Essays on Gender Gaps in Labor Market Outcomes and Time Allocation: Evidence from South Korea

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Abstract

Essays on Gender Gaps in Labor Market Outcomes and Time Allocation: Evidence from South Korea

This dissertation comprises three chapters focusing on gender gaps in both labor market outcomes and time allocation. The first chapter examines mothers' relative labour market outcomes around the first childbirth in South Korea, a country with the highest gender pay gaps and the lowest fertility rate among the OECD countries. Using an event study approach, we find that while fathers remain unaffected, mothers' earnings drop sharply by 66.2 per cent over the long run, mostly driven by a reduction in labour force participation. For women who continue to work, motherhood lowers the probability of entering male-dominated occupations and industries but increases the probability of working in female-dominated occupations and industries. Finally, we find that motherhood has a stronger negative effect on labour market outcomes for less-educated mothers, young mothers, mothers who first bear children within two years of marriage, and mothers with three or more children.

Despite an increase in female labor force participation over the last decade, the gender gap in labor supply between married men and women has been persistent in South Korea. The second chapter investigates the gender gap in labor supply with a focus on

education and spousal earnings in explaining the gap using the decomposition analysis. Endowment difference in the level of education between married men and women increases gender gap in participation. Yet, its adverse effect has decreased over time with Korean women's equal or even higher access to education. We also highlight spousal earnings as an important explanation for the unchanged gender gap in labor supply. Our result implies that intra-household equality in earnings may lead to gender equality in labor supply and vice versa. Consistent with other studies in the context of Asian countries, a large portion of the gender gap in labor supply in South Korea remains unexplained.

While women have made notable progress in labor market outcomes over the past decade, the unequal distribution of household labor persists. In the third chapter, I analyze the impact of spousal relative income on gender disparities in time allocation among dual-earner couples with children, using matched data from the Korean Time Use Survey and Korean Labor and Income Panel Study in 2004, 2009, 2014, and 2019. As a potentially exogenous measure of wives' relative income, I construct a Bartik-style instrument that utilizes region-specific labor demand shocks by interacting variations in preexisting industry employment shares and provincewide earnings growth for each industry, excluding the focal area. The results suggest that when the share of earnings contributed by wives increases by one standard deviation, the time gap in housework between husbands and wives decreases by 24 minutes per day. Additionally, as the wives' earnings increase, husbands and wives allocate more time to care work, mostly childcare.

Keywords: parenthood, gender gap, child penalty, occupational segregation, labor force participation, hours worked, labor supply, linear and nonlinear Oaxaca-Blinder decomposition, time-use, gendered household labor, spouses' relative income, gender norms

Chapter 1. The Motherhood Effect on Labour Market Outcomes: Evidence from South Korea[1]

1.1 Introduction

In South Korea (Korea hereafter), female labour force participation has continued to expand; however, the labour force participation rate of married women in their thirties who experience childbirth is still significantly lower than that of married men. Increased investment in female education and career coupled with a lower employment rate for women than the Organisation for Economic Co-operation and Development (OECD) average suggests that there is room to improve women's labour market outcomes in Korea.

Early literature has discussed the role of human capital, discrimination, and taste differentials to explain the widening gender gap in the labour market (Altonji and Rebecca 1999). However, as women obtain equal education and job opportunities, at least in developed countries, more recent papers focus on the role of parenthood to explain persistent gender inequality and its slow convergence rates in labour market outcomes. The phenomenon is termed 'motherhood penalty', 'child penalty', or 'family gap' (Waldfogel

[1] This chapter is based on Kim and Hahn (2022)'s paper titled 'The Motherhood Effect on Labour Market Outcomes: Evidence from South Korea,' which was published in *Asian-Pacific Economic Literature*.

1998; Budig and England 2001; Avellar and Smock 2003; Glauber 2007; Gangl and Ziefle 2009), implying that parents face a trade-off between childcare and labour market decisions.

In this paper, we examine the parenthood effect on gender inequality in the labour market in Korea. In particular, we show how parenthood has been costly for women relative to men and how this 'child penalty' evolves over time. When they become parents, mothers tend to leave the workforce or take more time off from their careers than fathers. They set on a trajectory of lower lifetime labour force participation and earnings relative to their male counterparts. By adopting a quasi-experimental approach based on an event study, as per Kleven et al. (2019b), we measure the child penalty around the first childbirth in several labour market outcomes, such as labour force participation, earnings, hours worked, and wage rate. We exploit the panel structure of the Korean Labor and Income Panel Study (KLIPS) to analyse how the first childbirth affects an individual's labour market out- comes and how the effects change over time by comparing labour market trajectories of mothers relative to fathers.

As shown in Figure 1.1, the gender gaps in labour force participation and wages in Korea have steadily declined over the past 30 years. In 1992, 53.3 per cent (that is, 41 percentage points lower than men) of women participated in the labour force, and women earned about 53 per cent of what men earned; however, the gender gaps in labour force participation and wages shrank to 22 percentage points and 31 per cent, respectively, in 2020. Despite the progress in recent decades and the low fertility rate (that is, the total

fertility rate of 0.84 in 2020[2]—was the lowest rate in the world), Korea's gender gap in labour force participation remains higher than the OECD average, and the gender gap in wages is the highest among the OECD countries in 2021.[3] Korea has one of the most pronounced gender pay gaps, the lowest fertility rate, and very severe gender inequality, making it a unique setting in which to study the relationship between having a child and labour market outcomes among women relative to men.

When estimating the short- and long-run effects of children on fathers' and mothers' labour market trajectories, we find that parenthood has a significant and persistent effect on mothers' labour market outcomes, while fathers remain largely unaffected. Mothers experience a sudden dip in earnings immediately after the first child's birth, and its effect does not converge to the original level of earnings over time. In the long run, mothers' labour earnings fall by 66.2 per cent, and their labour force participation rate lowers by 35.4 per cent relative to fathers. Among working parents, mothers' hours worked are reduced by 7.3 per cent, and mothers' wage decreases by 16.6 per cent compared to fathers. The sharp decrease in earnings largely comes from the extensive margin, suggesting that mothers respond and adjust to their newborn child by withdrawing from the labour force.

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[2] Source: Korean Statistical Information Service (web: https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1B81A21&conn_path=I2).

[3] Korea also ranked the last among the OECD countries regarding the female share of seats on boards of the largest companies: only 8.7 per cent of board members are women. Women make up 19 per cent of the legislative members in the national parliament and 15.6 per cent of the total number of employees in managerial positions-figures much lower than the OECD average (Source: OECD Gender Data Portal. https://www.oecd.org/gender/data).

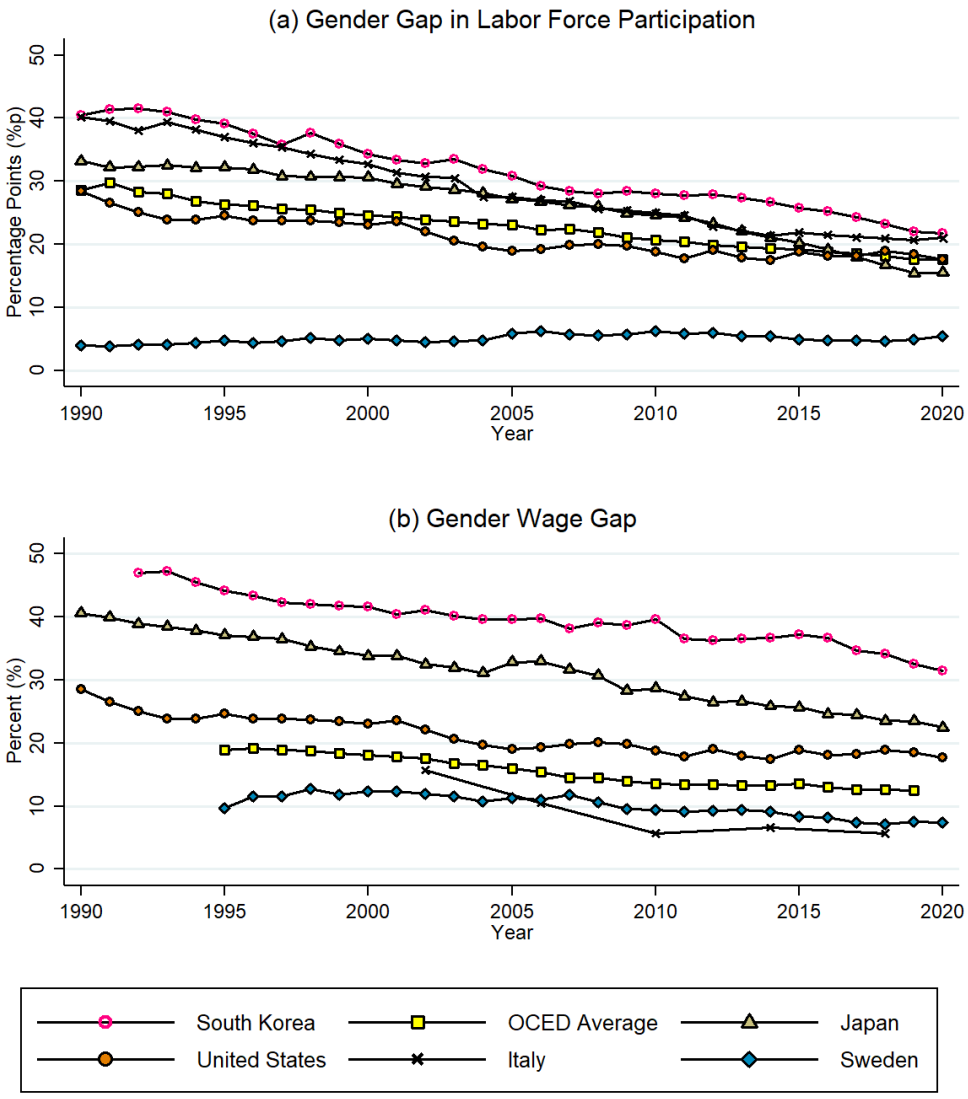

Figure 1.1. Gender Gap and Total Fertility Rate in Selected Countries

Notes: Data from the OECD. Panel (a) illustrates the gender differential in labor force participation defined as the average LFPR of men minus the average LFPR of women aged 25-54. Panel (b) shows the gender wage gap defined as the differentials between male and female median earnings divided by the male median earnings, restricting to full-time employees.

To explore potential mechanisms behind the child penalty, we examine how mothers change their occupations and industries in response to the first childbirth. The result shows a persistent decrease in mothers' probability of working in male-dominated occupations and industries after the first child is born, while there is no change for fathers. Mothers' probability of working in female-dominated occupations and industries continues to increase over the long run. Finally, we analyse heterogeneous impacts of children by mothers' characteristics, such as education, age at first childbirth, duration between marriage and first birth, and the number of children. The results show that motherhood has a larger negative impact on labour market outcomes for less educated and young mothers, and delaying the first childbirth can act as a buffer against withdrawal from the labour force. The long-run child penalties in both labour force participation and earnings increase with the number of children.

Our research contributes to three strands of the existing literature. First, we provide an international comparison of the long-run child penalty in Korea with other developed economies. Our results indicate that the long-run earnings penalty (that is, 66.2 per cent) is much higher than in the Scandinavian countries (that is, 21–27 per cent), the English-speaking countries (that is, 31–44 per cent), and the German-speaking countries (that is, 51–61 per cent). Second, we contribute by analysing the interplay between parenthood and occupational and industrial segregation (Buchmann and McDaniel 2016; Hook and Pettit 2016; Cortés and Pan 2017). One of the post-child effects is that women switch their

occupations and sectors in response to motherhood. Lastly, we contribute to the literature by investigating various heterogeneous effects using mothers' different characteristics.

1.2. Literature Review

Numerous studies have examined the effect of having children on female labour market outcomes. The timing of marriage and childbirth are important decisions; when and how many children to have and how much time women should devote to the market work is a joint decision problem (Nakamura and Nakamura 1992). Previous research attempted to solve the potential endogeneity problem of having children on family labour supply by applying the instrumental variables method, such as using twin births (Rosenzweig and Wolpin 1980) and the sex composition of siblings (Angrist and Evans 1998) as instruments for the number of children. One potential limitation of using these instrumental variables is that they can be used only to examine the impact of having an extra child, rather than looking at the effect of the first child. The latter presumably has a much greater impact on the labour market participation among women.

An event study framework is used to alleviate the endogeneity problem of children (Angelov et al. 2016; Kuziemko et al. 2018; Sieppi and Pehkonen 2019; Kleven et al. 2019b; Berniell et al. 2021) in the absence of reliable instrumental variables for having the first child. Kleven et al. (2019b) studied the effect of children on the gender gap in the labour market using Danish administrative data. They showed that the arrival of children generated a long-run gender inequality in earnings of around 20 per cent, driven by lower levels of participation, working hours, and wages. Sieppi and Pehkonen's (2019) study also

confirmed the negative effect of children on labour earnings in Finland, where the long-run child penalty was 25 per cent. Berniell et al. (2021) investigated the child penalty in Chile and found that informal labour market opportunities, such as temporary jobs and jobs without contracts, allowed more flexible work schedules and acted as buffers for new mothers leaving the labour market.

There are few studies on the impacts of children on female labour market outcomes in Korea. Chun and Oh (2002) discussed the effect of the number of children on female labour force participation using the sex of the first child as an instrumental variable. They found, in 1996, that an additional child lowered the probability of working for married women by 27.5 per cent. Nam (2010) used the number of daughters as an instrumental variable for having one more child and discovered that having a third child had a large negative effect on female labour force participation in the 1980s. Ma (2013) showed that Korean women typically dropped out of the labour market when anticipating motherhood.

In Korea, the share of births for unmarried women is significantly lower than in other developed economies. Thus, marriage and birth are far more intertwined. Lee et al. (2008) found a 40 to 60 per cent lower probability of married women participating in the labour market than single women in urban Korea. Yoo and Lee (2020) showed the employment rate of married women continued to decline during the first six years after being married, dropping about 46 percentage points after six years of marriage. In addition, earned income for married women fell as a direct consequence of the lowered employment rate. There has been relatively limited research on quantifying the long-run child penalty

in Korea, particularly in the dynamic effects of children. Our findings show how the effects of children differ for fathers and mothers and how they evolve by tracing the dynamic trajectory of those effects.

1.3. Estimation Strategy

We estimate the effect of first childbirth on fathers' and mothers' labour market outcomes using the event study method proposed in Kleven et al. (2019b). Event studies can provide causal estimates of the post-child effect if the timing of the event, which is the year of the first childbirth, is independent of the evolution of an individual's baseline labour market outcomes (Sun and Abraham 2021).[4] Fertility choices may not be exogenous if women who invest less in education and career have higher chances of leaving a job or reducing working hours before pregnancy (i.e., the pre-child effect of future children). However, the event of first childbirth creates a sudden change in labor outcomes that is, presumably, not correlated with unobserved determinants of those outcomes; evolution in the absence of such an event should be smooth in time (Kleven et al. 2019b).

We denote the first childbirth as the event $\tau = 0$ and index all years relative to the event year (e.g., $\tau = -1$ expresses a previous year in which the parents give birth to

[4] Kleven et al. (2019b) provide two identification checks of such an approach: one is the difference-in-differences event study, and the other is estimating the local treatment effect of having a third child based on a sibling sex mix instrumental variable. Section "Robustness Checks" discusses the results using the first type of robustness check. For a more detailed discussion on the identification assumptions in the event study approach, refer to Borusyak et al. (2022) and Sun and Abraham (2021).

the first child). The analysis includes the event dummies from 4 years before the first childbirth to 10 years after the first childbirth.[5] For a panel of $i = 1, \ldots, N$ individuals observed yearly for all or some $t = 1, \ldots, T$ calendar years, we run the following separate regression for men and women:

$$Y_{it}^{g} = \sum_{\tau=-4,\neq-1}^{\tau=\tau^{max}} \beta_{\tau}^{g} \mathbb{1}[\tau = t - c^{i}] + \sum_{a} \gamma_{a}^{g} [a = age]_{it} + \delta_{t} + \varepsilon_{it} \qquad \textit{eq. 1}$$

where Y_{it}^{g} denotes the labor market outcomes for individual i of gender g in year t. Event time τ is defined as year t minus the calendar year in which an individual i had his or her first child c^{i}. For the right-hand side of equation 1, we include a full set of event time dummies, age-in-years dummies, and calendar year dummies. We omit the base category of event time dummies at $\tau = -1$ so that all the event time coefficients, β_{τ}^{g}, can be interpreted as the impact of children relative to the year before the first childbirth. Adding age-in-years fixed effects and survey-year fixed effects on our baseline specification allows us to control for life-cycle trends and time trends.

As per Kleven et al. (2019b), we plot β_{τ}^{g} coefficients to show the within-person evolution of outcome variables relative to the event of parenthood, conditional on age and year fixed effects. We convert the estimated level effects into percentage effects by calculating $P_{\tau}^{g} \equiv \hat{\beta}_{\tau}^{g} / E[\tilde{Y}_{it}^{g} | \tau]$, where $\tilde{Y}_{it}^{g} = \sum_{a} \hat{\gamma}_{a}^{g} Age_{it}^{a} + \hat{\delta}_{t}$ (i.e., the prediction of the

[5] Therefore, long-term effects may include not only the impact of the first child but also the impact of siblings after the first child is born.

model omitting the effects of the event time dummies). Then, P_τ^g captures the event time τ effect of children as a percentage of the counterfactual outcome absent children, and P_τ^g is zero when the event time, τ, equals -1. We plot the different gender-specific impacts of children P_τ^f, P_τ^m separately for fathers and mothers across the event times and estimate using robust standard errors clustering at the individual level. We also define a child penalty on mothers relative to fathers at event time τ as follows:

$$P_\tau \equiv (\widehat{\beta_\tau}^f - \widehat{\beta_\tau}^m)/E[\tilde{Y}_{it}^m|\tau] \qquad \textit{eq.2}$$

Having estimated the impacts of children on fathers and mothers separately, we can calculate the child penalty, which measures the percentage by which mothers fall behind fathers due to children at event time τ. The long-run child penalty is the average value of the penalties from event time 5 to 10.

1.4. Data and Descriptive Statistics

1.4.1. Data

The primary data source for this study is the KLIPS from 1998 (1st wave) to 2019 (22nd wave). The KLIPS is a longitudinal study surveying a representative sample of Korean households and individuals, which contains a rich set of socio-demographic information, including relevant labor market outcome variables at the individual levels. For our purpose, we construct the year of the first childbirth by tracking married couples and their first child's age, allowing us to study the dynamics of labor outcomes before and after couples first become parents.

