Is There a Child Penalty in South Korea?

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March 19, 2021

Abstract

In many countries, the child penalty, which is the loss in earnings associated with childbirth, is large and persistent for mothers. In this study, I estimate the effect of a first birth on the labor market outcomes in South Korea (hereafter Korea) over time using a method proposed by Kleven, Landais, and Søgaard (2019b). First, I find that Korean women experience a substantial penalty in earnings with a first childbirth compared to women in other countries. Second, while the child penalty in other countries comes from both the intensive and extensive margins, the penalty for Korean women arises almost exclusively on the extensive margin. Third, I find a substantial drop in earnings for mothers even before the child is born. Finally, to shed light on the source of the child penalty, I examine several of its correlates, including marriage, the lack of work benefits, and opportunity costs.

Keywords: Child penalty, female earnings, labor supply, gender wage gap

JEL codes: J13, J21, J31

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1 Introduction

Although the size of the gender wage gap has narrowed over time (Blau and Kahn, 2006; Goldin, 2014), many papers across numerous countries show wage differentials between men and women with the birth of a child (Anderson, Binder, and Krause, 2002, 2003; Buckles, 2008; Glauber, 2018; Juhn and McCue, 2017; Kleven, Landais, Posch, Steinhauer, and Zweimüller, 2019a). This so-called child penalty can be an important source of the remaining gender gap in the labor market (Angelov, Johansson, and Lindahl, 2016; Kleven, Landais, and Søgaard, 2019b). Although the gender wage gap in Korea is the highest in OECD countries and the female labor force participation rates in Korea are low according to OECD (2017), there are few studies on the child penalty in Korea. I examine the child penalty for Korean women as a potential factor in the large wage gap.

I adopt an event study method to estimate the child penalty in Korea. This approach was first used by Kleven et al. (2019b) to examine the child penalty in Denmark around a woman's first childbirth. The event study allows me to examine the time path of the child penalty around the time of birth and across various aspects of the labor market: earnings, labor force participation, hours worked, and hourly wages. Kleven et al. (2019b) show that the child penalty in earnings is driven by all three margins (labor participation, hours worked, and hourly wages). With one of the lowest labor force participation rates for women in the OECD (Jones, 2005), the Korean child penalty may arise from different sources than other OECD countries.

I exploit the panel structure of the Korea Labor and Income Panel Study (hereafter KLIPS) to examine the impact of childbirth on labor market outcomes over time. Evidence from the KLIPS presents unique patterns in Korea. First, compared with other countries, the penalty in Korea is large. According to Kleven et al. (2019a), estimating the child penalty across six other countries such as Scandinavian (Denmark and Sweden), German Speaking (Austria and Germany), and English Speaking (the United Kingdom and the United States) countries, the size of the long-run child penalty in earnings is between 21 and 61 percent,

whereas the penalty in Korea is 68 percent. Second, while women in other countries experience the child penalty in participation rates, hours worked, and hourly wages, the penalty for Korean women comes almost exclusively from leaving the labor market. For women who stay in the labor force, I do not find differences in earnings. Third, I find that earnings decline for mothers even before the birth of the child, a pattern which is not observed in other countries. Fourth, the size of the child penalty differs by individual characteristics. Women with high opportunity costs of childbirth experience a lower child penalty than women with low opportunity costs around childbirth.

The remainder of this paper proceeds as follows. In Section 2, I introduce the previous literature on child penalties. Section 3 introduces the method. The data are described in Section 4. The results are presented in Section 5 and potential explanations for child penalties in Korea are discussed. Section 6 is the conclusion.

2 Literature Review

Kleven et al. (2019b) provide event study evidence of the effect of the first child on labor market outcomes in Denmark. They analyze the labor market outcomes for both the intensive and extensive margins. The key results from Kleven et al. (2019b) are presented in Figure 1. They find that women experience a decline in earnings with the birth of their first child, while men are not affected by childbirth. The long-run child penalty in earnings is 21 percent, which means women's earnings lag behind men's earnings by 21 percent 10 years after the first childbirth. Figure 1 shows that the child penalty in earnings is driven by both the intensive and extensive margins. Women in Denmark leave the labor market when they have a first child. At the same time, they experience a decline in hours worked and wage rates because women with children have a lower chance of achieving a high rank in a company and are more likely to move into the public sector and a family-friendly firm than men.

Kleven et al. (2019a) similarly examine the child penalty in six additional countries and find that women experience the child penalty in every country. The size of the child penalties in earnings in those six countries ranges from 21 percent in Denmark to 61 percent in Germany.

Sieppi and Pehkonen (2019) use the method proposed by Kleven et al. (2019b) to estimate the child penalty in Finland. Consistent with Kleven et al. (2019b), the child penalty in Finland arises from both the intensive and extensive margins. The long-run child penalty is 25 percent.

Berniell, Berniell, de la Mata, Edo, and Marchionni (2021) examine the child penalty in Chile based on Kleven et al. (2019b). The child penalty in earnings is 28 percent, which comes from declines in participation rates and hours worked.

In Figure 2, I compare the child penalties in labor force participation rates in seven different countries. Among the results of seven countries from Sieppi and Pehkonen (2019) and Kleven et al. (2019a), women in the countries in Scandinavian such as Denmark, Sweden, and Finland experience a relatively smaller child penalty than women in other countries like Germany, the United Kingdom, and the United States. Additionally, in Scandinavian and German-speaking countries, there are sharp and immediate declines in earnings right after childbirth and then a slight recovery within two years after childbirth. Women in all seven countries experience the effect of childbirth on the labor market outcomes for 10 years after childbirth.

Many additional studies examine the effect of children on female earnings using a variety of other methods (Anderson et al., 2002, 2003; Buckles, 2008; Glauber, 2018; Juhn and McCue, 2017). Loughran and Zissimopoulos (2009) simultaneously investigate the effect of marriage and childbearing in the United States. The first childbirth reduces female wages by 2 to 3 percent, but has no impact on wage growth. According to Angelov et al. (2016), although the difference in labor force participation between men and women in Sweden is negligible, 15 years after the first childbirth, the child penalty in earnings for women is 32

percent due to a drop in hours worked.

Few papers study the effect of childbirth on female labor market outcomes in Korea. In contrast to the United States and European countries, Korea has low female labor force participation rates and many Korea women leave the labor force when they have children (OECD, 2017), few papers study the effect of childbirth on female labor market outcomes.

The existing literature on the child penalty in Korea is dated and has a selection issue. Berger, Groothuis, and Jeon (1997) estimate the wage equation by year using the 1980 and 1991 waves of the Korean Occupational Wage Survey. The authors show that there is a marriage penalty in female wages and that the size of the penalty has decreased over time. In 1980, married women earned 18 percent less than single women, but the estimated difference between married and single women was 3 percent in 1991. However, selection into the labor market can explain the small size of the penalties. Given that many Korean women leave the labor market around marriage and childbirth; therefore, estimating the effect of marriage or childbirth on wages can be biased. In this paper, I consider various labor market outcomes, including labor force participation rates.

Marriage and childbirth are highly correlated events in Korea, so the papers focus on marriage. Lee (2005) investigates the effect of marriage on Korean female labor supply. He shows that female labor supply declines by 41 percent after marriage. The size of the marriage impact is consistent with the results of Lee, Jang, and Sarkar (2008), which show that the labor supply of married women is 40 to 60 percent lower than that of single women. On the other hand, Nam (2010) analyzes the impact of an additional child using the number of daughters as an IV based on data from the Korean Population and Housing Census from 1980 to 2000. The results indicate that one additional child reduced the labor force participation of women with two or more children by 11 to 13 percent in 1985 and 1995. However, leaving the labor force before childbirth is not considered here, so the effect of childbirth on the labor market outcomes can be underestimated. Ma (2013) studies the relationship between employment status and first childbirth using the KLIPS from 1998 to

2007. She categorizes three employment status at first childbirth; never employed, employed, and previously employed. Women who worked before first childbirth are more likely to become mothers earlier than women who are currently employed at first childbirth. She explains this result by noting that Korean women leave their jobs when they anticipate becoming mothers.

The existing literature on Korea shows that marriage has greater effects on the female labor market outcomes than childbirth unlike other countries. Therefore, it is necessary to analyze the effects of those events over time to fully understand the effects on the labor market outcomes. I examine the time path of the child penalty in Korea and show that Korean women receive the penalty mainly from childbirth.

3 Method

Following Kleven et al. (2019b), I analyze the effect of a first birth on labor market outcomes using an event-study method.

$$Y_{ist}^{g} = \sum_{j \neq -1} \alpha_j^g \cdot I[j = t] + \sum_k \beta_k^g \cdot I[k = age_{is}] + \sum_y \gamma_y^g \cdot I[y = s] + \nu_{ist}^g \tag{1}$$

Y_{ist}^{g} is the labor market outcome of individual i of gender g in year s and at event time t. I analyze four labor market outcomes: monthly wages, hours worked, the probability of having a job (participation rates), and hourly wages. The variable definitions are in Appendix A. The indicator variable for one year before the event, t=-1, is omitted; thus the event time coefficients measure the impact of childbirth relative to one year before the event. The event time, t, ranges from -5 to 10. The α_j^g in the baseline Equation 1 is the effect of the event of gender g at event time t. Childbirth can affect other aspects of economic status, such as occupation and workplace environment; thus Kleven et al. (2019b) suggest controlling only event time, age, and year in the event study. The regression controls for single year age, age_{is}, and year, y, indicators.

