}{\partial \beta_i} \underbrace{[-c_1\theta_i + c_1 h_{i,2}^{sp2} - c_1 h_{i,1}^{sp2} - \beta_i h_{i,1}^{sp2} + \beta_i h_{i,2}^{sp2}]}_{=0} \\
&= -\frac{1}{2} [(h_{i,1}^{sp2})^2 + (h_{i,2}^{sp2})^2 + (h_{i,3}^{sp2})^2].
\end{aligned}$$

Hence, it is straightforward to check that

$$\frac{\partial U^{sp2}(\theta_i, \beta_i)}{\partial \beta_i} < \frac{\partial U^{np}(\theta_i, \beta_i)}{\partial \beta_i} < 0.$$

Hence, as  $\beta_i$  increases, worker  $i$  becomes more likely to prefer  $np$  compared to any other case. It implies decreasing promotion rate from  $j = 1$  to  $j = 2$  as  $\beta_i$  increases.  $\square$

## B.2 Proof of Proposition 2.

Consider a case in which  $0 = c_1 < c_2 = c_3 = c$  and  $0 = d_3 = d_2 < d_1 = d$ . In this case, because  $c_2 = c_3$  and  $d_2 = d_3$ , no worker has an incentive to excessively work for the promotion to  $j = 3$ . Hence,  $bp2$  is not relevant. Also,  $h_{i,t}^{fp1} = h_{i,t}^{bp1}$  and  $U^{fp1} = U^{bp1}$ ;  $h_{i,t}^{fp2} = h_{i,t}^{bp3}$  and  $U^{fp2} = U^{bp3}$ . By computing each case, we obtain:

- $h_{i,1}^{np} = h_{i,2}^{np} = h_{i,3}^{np} = \frac{d}{\beta_i}$ , and  $U^{np} = \frac{3d^2}{2\beta_i}$ , where  $\frac{2d}{\beta_i} < \eta_1 - 3\theta_i$ .
- $h_{i,1}^{sp1} = h_{i,2}^{sp1} = \frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - 2c^2}$ ,  $h_{i,3}^{sp1} = \frac{2cd + 3c\beta_i\theta_i}{\beta_i^2 - 2c^2}$ ,  $U^{sp1} = 2d \left( \frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - 2c^2} \right) - \beta_i \left( \frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - 2c^2} \right)^2 + \frac{1}{2\beta_i} \left( \frac{2cd + 3c\beta_i\theta_i}{\beta_i^2 - 2c^2} \right)^2$ , where  $\frac{\eta_1}{2} - \frac{3}{2}\theta_i < \frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - 2c^2} < \eta_1 - 2\theta_i$ .
- $h_{i,1}^{sp2} = h_{i,2}^{sp2} = \frac{\eta_1}{2} - \frac{3}{2}\theta_i$ ,  $h_{i,3}^{sp2} = \frac{c\eta_1}{\beta_i}$ , and  $U^{sp2} = 2d \left( \frac{\eta_1}{2} - \frac{3}{2}\theta_i \right) - \beta_i \left( \frac{\eta_1}{2} - \frac{3}{2}\theta_i \right)^2 + \frac{c^2\eta_1^2}{2\beta_i}$ .
- $h_{i,1}^{fp1} = \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2}$ ,  $h_{i,2}^{fp1} = \frac{c(d\beta_i + 2\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)}$ ,  $h_{i,3}^{fp1} = \frac{c(d\beta_i + 3\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)}$ ,  $U^{fp1} = d \left( \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2} \right) - \frac{\beta_i}{2} \left( \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2} \right)^2 + \frac{1}{2\beta_i} \left( \frac{c(d\beta_i + 2\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)} \right)^2 + \frac{1}{2\beta_i} \left( \frac{c(d\beta_i + 3\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)} \right)^2$ , where  $\eta_1 - 2\theta_i < \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2} < \eta_2 - 3\theta_i$ .
- $h_{i,1}^{fp2} = \eta_1 - 2\theta_i$ ,  $h_{i,2}^{fp2} = \frac{c\eta_1}{\beta_i}$ ,  $h_{i,3}^{fp2} = \frac{c(\eta_1 + \theta_i)}{\beta_i}$ ,  $U^{fp2} = d(\eta_1 - 2\theta_i) - \frac{\beta_i}{2}(\eta_1 - 2\theta_i)^2 + \frac{c^2\eta_1^2}{2\beta_i} + \frac{c^2(\eta_1 + \theta_i)^2}{2\beta_i}$ , where  $\eta_1 + \theta_i < \eta_2$ .
- $h_{i,1}^{bp1} = \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2}$ ,  $h_{i,2}^{bp1} = \frac{c(d\beta_i + 2\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)}$ ,  $h_{i,3}^{bp1} = \frac{c(d\beta_i + 3\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)}$ ,  $U^{bp1} = d \left( \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2} \right) - \frac{\beta_i}{2} \left( \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2} \right)^2 + \frac{1}{2\beta_i} \left( \frac{c(d\beta_i + 2\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)} \right)^2 + \frac{1}{2\beta_i} \left( \frac{c(d\beta_i + 3\beta_i^2\theta_i + c^2\theta_i)}{\beta(\beta_i^2 - 2c^2)} \right)^2$ , where  $\frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2} > \max\{\eta_1 - 2\theta_i, \eta_2 - 3\theta_i\}$ .
- $h_{i,1}^{bp3} = \eta_1 - 2\theta_i$ ,  $h_{i,2}^{bp3} = \frac{c\eta_1}{\beta_i}$ ,  $h_{i,3}^{bp3} = \frac{c(\eta_1 + \theta_i)}{\beta_i}$ ,  $U^{bp3} = d(\eta_1 - 2\theta_i) - \frac{\beta_i}{2}(\eta_1 - 2\theta_i)^2 + \frac{c^2\eta_1^2}{2\beta_i} + \frac{c^2(\eta_1 + \theta_i)^2}{2\beta_i}$ , where  $\eta_1 + \theta_i > \eta_2$ .