Our sample includes only those individuals we observed at least once before and once after the first childbirth. Then, the sample consists of individuals who had their first child between 1999 and 2018. We restricted the sample to fathers, whose age at the first childbirth was between 20 and 60-years-old, and mothers, whose age at the first childbirth was between 20 and 50-years-old. Also, we do not impose any restrictions on the parents' marital status. The final sample comprises an unbalanced panel of 1,213 fathers and 1,205 mothers in the year just before the first childbirth.

We estimate the child penalties on labor force participation, earnings, hours worked, and wages. Labor force participation takes a value of 1 if an individual is currently employed or actively searching for a job and 0 if otherwise. Earnings are defined as the average monthly wage for wage and salary workers and the average monthly income for self-employed individuals. Earnings are imputed as 0 for the unemployed. Thus, the effect of earnings estimates not only the results of a decrease in working hours, low productivity, or income loss due to discrimination but also the consequences of income loss due to voluntary or involuntary unemployment. Hours worked per week and hourly wage (= monthly earnings/hours worked per week*4.3) are only observable for working individuals. All monetary variables, such as earnings and wages, are inflation-adjusted using the 2015-base consumer price index.

1.4.2. Descriptive Statistics

Table 1.1. Summary Statistics of One Year Before First Childbirth

Variables	Men		Women		Difference
	Mean	S.D.	Mean	S.D.	
Panel (a) Whole sample					
Birth year	1975.6	5.565	1978.2	5.363	−2.530***
Age at first child born	32.357	3.974	29.720	3.592	2.637***
Highest education achieved					
High school grad. or below	0.273	0.446	0.286	0.452	−0.013
Community college grad.	0.242	0.429	0.309	0.462	−0.066***
University grad. or above	0.485	0.500	0.405	0.491	0.080***
Labor force participation	0.948	0.222	0.650	0.477	0.298***
Monthly earnings	230.971	133.734	107.911	108.892	123.060***
Number of individuals	1,213		1,205		
Panel (b) Employed sample					
Hours worked (per week)	50.659	12.425	44.712	10.992	5.947***
Hourly wages	1.223	0.636	0.999	0.566	0.225***
Number of individuals	1,111		737		

Notes: The values are calculated based on one year before the first child's birth. Earnings and wages are CPI-adjusted, and monthly earnings take the value of 0 if an individual is unemployed. The sample is restricted to those observed at least once before and once after the first childbirth. The final sample is a panel of 1,191 men and 1,186 for monthly earnings and a panel of 1,089 men and 718 women for hourly wages due to the missing values in earnings and wages.

Table 1.1 shows the summary statistics of fathers and mothers a year before they first become parents. Before the first child was born, fathers, on average, are about three years older than mothers. The fathers' average labor force participation rate is 94.8 percent, whereas that of mothers is 65 percent, resulting in a difference of 30 percentage points. For earnings unconditional on working, mothers earn 1,230,600 KRW (i.e., 984 USD as on 2nd June 2022) less per month relative to fathers. Among the employed, fathers spend an average of 50.7 hours per week at their jobs, whereas mothers work an average of 44.7 hours per week, which led to a 6-hour difference in work hours between parents. Working

mothers earn an average of 9,990 KRW per hour while working fathers earn an average of 12,230 KRW per hour. In other words, working mothers earn 82 percent of what working fathers earn.

1.5. Estimation Results

1.5.1. Baseline Results: The Impact of Children

Panel (a) in Figure 1.2 shows the event time estimates of labor force participation separately for fathers and mothers. The participation paths of fathers and mothers start to diverge around the time of the first childbirth and slightly recover after that.[6] The child penalty in participation amounts to 46.2 percent in the short run (i.e., the average value between event time 0 to 4); however, it decreases to 35.4 percent in the long run. For instance, 65 percent of mothers participate in the labor force a year before the first childbirth, but only 38.4 and 45.7 percent of mothers decide to stay in the labor force at 5 years and 10 years after the first childbirth, respectively.

A similar pattern is observed in panel (b) in Figure 1.2, showing the earnings gap between fathers and mothers; however, the earnings gap remains persistent over time.

[6] Figure A1.1 (a) also indicates that women may start reducing their labor supply after marriage. According to Yoo and Lee (2020)'s findings, the probability of employment drops significantly by 12 percentage points in the first year of marriage, and its effect extends to 46 percentage points by the 6th year of marriage, which is also likely to include the effect of childbirth. They also find that earnings of married women decrease continuously after marriage due to the decreased probability of employment. We add the role of marriage in female labor market outcomes in the Appendix A1 using our sample and confirm that women start to withdraw from the labor market in the first year of marriage, although the size of the decline in labor force participation is much smaller (i.e., 15 percentage points) compared to the size of the decline after the first childbirth (i.e., 28.2 percentage points).

Mothers experience a sharp decline in earnings following the first childbirth, and their earnings never recover their original status, whereas men are unaffected or rather positively affected. More specifically, mothers experience earnings drop of 42 percent the year immediately after the first child's birth. In comparison, fathers experience a slight earnings increase of 6.7 percent during the same period. Consequently, the child penalty in mothers' earnings, relative to fathers', amounts to 52 percent in the short run, and its earnings gap increases to 66.2 percent in the long run. For instance, mothers earn 107.9 ten thousand KRW a year before the first childbirth; however, their earnings reduce to 66.1 and 75.3 ten thousand KRW at 5 years and 10 years after the birth of the first child.

Panels (c) and (d) in Figure 1.2 show the event time estimates of hours worked and the wage rate. For those who continue to work in the labor market, the evolution of working fathers and mothers is parallel in the pre-child period. Compared to labor force participation and earnings, those effects are relatively small in magnitude; on average, mothers' hours worked fall by 3.7 percent, whereas their hourly wages increase by 7.8 percent over the initial four years of the first childbirth. Those penalties increase to 7.3 and 16.6 percent in the long run. Despite the lowered child participation penalty in the long run, the widening gaps in hours worked and wage rates combine to worsen the long-run earnings differentials between fathers and mothers. The long-run effect and child penalty will capture the effect of the first child and the overall effect of children, including the additional costs of siblings born thereafter.

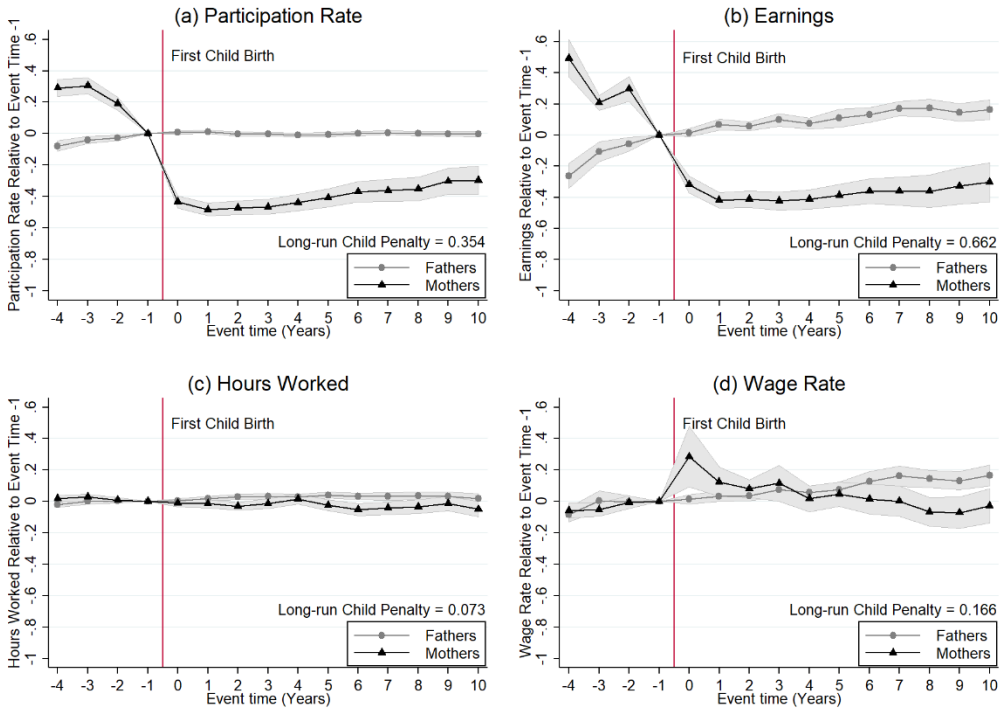

Figure 1.2. The Impact of Children

Notes: The graphs show event time coefficients estimated from equation 1 as a percentage of the counterfactual outcome absent children (i.e., $P_\tau^g \equiv \hat{\beta}_\tau^g / E[\tilde{Y}_{it}^g | \tau]$) separately for fathers and mothers. The long-run child penalty is calculated as the average value of the penalties from event time 5 to 10. The sample is restricted to those observed at least once before and once after the first childbirth. The effects on participation and earnings are estimated unconditional on employment status, while the effects on hours worked and wage rate are estimated conditional on employment. The shaded areas represent 90 percent confidence intervals.

The main force behind widening the earnings gap between fathers and mothers is the large negative impact of motherhood on the labor supply, in both extensive and intensive margins. In other words, mothers pay a significant earnings penalty after the first childbirth, as they are more likely to exit the labor market or, even if they decide to stay in their jobs, work fewer hours. Even though this earnings impact comes from both extensive

and intensive margins, the participation penalty is much closer in magnitude to the earnings penalty, indicating that the extensive margin mostly drives the earnings penalty.

Another point worth mentioning is a sudden rise in mothers' wage rate in the first child's birth year. When analyzing the impacts of children on hours worked and wage rates, we restrict the sample to the employed. Thus, the estimated effects of those outcomes include any selection effects into employment. Blah and Kahn (2017) review the existing literature on selection and the gender wage gap; they show some evidence of the positive selection into employment in more recent years due to the appreciable improvements in female educational attainment, experience levels, and occupational choices. In such cases, our estimates would be underestimated and serve as a lower bound of true estimates than the true parameters of children's impacts on mothers' hours worked and wage rates.

1.5.2. International Comparisons

Next, we compare our results from Korea with those of other economies, summarized in Table 1.2. The size of the long-run penalty on earnings is considerably different across countries. In Scandinavian countries, the long-run earnings penalties are 21–27 percent, and in English-speaking countries, the long-run penalties in earnings are 31–44 percent. Both penalties are smaller than the 51–61 percent reduction in mothers' earnings in Germanic countries. The earnings penalties are driven from different margins across countries. In the Scandinavian and Germanic countries, the earnings penalty is driven more by the intensive margin and wage rate effect. However, the extensive margin effect is largely responsible for the earnings penalty in English-speaking countries (Angelov et al.

2016; Kleven et al. 2019a; Sieppi and Pehkonen 2019; Berniell et al. 2021). Korea ranks the highest in child penalty in earnings (i.e., 66.2 percent). The reduced participation is a key driver of the earnings penalty, similar to the U.S. and U.K.

Table 1.2. Comparison of the Long-run Child Penalties in Different Economies

Paper	Country	Child Penalties in Earnings
Angelov et al. (2016)	Sweden	32%
Kleven et al. (2019a)	Denmark	21%
	Sweden	27%
	United States	31%
	United Kingdom	44%
	Austria	51%
	Germany	61%
Sieppi and Pehkonen (2019)	Finland	25%
Berniell et al. (2021)	Chile	28%
Our paper	South Korea	66%

Notes: Child penalties are defined as the average penalty from event time 5 to 10. Earnings are unconditional on employment, and thus the effects come from both the extensive and intensive margins.

Compared to other Western countries, Korea exhibiting the highest child penalty might be related to gender roles and family norms in a male breadwinner society. Despite no gender gap in college enrollment and growing numbers of dual-earner couples, Korean women spend about 166 minutes more (49 vs. 215 minutes) per day in unpaid work than Korean men. The gender time gap in unpaid work is much greater than the OECD average of 127 minutes (136.5 vs. 263.4 minutes) in the latest available year.[7] Even among the dual-earner households, Korean wives spend two hours per day more on nonmarket activities than husbands (Hwang 2016). Korean couples' unequal division of household

[7] Source: OECD Time Use Database. (Web: https://stats.oecd.org/Index.aspx?DataSetCode=TIME_USE)

labor preexists before the first childbirth. When the first child arrives, wives' household work increases by 6 hours per day, whereas husbands' unpaid work decreases by 30 mins per day on average. This discrepancy may lead some women to leave the workforce entirely or spend less time on paid labor (Kim and Cheung 2019).

1.5.3. Robustness Checks

The long-run impact of children can be biased if the evolution of labor market outcomes largely changes over a long event time window, although controlling for age and year fixed effects may alleviate some bias. Kleven et al., (2019b) proposed one solution using men and women without children as control groups in the Difference-in-differences (DID) setting. We use a DID-Event study design[8] to check the robustness of our event study results. This design compares men with children to men without children and women with children to women without children, as opposed to our gender gap estimates comparing mothers to fathers. This approach alleviates the concern that fathers may not serve as an appropriate control group of mothers because of their gender difference. We define a father

[8] The DID-event study design is based on assigning placebo births to individuals who never have children, drawing from the observable characteristics of age at first child among those who do have children. Specifically, we estimate the following model:

$$Age\ at\ the\ first\ childbirth_i = Female_i + Edu\_max_i + Earnings_i + Birth\ year_i + \varepsilon_i$$

We assign the year of placebo births by predicting the age at which individuals have their first child as a function of observables such as female dummy, highest educational level received (i.e., years of schooling), and earnings at age 25 or initially observed earnings. Following Kleven et al. (2019b), we drop the age dummies in the DID-event study model specification and analyze the same way as the event study design.

penalty as the percentage by which men with children rise or fall behind men without children and a mother penalty as the percentage by which women with children fall behind women without children. The results, presented in the Appendix, Figure A2.1, show significant participation and earnings gaps between women with and without children, suggesting that gender, by itself, does not drive child penalties. In both labor force participation and earnings, women with and without children sharply diverge immediately after the first actual or placebo year of childbirth. The impacts slightly recover over time but never return to levels before childbearing. The long-run child penalties for women with children compared to women without children are 26.9 in participation. The long-run effect on earnings, however, is smaller at 31 percent when using women without children as counterfactuals than using men (both with and without children) as counterfactuals.

1.5.4. Motherhood and Occupational and Industrial Choices

So far, we provide the event study evidence of the long-run child penalties in different labor market outcomes. The finding of the negative wage differential between fathers and mothers raises an important question: Why is there still a gender pay gap even among working parents? Much of this gap can be explained by measurable factors, such as educational attainment, job experience, and occupational and industrial segregation. Despite the increased portion of women in high-paying occupations and industries traditionally dominated by men, women are still over-represented in low-paying occupations and industries relative to their total share of the labor force.

A growing body of research shows the association between motherhood and occupational and industrial segregation. Family responsibilities, such as childrearing, may segregate fathers and mothers into and out of certain occupations and industries. Mothers are more likely to be out of the labor market and over-represented in less desirable occupations than women without children (Hook and Pettit 2016). A low share of skilled women in an occupation with long work hours suggests that women may switch to more family-friendly occupations or opt-out of the labor force to manage family and career (Cortés and Pan 2017). Buchmann and McDaniel (2016) suggested that a positive association between motherhood and wage exists in some professions with greater workplace flexibility and autonomy, such as medicine. Women tend to work as part-time workers or get jobs in industries with shorter work hours; thus, industries with higher earnings and longer working hours are male-dominated (Blau and Kahn 2017).

In order to investigate how motherhood affects women's occupational and industrial choices, we define male- and female-dominated occupations (industries) as those whose average ratio of male workers is above 0.6 and below 0.4, respectively.[9] Table 1.3 shows that female-dominated occupations (industries) are more likely to be low-paying occupations (industries) with high job flexibility. In contrast, male-dominated occupations (industries) are more likely to be high-paying and long-hour occupations (industries). The

[9] We construct the ratio of male workers in each occupation and industry (i.e., number of male workers/ numbers of total workers in each occupation and industry) for the entire survey year using the cross-sectional weights.

Appendix, Table A2-1 lists the top 10 male- and female-dominated occupations and industries.

Table 1.3. Descriptive Statistics of Occupation and Industry at $\tau = -1$

	Occupation		Industry	
	Male-dominated	Female-dominated	Male-dominated	Female-dominated
Occ. or Ind. with High Job Flexibility (share)	0.067	0.435	0.095	0.713
	(0.250)	(0.496)	(0.294)	(0.453)
High-paying Occ. or Ind. (share)	0.454	0.217	0.361	0.062
	(0.498)	(0.413)	(0.481)	(0.242)
Low-paying Occ. or Ind. (share)	0.008	0.085	0.001	0.274
	(0.089)	(0.279)	(0.032)	(0.446)
Long-hour Occ. or Ind. (share)	0.375	0.204	0.469	0.347
	(0.484)	(0.404)	(0.499)	(0.477)

Notes: Occupations (Industries) with high job flexibility are defined as those with a higher ratio of part-time workers than the average value of the total occupations (industries). High-paying occupations (industries) are those that pay more than the hourly wage at the 75th percentile of the total occupations (industries). Low-paying occupations (industries) are defined as those in which the median hourly wages are below two-thirds of the median wage of the total occupations (industries). Long-hour occupations (industries) are defined as those with longer weekly hours worked than the average working hours of the total occupations (industries). Statistics are calculated with pooled data using cross-sectional weights. Standard deviations are shown in parentheses.

We study how the probability of having male- and female-dominated occupations and industries changes with the first childbirth for working fathers and mothers. Figure 1.3 shows the gender-specific impacts of the first childbirth on occupational and industrial choices using the same specification as section 5.1. All panels exhibit that working fathers and mothers are on identical pre-trends regarding their probability of having male- and female-dominated occupations and industries before parenthood. However, we see a persistent drop in working mothers' probability of entering male-dominated occupations and industries after the first child is born. Contrarily, there is no change in working fathers' probability of having male-dominated occupations and industries around parenthood. In

the long run, the probability of having male-dominated occupations and working in male-dominated industries is lowered by 36.2 and 31.7 percent, respectively, for working mothers relative to working fathers, due to raising children.