P_t^g is the effect of the first childbirth at year t as a percentage of the counterfactual outcome absent childbirth.

$$P_t^g \equiv \frac{\hat{\alpha}_t^g}{E[\tilde{Y}_{ist}^g|t]} \tag{2}$$

$\tilde{Y}_{ist}^g$ is the predicted outcome when omitting the effect of the event, so $\hat{\alpha}_j^g$ is subtracted from the fitted value, $\hat{Y}_{ist}^g$. $\tilde{Y}_{ist}^g = \sum_k \hat{\beta}_k^g \cdot I[k = age_{is}] + \sum_y \hat{\gamma}_y^g \cdot I[y = s]$.

$$P_t \equiv \frac{\hat{\alpha}_t^m - \hat{\alpha}_t^w}{E[\tilde{Y}_{ist}^w|t]} \tag{3}$$

P_t measures the percentage by which women lag behind men due to the first childbirth at event time t. The long-run penalty is the average value of the penalty (P_t) from event time 5 to 10 (from t=5 to t=10).

4 Data

I use the Korea Labor and Income Panel Study (KLIPS) from 1998 (1st wave) to 2018 (21st wave). The KLIPS selected 5,000 households in 1998 and added 1,415 households in 2009. The KLIPS follows all household members over 15 years old every year since 1998. The effect of a first child on an individual's labor market outcomes over time can be estimated by exploiting the panel structure.

The sample consists of all people aged 20-49 who had a first childbirth between 1999 and 2017. I use an unbalanced panel to maximize the sample size. The sample is all persons who are observed in the year of childbirth and at least one year before childbirth. The year of the first childbirth is recovered from the birth-date information of household members and their relation to the head of household. The KLIPS asks the year of the respondent's first birth only in the survey year when the respondent enters the sample. I infer the year of the first childbirth for others based on the birth-date information of household members and their relationship to the head of the household. For example, if the oldest child of the head of the

household is in the data set and the child is two years old, the head and the spouse of the head are considered to have had their first child two years ago. The limitation of the data is that the year of the first childbirth cannot be identified if the parents and the child have never lived in the same household.

Like Kleven et al. (2019b), my main outcomes are earnings, labor force participation, hours worked, and hourly wages. Table 1 shows the summary statistics of those who gave birth to their first child between 1999 and 2017, measured one year prior to childbirth. *Earnings* is a self-reported average monthly wage, and it is a real wage in 2019 Korean 10,000 won that is not conditional on employment. *Earnings* is 0 if a person does not have a job. *Labor Force* is an indicator variable for job status with a value of 1 if an individual earns a positive wage when the survey is conducted. Even before childbirth, men are paid twice as high as women. In addition to the gender pay gap, women's participation rate is just 0.59 one year before childbirth, while almost all men are in the labor force. These gender gaps in earnings and labor force participation rates observed in the summary statistics may indicate that the child penalty starts prior to childbirth. *Hours Worked* and *Hourly Wages* are conditional on employment, which means that these values are missing if a person does not work. *Hours Worked* is the reported average working hours per week. Men tend to work more than women by 7 hours a week on average. I calculate *Hourly Wages* as (monthly earnings/monthly total hours worked). Men's hourly wages are approximately 20 percent higher than women's wages. Women in the sample were approximately 2.5 years younger than men. The average level of education for both men and women are 14 years, with a college degree, and the level of education for men is slightly higher than that for women. The detailed definition for variables is in the Appendix.

5 Results

5.1 Baseline Results

Figure 3 shows how labor market outcomes change after a first birth. The dots in the graph represent estimates of the gender-specific impacts of childbirth for men, P_t^m, and women, P_t^w, across event time. P_t^m and P_t^w indicate the effect of the first child on labor market outcomes at t as a percentage of the counterfactual outcome. The long-run penalty is the average of the difference between men and women from 5 years to 10 years after the event. The shaded area is the 95 percent confidence band. The long-run child penalty in earnings is 67.5 percent. This penalty mostly arises from a decline in the female labor force participation rates.

A sharp divergence occurs one year before childbirth in Korea. In Figure 3, the estimated child penalty in earnings at two years before childbirth, P_{-2}^w, is 23.9 percent. Given that P_1^w is 32.1 percent, Korean women face a substantial penalty even before childbirth.

If this penalty prior to childbirth is considered, the long-run child penalty in earnings in Korea can be larger. According to the definition of the child penalty in Section 3, the long-run child penalty in earnings of women relative to men is 68 percent. However, this penalty is calculated by comparing earnings at t to earnings one year before childbirth to be consistent with previous research. The decline in earnings starts before childbirth. If I calculate the child penalty using two years before childbirth as a base year instead of one year before childbirth, the long-run child penalty in earnings is 80 percent.

The size of the penalty is larger than in other countries. Even when the decrease before childbirth is not taken into account, the penalty in Korea is the largest among them in eight countries. As the child penalty in Korea mostly comes from extensive margins, Figure 2 compares the child penalty in labor force participation rates across countries. Even when the child penalty two years prior to childbirth (P_{-2}), which is observed only in Korea, is not included in the long-run child penalty, the size of the penalty in Korea is the third-largest

after the United States and the United Kingdom.

The penalty in earnings is driven almost exclusively by the extensive margin (being out of the labor force). If a woman continues to hold her job after marriage, there is no penalty in working hours and hourly wages. One feature that distinguishes Korea from other countries is that there is a spike in the female hourly wage after childbirth, as shown in panel (d) in Figure 3. This can be evidence of selection into employment. A substantial number of women leave their jobs when their children are born. If a woman stays at her job after childbirth, the selection suggests that she is likely to have high incentives to remain in the labor force, possibly due to higher wages or the value she places on her career. As women tend to return to work overtime, the penalty of women in hourly wages starts to decrease.

The child penalty explains the substantial part of the gender gap. The gender earning gap at age 40 to 44, which is almost 10 years after first childbirth, in the KLIPS is 74.1 percent.[1] To compare the gender gap and the child penalty, I re-calculate the child penalty using counterfactual male earnings as a denominator. The re-calculated child penalty is 43.8 percent.[2] The long-run child penalty explains 59.1 percent of the gender gap in earnings in the early 40s.

5.2 Contributing Factors

While changing job characteristics, such as move into the public sector (Pertold-Gebicka, Pertold, and Gupta, 2016), help explain the child penalty in other countries, the child penalty for Korean women comes exclusively from leaving the labor force, so changes within a job cannot explain the penalty in Korea. Therefore, I provide other contributing factors for the child penalty: the role of marriage, a lack of job benefits, and opportunity costs.

[1] $The\ unadjusted\ gender\ earning\ gap = \left(\frac{average\ male\ earning - average\ female\ earning}{average\ male\ earning}\right)$

[2] $P_t \equiv \frac{\hat{\alpha}_t^m - \hat{\alpha}_t^w}{E[\tilde{Y}_{ist}^m | t]}$

5.2.1 Role of Marriage

In this section, I investigate the role of marriage in explaining the earnings gap drop prior to childbirth among Koreans. An important difference between Korea and most other OECD countries is the fact that out-of-wedlock childbearing is much lower in Korea. While the average share of out-of-wedlock births among the OECD countries was 40.35 percent in 2016, the share in Korea was only 1.91 percent.[3] Thus, marriage almost always precedes childbirth in Korea.

To separate the effect of marriage and childbirth on the labor market outcomes, I divide the sample into four groups based on the time gap between marriage and childbirth. The time gap is the calendar year difference between the first marriage and childbirth (the year of the first childbirth - the year of the first marriage). A one-year time gap means that a person has a first child one calendar year after marriage. These four groups are most common in the sample, and approximately 85 percent of women belong to one of these four groups. The share of each group is indicated in Figure 4. Figure 4 plots the child penalty in participation rates. The first panel in Figure 4 is the child penalty of people who marry and have a child in the same year. The rest of the panels show the child penalty of people who have a time gap between marriage and childbirth of 1 year, 2 years, and 3 years, respectively.

Women who marry and have a child in the same calendar year (panel (a)), which are the smallest share among the four groups, do not experience a decrease in the labor force participation rate before childbirth. The remaining three panels ((b), (c), and (d)) suggest that Korean women experience the penalty prior to childbirth. This penalty starting before childbirth can be from marriage or still from childbirth. Panel (d) illustrates that there is no marriage penalty, a decline in participation rates at the year of marriage, if a woman has her first child three years after marriage. The size of the subsample for panel (d) is only 13 percent. Panels (b) and (c) in Figure 4 show the evidence of the marriage penalty. Women who have a first child after one or two years of marriage experience a drop in participation

[3]OECD Family Database, `http://www.oecd.org/els/family/database.htm`

rates at the year of marriage. The penalty for participation rate for women in (c) decreases from 43.7 percent (P^w_{-3}) to 25.9 percent (P^w_{-2}) at the year of marriage, which confirms that marriage is a substantial part of the penalty prior to childbirth. The penalty using marriage as an event is presented in Appendix C. In the next section, I will discuss other potential explanations for the child penalty.