Suppose  $c = 0.1$ ,  $d = 0.02$ ,  $\eta_1 = 1$ ,  $\eta_2 = 1.5$ ,  $\beta_{female} = 2$ ,  $\beta_{male} = 1.8$ , and  $\theta < 0.3$ . In this case, for both male and female workers, promotion to  $j = 2$  at some period is determined by comparing between  $U^{np}$  and  $U^{sp2}$ , whereas promotion to  $j = 3$  is determined by the condition  $\eta_2 = 3\theta_i + \frac{d\beta_i + 5c^2\theta_i}{\beta_i^2 - 2c^2}$  (and other conditions for promotions/non-promotions are satisfied). Also, female workers are promoted to  $j = 2$  at some period if and only if  $\theta \geq 0.3036$ , while male workers are promoted to  $j = 2$  at some period if and only if  $\theta \geq 0.3003$ . Also, female workers are promoted to  $j = 3$  if and only if  $\theta \geq 0.4946$ , while male workers are promoted to  $j = 3$  if and only if  $\theta \geq 0.4937$ .

Note that the promotion rate from  $j = 2$  to  $j = 3$  for female workers is  $\frac{\bar{\theta} - 0.4946}{\bar{\theta} - 0.3036}$ , whereas the one for male workers is  $\frac{\bar{\theta} - 0.4937}{\bar{\theta} - 0.3003}$ . By comparing these two, the latter is higher than the former if  $\bar{\theta} \geq 0.57$ . For example, when  $\bar{\theta} = 1$ , the promotion rate from  $j = 2$  to  $j = 3$  for female workers is 72.57%, while that for male workers is 72.35%.  $\square$

### B.3 Proof of Proposition 3.

Consider a case in which  $0 = c_1 = c_2 < c_3 = c$ ,  $0 = d_3 < d_2 = d_1 = d$ , and  $\eta_1 + \theta_i > \eta_2$  for all  $\theta_i$ . In this case, no worker has an incentive to excessively work for the promotion to  $j = 2$ , so  $fp2$  and  $sp2$  are not relevant. Because  $\eta_1 + \theta_i > \eta_2$ ,  $bp2$  is not relevant. Also,  $h_{i,t}^{np} = h_{i,t}^{sp1} = h_{i,t}^{fp1}$  and  $U_{i,t}^{np} = U_{i,t}^{sp1} = U_{i,t}^{fp1}$ . By computing relevant cases, we obtain:

- $h_{i,1}^{sp1} = h_{i,2}^{sp1} = h_{i,3}^{sp1} = \frac{d}{\beta_i}$ , and  $U^{sp1} = \frac{3d^2}{2\beta_i}$ , where  $\frac{d}{\beta_i} < \eta_1 - 2\theta_i$ .
- $h_{i,1}^{bp1} = \frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - c^2}$ ,  $h_{i,2}^{bp1} = \frac{d}{\beta}$ ,  $h_{i,3}^{bp1} = \frac{c(d + 3\beta_i\theta_i)}{\beta_i^2 - c^2}$ , and  $U^{bp1} = d \left( \frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - c^2} \right) - \frac{\beta_i}{2} \left( \frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - c^2} \right)^2 + \frac{d^2}{2\beta_i} + \frac{1}{2\beta_i} \left( \frac{c(d + 3\beta_i\theta_i)}{\beta_i^2 - c^2} \right)^2$ , where  $\frac{d\beta_i + 3c^2\theta_i}{\beta_i^2 - c^2} > \eta_1 - 2\theta_i$ .
- $h_{i,1}^{bp3} = \eta_1 - 2\theta_i$ ,  $h_{i,2}^{bp3} = \frac{d}{\beta_i}$ ,  $h_{i,3}^{bp3} = \frac{c(\eta_1 + \theta_i)}{\beta_i}$ ,  $U^{bp3} = d(\eta_1 - 2\theta_i) - \frac{\beta_i}{2}(\eta_1 - 2\theta_i)^2 + \frac{d^2}{2\beta_i} + \frac{c^2(\eta_1 + \theta_i)^2}{2\beta_i}$ , where  $\eta_1 + \theta_i > \eta_2$ .

Suppose  $c = 0.192$ ,  $d = 0.154$ ,  $\theta_{male} = 0.082$ ,  $\beta_{male} = 0.35$ ,  $\theta_{female} = 0.085$ ,  $\beta_{female} = 0.3546$ ,  $\eta_1 = 1$ , and  $\eta_2 < \eta_1 + \theta_{male}$ . In this case, the male worker chooses  $h_{i,t}^{bp3}$  so that he is promoted to  $j = 3$  in  $t = 3$ , whereas the female worker chooses  $h_{i,t}^{sp1}$  and she is promoted to  $j = 2$  in  $t = 3$ . Also,  $\eta_{male,3} = 1.082$  and  $\frac{d_3 + c_3\eta_{male,3}}{\beta_{male}} = 0.594$ , whereas  $\eta_{female,3} = 1.124$  and  $\frac{d_3 + c_3\eta_{female,3}}{\beta_{female}} = 0.608$ .  $\square$