On the other hand, panels (b) and (d) in Figure 1.3 show opposite patterns after the first childbirth. The probability of working in female-dominated occupations and industries increases for working mothers but not for working fathers. Computing the average effect from event time $\tau = 5$ to $\tau = 10$, the probability of having female-dominated occupations among working mothers is increased by 22.8 percent compared to their male counterparts. The average effect of being employed in female-dominated industries is 14 percent over the same period. These results indicate that motherhood contributes to high occupational and industrial segregation among working parents and, thus, to the gender pay gap. Our evidence suggests that mothers respond to motherhood by forgoing higher wages by changing occupations and industries with higher flexibility and relatively low working hours.

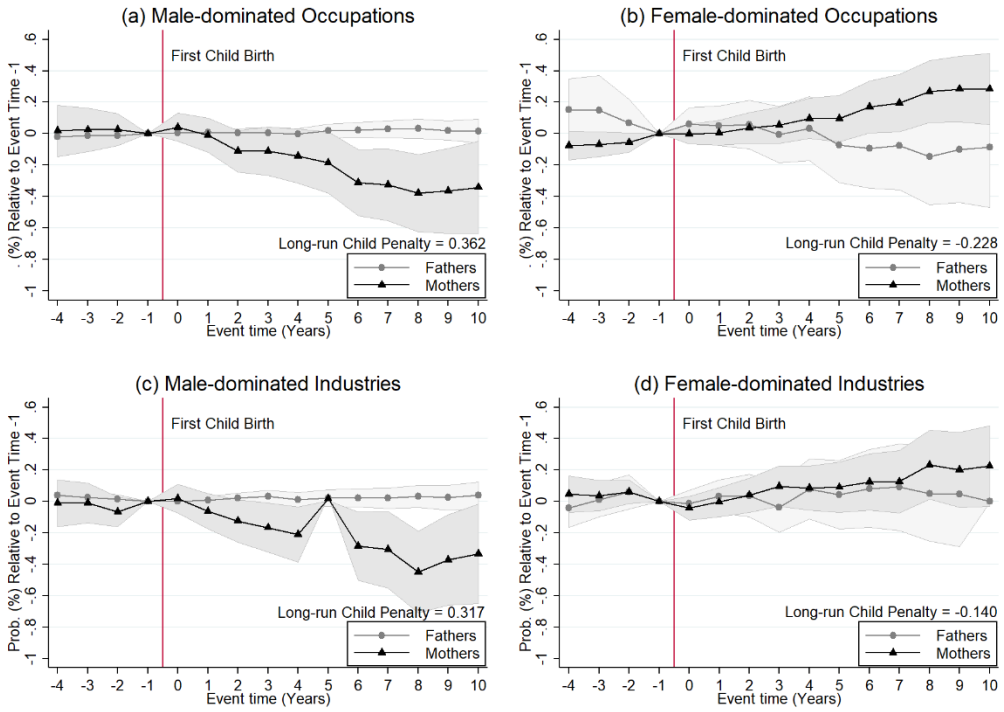

Figure 1.3. The Impact of Children on Occupational and Industrial Choices

Notes: The figure shows the impacts of children on the probability of having male- and female-dominated occupations or industries conditional on employment. Event time coefficients are estimated as the percentage of the counterfactual outcome absent children for fathers and mothers separately. The long-run child penalty is calculated as the average value of the penalties from event time 5 to 10. The sample is restricted to those observed at least once before and once after the first childbirth. The shaded areas represent 90 percent confidence intervals.

1.5.5. Heterogeneous Effects by Mothers' Characteristics

This section analyzes the impact of children on mothers' labor force participation with different characteristics and investigates heterogeneous effects across our sample. We exclude other labor market outcomes since most of the penalties are driven by labor force participation in Korea. Previous literature suggests that the effect of having children on labor market outcomes may depend on educational attainment, age at birth, duration

between marriage and first birth, and the number of children (Amuedo-Dorantes and Kimmel 2005; Goldin 2014; Doren 2019; Blackburn et al. 1993; Miller 2011; Kahn et al. 2014; Troske and Voicu 2012; Gough 2017; Kleven et al. 2019b; Sieppi and Pehkonen 2019). We look at how the long-run child penalty varies across four dimensions: whether mothers have at least a bachelor's degree, whether mothers give birth before or after the age of 29, whether parents decide to have their first child within two years of marriage, and whether mothers have one child, two children, or three or more children. The median values[10] of the age at the first childbirth and the duration between marriage and first birth are used to separate the sub-groups (see the Appendix, Figure A2.2).

The effects of motherhood likely differ with educational attainment, as women with and without college educations are dissimilar in many ways. For example, they are expected to have different labor market trajectories, different levels of wealth and attitudes toward family, and face different fertility schedules (Doren 2019). College-educated mothers may find "good jobs" with family-friendly benefits that reduce the costs of childbearing and provide job flexibility (Amuedo-Dorantes and Kimmel 2005). For instance, pharmacists (i.e., more linear relationship between earnings and hours worked) with children often work part-time instead of exiting the labor force (Goldin 2014).

[10] In our sample, the median age at which women give birth to their first child is 29-years-old. The median value of the first birth interval among married women is 2 years.

We classify women into two groups to estimate the heterogeneous motherhood effects by educational attainment:[11] mothers who earn at least a bachelor's degree and mothers who graduate from some college, high school, or less. Panel (a) in Figure 1.4 presents the event time estimates of labor force participation separately for college-educated mothers, non-college-educated mothers, and fathers. Less-educated mothers generally experience a more sizable drop in participation upon the first childbirth than college-educated mothers); in the long run, relative to fathers, college-graduated mothers' participation declines by 27.9 percent, and non-college-graduated mothers' participation falls by 35.4 percent. The child earnings penalty is almost double for less-educated mothers (see the Appendix, Table A2.2).

Women who become mothers at younger ages tend to invest less in human capital than women who bear first births relatively late in their lives. Consequently, 'early' child-bearers experience greater career penalties and lower wages than 'late' child-bearers (Blackburn et al. 1993; Kahn et al. 2014). According to Miller (2011)'s estimates, career earnings, work experience, and average wage rates increase by 9, 6, and 3 percent, respectively, for a year in which women decide to delay their motherhood.

[11] We classify women based on their maximum educational level received during the sample period so that the definition of groups can be time-invariant.

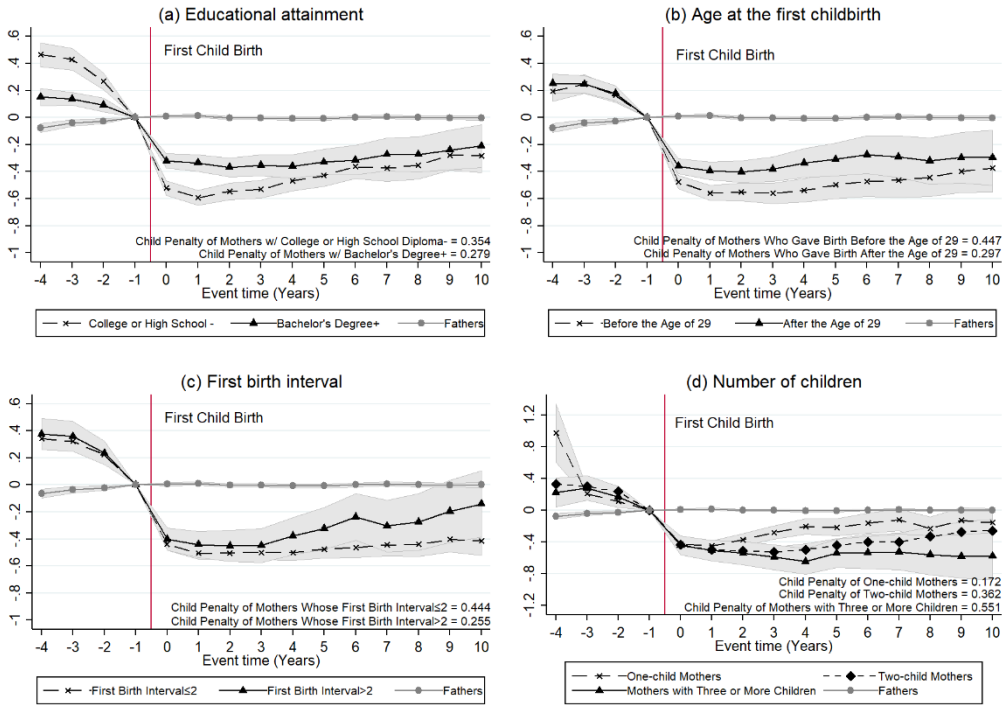

Figure 1.4. Heterogeneous Effects on Labor Force Participation by Mothers' Characteristics

Notes: The figure presents different motherhood impacts by mothers' characteristics, with the same specification in Figure 3. Each panel reports: (a) the child penalties of mothers with some college, high school diploma, or less and mothers with bachelor's degree and more; (b) the child penalties of mothers who give birth before the age of 29 and after the age of 29; (c) the child penalties of mothers who have their first child within two years of marriage and after; (d) the child penalties of one-child mothers, two-child mothers, and mothers with three or more children (the percentage by those mothers fall behind fathers due to children). The total number of children splits the sample as of the last observed year (1, 2, 3, or more children).

Young mothers face higher child penalties in participation than mothers who postpone their pregnancy past the age of 29, as shown in panel (b) in Figure 1.4. In the long run, relative to fathers, labor force participation decreases 44.7 percent for mothers who bear their first child before the age of 29, while it falls to 29.7 percent for mothers who first give birth after the age of 29. After the first child is born, both groups of mothers experience

a persistent loss of earnings, but, again, the negative effect is greater for young mothers (see the Appendix, Table A2.2).

Birth spacing has a significant role in determining the effect of children on mothers' labor market outcomes. After marriage, delaying the time-to-first birth leads to higher prenatal levels of labor market involvement, mitigating the negative effects of the first childbirth on mothers' participation and wages (Troske and Voicu 2012; Gough 2017). To estimate how the timing of birth affects the long-run child penalty, we define the first birth intervals of 0 to 10 years after marriage as the duration of time before married couples have their first child. We divide the sample into two groups based on the length of the marriage and first birth interval: parents whose interval is less than or equal to 2 and parents with an interval greater than 2.[12]

Panel (c) in Figure 1.4 shows that women who postpone childbearing experience lower long-run child penalties in participation, whereas both groups of women experience similar earnings penalties (see the Appendix, Table A2.2) for the next 10 years after their first child is born. Over the long run, participation falls by 44.4 percent for women who bear their first child within two years of marriage in the long run; however, women who delay their first childbirth for 2–10 years after marriage are 25.5 percent more likely to leave the labor market relative to fathers. The result suggests that delaying the first

[12] Divorce, separation, and bereavement can affect an individual's labor market outcomes, leading to biased estimates in analyzing the heterogeneous effect of children by marriage and the first birth interval. Thus, the sample is restricted to individuals who did not experience marital status changes during the sample period and were observed at least once before and after the first childbirth.

childbirth (rather than having a child immediately after marriage) may act as a buffer against the negative impacts of motherhood and alleviate the long-run penalty in participation for mothers.

Having additional children may have more adverse gender-specific responses to the birth of the first child. Mothers may take on greater responsibility for the childcare burden in terms of time, money, and emotional investment as they have more children, resulting in lower long-term earnings for mothers (Kahn, García-Manglano, and Bianchi 2014). Thus, we investigate whether the number of children affects parents' labor market outcomes in panel (d) in Figure 1.4. Confirming the results of Kleven et al. (2019b) and Sieppi and Pehkonen (2019), we find that the long-run child penalties are highest for mothers with more than three children in both labor force participation and earnings. In part, these findings can be related to differences in socio-economic characteristics across family types. For instance, mothers with more than three children are less likely to be educated, experienced, and employed than mothers with fewer children at the baseline, that is, before giving a birth (Sieppi and Pehkonen 2019). Future mothers of one child are 5.1 percentage points (44.5 percent vs. 39.4 percent) more likely to have a bachelor's degree, 7.3 percentage points (65.3 percent vs. 58 percent) more likely to be employed, and earn 20 ten thousand won (121.2 vs. 101.2) more than mothers of two children a year before their first childbirth.[13]

[13] Summary of the heterogeneous effect is presented in the Appendix, Table A2.2.

1.6. Conclusion

Even with the considerable improvement in gender inequality in education, many countries still experience a substantial gender gap in the labor market. Recent papers document that motherhood is an important driver behind the gender gap in labor supply and earnings (Angelov et al. 2016; Kleven et al. 2019a; Kleven et al. 2019b; Sieppi and Pehkonen 2019; Kuziemko et al. 2018; Berniell et al. 2021). Our paper extends the literature by measuring the negative effect of children on mothers' labor market outcomes in Korea using the event study approach.

We find that the first child's arrival decreases mothers' labor force participation and earnings, and the effect persists over time. In the long run, mothers earn 66.2 percent less than their male counterparts, and they are 35.4 percent more likely than fathers to leave the labor force. The earning penalty is higher than those studies done in other countries, largely resulting from the extensive margin of women's moving out of the labor force. Our results also suggest that motherhood contributes to the high levels of occupational and industrial segregation among working parents and, thus, to the gender wage gap.

We further investigate heterogeneous effects of children across different groups based on mothers' characteristics and find some mothers are more vulnerable than others. For instance, non-college-graduate mothers and young mothers, relative to college-graduate mothers and mothers who give first birth after the age of 29, experience higher child penalties in participation and earnings. Also, mothers who give birth within a short period after marriage face greater negative consequences on labor force participation than

those who delay the time after marriage for the first birth. Finally, the negative effects of becoming a mother on labor market outcomes worsen as the number of children increases.

Fathers and mothers adjust differently to their careers to balance their work and family while raising the first child. Motherhood can lead to career interruptions and a permanent negative impact on long-term earnings. Improving social benefits and relevant policies may assist mothers to remain in the labor market without any child-related participation and earnings penalties.

Chapter 2. Explaining the Gender Gap in Labor Supply of Married People in South Korea[1]

2.1. Introduction

Female participation in the labor markets tends to increase with economic growth or development in a country (Goldin 1995; Mammen and Paxson 2000; Lincove 2008; Luci 2009; Tam 2011). Women's labor force participation (henceforth, LFP) in OECD countries has increased over the last few decades, getting closer to gender equality in employment. From 1990 to 2021, the gender gap in LFP for those aged from 25 to 54 has considerably reduced by 11.5 percentage points across the OECD (from 28.6 to 17.1 percentage points) and by 19.5 percentage points in South Korea (from 40.4 to 20.9 percentage points). However, the gender gap in South Korea still lies much higher than the OECD average, which is above any average gaps among other selected OECD countries: Japan, the United States, Italy, and Sweden, as shown in panel (a) of Figure 2.1.

[1] This chapter is a revision of one of author's working paper (Anna Kim and Youjin Hahn, 2023).

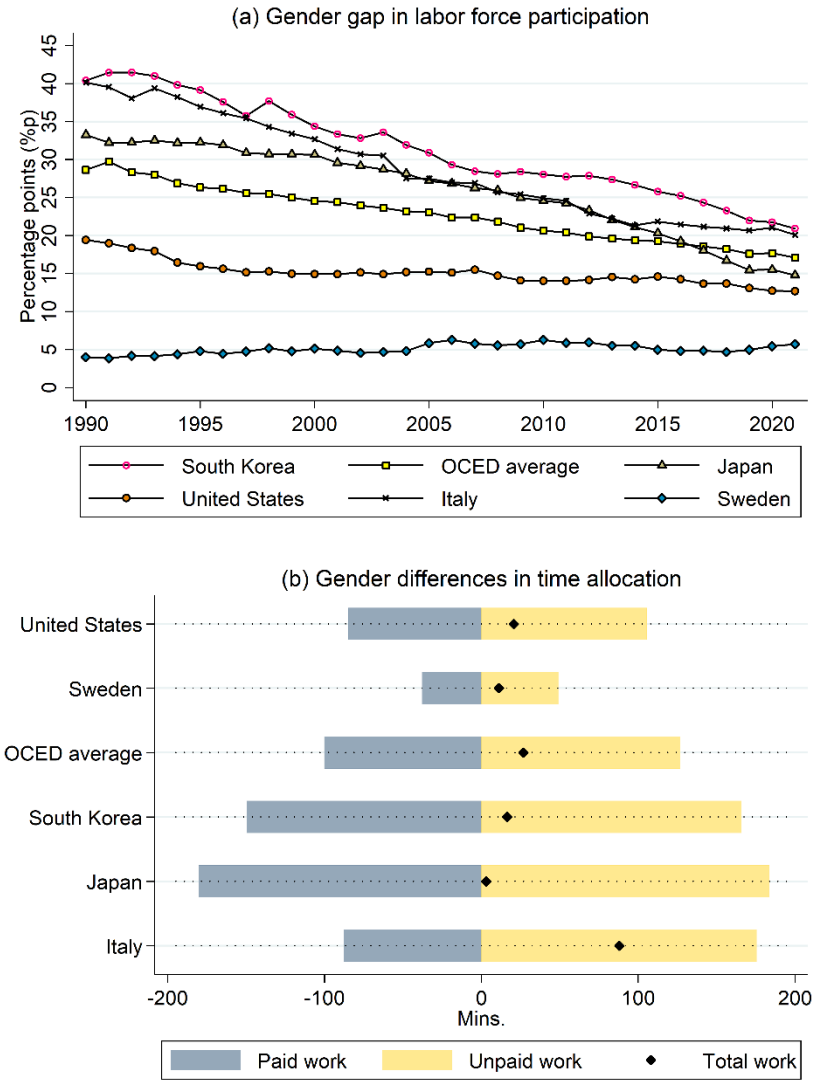

Figure 2.1. The Gender Gap in LFP and Time Allocation
for Selected OECD Countries

Source: OECD Employment Database (2021)
Notes: The gender gap in LFP is defined as the average LFPR of men minus that of women. Gender differences in daily time spent working in paid and unpaid work are defined as the average time spent in paid and unpaid work by women minus those of men. For panel (a), the sample is restricted to individuals whose ages are between 25 and 54; however, panel (b) uses the population aged from 15 to 64, for the latest available data.

Women not only are less likely to be employed but also spend considerably fewer hours at work than men. Panel (b) in Figure 2.1 shows the gender differences in daily time spent on total, paid, and unpaid work. On average, women spend about 127 minutes more per day (263 vs. 137 minutes) on unpaid work than men; however, men spend 100 minutes more per day (218 vs. 318 minutes) on paid work in OECD countries. The gender gap in time allocation in South Korea displays a similar pattern. More specifically, men averagely work 166 minutes longer a day (215 vs. 49 minutes) than women whereas women dedicate 150 minutes more per day (269 vs. 419 minutes) to housework such as childcare than men.[2] The gender gap on the hours spent on both paid and unpaid labor is much larger than the OECD average, although the gap is slightly smaller in magnitude compared to Japan.