5.2.2 Lack of Work Benefits

Existing research shows that more generous family leave policies are associated with lower gender wage gaps (Gornick, Meyers, and Ross, 1998; Waldfogel, 1998). Korea introduced maternity leave in 1953. The length of leave was extended from 60 days to 90 days in 2001. An employer with more than one employee must provide maternity leave. An employer fully pays wages for the first 60 days of the leave period.[4] The employment insurance covers the wages for the last 30 days. This leave is given even for miscarriage or stillbirth. Even though any working woman who gives a birth to a child has been statutorily entitled to maternity leave for many years, studies show that many female workers do not have access to the leave. Kim (2018) points out that 25.7 percent of women eligible for employment insurance are not registered for the insurance as of 2016. Even with the insurance, 35.9 percent of pregnant female workers leave the labor force before their childbirth. Won and Pascall (2004) also show that approximately 36 percent of firms violate the legislation because the penalties of violation of maternity leave are insufficient. This implies that pregnancy is not protected well enough in Korea, which results in higher child penalties.

Evidence from the KLIPS also confirms that many Korean women do not have access to maternity leave. In Figure B.1, for women in the labor force at one year before childbirth, only 57 percent of them have access to maternity leave. Korean women leave the labor force before childbirth, and therefore, access to leave at a specific event time reflects selection into

[4]The employment insurance covers the maternity leave for preferentially supported enterprises for the first 60 days as well. Ministry of Employment and Labor (2013) provides the details of maternity protection programs.

the labor market. For example, women in the labor force at the year of childbirth can stay in the labor market because they have access to maternity leave at that time. Figure B.1 shows that more women report that they have access to leaves as event time increases.

Due to this selection issue, I define the access to maternity leave as whether or not the woman reports having ever worked at a firm that provides maternity leave before childbirth. Figure 6 shows the status of working through one year before to after childbirth by access to maternity leave. For those women with access to maternity leave, the probability of working through one year before childbirth (t=-1) to one year after childbirth (t=+1) is 48 percent. In contrast, women who worked at a firm not providing the leave or did not have a job before childbirth, only 14 percent of women continue to work around childbirth. Therefore, maternity leave can be one of the crucial factors for whether women continue to work. In Figure 6, there are three groups: men, the women who had worked in a workplace providing maternity leave before childbirth, and the rest of women. Women with access to maternity leave receive the smaller child penalty before and after childbirth than women without access to leave. Although the estimated size of the long-run child penalty for women with access to maternity leave is larger than that for women without access to leave, this is because of the pre-trend. There is no pre-trend between men and women with access to maternity leave. If the decrease prior to childbirth is taken into account, the penalty for women without leave would become larger. The women in workplaces offering maternity leave stay in their jobs before childbirth, but they still leave the labor force after childbirth. This result indicates that maternity leave plays an important role in reducing the size of the child penalty. It also confirms that it is difficult for married women to stay in their jobs after pregnancy. The child penalty by access to parental leave is presented in Appendix B.

5.2.3 Opportunity Costs

Finally, I consider whether opportunity cost is correlated with the child penalty. Existing research finds that the child penalty can vary by opportunity costs of childbirth. Anderson

et al. (2003) show the child penalty by the level of education. Women with a high school diploma experience the largest child penalty in wages among women with no degree or a college degree. They argue that the largest child penalty for medium-skilled women is due to a less flexible work schedule.

Table 2 compares characteristics based on the job status of women from one year before and one year after childbirth. If a woman *"Did Not Work"* works through one year before childbirth (t=-1) to one year after childbirth (t=+1), then her work status is defined as working (*"Work"*). Those who leave the labor force at least once from t=-1 to t=+1 are defined as nonworking (*"Did Not Work"*). Women who stay in the labor force tend to be older, highly educated, well-paid, and more experienced than those who leave the labor force around childbirth. Those women have higher opportunity costs for leaving the labor force, so they tend to stay more before and after childbirth. On the other hand, women with low earnings are more likely to leave the labor force because the opportunity cost of leaving the workforce to care for their child by themselves is lower. In summary, women with high opportunity costs in childbearing have a high level of education, high earnings, and longer tenure years.

The estimated child penalty by opportunity costs is plotted in Figure 7. First, panel (a) in Figure 7 is the child penalty in the participation rates by education. Females with low education are women with less than 14 years of education. Females with high education face a lower child penalty than females with low education around childbirth. In the short-run, while women with high education lag behind 34.5 percent in the participation rates relative to men, the penalty for women with low education is 41.1 percent.

In Figure 7 (b), women are categorized based on earnings at two years before childbirth (t=-2). The solid line in (b) represents the child penalty for women earning below the median. Those women earning below the median receive the higher child penalty at the time of childbirth than women earning above the median, but they are more likely to return to the labor force. As a result, the long-run child penalty is 45 percent point smaller for

women earning below the median.

In panel (c), Women are grouped based on the most current job experience before childbirth. If a woman has less than 4 years of experience, this woman is regarded as a woman with short job experience (solid black line in Figure 7.(c)). Women with short experience receive a higher penalty than women with long experience at childbirth. However, women with short job experience return to the labor force more, so the long-run penalty for them is smaller. The long-run child penalty for women with low opportunity costs is lower.

All panels in Figure 7 show that women with higher opportunity costs, who are highly educated, paid above the median, and worked longer before childbirth, receive a smaller child penalty in the short-run, but their penalty is more persistent than women with low opportunity costs.

Couples can jointly decide their labor market decisions, and therefore, the characteristics of a husband may affect the size of the child penalty of his wife. Panel B in Table 2 reports the characteristics of a husband in the year of childbirth (t=0). Husbands of the two groups are also different. Husbands of working women are more likely to be highly educated and have higher wages like their wives, which suggests assortative mating in Korean marriages. One interesting difference is hours worked. Even though the husbands of women who leave the labor force earn less, they work four hours longer a week. Their wives may be more responsible for childcare, which can lead to leaving the labor force. Figure 8 plots the child penalties by husband's characteristics. Women with a husband who is well paid, highly educated, and work less face a smaller child penalty around childbirth than women with a husband who is paid below the median, low educated, and work more.

Table 3 compares the short-run and the long-run penalty by individuals' opportunity costs. The long-run penalty defined in Section 3 is the average value of the penalty from t=5 to t=10. The short-run penalty is the average value of the penalty from t=0 to t=4. In the table, *Low* means the child penalty for women with low opportunity costs, and *High* is the child penalty for women with high opportunity costs.

Women with high opportunity costs in terms of their own characteristics receive a 4.1 percent point to 11.7 percent point smaller child penalty around childbirth (in the short-run) than women with low opportunity costs. This contradicts with the result of Anderson et al. (2002). They argue that women experience skill depreciations when they leave the labor force with a birth of a child, so high skilled women receive a higher child penalty from the absence from the labor force. In Korea, many women leave the labor market around childbirth, and therefore, the pattern of women's staying in and returning to the market can be different by characteristics. Ma (2014) studies how women return to the labor force after childbirth in Korea using the KLIPS. She shows that women with good labor market standing are less likely to leave the labor force after childbirth, which is consistent with my result that women with high opportunity costs receive the smaller child penalty in the short-run. She argues that this results from job-protected maternity leave. Also, she shows that women return to the labor force three years after childbirth, and after their return, they experience downward occupational moves. Berniell et al. (2021) also show that labor informality increases for women in Chile with childbirth. My result shows that women's probability of working as a regular worker is lower relative to men in the long-run. Still, there is no statistically significant increase in the irregular job for women before and after childbirth (Figure B.4).

6 Conclusion

Many researchers consider the effect of children on the gender gap in numerous countries. However, there is not much literature on the child penalty in Korea despite the large gender gap. This paper uses the method proposed by Kleven et al. (2019b) to estimate the effect of first childbirth overtime. Using microdata from 1998 to 2018, I show that the child penalty in earnings is 68 percent and that this penalty in earnings is driven by the extensive margins. The child penalty in Korea has aspects that differ from those in other countries.

First, the 68 percent long-run penalty in earnings in Korea is the largest among those in countries investigated by studies using the same method. According to Kleven et al. (2019a), the long-run penalty is the smallest in Denmark, 21 percent, and German women suffer the largest penalty, 61 percent.

Second, the decrease in earnings of Korean women begins before the first childbirth. If this drop prior to childbirth is taken into account, the child penalty becomes larger, 82 percent in the long-run. A part of the penalty prior to childbirth is explained by marriage. Women who have worked in a job with maternity leave experience no penalties prior to childbirth.