Although the overall gender gap in LFP has narrowed in South Korea, the gender gap in participation among married people remains persistent at a higher level. Panel (a) in Figure 2.2 shows that the gender LFP gap in the whole sample has decreased from 29 to 25 percentage points over a decade. Meanwhile, such a gap among married people has been hovering around 40 percentage points during the same period. Traditional gender roles such as domestic and caregiving responsibilities in marriage may have reinforced gender inequality in the labor market.

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[2] Kim and Cheung (2019) found that wives' household labor was increased by more than 6 hours a day at the arrival of the first child whereas that of husbands was reduced by 30 minutes a day. Consistent with this finding, Kim and Hahn (2022) found that relative to fathers, mothers' LFP rate decreased by a large extent upon the first childbirth using an event-study approach. Hwang, Lee, and Lee (2019) showed that the parental gender norms (proxied by sex ratio at birth in the province of birth) affected the time allocation of unpaid work among dual-earner couples. When the husband was from a traditional province, the wife's time spent on household work increased; however, the husband's time used for housework was not influenced by the wife's birthplace.

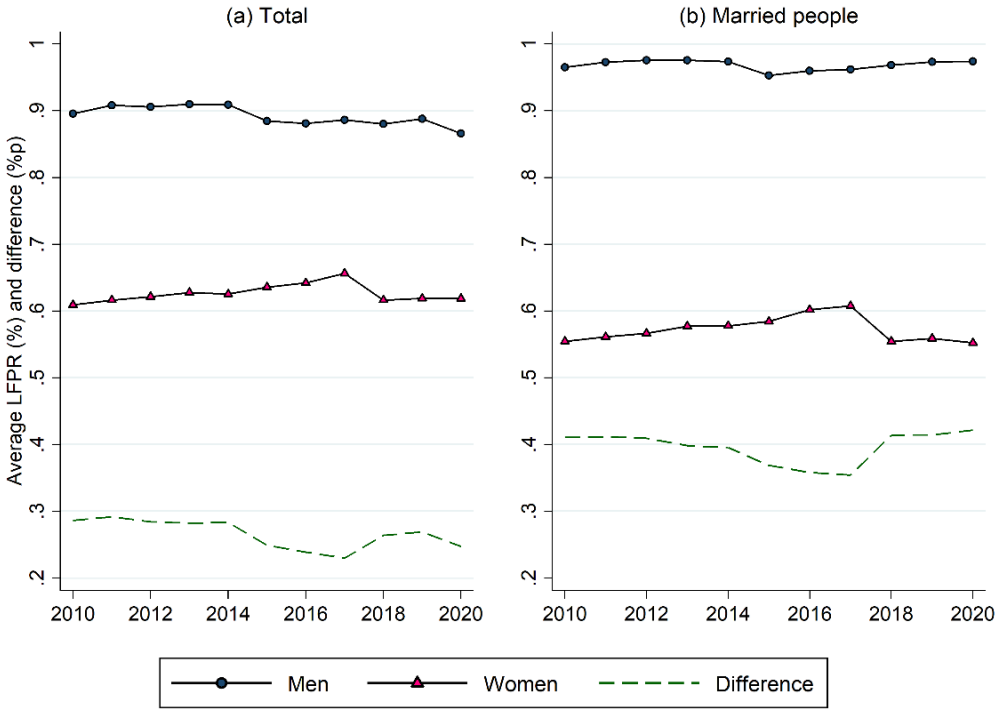

Figure 2.2. Gender Differences in LFP Rates

Notes: The sample includes the population aged from 25 to 54. Gender difference is defined as the average LFPR of men minus the average LFPR of women. Estimates are adjusted using cross-sectional sampling weights.

Figure 2.3. Gender Differences in Hours Worked
among Wage and Salary Workers

Notes: The sample is restricted to wage and salary workers whose ages vary between 25 and 54. Gender difference is defined as the average working hours of men minus those of women. Estimates are adjusted using cross-sectional sampling weights.

Gender inequality in time allocation, especially time on paid work, is also visible among wage and salary workers in South Korea. The gender gap in work hours has remained unchanged for years, which implies that women's work is more concentrated on part-time or short-hour jobs with lower levels of earnings, job security, condition, and

benefits (Doan et al. 2021).[3] Comparing panel (a) with panel (b) in Figure 2.3 indicates that the observed gender work-hour gap does not depend on whether individuals are married or not, once working.

Although several studies explore potential explanations for the gender wage gap in South Korea (Monk-Turner and Turner 2001, 2004; Cho, Lee, and Jung 2014; Tromp 2019; Tromp and Kwak 2022), there are few papers examining the evident gender gap in labor supply, and much less attention has been paid to married people whose gender disparity in labor supply is most pronounced. This paper aims to explain the gender difference in both extensive and intensive margins of labor supply among married people by identifying how much education and spouses' earnings contribute to the gap, and how the contributions of such factors have changed in the last decade.

We focus on individuals' own educational attainment and spousal earnings in explaining the gender gaps for two main reasons. First, the impact of education on women's employment decision-making has been widely examined in the literature. Goldin (2006) summarized the long-run revolution of the modern economic role of women in the United States. She pointed out that the convergence in the gender LFP gap accounted for larger

[3] Studies have shown that women tend to work as part-time workers or get jobs in industries with shorter work hours. Industries with higher earnings and longer working hours are male-dominated (Blau and Kahn 2017b; Minnotte, Cook and Minnotte 2010). Rose and Hartmann (2004) showed that at least for wage and salary workers in the United States, average hours worked in male-dominated sectors (or occupations) were higher than average hours worked in female-dominated sectors (or occupations), regardless of their gender. Women's short-hour jobs often tend to be a lower quality of the job and a higher level of job insecurity. Mothers' jobs on casual or precarious employment contracts reinforce a gendered polarization of good quality jobs (Charlesworth et al. 2011).

investment in education, changes in household production technology, the availability of part-time work, and the introduction of the contraceptive pill at the early stage of development. Abdulloev, Gang, and Yun (2014) suggested that migration and education largely explained the gender participation gap in Tajikistan. Increased female students in the university and vocational schools improved the participation of women in the labor market, reducing the gender gap in LFP. Like many other countries, South Korea has shown increasing trends in educational attainment over the past decade (refer to Figure B1 in the Appendix). Examining the role and the patterns of education in explaining the gender LFP gap in the country exhibiting the highest gender gap among the OECD countries would therefore add to the literature.

Second, studies that focus on married women's participation in the labor market find that a reduction in women's own wages and an increase in family income such as husbands' wages tend to discourage women with children to go out to work (Blau and Kahn 2007a). Klasen and Pieters (2015) uncovered that rising household incomes and husbands' education of urban Indian married women were the main supply-side factors attributed to the stagnant female LFP despite a growing economy and increased levels of education. Lee, Jang, and Sarkar (2008) also suggested that married women in South Korea had a much lower probability to take part in the labor market than single women, and husbands' education was inversely related to women's decision to work. Our research makes a unique contribution to the literature by exploring the role of spousal earnings on married women's labor supply and examining how it evolves over time. Despite the importance of

intrahousehold decision of labor supply, most papers examining the gender gap in labor supply in South Korea focus on own characteristics such as education and marital status, and information on spouses has been underutilized.

To understand how much education and spousal earnings drive the gender gap in labor supply in South Korea, we conduct the decomposition analyses using recent longitudinal data from the Korean Labor and Income Panel Study (KLIPS). Decomposing the gender LFP gap shows that if married women had the same levels of education and spouses' earnings as married men, they would participate more fully in the labor market. Yet, the contributions of those factors have been reduced in the explained portion of the gender LFP gap over the past ten years. Further, our decomposition analysis confirms the significance of spousal earnings in widening the gender workhour gap between working married men and women; however, despite its relatively small size in magnitude, the endowment difference in own education shows the opposite effect. Given that the share of spousal earnings continues to account for more than half of the total gender workhour gap in South Korea, spousal earnings remain to be a key determinant of married women's working hours.

2.2. Estimation Strategy

2.2.1. Oaxaca-Blinder Decomposition

The counterfactual decomposition method developed by Oaxaca (1973) and Blinder (1973) is a popular empirical tool that allows researchers to decompose the difference in the means

of an outcome variable between two groups into two components. The first is a part that can be explained by differences in means of observed characteristics, and the second is an unexplained component attributable to differences in the coefficients of these characteristics. The regression equations for the O-B decomposition are given as *eq. 1* and *eq. 2*:

$$Y_m = X_m\beta_m + \epsilon_m \qquad \textit{eq. 1}$$

$$Y_w = X_w\beta_w + \epsilon_w \qquad \textit{eq. 2}$$

For each year t, the ordinary least squares (OLS) regressions are estimated separately for men (m) and women (w), where Y is the outcome variable, X is a vector of explanatory factors, β is a vector of coefficients, and ϵ is an error term. The standard assumptions are (1) the outcome variable Y is linearly related to the covariates X, and (2) the conditional expectation of the residual error does not depend on the covariates X. Then, the mean difference between the two groups can be expressed as follows with mean values denoted with a bar over the variables:

$$\bar{Y}_m - \bar{Y}_w = \underbrace{(\bar{X}_m - \bar{X}_w)'\hat{\beta}_m}_{Characteristics\ effect} + \underbrace{\bar{X}'_w(\hat{\beta}_m - \hat{\beta}_w)}_{Coefficients\ effect} \qquad \textit{eq. 3}$$

The first component of the right-hand side in *eq. 3* is the part attributable to the mean difference in the covariates (i.e., characteristics effect), which measures the expected change in men's mean outcomes if men had women's mean outcome levels. The second component of the right-hand side is the part contributing to the difference in the coefficients

(i.e., coefficients effect), which sizes the expected change in men's average predictor levels if men had women's coefficients.[4]

The detailed decomposition identifies how each covariate X is attributed to the characteristics and coefficients effects. Then, the first and second terms of the right-hand side of *eq. 3* can be rewritten as follows:

$$(\bar{X}_m - \bar{X}_w)'\hat{\beta}_m = (\bar{X}_{1m} - \bar{X}_{1w})'\hat{\beta}_{1m} + (\bar{X}_{2m} - \bar{X}_{2w})'\hat{\beta}_{2m} + (\bar{X}_{3m} - \bar{X}_{3w})'\hat{\beta}_{3m} + \cdots \qquad eq.4$$

$$\bar{X}'_w(\hat{\beta}_m - \hat{\beta}_w) = \bar{X}'_{1w}(\hat{\beta}_{1m} - \hat{\beta}_{1w}) + \bar{X}'_{2w}(\hat{\beta}_{2m} - \hat{\beta}_{2w}) + \bar{X}'_{3w}(\hat{\beta}_{3m} - \hat{\beta}_{3w}) + \cdots \qquad eq.5$$

where $\overline{X_1}, \overline{X_2}, \overline{X_3}, \cdots$ are the means of each regressor, and $\beta_1, \beta_2, \beta_3, \cdots$ are the coefficients of those regressors, respectively. *Eq. 4* and *eq. 5* show that the characteristics and coefficients effects are the mere sums of the contributions of each covariate X. In the conventional O-B decomposition, the adding-up property ensures the additive linearity assumption to be held; however, it is not likely to be satisfied in nonlinear settings, especially when the distribution of each variable X is changed while holding the

[4] In such a case, the model assumes that there is only negative discrimination against women (i.e., no positive discrimination towards men). Alternatively, Neumark (1998) and Oaxaca and Ransom (1994) suggested using OLS estimates obtained from the pooled sample of both men and women instead of using male indicators as the reference coefficients. However, this approach may overestimate the explained part of the outcome differentials by omitting a group indicator in the pooled regression. Thus, Jann (2008) recommended including the group variable (i.e., men) in the pooled regression model as an additional explanatory variable and utilized the coefficients from the pooled model over both groups as some nondiscriminatory coefficients. The -oaxaca- command in STATA provides the 'pooled' option so that the twofold decomposition is computed using the coefficient from a pooled model including a group indicator (Jann 2008).

distribution of other variables constant (Fortin et al. 2011).[5]

2.2.2. Nonlinear Oaxaca-Blinder Decomposition

Up to this point, the linearity assumption between the outcome variable and the covariates has been imposed, but it is relaxed for a binary outcome variable (e.g., LFP). For the nonlinear model, the decomposition can be not accurate when using the estimated βs and the mean values of each covariate as in the standard O-B decomposition setting because the conditional expectation of $E(Y_m|X_m)$ and $E(Y_w|X_w)$ may not equal to $\bar{X}_m\hat{\beta}_m$ and $\bar{X}_w\hat{\beta}_w$, respectively. Yun (2004) presented a general and systematic decomposition method using the differences in the first moment. Let the outcome variable Y be a function of a linear combination of covariates X through some arbitrary linear or nonlinear functional form of $F: Y = F(X\beta)$. The function F is assumed to be first-differentiable. The first-moment condition with the mean values denoted with a bar over the variables can be decomposed as follows:

[5] Another relevant issue to look at is the identification problem regarding a categorical variable in the coefficients effect of the detailed decomposition. Oaxaca and Ransom (1999) showed that the estimated contributions of the categorical variable (with more than two categories) to the coefficients effect varied with the choice of the reference group (omitted to avoid a multicollinearity problem). The problem is that the categorical variable does not have a natural zero point (arbitrary categorical scaling is chosen), and thus the coefficients effect cannot be compartmentalized into the parts attributed to the differences in intercepts and the coefficient of the omitted base category (Fortin et al. 2011). To solve such problem, Yun (2005) proposed to use the normalized regression equation, where the estimate was calculated as an average of all sets of category estimates based on each reference category selected. The -oaxaca- command in the STATA supports the 'normalize' option for the categorical variable so that the contribution of the categorical variable to the coefficients effect is independent to the choice of reference category (Jann 2008).

$$\bar{Y}_m - \bar{Y}_w = \underbrace{\left[\overline{F(X_m\beta_m)} - \overline{F(X_w\beta_m)}\right]}_{Characteristics\ effect} + \underbrace{\left[\overline{F(X_w\beta_m)} - \overline{F(X_w\beta_w)}\right]}_{Coefficients\ effect} \qquad eq.\ 6$$

Then, the overall effect of the decomposition can separate into the differences in characteristics and the differences in coefficients. To examine the detailed decomposition, the model now needs two types of approximation: the value of the function evaluated at the mean R_A and a first-order Tylor expansion R_T (linearization of $\overline{F(X_m\beta_m)}$, $\overline{F(X_w\beta_w)}$ around $\bar{X}_m\beta_m$, $\bar{X}_w\beta_w$).

$$\bar{Y}_m - \bar{Y}_w = [F(\bar{X}_m\beta_m) - F(\bar{X}_w\beta_m)] + [F(\bar{X}_w\beta_m) - F(\bar{X}_w\beta_w)] + R_A \qquad eq.7$$

$$= [(\bar{X}_m - \bar{X}_w)\beta_m]f(\bar{X}_m\beta_m) + \bar{X}_f(\beta_m - \beta_w)f(\bar{X}_w\beta_w) + R_A + R_T \qquad eq.8$$

where $R_A = [\overline{F(X_m\beta_m)} - \overline{F(X_w\beta_m)}] + [\overline{F(X_w\beta_m)} - \overline{F(X_w\beta_w)}] - [F(\bar{X}_m\beta_m) - F(\bar{X}_w\beta_m)] - [F(\bar{X}_w\beta_m) - F(\bar{X}_w\beta_w)] R_T = [F(\bar{X}_m\beta_m) - F(\bar{X}_w\beta_m)] + [F(\bar{X}_w\beta_m) - F(\bar{X}_w\beta_w)] - [(\bar{X}_m - \bar{X}_w)\beta_m]f(\bar{X}_m\beta_m) - \bar{X}_w(\beta_m - \beta_w)f(\bar{X}_w\beta_w)$ and $f(\cdot)$ is the first-order derivative of the function F: $\left(\bar{X}_j\beta_j\right) = \frac{dF(\bar{X}_j\beta_j)}{d(\bar{X}_j\beta_j)}, j = m, w$. In the detailed decomposition, *eq. 6* can be rewritten as follows:

$$\bar{Y}_m - \bar{Y}_w = \sum_{i=1}^{K} W_{\Delta X}^{i}\left[\overline{F(X_m\beta_m)} - \overline{F(X_w\beta_m)}\right] + \sum_{i=1}^{K} W_{\Delta\beta}^{i}\left[\overline{F(X_w\beta_m)} - \overline{F(X_w\beta_w)}\right] \qquad eq.9$$

where $W_{\Delta X}^{i} = \frac{(\bar{X}_m^i - \bar{X}_w^i)\beta_m^i f(\bar{X}_m\beta_m)}{(\bar{X}_m - \bar{X}_w)\beta_m f(\bar{X}_m\beta_m)} = \frac{(\bar{X}_m^i - \bar{X}_w^i)\beta_m^i}{(\bar{X}_m - \bar{X}_w)\beta_m}, W_{\Delta\beta}^{i} = \frac{\bar{X}_w^i(\beta_m^i - \beta_w^i)f(\bar{X}_w\beta_w)}{\bar{X}_w(\beta_m - \beta_w)f(\bar{X}_w\beta_w)} = \frac{\bar{X}_f^i(\beta_m^i - \beta_w^i)}{\bar{X}_f(\beta_m - \beta_w)}$, and $\sum_{i=1}^{K} W_{\Delta X}^{i} = \sum_{i=1}^{K} W_{\Delta\beta}^{i} = 1$. By using proper weights, how each covariate contributes to the characteristics and coefficients effects can be estimated.

2.3. Data and Descriptive Statistics

2.3.1. Data

The primary source of data for this study is the KLIPS from 2010 (13th wave) to 2020 (23rd wave). The KLIPS is a longitudinal study surveying a representative sample of Korean households and individuals residing in urban areas. The first panel in 1998 started with 5,000 households (i.e., the original household of the 1998 sample), and 1,415 and 5,044 households were added as an additional sample in 2009 and 2018 (i.e., the consolidated sample) to resolve a limitation of representability of the population due to sample attrition. The KLIPS provides information on the socioeconomic status such as employment status, income, hours worked, wages, family wealth, poverty status, and homeownership. The data also provide more detailed demographic characteristics such as marital status, the number of children, and education linked with household-related data such as family relations, household income, assets, and debts.