Third, the penalties come from losing or quitting their job. If women remain in the labor force after their first childbirth, then childbirth has no impact on women's working hours and hourly wage. This finding is not consistent with the results of Sieppi and Pehkonen (2019); Kleven et al. (2019a,b), which shows that women in those countries experience the child penalty mainly from the intensive margins.

Fourth, the pattern of the child penalty varies by opportunity costs. Women with low opportunity costs receive the higher child penalty in the short-run. However, they are more likely to return to the labor force, and thus, their long-run child penalty is smaller than the child penalty of women with high opportunity costs.

In this paper, I show the penalty patterns in Korea and examine factors for the penalty such as marriage, lack of work benefits, and opportunity costs. It does not explain why women leave their jobs after childbirth. Future research will investigate why women quit or lose their jobs and why Korean women suffer from such a large child penalty.

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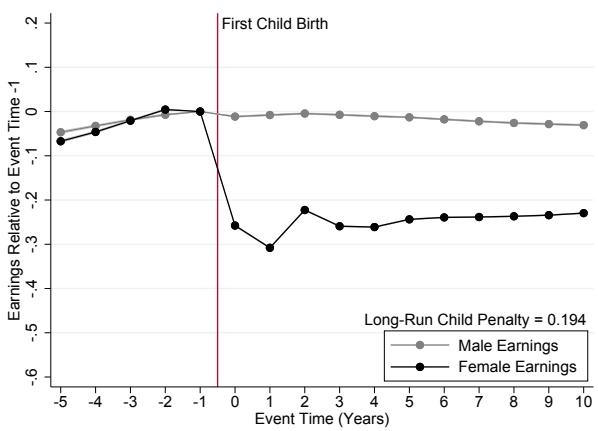
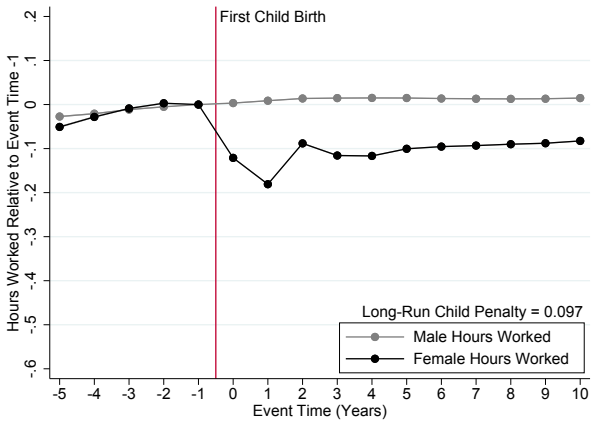
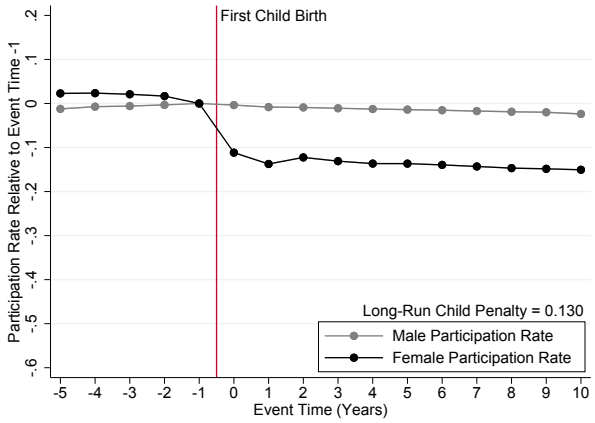


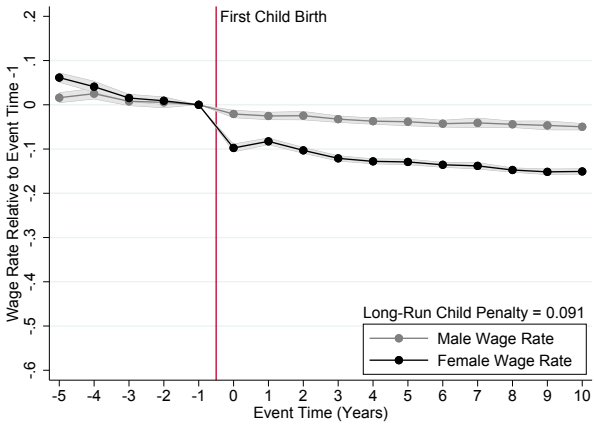
(a) Earning



(b) Hours Worked



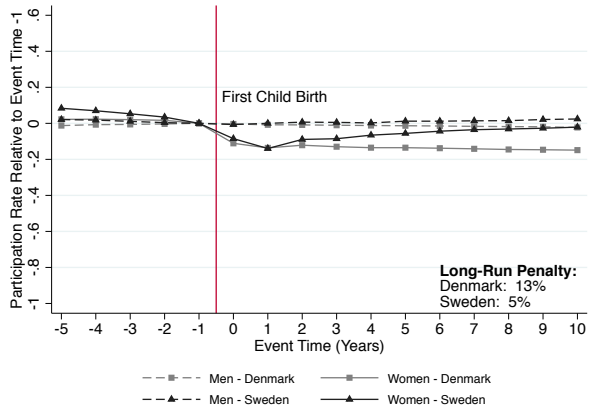
(c) Labor Force



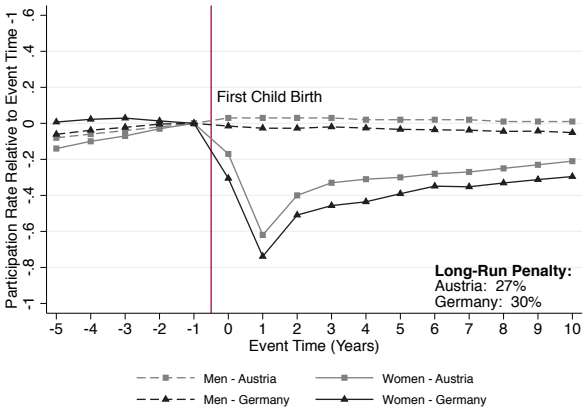
(d) Hourly Wage

Figure 1: The Child Penalty in Denmark

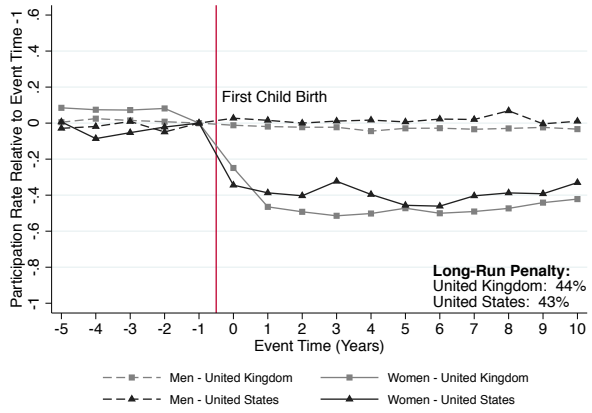
Notes: These figures are the baseline results of Kleven et al. (2019b). The long-run child penalty is measured at event time 10 (P_{10}).



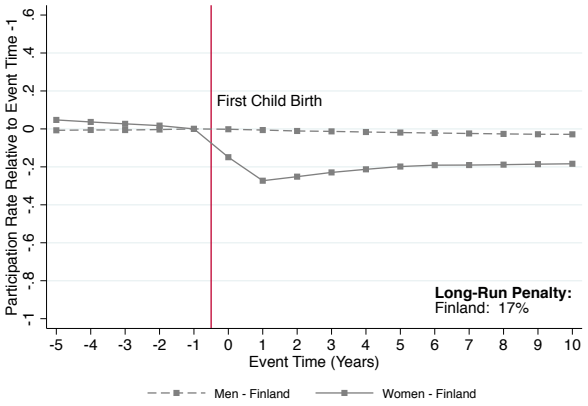
(a) Scandinavia



(b) German Speaking



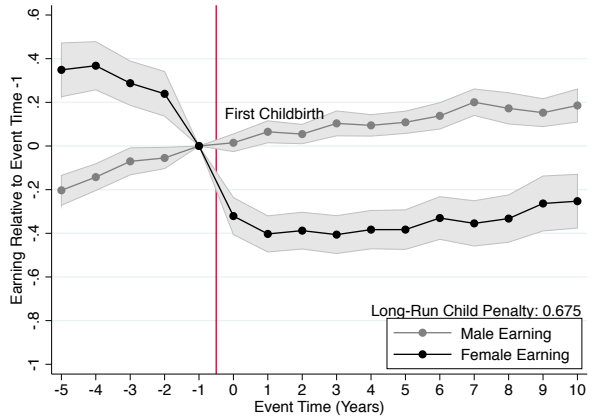
(c) English Speaking



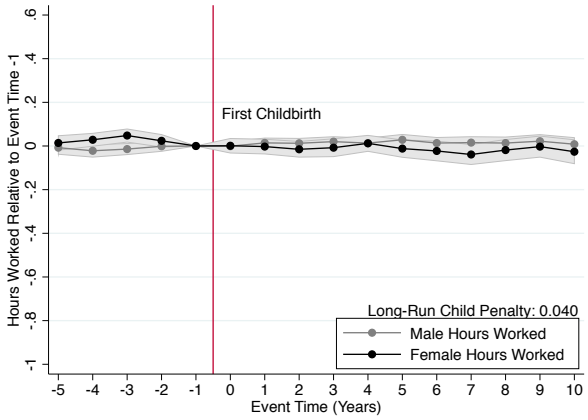
(d) Finland

Figure 2: The Children Penalties in Other Countries

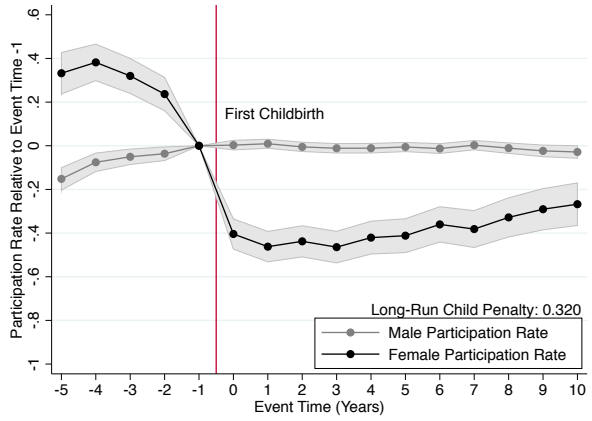
Notes: Panels (a), (b) and (c) are the results of Kleven et al. (2019a). The child penalty of Finland in panel (d) is from Sieppi and Pehkonen (2019). The long-run child penalty is the average value of the penalty from event time 5 to 10.



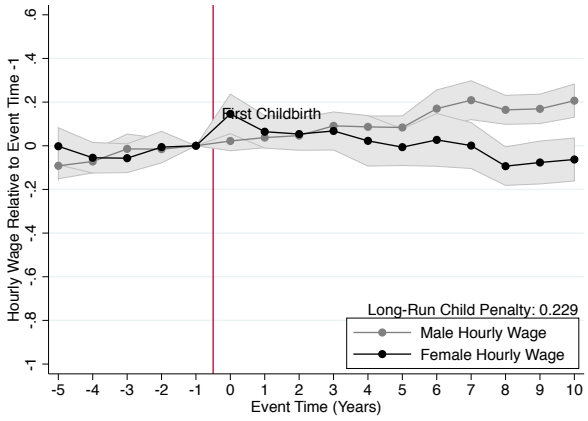
(a) Earning



(b) Hours Worked



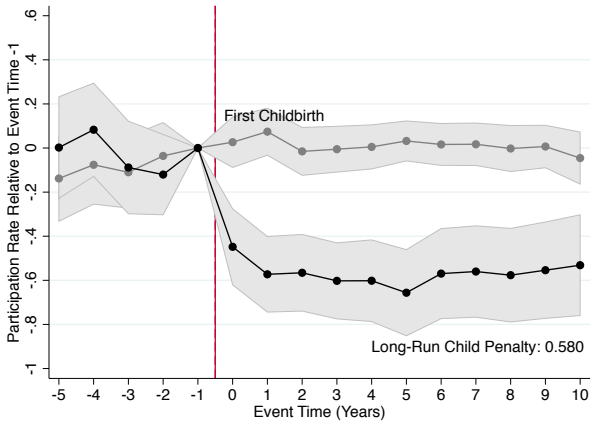
(c) Labor Force



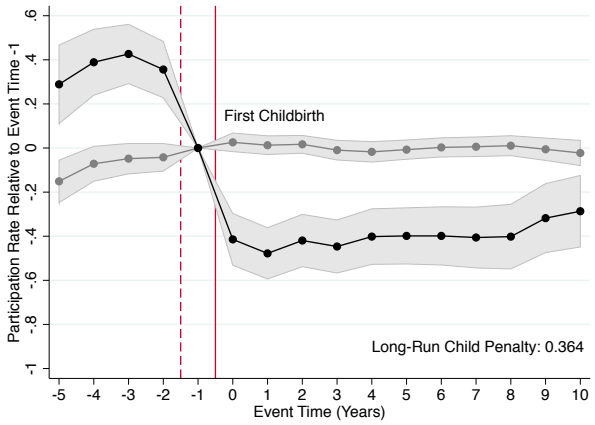
(d) Hourly Wage

Figure 3: The Child Penalty in Korea

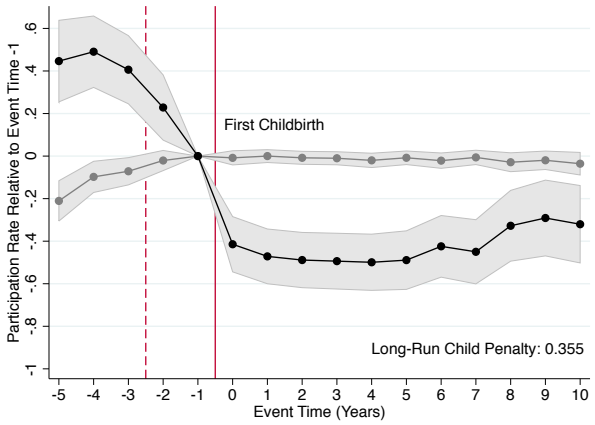
Notes: The long-run child penalty is the average value of the penalty from event time 5 to 10.



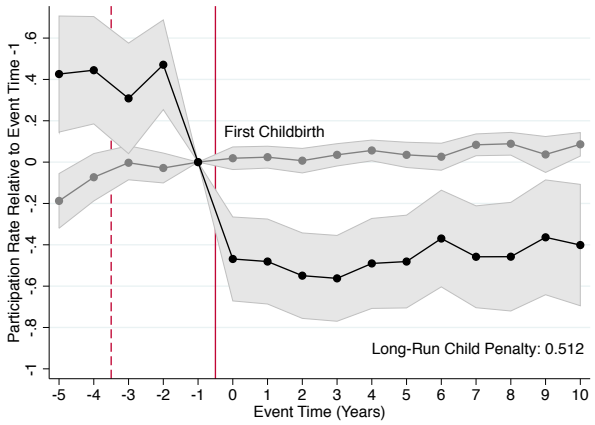
(a) Time Gap = 0 (10%)



(b) Time Gap = 1 (34 %)



(c) Time Gap = 2 (27%)



(d) Time Gap = 3 (13%)

Figure 4: The Child Penalty Depending on the Time Gap between Marriage and Childbirth

Notes: The proportion of subsample is in parentheses. The solid red line represents the year of first childbirth, and the dashed line plots the year of marriage. The time gap is the year difference between the first marriage and childbirth (the year of the first childbirth - the year of the first marriage).

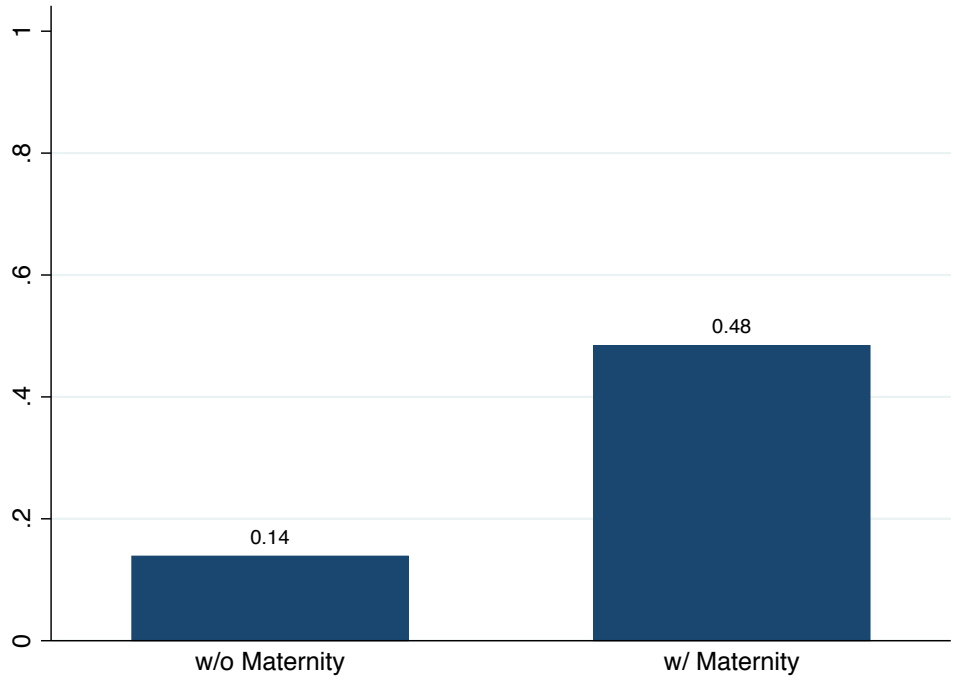


Figure 5: Probability of Working Through t=-1 to t=+1 by Access to Maternity Leave

Notes: Access to maternity leave is calculated based on whether they have worked in a firm providing maternity leave before childbirth or not.