We attempt to explain the gender gap in the labor supply of married people in both the extensive and intensive margins. We use the LFP rate and hours worked as the main outcome variables for our regression and decomposition analyses. If an individual is

currently working or actively looking for a job,[6] the LFP rate takes a value of 1 and 0 if otherwise. Weekly working hours are only observable for those who are employed. To capture the role of human capital and spousal resources in gender gaps, we include individual and spousal educational attainments and spousal earnings. Other individual characteristics include age, whether having children aged under 6 years, whether having children aged between 7 and 18, and location of residence. We further add job characteristics such as job tenure, industry, and occupation to shed the light on the determinants of the gender gap in hours worked.[7]

When analyzing the gender gap in LFP, the sample is restricted to married people[8] of prime working age (i.e., aged from 25 to 54) with non-missing values for all covariates. For the analysis of hours worked, we further limit our sample to married people who are wage and salary workers aged between 25 and 54 due to the data availability of working

[6] Seeking employment means that the person who try to find a job within the past one week or one month is likely to be a prospective employee (criteria for OECD, Economically Active Population Survey-South Korea).

[7] Educational attainment is a categorical variable with three levels: high school graduates (or less), two-year college degree, and university degree (or more). Monthly spousal earnings are zero for the unemployed (CPI-adjusted) and converted to quartiles. Location of residence is a categorial variable with three levels: Seoul, metropolitan area, and other provinces. Job tenure is the length of time (year) in which a worker has been employed by the current job. Industry is a categorial variable with six levels: construction; manufacturing; wholesale, retail trade, accommodation, or food; transportation or communication; finance and insurance, real estate and renting computer and research, or business service; and public administration, education, health and welfare, arts, sports and recreation, household service, or others. Occupation is a categorial variable with six levels: managers and professionals; technicians; office workers; service and sales workers; craftsmen and equipment, machine, or assembly workers; and low-skilled workers or others.

[8] We exclude those who experience marital status changes such as divorce, separation, and bereavement during the sample period and include married people whose partners and themselves are both observable in the data due to the use of information on spouses' educational attainment and earnings.

hours only among the employed.[9] Blau and Kahn (2017) pointed out the issue of selection bias when using the data on wages and hours worked which were only observable for the self-selected participants in the labor force. The inclusion of measurable factors (i.e., the determinants of LFP) and the absence of changes in labor force participation rates may not change the direction of selection bias and therefore the estimated trends.

2.3.2. Descriptive Statistics

The first panel of Table 2.1 shows the sample means of married men and women and the mean differences between the two. Among married people aged from 25 to 54, in 2010, the average LFP rate of married men was 96.8 percent, and that of married women was significantly lower at 54.2 percent, resulting in a 42.6 percentage-point difference. That difference slightly decreased to 40.5 percentage points in 2015 but increased even more in 2020 reaching 44.3 percentage points.

[9] In 2020, the self-employed individuals worked an average of 46.86 hours per week. Broken down by sex, the average weekly hours worked were 49.97 hours for male self-employed workers and 40.41 hours for female self-employed workers. The self-employed workers tend to work much longer hours than the wage and salary workers, and small businesses with fewer than 5 employees are not subject to restricting maximum working hours to 52 per week. Thus, the self-employed workers are excluded from the analysis.

Table 2.1. Sample Means of Married People

	2010			2015			2020		
Variables	Men	Women	Diff.	Men	Women	Diff.	Men	Women	Diff.
Panel A. Whole sample									
LFP rate	0.968	0.542	0.426***	0.965	0.560	0.405***	0.975	0.532	0.443***
High school	0.464	0.583	-0.119***	0.375	0.467	-0.092***	0.298	0.334	-0.036***
College 2+	0.198	0.188	0.010	0.222	0.220	0.002	0.225	0.270	-0.045
College 4+	0.338	0.229	0.109***	0.403	0.313	0.090***	0.477	0.396	0.081***
Spouse: high school	0.585	0.461	0.124***	0.469	0.372	0.097***	0.335	0.295	0.039***
Spouse: college 2+	0.188	0.201	-0.013	0.221	0.224	-0.004	0.270	0.227	0.043
Spouse: college 4+	0.228	0.338	-0.111***	0.310	0.404	-0.094***	0.395	0.477	-0.082***
Spouse's earnings Q1	0.419	0.042	0.377***	0.421	0.041	0.380***	0.452	0.038	0.415***
Spouse's earnings Q2	0.339	0.139	0.200***	0.359	0.136	0.222***	0.336	0.145	0.191***
Spouse's earnings Q3	0.105	0.351	-0.246***	0.111	0.343	-0.232***	0.124	0.363	-0.239***
Spouse's earnings Q4	0.137	0.467	-0.331***	0.110	0.480	-0.370***	0.088	0.454	-0.367***
Age	43.028	40.295	2.733***	44.157	41.594	2.563***	44.007	41.741	2.266***
Children 0-6	0.292	0.304	-0.012	0.296	0.306	-0.010	0.310	0.312	-0.002
Children 7-18	0.559	0.547	0.013	0.579	0.571	0.008	0.562	0.560	0.002
Seoul	0.187	0.191	-0.004	0.159	0.161	-0.003	0.162	0.159	0.003
Metropolitan	0.512	0.522	-0.010	0.521	0.532	-0.011	0.540	0.550	-0.010
Other provinces	0.302	0.287	0.014	0.320	0.307	0.014	0.298	0.290	0.007
N	2,264	2,390		2,027	2,110		2,927	3,008	
Panel B. Wage and salary workers									
Hours worked per week	49.501	43.482	6.020***	46.550	40.257	6.293***	42.963	38.330	4.633***
High school	0.425	0.578	-0.153***	0.333	0.448	-0.116***	0.261	0.340	-0.079***
College 2+	0.205	0.176	0.028	0.226	0.213	0.013	0.221	0.252	-0.030
College 4+	0.370	0.245	0.125***	0.442	0.339	0.103***	0.518	0.408	0.110***
Spouse: high school	0.536	0.485	0.051***	0.425	0.376	0.049***	0.310	0.307	0.003***
Spouse: college 2+	0.204	0.176	0.028***	0.227	0.204	0.023***	0.261	0.203	0.058***
Spouse: college 4+	0.260	0.339	-0.079***	0.347	0.420	-0.073***	0.429	0.490	-0.061***
Spouse's earnings Q1	0.457	0.053	0.404***	0.438	0.045	0.393***	0.461	0.037	0.424***
Spouse's earnings Q2	0.357	0.177	0.180***	0.387	0.176	0.210***	0.356	0.180	0.176***
Spouse's earnings Q3	0.118	0.397	-0.279***	0.114	0.377	-0.263***	0.137	0.398	-0.262***
Spouse's earnings Q4	0.068	0.373	-0.305***	0.062	0.402	-0.340***	0.047	0.384	-0.338***
Age	42.030	40.397	1.633***	43.308	41.918	1.389***	43.470	41.579	1.890***
Children 0-6	0.341	0.232	0.109***	0.331	0.258	0.074***	0.339	0.278	0.060***
Children 7-18	0.527	0.588	-0.061***	0.567	0.587	-0.020***	0.559	0.549	0.010***
Seoul	0.186	0.183	0.003	0.166	0.176	-0.011	0.167	0.160	0.007
Metropolitan	0.517	0.536	-0.020**	0.531	0.511	0.019**	0.549	0.540	0.009**
Other provinces	0.297	0.281	0.016	0.303	0.312	-0.009	0.284	0.300	-0.016
Job tenure	8.670	4.906	3.765***	10.018	6.340	3.679***	10.629	6.724	3.905***
Construction	0.140	0.016	0.125***	0.160	0.021	0.139***	0.140	0.022	0.117***
Manufacturing	0.292	0.208	0.084***	0.303	0.141	0.162***	0.300	0.126	0.174***
Wholesale, retail, accommodation	0.116	0.219	-0.104***	0.115	0.194	-0.079***	0.118	0.164	-0.046***
Transportation	0.089	0.029	0.060***	0.061	0.034	0.027***	0.061	0.028	0.033***
Finance, real estate, comp., biz.	0.155	0.123	0.032**	0.163	0.139	0.024**	0.169	0.140	0.029**
Public admin., education, welfare	0.208	0.406	-0.197***	0.197	0.470	-0.273***	0.213	0.520	-0.307***
Managers and professionals	0.177	0.166	0.011***	0.191	0.195	-0.004***	0.241	0.224	0.016***
Technicians	0.104	0.132	-0.028***	0.108	0.167	-0.059***	0.094	0.177	-0.083***
Office workers	0.212	0.224	-0.013***	0.236	0.248	-0.012***	0.250	0.293	-0.044***
Service and salesperson	0.075	0.211	-0.137***	0.086	0.211	-0.124***	0.075	0.187	-0.112***
Craftsman, Machine assembler	0.370	0.153	0.216***	0.328	0.091	0.238***	0.296	0.061	0.235***
Low-skilled and others	0.063	0.113	-0.050***	0.050	0.089	-0.039***	0.045	0.058	-0.013***
N	1,590	874		1,492	849		2,215	1,248	

Notes: Estimates are adjusted using cross-sectional sampling weights. The difference shows the mean comparison of two groups using a two-sample t-test with unequal variances. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

In 2010, married women were 11.9 and 10.9 percentage points less likely to go on to higher education and complete at least a bachelor's degree than married men. The gender gap in educational attainment declined to 3.6 percentage points at the high school's or lower

degree level and 8.1 percentage points at the bachelor's or higher degree level in 2020. This education gap may also reflect gender-differential selection into marriage as suggested by Hwang (2016).[10] Gender difference in spousal education is completely the reverse of their own educational attainment: married women tend to live with spouses with higher educational attainment compared to married men. Its difference has been narrowed over the last decade.

For spousal income, married men were 37.7 percentage points more likely to have spouses in the bottom income quartile than married women in 2010, and its gap expanded to 41.5 percentage points in 2020. On the other hand, married women were 33.1 and 36.7 percentage points more likely to have spouses in the top income quartile than married men in 2010 and 2020, respectively. Higher spousal earnings observed among married women are likely to partially reflect gender gaps in wages and employment in South Korea. Women, on average, are paid less than their male counterparts, and their LFP rate is significantly lower than that of men.[11] Also, married women on average are about 2-3 years younger than married men. There are no gender differences in whether having children aged under 6 years old, whether having children aged between 7 and 18, and place of residence, as the survey is conducted at the level of the households.

[10] Hwang (2016) showed that in four Asian countries, South Korea, Hong Kong, Japan, and Singapore, men with higher education were more likely to get married, whereas women with higher education were less likely to get married. As a consequence, the least educated men and highly educated women stayed unmarried.

[11] The gender wage gap in Korea was the highest among the OECD economies in 2020; employed women, on average, earned only 68.5 percent of what employed men earned (OECD Employment Database).

The means of individual and job characteristics among wage and salary workers are reported separately by gender for each selected year in Table 2.1 panel (b). In 2010, working married men worked 49.5 hours per week whereas working married women worked 43.48 hours per week, resulting in a 6.02 work-hour difference. Its work-hour gap remained steady until 2015 but slightly fell to 4.63 work hours per week in 2020. Regarding the demographic characteristics, we find persistent gender differences in the highest level of educational attainment, spousal education, spousal earnings, and age, which follow a similar pattern shown in Table 2.1 panel (a). Mothers with preschool children are still more likely to opt out of the workforce. This is reflected in the fact that more working married men have children under the age of six than working married women.

For the job characteristics, the average job tenure was 8.67 and 4.91 years for working married men and women in their current job in 2010. Eleven years after, working married men and women stayed in their current employment for an average of 10.63 and 6.72 years. Married men predominate industries such as construction, manufacturing, and transportation; however, married women predominate industries such as wholesale, retail, accommodation, public administration, education, welfare, and others. Married women are a range of 11.2 and 13.7 percentage points more likely to have a job in sales and service relative to married men. By contrast, married men are a range of 21.6 and 23.8 percentage points more likely to be employed as craftsmen, equipment, machine, and assembly workers than their counterparts.

2.4. Estimation Results

2.4.1. Determinants of LFP and Hours Worked

We first look at the determinants of LFP and hours worked using the baseline models applied in the decomposition analyses. Table 2.2 demonstrates how individual characteristics affect married people's participation decisions in the labor markets using the logit regression model separately for pooled, male, and female samples. The estimated results are average marginal effects showing the change in the probability of LFP associated with a unit change in the covariates. For pooled samples, gender differential in LFP is captured by the male dummy, and its coefficient estimates are positive and persistent. Being married men rather than married women significantly increased the likelihood of participating in the labor market by 40.2 percentage points in 2010. Its gender gap in LFP slightly dropped to 38 percentage points in 2015 but even widened to 44.6 percentage points in 2020. Overall, Table 2.2 suggests that men's LFP is quite inelastic; except for some regional factors, the LFP is not influenced by own or spousal characteristics. This is consistent with the fact that most married men, 96 to 98 percent of the sample, already participate in the labor force, as shown in Table 2.1. In contrast, women's LFP is influenced by several factors, such as own education, spousal earnings, and whether the women have a young child under age 6.[12]

[12] One of the factors worth looking is the effect of raising pre-school children on mothers' participation in the labor force. In 2010, mothers with children aged 0 to 6 had a 21.5 percentage points lower probability of joining the workforce than women without children or mothers with older children; however, men were unaffected.

We now closely examine the effects of two factors of interest: educational attainment and spousal earnings on individuals' LFP decisions. Married women with at least a bachelor's degree were 14.3 and 15.3 percentage points more likely to participate in the labor force than married women who graduate from high school or have a lower educational degree in 2010 and 2015, respectively. On the contrary, LFP rates of married men are not statistically associated with their educational qualifications. This reflects the fact that married men's LFP rates have been continuously close to 100 percent regardless of their education levels, again, consistent with the inelastic labor supply within married men with respect to education. More educated married women have participated more in the labor market, although the LFP gap between high-, middle-, and low-education groups has shrunk over time (refer to Figure B2 in the Appendix).

The negative effect of young children on the LFP of married women has somewhat diminished but been quite continuing over time.

Table 2.2. Determinants of LFP

Variables	2010			2015			2020		
	All	Men	Women	All	Men	Women	All	Men	Women
Male	0.402***			0.380***			0.446***		
	(0.017)			(0.021)			(0.019)		
College 2+	0.024	0.027*	0.044	0.028	-0.003	0.073**	-0.006	0.001	-0.012
	(0.017)	(0.014)	(0.034)	(0.019)	(0.016)	(0.035)	(0.015)	(0.010)	(0.028)
College 4+	0.059***	-0.002	0.143***	0.063***	-0.004	0.153***	0.025	0.012	0.043
	(0.020)	(0.011)	(0.038)	(0.021)	(0.015)	(0.039)	(0.016)	(0.010)	(0.031)
Spouse: college 2+	-0.017	-0.003	-0.037	-0.007	0.004	-0.027	-0.023	-0.007	-0.042
	(0.017)	(0.012)	(0.032)	(0.019)	(0.014)	(0.036)	(0.016)	(0.010)	(0.030)
Spouse: college 4+	-0.010	0.008	-0.037	0.002	0.007	-0.015	0.006	0.007	0.002
	(0.018)	(0.014)	(0.034)	(0.020)	(0.016)	(0.037)	(0.015)	(0.010)	(0.030)
Spouse's earnings Q2	-0.015	-0.009	0.050	0.044	0.003	0.177**	0.031	-0.002	0.118*
	(0.026)	(0.009)	(0.062)	(0.032)	(0.012)	(0.073)	(0.027)	(0.007)	(0.067)
Spouse's earnings Q3	-0.023	-0.004	0.012	-0.019	-0.012	0.045	0.002	-0.005	0.056
	(0.025)	(0.014)	(0.056)	(0.030)	(0.016)	(0.068)	(0.027)	(0.010)	(0.064)
Spouse's earnings Q4	-0.076***	0.012	-0.096*	-0.057**	0.024	-0.043	-0.042	0.003	-0.030
	(0.024)	(0.015)	(0.056)	(0.029)	(0.019)	(0.067)	(0.026)	(0.014)	(0.064)
Age	0.030**	0.012	0.014	0.055***	0.002	0.061*	0.005	0.006	-0.005
	(0.012)	(0.009)	(0.023)	(0.016)	(0.014)	(0.032)	(0.011)	(0.006)	(0.022)
$Age^2/100$	-0.036**	-0.017	-0.011	-0.065***	-0.007	-0.065*	-0.006	-0.007	0.005
	(0.015)	(0.010)	(0.029)	(0.019)	(0.016)	(0.038)	(0.013)	(0.007)	(0.027)
Children 0-6	-0.111***	0.001	-0.215***	-0.075***	0.001	-0.146***	-0.075***	0.009	-0.161***
	(0.016)	(0.015)	(0.029)	(0.018)	(0.021)	(0.034)	(0.014)	(0.009)	(0.028)
Children 7-18	0.001	-0.010	0.040	-0.019	-0.000	-0.014	-0.007	0.010	-0.021
	(0.014)	(0.010)	(0.027)	(0.017)	(0.012)	(0.032)	(0.013)	(0.008)	(0.026)
Metropolitan	0.048***	0.015	0.076**	-0.008	0.008	-0.027	0.033**	0.025***	0.034
	(0.016)	(0.009)	(0.030)	(0.020)	(0.014)	(0.038)	(0.015)	(0.008)	(0.030)
Other provinces	0.067***	0.022**	0.103***	0.028	0.009	0.043	0.074***	0.027***	0.115***
	(0.018)	(0.011)	(0.033)	(0.023)	(0.015)	(0.042)	(0.017)	(0.009)	(0.033)
N	4,836	2,418	2,418	4,232	2,116	2,116	6,063	3,031	3,032
Pseudo R^2	0.2863	0.0564	0.0607	0.2598	0.0586	0.0482	0.2974	0.0469	0.0289

Notes: Estimates only report the average marginal effects rather than log odds after being adjusted using cross-sectional sampling weights. The marginal effects are evaluated at the mean values of the covariate. Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

Figure 2.4 shows how the coefficients of these variables of interest have changed over the past decade for married men and women, separately. Regarding the highest level of own educational achievement, as in panels (a) and (b) in Figure 2.4, the effect of

attending a 2-year college and a 4-year college (relative to high school education) on individuals' LFP behaviors are initially almost zero for married men but positive for married women. The returns of married men have been constant over time; however, those of married women have decreased and got close to zero during the same period. Along with the increased enrollment of married women in higher education, high and rising education premiums for LFP of married women almost disappear in recent years. We found that there were no statistical differences in LFP rates between married women with better education and those with lower levels of education in 2020.

Although the labor market decisions of married men are unaffected by the spouse's income, married women with spouses in the top income quartile are 9.6 percentage points less likely to work compared to married women with spouses in the bottom income quartile in 2010. The negative income effect implies that the additional spousal income in the household discourages other family members, especially wives, from participating in economic activity. Consistent with Blau and Kahn (2007a) and Heim (2007),[13] we find that some negative effects of spousal earnings on the LFP of married women become weaker in recent years, as shown in panel (d) in Figure 2.4. For instance, relative to married women with spouses' earnings in the lowest quartile (the reference group), married women

[13] Blau and Kahn (2007a) showed that the labor supply of married women is negatively affected by husbands' wages, whereas that of married men is little responsive to their spouse's wages. However, over the two decades, married women's cross wage labor supply elasticities were reduced by 38-47 percent, beginning to resemble those of married men. Heim (2007) also found the considerable decrease in married women's participation wage elasticities over the 25 years in the US. Such a decline may be driven by some factors such as increased age at first marriage and first birth, shifts in industrial and occupational composition, and increase in probabilities of divorces.

with spouses' earnings in the second, third, and highest quartiles showed lower probabilities of working in 2016. However, in 2020, the likelihood of working for married women with spouses' earnings in the second and third quartiles exceeded that of married women whose husbands' income is in the bottom quartile.

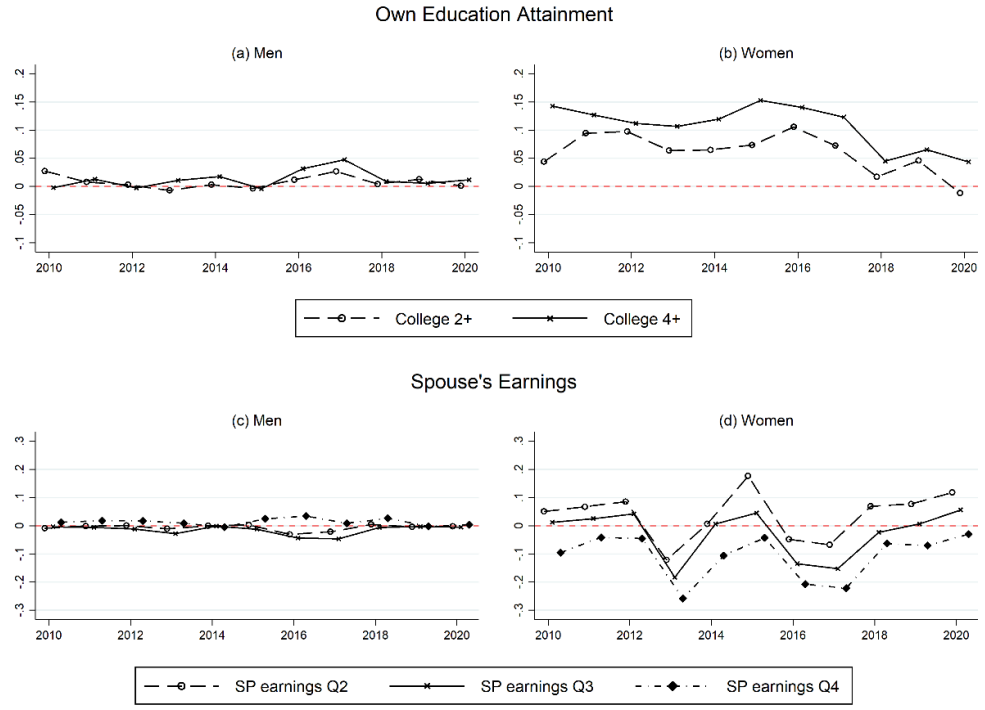

Figure 2.4. Marginal Effects of Selected Determinants in LFP

Note: The figure plots OLS regression coefficients presenting values of marginal effects instead of log odds.

Table 2.3. Determinants of Hours Worked among Wage and Salary Workers

Variables	2010			2015			2020		
	All	Men	Women	All	Men	Women	All	Men	Women
Male	5.518***			5.887***			3.818***		
	(0.730)			(0.787)			(0.403)		
College 2+	-1.444*	-2.104**	0.128	-1.436**	-0.764	-2.292**	0.011	0.340	-0.101
	(0.799)	(0.928)	(1.486)	(0.721)	(0.926)	(1.032)	(0.464)	(0.519)	(0.855)
College 4+	-1.049	-1.876*	1.047	-1.522**	-1.788**	-0.835	-1.028**	-0.799	-1.256
	(0.911)	(1.102)	(1.700)	(0.709)	(0.848)	(1.083)	(0.453)	(0.510)	(0.848)
SP: college 2+	-1.337*	-0.909	-2.902**	0.367	0.477	-0.988	0.112	-0.020	-0.383
	(0.773)	(0.986)	(1.219)	(0.638)	(0.793)	(1.016)	(0.443)	(0.500)	(0.819)

SP: college 4+	-2.061**	-1.900	-3.470**	0.277	0.336	-0.524	-0.161	-0.363	-0.032
	(0.906)	(1.169)	(1.483)	(0.730)	(0.855)	(1.025)	(0.401)	(0.445)	(0.771)
SP earnings Q2	0.155	0.168	-0.646	-1.143**	-1.571***	-0.668	-0.382	-0.684*	1.448
	(0.689)	(0.747)	(1.871)	(0.564)	(0.598)	(1.874)	(0.388)	(0.395)	(1.902)
SP earnings Q3	-0.245	-0.210	-1.214	-0.484	0.448	-0.922	-0.636	-0.730*	0.646
	(0.834)	(1.074)	(1.699)	(0.911)	(1.299)	(1.773)	(0.421)	(0.438)	(1.832)
SP earnings Q4	-1.452	-0.444	-3.258*	-1.021	-0.307	-2.118	-1.017**	-0.636	-0.252
	(0.991)	(1.425)	(1.793)	(0.832)	(1.149)	(1.740)	(0.503)	(0.587)	(1.815)
Age	0.249	0.633	-0.452	0.370	0.612	-0.113	0.155	0.666**	-0.373
	(0.489)	(0.621)	(0.818)	(0.471)	(0.644)	(0.731)	(0.283)	(0.338)	(0.545)
$Age^2/100$	-0.289	-0.725	0.554	-0.564	-0.774	-0.071	-0.221	-0.756*	0.363
	(0.605)	(0.757)	(1.025)	(0.564)	(0.759)	(0.899)	(0.338)	(0.399)	(0.685)
Children 0-6	1.490**	1.897**	0.059	-0.046	0.971	-2.764***	-0.267	-0.094	-1.157*
	(0.692)	(0.849)	(1.213)	(0.611)	(0.794)	(0.884)	(0.352)	(0.399)	(0.615)
Children 7-18	-0.154	0.003	-0.166	-0.868	-0.274	-1.495*	-0.570	0.051	-1.583***
	(0.654)	(0.801)	(1.137)	(0.534)	(0.687)	(0.835)	(0.353)	(0.439)	(0.597)
Metropolitan	1.680**	1.233	2.493**	0.709	0.883	0.447	-0.772**	-1.046**	0.103
	(0.693)	(0.869)	(1.171)	(0.611)	(0.749)	(1.005)	(0.391)	(0.445)	(0.744)
Other provinces	0.835	0.072	2.122	0.438	0.614	0.459	0.309	0.111	0.922
	(0.826)	(1.006)	(1.424)	(0.677)	(0.797)	(1.133)	(0.454)	(0.534)	(0.811)
Job tenure	0.282**	0.051	0.494**	0.119	-0.359***	0.685***	0.325***	0.049	0.624***
	(0.116)	(0.137)	(0.239)	(0.095)	(0.115)	(0.148)	(0.067)	(0.082)	(0.104)
Job $tenure^2/100$	-1.181**	-0.606	-0.450	-0.561	0.786*	-1.674***	-1.050***	-0.389	-1.435***
	(0.466)	(0.518)	(1.102)	(0.345)	(0.411)	(0.548)	(0.252)	(0.307)	(0.360)
Construction	-4.139***	-4.008***	-5.347	-0.621	-0.539	-1.366	-0.275	-0.542	2.524
	(0.974)	(1.046)	(3.505)	(0.854)	(0.918)	(1.609)	(0.552)	(0.591)	(1.537)
Wholesale, retail	2.327**	1.889*	2.524	0.159	0.442	-1.343	2.319***	2.293***	1.620
	(0.952)	(1.136)	(1.978)	(0.912)	(1.150)	(1.639)	(0.553)	(0.644)	(1.091)
Transportation	-0.897	-0.160	-5.747***	0.673	1.151	-4.735***	2.968***	2.575***	2.283
	(1.055)	(1.192)	(2.020)	(1.027)	(1.161)	(1.823)	(0.833)	(0.956)	(1.407)
Finance, real estate	-2.837***	-3.508***	-2.190	-1.473**	-1.822**	-2.671*	0.261	-0.326	0.774
	(0.826)	(0.965)	(1.894)	(0.718)	(0.892)	(1.458)	(0.344)	(0.380)	(0.848)
Education, welfare	-2.049**	-1.334	-4.100**	-1.716**	-0.920	-4.489***	0.081	0.297	-0.822
	(0.849)	(1.094)	(1.887)	(0.685)	(0.798)	(1.416)	(0.367)	(0.418)	(0.866)
Technicians	-0.841	-2.434	2.149	-0.267	-0.393	1.041	0.016	-0.201	0.658
	(1.151)	(1.534)	(1.834)	(0.846)	(1.113)	(1.251)	(0.467)	(0.531)	(0.823)
Office workers	-0.886	-1.629*	-0.148	-0.348	-0.706	-0.359	0.406	0.163	0.095
	(0.811)	(0.870)	(1.657)	(0.615)	(0.786)	(0.937)	(0.331)	(0.409)	(0.650)
Service, salesperson	1.873	3.950**	1.373	1.938	5.283***	-0.972	0.525	2.882***	-1.258
	(1.318)	(1.931)	(1.982)	(1.315)	(2.043)	(1.313)	(0.652)	(0.885)	(0.983)
Craftsman, Machine	1.663	0.546	3.198	1.266	1.007	1.176	1.069**	0.905*	2.165*
	(1.025)	(1.057)	(2.769)	(0.875)	(1.035)	(1.830)	(0.444)	(0.477)	(1.180)
Low-skilled, others	-1.719	-1.439	-2.079	-2.472*	-0.418	-5.673***	-1.861**	0.008	-4.950***
	(1.446)	(1.742)	(2.585)	(1.340)	(1.613)	(1.983)	(0.940)	(0.952)	(1.805)
Constant	38.777***	38.288***	52.476***	36.818***	37.587***	50.469***	35.782***	29.326***	45.819***
	(9.670)	(12.340)	(16.431)	(9.636)	(13.319)	(14.407)	(5.777)	(6.957)	(10.379)
N	2,447	1,580	867	2,316	1,475	841	3,463	2,215	1,248
R^2	0.134	0.090	0.133	0.138	0.094	0.133	0.121	0.069	0.117

Notes: Estimates are adjusted using cross-sectional sampling weights. Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

In the following, we present the OLS regression results on contributing factors of hours worked among married people who are wage and salary workers. As shown in Table 2.3, the coefficient on the male dummy is positive in the pooled regression confirming the

remaining gender gap in work hours, after controlling for observable characteristics. Working married men spent 5.5 and 5.9 hours longer per week at work in comparison with working married women in 2010 and 2015, respectively. The gender workhour gap between the two decreased by 3.8 hours per week in 2020.

Concerning education, one factor of our interest, we found that higher levels of education were negatively associated with hours worked, especially for married men in 2010. This may reflect the fact that their jobs more often entail higher levels of wage and security. As panel (a) of Figure 2.5 shows, the gaps in working hours between high-, middle-, and low-educated married men have shrunk considerably and become almost nonexistent over the past 10 years. Consistent with Park (2023)'s findings using the Economically Active Population Survey from 1981 to 2022, the working hours of married male workers with high school diplomas or lower education have significantly reduced compared to those with higher levels of education. As a result, the gap in working hours between low-, middle-, and high-education groups has narrowed considerably for married men. Despite the relatively lower likelihood of working in long-hour industries for married female workers, the more educated are less likely to work in long-hour industries both for married male and female workers (refer to Figure B3 in the Appendix). In industrialized countries like the US, the Netherlands, and Sweden, the more educated spend longer hours at work than the less educated; however, this pattern is reversed in middle and low-income countries, with the less educated working longer hours. Our result implies that South Korea

shows the opposite pattern from the US or other industrialized countries (Frase and Gornick 2013).

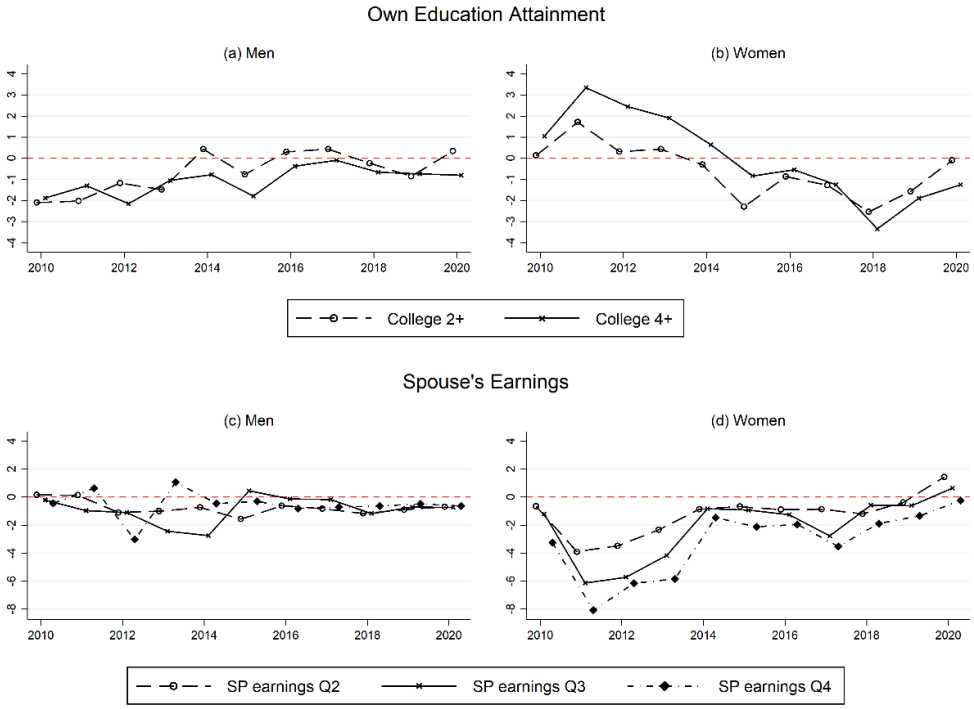

Figure 2.5. Marginal Effects of Selected Determinants in Hours Worked

Note: The figure plots the raw coefficient values estimated using OLS regression.

Spousal earnings are found to negatively influence the working hours of working married men and women. However, the adverse effects are much stronger for working married women compared to their counterparts. In 2010, working married women with their spouses' earnings in the top quartile devoted 3.3 hours fewer per week to their jobs than those whose spouses earned income in the bottom quartile (Table 2.3). Compared to working married men with spousal earnings in the lowest quartile, those with spousal

earnings belonging to the second income quartile worked 0.68 hours less per week, and those with spousal earnings falling into the third income quartile worked 0.73 hours less per week in 2020. Nonetheless, spousal earnings have had increasingly weak effects on both married men's and women's working hours in recent years, as depicted in panels (c) and (d) in Figure 2.5.[14]

2.4.2. The Detailed Decomposition of LFP

Table 2.4 reports the detailed decomposition results based on the nonlinear B-O analysis, which measures how much each explanatory variable contributes to the gender differentials in LFP. The total differences of the average LFP rates between married men and women amounted to 42.6, 40.4, and 44.3 percentage points in 2010, 2015, and 2020, respectively.

[14] There are several findings noteworthy when examining the estimation results of hours worked. Having children with ages of younger than 6 years old and from 7 to 18 years old reduces working hours for married women, but not for married men. Married women with young children lowered their hours worked by 2.8 and 1.6 hours per week relative to those without young children in 2015 and 2020, respectively. Over the same years, married women with children aged between 7 and 18 years old worked 1.5 and 1.6 hours per week less than those without children in the same age range. Regarding job characteristics, the marginal effects of contributing factors including tenure and specific industries and occupations on hours worked are different by gender. For married women, a one-year increase in job tenure increased 6.24 more working hours per week; however, it does not affect married men in 2020. In the same year, married men among the employees involved in transportation and the retail and wholesale sector worked about 2.8 and 2.3 hours per week longer than those in manufacturing. On contrary, married women who employed in the public administration and education sector worked 4.5 hours per week fewer than those working in the manufacturing sector in 2015. Working married men who engage in service and sales, or craft men, equipment, machine, and assembly put in more hours at work managers or professionals, whereas working married women with low-skilled jobs put in less time at work than managers or professionals.

Table 2.4. Decomposition of Gender Gap in LFP

	Characteristics Effect			Coefficients Effect		
	2010	2015	2020	2010	2015	2020
Overall	0.066***	0.069***	0.038*	0.360***	0.335***	0.405***
	(15.57)	(17.12)	(8.49)	(84.43)	(82.88)	(91.51)
Education	0.012***	0.010***	0.004**	-0.009	0.001	0.004
	(2.76)	(2.45)	(0.97)	(-2.10)	(0.27)	(0.86)
Spouse's education	0.002	-0.000	-0.003	-0.005	-0.003	0.003
	(0.55)	(-0.08)	(-0.62)	(-1.17)	(-0.71)	(0.73)
Spouse's earnings	0.049***	0.061***	0.039*	-0.018***	-0.022**	-0.013
	(11.52)	(15.11)	(8.70)	(-4.12)	(-5.37)	(-2.85)
Age	0.000	-0.003	-0.003	0.614	-0.814	0.569
	(0.00)	(-0.80)	(-0.71)	(144.08)	(-201.18)	(128.52)
Children aged between 0-6	0.002	0.001	0.000	0.032*	0.022	0.036***
	(0.53)	(0.32)	(0.06)	(7.42)	(5.40)	(8.14)
Children aged between 7-18	0.000	-0.000	-0.000	-0.031	0.003	0.033
	(0.00)	(-0.06)	(-0.00)	(-7.38)	(0.75)	(7.51)
Residence	0.001	0.001	0.000	0.002	0.008	0.018***
	(0.19)	(0.20)	(0.08)	(0.49)	(1.87)	(4.08)
Constant				-0.225	1.141	-0.246
				(-52.80)	(281.85)	(-55.49)
N	4,836	4,232	6,063	4,836	4,232	6,063

Notes: The raw estimates are the log odds since the logit regression model is being used. Estimates are adjusted using cross-sectional sampling weights. Shares are indicated in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively. The choice of the reference coefficients is the coefficients from the pooled models including a group membership indicator. Age and the squared term of age are grouped, and all categorical variables are grouped and normalized: education, spouse's education, spouse's earnings, and residence. The reported results are subsumed as groups.