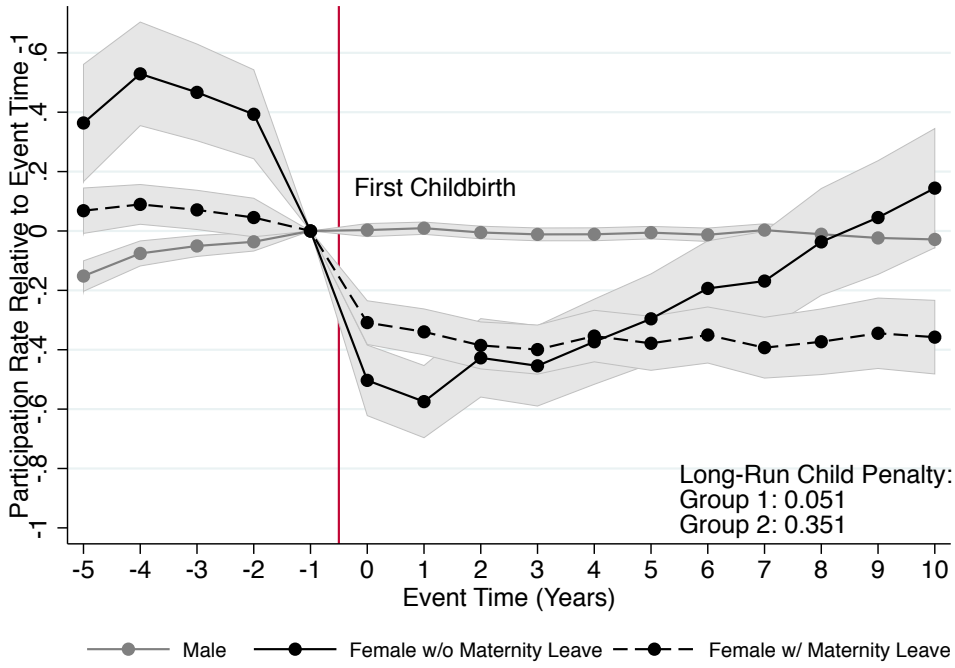
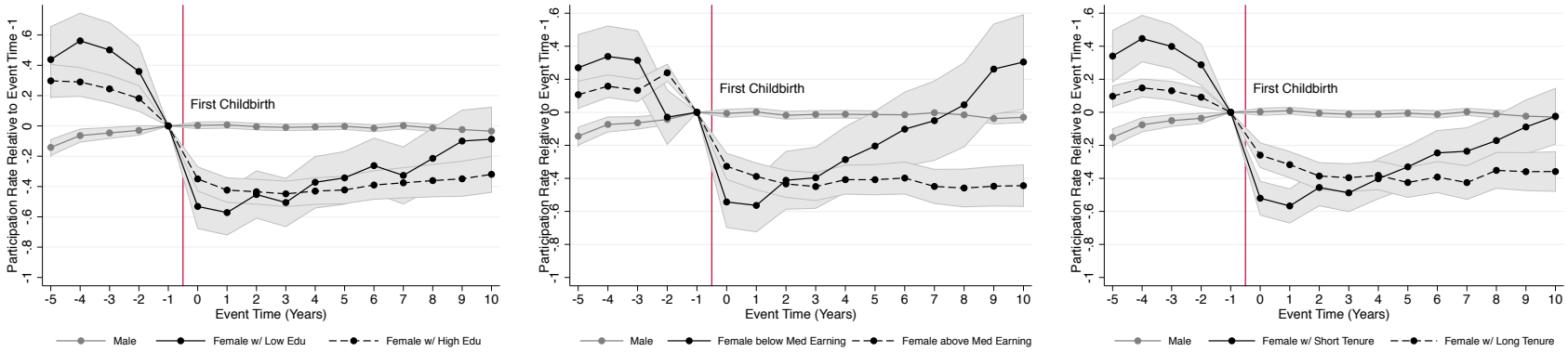


Figure 6: The Child Penalty by Access to Maternity Leave

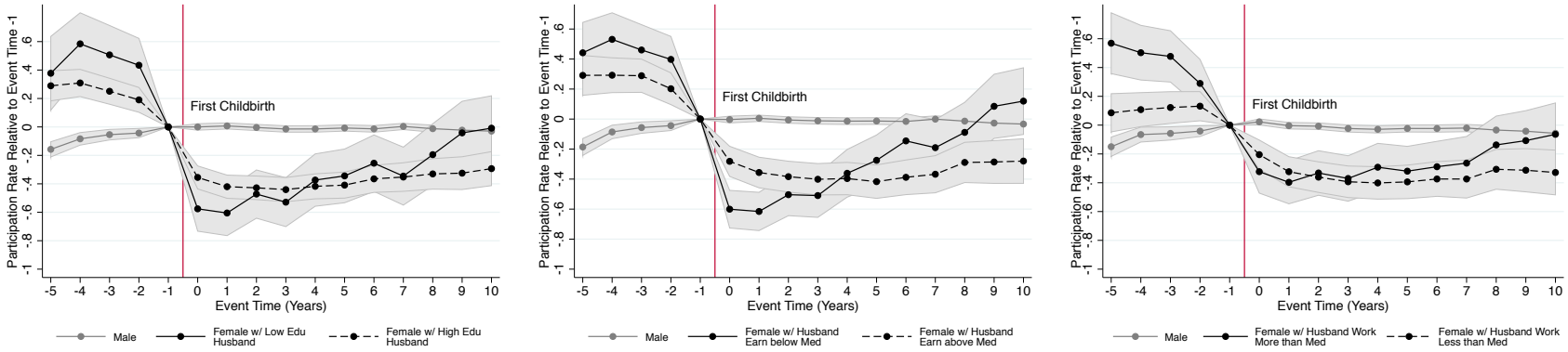
Notes: The dashed black line represents the impact of childbirth of females who worked in a workplace that provides maternity leave before childbirth. The solid black line shows the effect of childbirth on the rest of the females.



(a) By Education (b) By Earning (c) By Tenure Year

Figure 7: Heterogeneities in the Child Penalty

Notes: (a) Females with low education indicate women with less than 14 years of completed education. Women with high education means women with 14 or higher years of completed education (higher than a college degree). (b) Median earnings are calculated based on earnings at t=-2. (c) Tenure year counts tenure years at the most recent job before having a first child. Women with long tenure years mean women with more than 4 years at the job. If a woman works less than 4 years at the most recent job before childbirth, she is included in the group with short tenure years.



(a) By Education (b) By Earning (c) By Hours Worked

Figure 8: Heterogeneities in the Child Penalty by Husband's Characteristics

Notes: All husband's characteristics are based on t=0. (a) Men with low education indicate men with less than 14 years of completed education. Men with high education means men with 14 or higher years of completed education (higher than a college degree). Women with a husband with less than 14 years of completed education are women with low educated husband. (b) Median earnings are calculated based on earnings at t=0. (c) The solid black line is for women with a husband who works above the median hours worked.

Table 1: Summary Statistics at One Year Before Childbirth

	Female	Male
Age	28.91	31.49
	(3.56)	(3.93)
Education	14.09	14.32
	(2.01)	(2.14)
Earnings	105.90	233.89
	(109.78)	(129.06)
Labor Force	0.59	0.92
	(0.49)	(0.27)
Hours Worked	43.91	50.76
	(10.81)	(12.35)
Hourly Wages	1.02	1.22
	(0.59)	(0.62)
Observations	1004	1054

Notes: Standard deviations are in parentheses. The sample consists of people who had a first child between 1999 and 2017. This table is based on the values at one year before childbirth. Earnings are monthly wages in 2019 Korean 10,000 won ($\simeq$ \$10). Average male earnings are 2.34 million Korean won (approximately \$2100). Education is the years of completed education.

Table 2: Comparison between Working and Non-working Women

	Work	*Did Not Work*	T-test
A. Own characteristics at t=-2			
Age	28.67	27.91	0.76***
	(3.49)	(3.69)	
Education	14.50	13.75	0.74***
	(1.92)	(1.90)	
Earnings	195.68	95.35	100.33***
	(133.81)	(89.00)	
Tenure Years	4.52	1.98	2.54***
	(3.68)	(2.70)	
B. Her husband's characteristics at t=0			
Age	31.66	30.96	0.70**
	(3.46)	(3.83)	
Education	15.17	13.99	2.06***
	(1.86)	(2.06)	
Earnings	257.63	143.48	114.15***
	(117.97)	(155.55)	
Hours Worked	46.74	50.46	-3.72***
	(11.91)	(13.05)	

Notes: Standard deviations in parentheses. The job status is defined based on the job between -1, 0, and +1. *"Work"*=women continue to work through t=-1 to t=+1, *"Did not work"*=women leave the labor force between -1 to +1.