Converting such gaps to out of 100 percent,[15] for each year, 15.57, 17.12, and 8.49 percent of the total gender gap were due to mean differences, whereas 84.43, 82.88, and 91.51 percent of the total gender gap were due to variations in the coefficients. We find that the gender LFP gap in South Korea is mostly driven by differences in coefficient responses or behaviors between married men and women, which is consistent with other

[15] The shares are the coefficient of each covariate divided by the coefficient of total difference (multiplied by 100 to form a percentage), and they can be interpreted as how much each factor contributes to the characteristics effect and the coefficients effect.

studies done in the context of Asian countries (Xiao and Asadullah 2020; Abdulloev, Gang, and Yun 2014). It may relate to discrimination against married women or women in general, or other unmeasured differences in institution or preference.

Our findings of the detailed decomposition results confirm the role of educational attainment and spousal earnings in interpreting the characteristics effect of the observed gender gap in LFP between married men and women. Married men have a higher probability of attending college or university after high school and possess lower levels of spousal earnings than married women, which leads to increases in their probability of working. In 2010, endowments for educational attainment and spousal earnings accounted for 2.76 and 11.52 percent of the characteristics effect of the gender LFP gap.

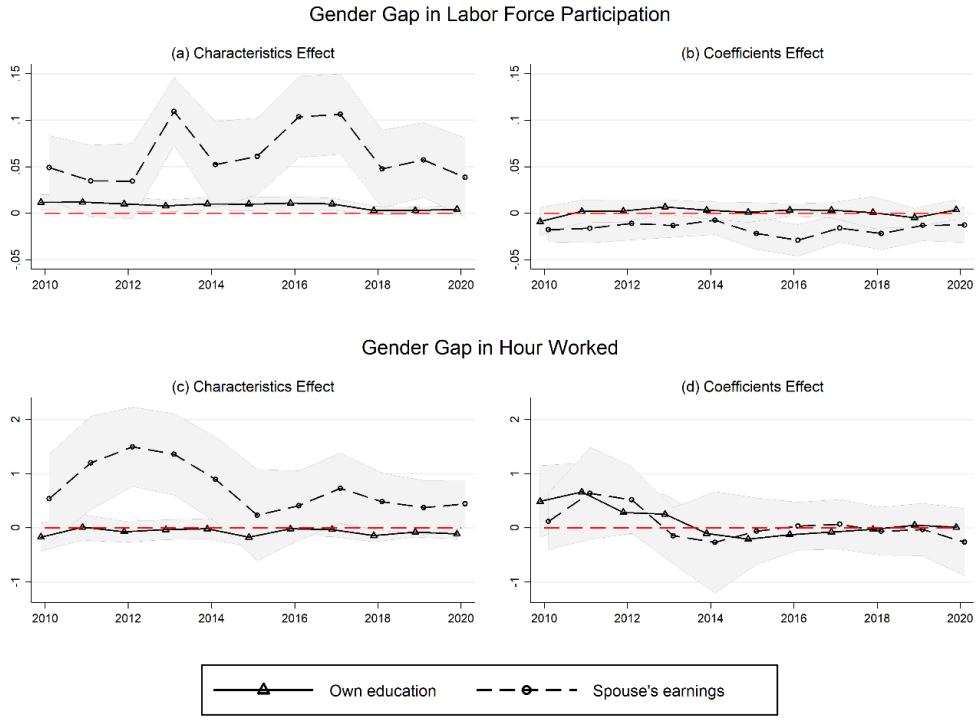

Figure 2.6. Coefficient Plot of Selected Determinants in Gender Gaps

Note: The figure plots the coefficients of selected variables. The shaded area represents the 95 percent confidence interval.

Panels (a) and (b) in Figure 2.6 plot how the contributions of educational attainment and spousal earnings in characteristics and coefficients effects of the gender LFP gap have evolved over the last ten years. In 2020, the share of educational attainment in characteristics effect reduced to 0.97 percent, indicating that its negative effect on the gender LFP gap was almost gone. The characteristics effect of spousal earnings has somewhat fluctuated over time. Nevertheless, still the sizable portion of the gender LFP

gap is explained by the endowment difference in spousal earnings between married men and women.

Table 2.4 further shows the relative contribution of spousal earnings in the coefficients effect from the detailed decomposition analysis. Married women are more likely to participate in the labor force relative to married men if they have a similar amount of their spousal earnings. This leads to the negative coefficient effect for spousal earnings, revealing that the gender LFP gap would have been even higher if the coefficient on spousal earnings categories is the same. Panel (b) of Figure 2.6 shows that the negative share of spousal earnings in the coefficients effect has slightly decreased over the last five years, reducing the participation-enhancing effect of spousal earnings.[16]

2.4.3. The Detailed Decomposition of Hours Worked

Table 2.5 presents the decomposition results of the gender gap in hours worked for wage and salaried workers. The total gender gap in hours worked between working married men and women was 6.02, 6.29, and 4.63 hours per week in 2010, 2015, and 2020, respectively.

[16] For the detailed decomposition results in the coefficients effect, the positive and statistically significant effect of raising younger children aged under 6 years old indicates that mothers with preschool children are undervalued than fathers. Age comprises of the largest share of the coefficients effect, yet it is statistically insignificant. The age effect in part is likely to capture the return-to-work experience, although in this study we cannot use years of work experience as a key factor since our study focuses on labor supply, rather than wage rate. Also, the age effect may reflect the gender difference in childcare burden and other changes over the life cycle. When looking at the age profile of LFP rates for married men and women (refer to Figure B4 in the Appendix), the gender difference between the average LFP rates of married men and women is consistently high for those aged from 25 to 35. However, that of the whole sample including single men and women starts at the lower level and gradually increases between the ages of 25 and 35.

In 2020, out of the total workhour difference, 0.814 hours (i.e., 17.58 percent) was explained by individual and job characteristics, and 3.818 hours (i.e., 82.42 percent) was unexplained variation driven by the coefficient difference between working married men and women. This result is aligned with the existing literature related to the gendered workhour gap, which shows that the unexplained component of the overall difference accounts for 70 percent. It is more likely to be the result of unobserved individual characteristics, behavior differences, and gender discrimination in the labor market (Doan et al. 2021).[17]

[17] In Figure B5 in the Appendix, we plot the combined effect due to gender differences in characteristics and the effect due to gender differences in coefficients. The results in both panels suggest that the substantial gender gaps in the labor supply have still unexplained by observable characteristics over the last decade. As illustrated in panel (b) of Figure B5, the reduced gender difference in hours worked has been largely driven by the gradual decrease in the unexplained portion of the gender workhour gap in the recent five years.

Table 2.5. Decomposition of Gender Gap in Hours Worked

	Characteristics Effect			Coefficients Effect		
	2010	2015	2020	2010	2015	2020
Overall	0.502	0.405	0.814***	5.518***	5.887***	3.818***
	(8.34)	(6.44)	(17.58)	(91.66)	(93.56)	(82.42)
Education	-0.172	-0.175**	-0.113**	0.486	-0.208	0.013
	(-2.85)	(-2.78)	(-2.44)	(8.08)	(-3.30)	(0.29)
Spouse's education	0.126	-0.012	0.016	-0.305	-0.117	-0.094
	(2.09)	(-0.18)	(0.35)	(-5.07)	(-1.85)	(-2.04)
Spouse's earnings	0.539	0.234	0.443**	0.119	-0.063	-0.265
	(8.95)	(3.72)	(9.56)	(1.98)	(-1.00)	(-5.72)
Age	0.008	-0.180**	-0.058	22.409	17.859	23.501*
	(0.13)	(-2.86)	(-1.25)	(372.26)	(283.80)	(507.30)
Children aged 0-6	0.162**	-0.003	-0.016	0.472	1.038***	0.307
	(2.70)	(-0.05)	(-0.35)	(7.84)	(16.49)	(6.62)
Children aged 7-18	0.009	0.018	-0.006	0.089	0.705	0.904**
	(0.16)	(0.28)	(-0.12)	(1.49)	(11.21)	(19.51)
Residence	-0.019	0.010	-0.012	-0.151	0.076	-0.210
	(-0.32)	(0.16)	(-0.26)	(-2.51)	(1.21)	(-4.54)
Job tenure	0.121	-0.015	0.422***	-2.671***	-5.293***	-3.434***
	(2.02)	(-0.24)	(9.10)	(-44.36)	(-84.11)	(-74.12)
Industry	-0.498**	0.352*	-0.059	-0.342	-0.013	0.699**
	(-8.27)	(5.60)	(-1.26)	(-5.69)	(-0.21)	(15.09)
Occupation	0.225	0.177	0.197*	-0.297	-0.695***	-0.621**
	(3.73)	(2.81)	(4.25)	(-4.94)	(-11.04)	(-13.39)
Constant				-14.291	-7.403	-16.982
				(-237.40)	(-117.65)	(-366.57)
N	2,447	2,316	3,463	2,447	2,316	3,463

Notes: Estimates are adjusted using cross-sectional sampling weights. Shares are indicated in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively. The choice of the reference coefficients is the coefficients from the pooled models including a group membership indicator. Age and the squared term of age /tenure and the squared term of tenure are grouped, and all categorical variables are grouped and normalized: education, spouse's education, spouse's earnings, residence, industry, and occupation. The reported results are subsumed as groups.

Among the characteristics effect of the gender workhour gap, spousal earnings were the biggest contributor in 2010 and 2020, accounting for 8.95 and 9.56 percent, respectively. Working married men have relatively lower levels of spousal earnings than working married women, which incentivizes them to spend more time at work. As a consequence, the endowment difference in spousal earnings between working married men

and women leads to a widening gender gap in work hours. As shown in panel (c) of Figure 2.6, the characteristics effect of spousal earnings has been persistent over time, even with few humps. Conversely, the characteristics effect of education, particularly higher education, contributes to narrowing the gender gap in work hours albeit at a small magnitude. Working married women are, on average, somewhat less educated than their counterparts, encouraging them to work longer hours. The share of education in the characteristics effect was -2.85, -2.78, and -2.44 percent in 2010, 2015, and 2020, accordingly. Reduced gender mean difference in education between working married men and women has slightly worsened the gender gap in hours worked.

In the latest year, the coefficients effect comprised 3.818 hours of the total gender difference in hours worked, meaning that if working married women had working married men's coefficients, their working hours would increase by an average of 3.818 hours per week. The coefficients effects of education and spousal resources are statistically insignificant, implying that working married men and women have similar responses to having higher education and more spouses' earnings. Panel (d) in Figure 2.6 shows that the negative or positive effects of those factors have gradually approached close to zero over the past ten years. Our results reflect the fact that observable differences in returns across education levels have shrunk over time.[18]

[18] Job tenure is the major contributors to narrowing the gender gap in hours worked. If working married women had the equivalent effect of job tenure on their working hours as their male partners, they would reduce work by 2.7, 5.3, and 3.4 hours in 2010, 2015 and 2020, respectively. The coefficients effect of job tenure has been long-lasting, even though that effect has fluctuated over time.

2.5. Conclusion

Despite an increased number of women attending higher education and labor policies promoting women to enter or re-enter the labor market, there is still a remaining gender gap in LFP rates between married men and women in South Korea. Even if married men and women decide to work, their working hours are not equal. This paper investigates how education and spousal earnings play a role in explaining the gender gap in both extensive and intensive margins of labor supply among married men and women.

Our decomposition results confirm that different level of educational attainment between married men and women is one of the important contributors to widening the gender LFP gap. The explained portion of education in the total gender LFP gap has reduced to 0.97 percent by 2020, indicating that its detrimental impact has practically disappeared over a decade. Meanwhile, increased numbers of women with greater access to education, especially higher education, promote female participation but reduce hours spent on paid work. The explained share of education in the total gender workhour gap was -2.85 percent in 2010 and slightly declined to -2.44 percent in 2020. That is, the endowment difference in education contributes to alleviating the gender gap in hours worked; however, the positive effect of narrowing the gender gap has slightly decreased due to the increased level of women's education.

Our results highlight the role of spousal earnings as a persistent contributing factor in both the gender gap in LFP and work hours. It implies that intra-household equality in prospective earnings is likely to reduce the gender gap in labor supply. The gender pay gap,

which is likely to widen the endowment difference in spousal earnings between married men and women, would continue to aggravate the gender gap in labor supply. Thus, the labor policies attempting to increase the labor supply for women should pay close attention to how to reduce the gender pay gap as well, since gender gaps in wages and labor supply are closely intertwined.

At last, our decomposition results indicate that a substantial gender gap in the labor supply remains unexplained. Xiao and Asadullah (2020) found social norms as a significant factor influencing Chinese women's labor force participation, accounting for nearly half (41.4 percent) of the unexplained part of the total gender gap. Policies promoting favorable attitudes toward women working outside of the home and changing ingrained social norms related to women’s unpaid care work should have in place in South Korea.

Chapter 3. Relative Income within Households and Time-use of Dual-earner Couples in South Korea

3.1. Introduction

Gender inequality occurs in both the labor market and within households. Many countries experience disparities between genders in the time allocated to both paid and unpaid work. Compared with men, women tend to allocate more time to housework and childcare, whereas men tend to spend more time on paid work (Fisher & Robinson 2011). The unequal sharing of time between genders within households contributes to gender inequality in terms of income and work opportunities and vice versa. Women who bear a greater burden of unpaid work experience stronger adverse effects on their wages relative to men (Hersch & Stratton 2002).

Gender inequality in the labor market may serve as one of the key drivers of the unequal distribution of unpaid work within household. The bargaining model, among various theories[1] explaining intra-household time allocation, proposes that husbands and wives negotiate over decisions related to time distribution within the couple. According to this model, spouses are inclined to participate more in household labor when their partners possess greater bargaining power, often determined by individual earnings (Lundberg &

[1] Alternative theories, such as the unitary model, posit that the breadwinner, usually husbands, earns more than wives. Consequently, husbands focus on labor market, whereas wives focus on home production to maximize the overall household utility (Becker, 1973, 1974).

Pollak, 2016; Pollark, 2005). However, the existing theories encounter obstacles when attempting to accurately explain situations where high-earning women assume more household responsibilities. Another potential explanation emerges from gender norms, which define the societal roles of men and women. The gendered distribution of both paid and unpaid work may result from gender norms (Burda et al., 2013; Campaña et al., 2023).

The societal expectation that a husband should out-earn his wife also plays a role in shaping the income distribution within households and consequently contributes to gender gaps in time allocation. Despite earning higher wages than their husbands, wives still engage in more than half of the nonmarket work, including household chores (Bittman et al., 2003; Bertrand et al., 2015; Akerlof & Kranton, 2000; Sevilla-Sanz et al., 2010). Hwang et al. (2019) discovered that husbands' adherence to parental gender norms increases the amount of time allocated to housework by wives in Korean dual-earner couples.

Consistent with research conducted in the United States and Finland (Bertrand et al., 2015); Zinovyeva & Tverdostup, 2020), the distribution of the share of earnings attributed to wives in South Korea (hereafter Korea) exhibits a sudden discontinuity at approximately 0.5 (refer to Figure 3.1). The magnitude of the estimated decline is more than double of that observed in Finland and the United States. This pattern can be primarily ascribed to the existence of a gender identity norm, which influences the formation and dissolution of couples and reduces the labor supply of high-earning married women

(Bertrand et al., 2015; Shenhav, 2021). Even in recent times, this discontinuity still exists (see Figure C1 in the Appendix).

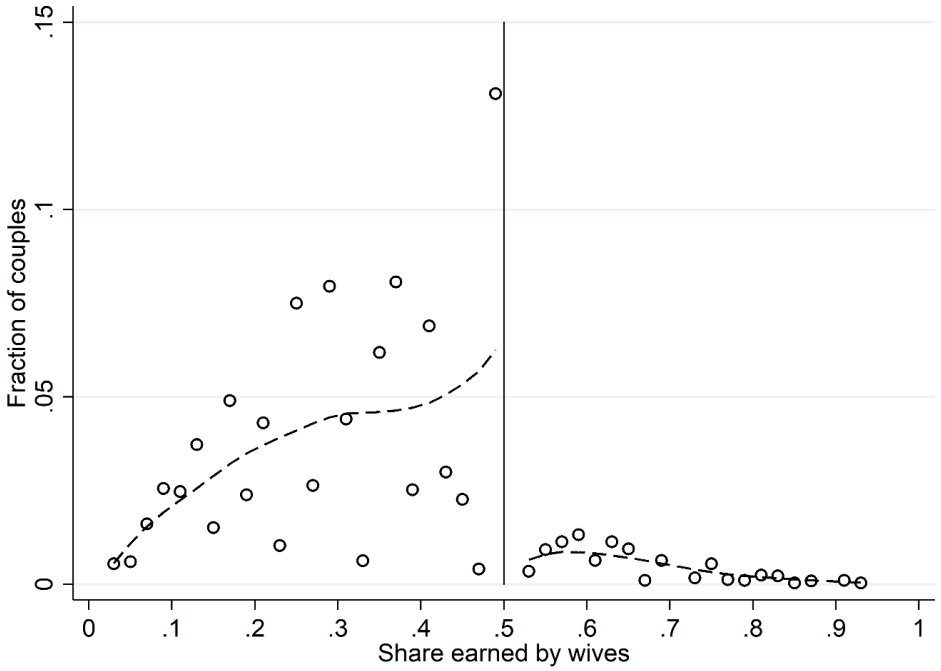

Figure 3.1. Distribution of Relative Income

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings and raising at least one child aged 0-18. Each dot indicates a fraction of couples in a 2 percent relative income bin; bins are right closed. The dashed line is the locally weighted scatterplot smoothing (LOWESS) applied to the distribution allowing for a break at 0.5.