Table 3: Short-run and Long-run Penalty in Participation Rates by Characteristics

	(1)	(2)	(3)	(4)
	Short-Run		Long-Run	
	Low	High	Low	High
A. By own characteristics				
Education	41.1	34.5	22.7	35.0
Earnings	36.6	32.5	-3.7	41.3
Tenure Years	40.4	28.7	19.2	37.1
B. By husband's characteristics				
Education	43.2	33.7	21.4	32.6
Earnings	43.9	29.6	9.0	31.3
Hours Worked	28.0	27.2	16.9	30.6

Notes: The short-run penalty is the average value of the penalty (P_t) from t=0 to t=4. The long-run penalty is from t=5 to from t=10. The penalties in (1) and (3) are for women with low opportunity costs who are low educated, paid below the median, and have short tenure years.

Appendices

A Variable Definition

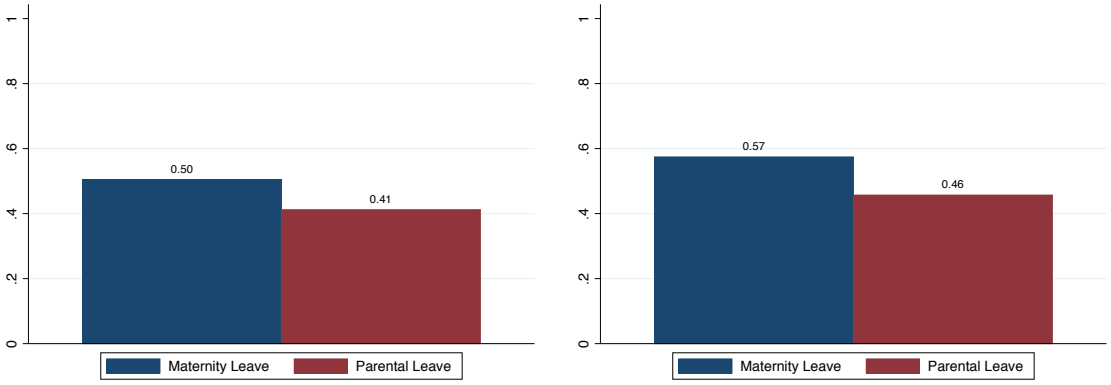
- **Earnings**: Reported average monthly net income from the job is used (Q. What is the average monthly net income you make from this job?). The KLIPS provides the definition of the net income on the questionnaire. Net income = Total revenue - Total costs. Total costs (total expenses) include sales activity expenses, tax and duties, and other operational expenses for business maintenance(electricity, vehicle maintenance, etc.)

- **Hours Worked**: Reported average weekly work hours are used (Q. How many hours a week do you usually work at this job, excluding lunchtime? And how many days a week do you usually work?).

- **Labor Force**: Reported employment status is used (Q. Please tell us which best describes your current employment status.). Even if an individual answers that s/he is working, s/he is coded as nonworking if his (or her) earning is zero.

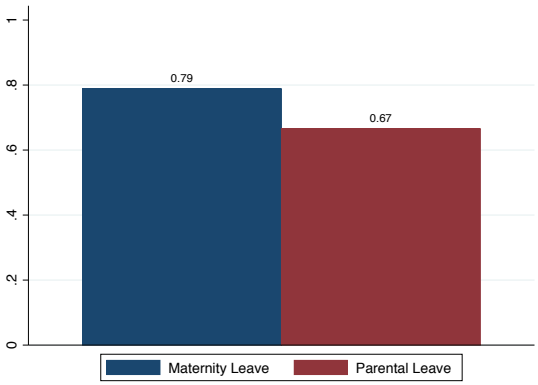
- **Hourly Wages**: Earnings/(Hours Worked*4.345)

B Supplement

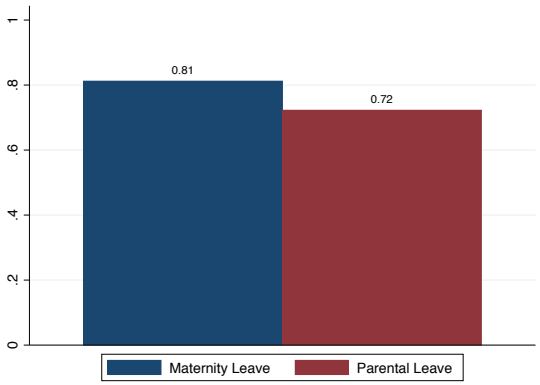


(a) t=-2

(b) t=-1



(c) t=0



(d) t=+1

Figure B.1: Access to Leaves by Eventtime

Notes: Using only women with a job.

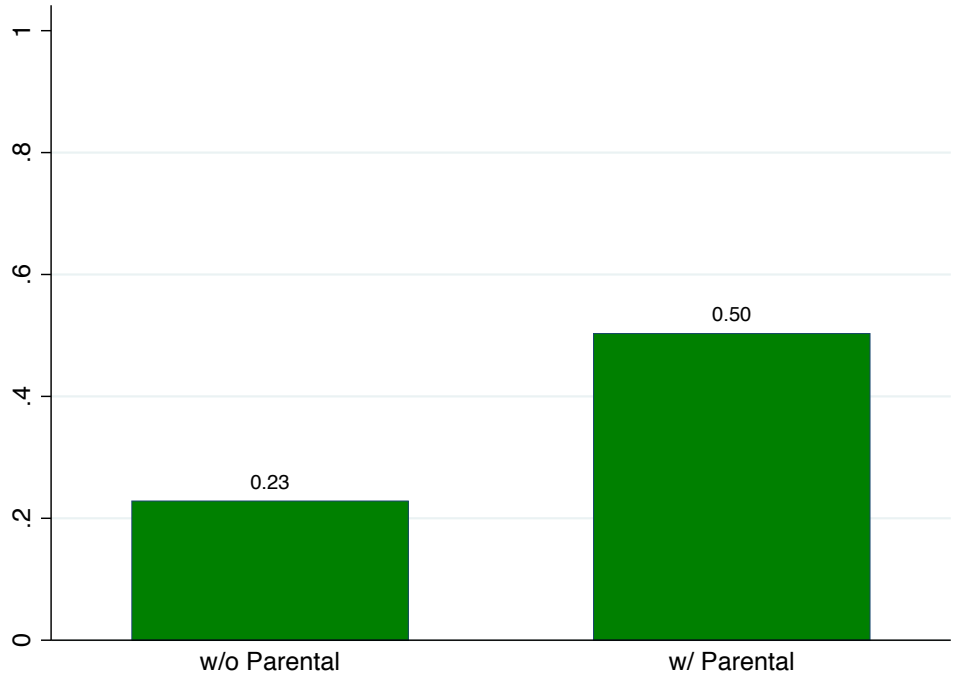


Figure B.2: Probability of Working Through t=-1 to t=+1 by Access to Parental Leave

Notes: Access to parental leave is calculated based on whether they have worked in a firm providing parental leave before childbirth or not. Parental leave in Korea: The length of the leave is one year. The employment insurance covers 80 percent of ordinary earnings for the first three months (with a minimum of KRW 700,000 ($\approx$ \$650) and a maximum of KRW 1,500,000($\approx \$1,350$)) and 50 percent of ordinary earnings for the rest of the leave (with a minimum of KRW 700,000 ($\approx$ \$650) and a maximum of KRW 1,200,000($\approx \$1,100$))

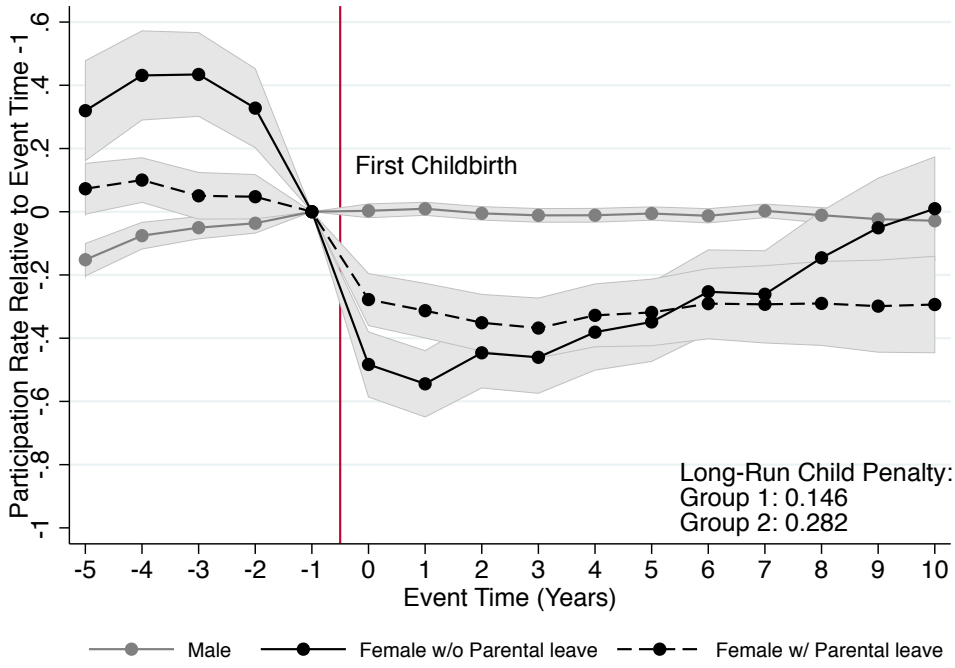


Figure B.3: The Child Penalty by Access to Parental Leave

Notes: The black dash line represents the impact of childbirth of female who had worked in a workplace that provides parental leave before childbirth. The solid black line shows the effect of childbirth of the rest of female.

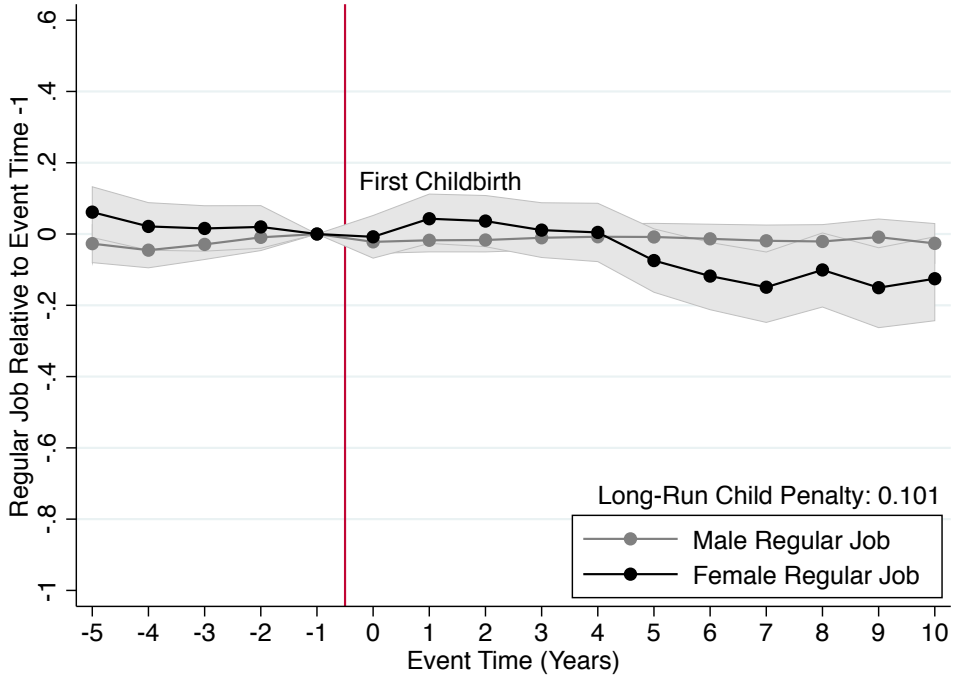


Figure B.4: The Child Penalty in Working as a Regular Worker

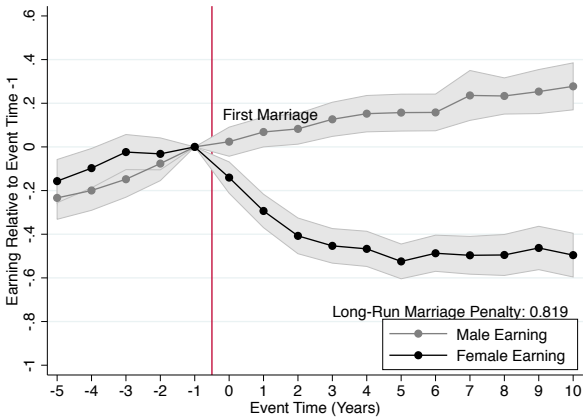
C Marriage Penalty

Many papers estimate the effect of marriage on the labor market Loughran and Zissimopoulos (2009). Lee (2005) also shows the great effect of marriage in Korea, where marriage reduces the female labor supply by 41 percent. Figure 3 confirms that the penalty starts before the first childbirth, which may coincide with the timing of marriage. Therefore, in this section, I estimate the marriage penalty instead of the child penalty. The event is the first marriage, not the first childbirth. The KLIPS asks for the year of marriage for people included for the first time and their marital status every year, and these data are used as the year of the first marriage. Table C.1 shows the summary statistics for the marriage penalty one year before marriage. The average age at marriage was 27.39 for women and 30.50 for men; thus, men are approximately three years older than women on average when they marry. The two samples used to estimate the child and marriage penalties may be different. While the sample for the estimation for the child penalty is people who had a first child between 1999 and 2017, the sample here is people who married between 1999 and 2017. Some married couples might not have a child, and there could be some out-of-wedlock births. People who did not have the information before the event in the survey were excluded. Therefore, people who are added to a household due to marriage are excluded from the estimation of the marriage penalty. Some couples married before the KLIPS started and had a first child after that; those couples were not included in the sample for marriage penalty but are included in the sample for the child penalty. Therefore, there are more individuals in the estimation of the child penalty.

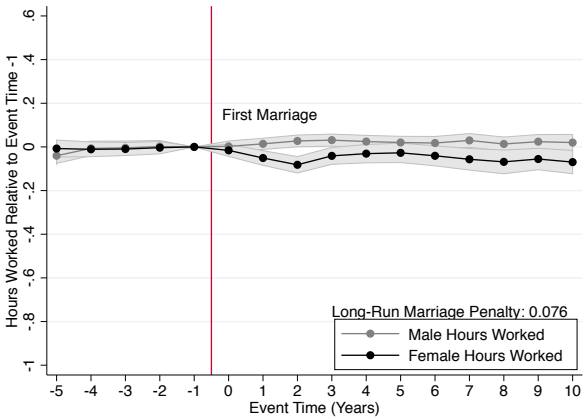
Figure C.1 illustrates the effect of the first marriage. The sample here is people who married between 1999 and 2017. The base year, therefore, is the one year before the first marriage. Earnings are unconditional on employment, so an individual has zero earnings if he or she is not working. Panels (b) and (c) in the figure show the estimates for working hours and hourly wages among employed people. The long-run marriage penalty in earnings is 82 percent for women; thus, Korean women experience a significantly large penalty from

marriage. This divergence in earnings is not observed in Sieppi and Pehkonen (2019); Kleven et al. (2019a,b). As a result of changing the definition of the event, both men and women have the same increasing trend in earnings before marriage, but while men's earnings continue to increase after marriage, women's earnings have decreased since their marriage. Panels (b) and (d) show that there are few gaps between men and women before and after their marriage when childbirth is used as the event. In panel (c), the probability of working is significantly reduced for women, which explains the driver for the reduction in women's earnings. Women who continue to work after marriage have working conditions similar to shoes of men in terms of hourly wages and working hours. However, it is difficult for women to remain in the labor market after marriage. Therefore, being out of the labor force is the main cause of the marriage penalty for women.

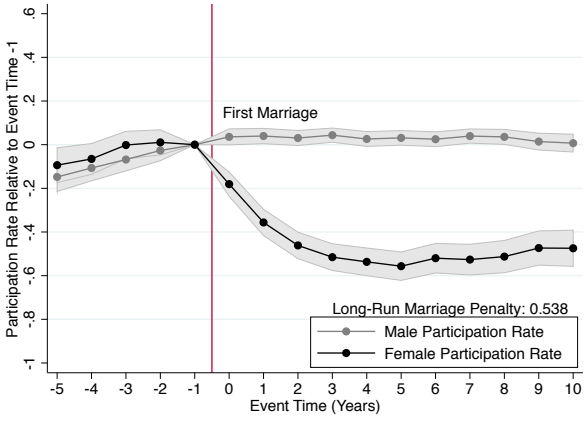
C.1 Baseline Results of Marriage Penalty



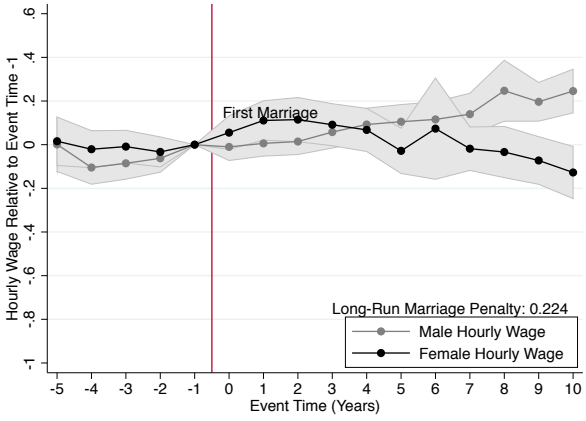
(a) Earning



(b) Hours Worked



(c) Labor Force



(d) Hourly Wage

Figure C.1: Marriage Penalty

C.2 Summary Statistics

Table C.1: Summary Statistics at One Year Before Marriage

	Female	Male
Age	27.40	30.53
	(3.66)	(4.43)
Education	13.97	13.95
	(2.04)	(2.20)
Earnings	135.26	205.51
	(99.99)	(182.75)
Labor Force	0.78	0.84
	(0.41)	(0.36)
Hours Worked	46.08	50.87
	(10.61)	(12.74)
Hourly Wages	0.93	1.17
	(0.58)	(0.76)
Observations	708	788

Notes: Standard deviations are in parentheses. The sample consists of people who married between 1999 and 2017. This table is based on the values at one year before marriage. Wages are monthly in 2019 Korean 10,000 won ($\simeq$ \$10). Education is the years of completed education.