Considering the prevalence of gender norms in Korea, I first describe the relationship between the relative income within dual-earner households on the distribution of time between husbands and wives for nonmarket work—comprising housework and informal caregiving—and market work. Based on the share of total household income earned by wives, Figures 3.2 and 3.3 depict the average time husbands and wives spend in housework and informal care work, respectively. An increasing relative income of wives

results in a more egalitarian allocation of time spent on nonmarket work within households. However, even at the highest share, there still exists a time disparity in the unpaid work between wives and husbands. Spouses allocate their time differently for various daily activities, such as sleeping and commuting, based on the relative income of wives (see Figure C2 of the Appendix).[2] These descriptive findings highlight that understanding how couples make time allocation decisions is crucial for achieving an equal division of labor in both the labor market and the home.

This study examines the impact of relative income on the overall patterns of time distribution in dual-earner households. It specifically investigates the time dedicated to activities such as sleeping, personal care, housework, caregiving, social activities, leisure activities, commuting, and travel. To explore the impact of relative income on intra-household time allocation, I create plausibly exogenous Bartik-style earnings by leveraging two variations: preexisting employment shares across genders within industries and the provincewide earnings growth for each industry, excluding the focal area. My findings suggest that when relative income of wives increases by one-standard deviation, wives tend to spend two minutes less on daily housework, while husbands tend to spend an additional 22 minutes on it. However, in response to an increase in wives' contribution to household

[2] Wives tend to reduce their sleeping hours and extend commuting times when wives outperform husbands in the labor market; however, husbands are nonresponsive to the relative income of wives in their time allocation for both tasks.

income, wives and husbands allocate an additional 35 and 21 minutes, respectively, to caregiving daily.

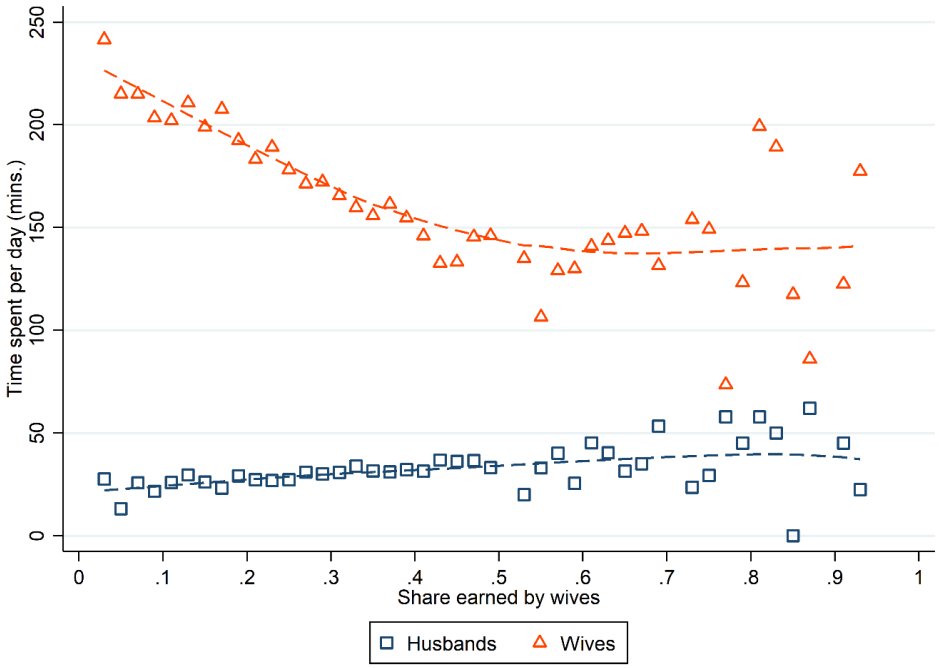

Figure 3.2. Time-use Pattern in Housework by Gender and Relative Income

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Each dot indicates a fraction of couples in a 2 percent relative income bin; bins are right closed. The dashed line is the lowess smoother applied to the distribution allowing for a break at 0.5.

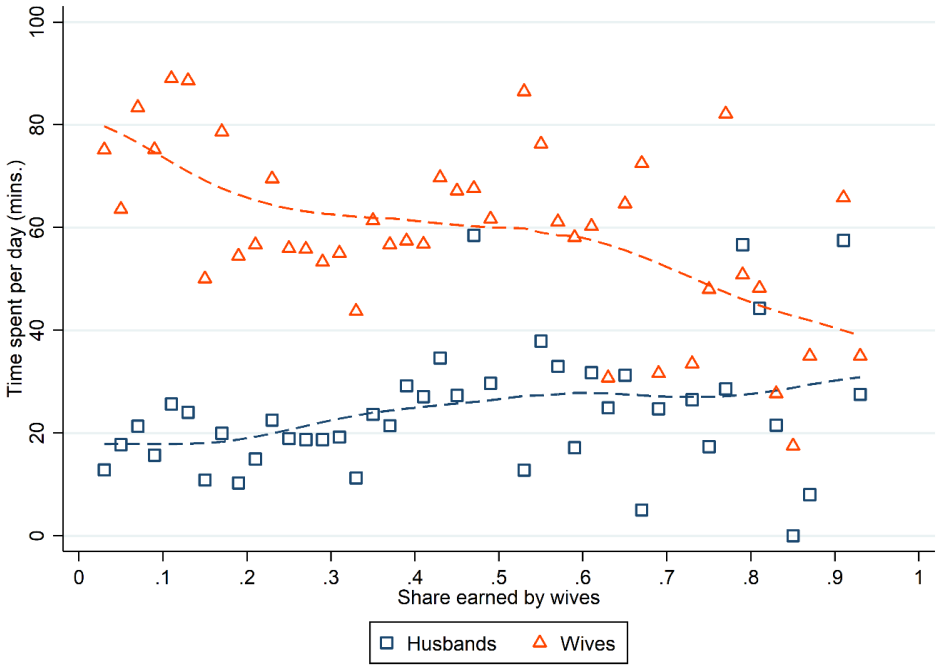

Figure 3.3. Time-use Pattern in Informal Care Work by Gender and Relative Income

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Each dot indicates a fraction of couples in a 2 percent relative income bin; bins are right closed. The dashed line is the lowess smoother applied to the distribution allowing for a break at 0.5.

This study contributes to two strands of the literature. First, by examining various dimensions of time allocation, it expands upon existing research that emphasizes the division of household labor. This research diverges from prior studies by not solely focusing on the influence of relative income on household chores (Bitterman et al., 2003; Akerlof & Kranton, 2000; Bertrand et al., 2015). Instead, it explores additional dimensions of time allocation within two-earner couples. For instance, I demonstrate that differences in the relative income among spouses have varying effects on the time invested in household chores and caregiving. Sevilla-Sanz et al. (2010) and Guryan et al. (2008)

emphasized the importance of distinguishing childcare activities to determine whether they align more closely with unpaid labor or leisure. Consistent with their study, I find that husbands and wives respond differently in their allocation of time to housework and childcare with respect to the relative income of spouses.

The study of Korea, a nation whose household dynamics are less well-known in comparison to those of Western nations, constitutes a second contribution to the current literature. The labor force participation rate of Korean women is one of the lowest among Organisation for Economic Co-operation and Development (OECD) member countries. Consequently, this results in an imbalanced distribution of both market and nonmarket work hours[3] in Korea. There is evidence suggesting that gender roles significantly influence the division of household labor in Korea. Hwang et al. (2019) utilized regional birth sex ratios as a proxy for parental gender norms, and this resulted in an uneven distribution of housework time. In contrast, I explore not only the specialization of housework but also other dimensions of time allocation, including childcare.

The subsequent sections of the paper are organized as follows: Section 3.2 provides the data and presents summary statistics for the analysis. Section 3.3 outlines the empirical framework. Section 3.4 delves into the impact of relative income on intra-household time

[3] In OECD countries, on average, women spend about 126 minutes more per day on unpaid work than men (137 vs. 263 minutes). However, in South Korea, women dedicate 150 minutes more per day to housework such as childcare than men (269 vs. 419 minutes).

allocation and explores its heterogeneous effects. Section 3.5 summarizes the main conclusions.

3.2. Data and Descriptive Statistics

By utilizing two distinct data sources—the Korean Time Use Survey (KTUS) and the Korean Labor and Income Panel Study (KLIPS)—this research examines the impact of relative income on time allocation within dual-earner couples with children. This section delineates the two datasets employed in the empirical strategies.

3.2.1. Data on Relative Income

To formulate a Bartik-style measure of the proportion of income earned by wives within double-income households, I use KLIPS data for the years 1998, 2004, 2009, 2014, and 2019. I limit the samples to individuals within the working age range of 15 to 64 years, who report positive earnings and are not engaged in self-employment. The 1998 KLIPS datasets, encompassing approximately 3,800 working age individuals, enables me to construct the industry[4] employment share at the education[5] and province[6] levels for each

[4] Industry group is categorized as follows: agriculture, forestry, fisheries, and mining; manufacturing; construction; wholesale and retail trade; accommodation and food; transportation, communication, finance and insurance, and real estate; renting, computer and research, business service, and public administration; education; health and welfare; arts, sports, and recreation; household service and others.

[5] Education level is categorized as follows: less than high school graduate, high school graduate, some college graduate, and university graduate or higher. Individuals who complete coursework, drop out, are currently enrolled, or are on leave of absence are coded as having a lower level of education.

[6] Province is listed as follows: Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan, Gyeonggi, Gangwon, Chungbuk, Chungnam and Sejong, Jeonbuk, Jeonnam and Jeju, Gyeongbuk, and Gyeongnam.

gender before the analysis period. It represents the proportion of individuals employed in a particular industry in 1998, categorized by gender, education, and province. In addition, for each year except for 1998, I calculate the average monthly earnings for each industry of workers of a given gender and education across the entire nation excluding the local province.

3.2.2. Time Allocation Data

I use the KTUS to examine the outcomes of interest for the years 2004,[7] 2009, 2014, and 2019. The KTUS is a cross-sectional survey collecting data on how people aged 10 years and over allocate their time among various activities. The survey aims to provide a comprehensive understanding of the daily time allocation and behavioral patterns of Koreans. Respondents are asked to document their primary and concurrent activities in a time diary that is organized into 10-minute intervals and spans two consecutive days[8] (i.e., Friday and Saturday; Sunday and Monday; Tuesday and Wednesday; Thursday and Friday; and Saturday and Sunday). The KTUS involves a nationally representative sample of approximately 8,100 to 12,000 households each year.

[7] The KTUS was initially surveyed in 1999 by the Korea National Statistical Office (KNSO) and has been conducted every five years; however, the 1999 KTUS failed to collect information on individual earnings, so it was not included in the analysis.

[8] Each participant completes a 24-hour time diary for two consecutive days, resulting in two records for everyone, and each record is considered as an individual entry.

This research aims to elucidate how relative income affects the time allocation among dual-earner couples with children across various facets of life. The KTUS provides data on the duration, measured in minutes, of around 150 different daily activities, which may vary from year to year. Table 3.1 illustrates the grouping of detailed behavior classifications into broader categories. Thus, I classify daily activities into eight behavior categories: daily time allocated to sleep, housework, informal care work, social activities, leisure activities, commuting, and travel. Unfortunately, the KTUS provides individual monthly income as a categorical variable, calculated by averaging the total income derived from earnings, business profits, property income, transfers (e.g., pensions and living allowances), and other kinds of income throughout the year. Relative income, which is defined by the proportion of earnings contributed by wives in dual-earner couples with children, is constructed using average income data from the KTUS with certain adjustments. Depending on the years, I re-coded the midpoints of five hundred thousand or one million won intervals. Top-coded categories are subject to a 1.5 times multiplication in accordance with the standard adjustment (Bertrand et al. 2015).

Table 3.1. Daily Time Use Classification

Main Behavioral Category	2digits	Behavioral Subcategory
Sleep	11	Sleep, insomnia
Personal care	12	Eating meals and snacks
	13	Medical healthcare
	14	Personal hygiene and beauty
Housework	41	Preparing food, cooking, and washing up
	42	Washing, ironing, or mending clothes and shoes
	43	Cleaning and tidying the house
	44	Maintenance of house

	45	Car maintenance
	47	Purchasing home care-related products and services
	49	Home management (household budgeting, banking, going to government offices, or etc.)
Informal care work	51	Caring for children aged 0-9 (physical care, nursing, discipline, teaching, reading books, talking, engaging in sports, counseling with a teacher, or etc.)
	52	Caring for children aged 10-18 (physical care, nursing, discipline, teaching, reading books, talking, engaging in sports, counseling with a teacher, or etc.)
	53/54	Helping or caring for adults (spouses, parents, or etc.)
Social activities	61	Helping neighbors and friends
	62	Voluntary work
	71	Social interaction (face-to-face, voice, text, or etc.)
	72	Participation activities (i.e., participating social events or community engagement)
	73	Religious activities
Leisure activities	81	Cultural and tourism activities (watching movie, attending theater or concert, visiting museum, watching sports games, or going for a drive)
	82	Media-based leisure (reading books, newspapers, and magazines, watching television, listening to radio, internet searching, or etc.)
	83	Playing sports (walking, jogging, hiking, cycling, inline skating, fishing, hunting, sports, or etc.)
	84	Playing games (Online/PC or mobile games)
	85	Resting (taking a break or smoking)
	89	Other leisure (hobbies, entertainment, or etc.)
Commute time	92	Commuting to work and home and travel time related to work
Travel time	91	Travel time related to personal care
	93	Travel time related to learning
	94	Travel time related to housework
	95	Travel time related to family caring
	96	Travel time related to voluntary work
	97	Travel time related to social activities
	98	Travel time related to leisure activities

Note: The mid-level category numbers in the behavior classification chart are based on the data from the year 2019.

In addition, the KTUS provides information on the household characteristics, including the number of children, residential location, household income, and family structure. There are several demographic and socioeconomic characteristics, such as age, gender, education, gender norms, employment status, hours worked, average income, industry, and occupation. Because the survey is conducted at the household level, I can also explore spousal information for married couples using the relationship with the household head. This information enables me to utilize individual, spouse, and household-level characteristics as covariates in my analysis.

This research targets married dual-earner couples aged 25 to 54 with positive earnings. To analyze time spent caring for children, the sample is restricted to married couples with at least one child under the age of 18.[9] Further, I restrict the samples to those in which both partners are observable for each year and date. Couples where both the husband's and wife's incomes are top-coded are excluded due to measurement error. The resulting sample comprises 11,659 married couples with children aged between 0 and 18.

[9] The Time Use Survey does not uniformly collect information on all children; instead, it categorizes data based on the age of the respondent's children. Therefore, in this study, the identification of having children under 18 is ascertained in the following ways: (1) respondents starting the questionnaire from age 10 allows me to determine the number of children aged 10 to 18 based on individual age, (2) the number of preschool children helps identify those raising children aged 0-6, and (3) the time spent caring for children aged 0-9 from the time diary is utilized to identify the presence of children aged 7 to 9.

3.2.3. Descriptive Statistics

Table 3.2 presents the summary statistics of important variables for dual-income couples with children, which were used in my analyses, and the mean differences between wives and husbands. Panel (a) demonstrate a significant disparity in the labor market outcomes between wives and husbands even in households where both partners have income. On average, the monthly income for wives is 1.789 million won (approximately 1,491 USD[10]), whereas that of husbands is 3.397 million won (approximately 2,831 USD), indicating a twofold difference. The probability of husbands belonging to the top-coded income category is 4.3 percentage points higher than that of wives. When computing wives' actual contributions to total household income, the share amounts to 0.341. Compared with their husbands, wives devote approximately 10 fewer hours per week to work.

Table 3.2. Summary Statistics of Dual-earner Couples

Variables	Wives		Husbands		Diff.
	Mean	S.D.	Mean	S.D.	
Panel (a) Labor market outcomes					
Monthly income (million won)	1.789	1.314	3.397	1.811	-1.607***
Top-income earner	0.007	0.082	0.050	0.218	-0.043***
Household income (W+H)	5.186	2.465	5.186	2.465	0.000
Actual share earned by wives	0.341	0.156	0.341	0.156	0.000
Total hours worked	41.282	16.904	51.162	13.406	-9.880***
Bartik-style earnings	35.594	26.140	51.126	26.760	-15.532***
Bartik share earned by wives	0.395	0.144	0.395	0.144	0.000
Panel (b) Average minutes per day from time-use diaries					
Working	262.410	208.875	345.904	226.565	-83.493***
Sleep	463.748	91.116	472.477	102.008	-8.729***

[10] I calculate using an exchange rate of 1 dollar to 1200 won.

Personal care	179.651	56.531	182.218	53.771	-2.567***
Housework	166.953	104.428	30.512	53.442	136.441***
Informal care work	61.757	82.458	22.983	51.663	38.773***
Social activities	55.064	74.403	47.440	68.745	7.624***
Leisure activities	135.145	104.389	198.297	145.376	-63.153***
Commute time	44.680	49.113	74.850	73.644	-30.171***
Travel time	50.898	64.081	48.526	67.686	2.372**
Panel (c) Individual and household characteristics					
Age	39.567	5.512	42.290	5.732	-2.723***
Years of schooling	13.284	2.339	13.706	2.411	-0.422***
Children aged 0-6	0.339	0.473	0.339	0.473	0.000
Num. of children aged 10-18	1.013	0.850	1.013	0.850	0.000
Living with parents	0.087	0.282	0.087	0.282	0.000
Weekend	0.403	0.490	0.403	0.490	0.000
Seoul	0.113	0.317	0.113	0.317	0.000
Busan	0.063	0.243	0.063	0.243	0.000
Daegu	0.057	0.233	0.057	0.233	0.000
Incheon	0.071	0.256	0.071	0.256	0.000
Gwangju	0.058	0.235	0.058	0.235	0.000
Daejeon	0.053	0.223	0.053	0.223	0.000
Ulsan	0.052	0.223	0.052	0.223	0.000
Gyeonggi	0.142	0.350	0.142	0.350	0.000
Gangwon	0.042	0.201	0.042	0.201	0.000
Chungbuk	0.044	0.205	0.044	0.205	0.000
Chungnam, Sejong	0.062	0.241	0.062	0.241	0.000
Jeonbuk	0.040	0.196	0.040	0.196	0.000
Jeonnam, Jeju	0.095	0.293	0.095	0.293	0.000
Gyeongbuk	0.050	0.217	0.050	0.217	0.000
Gyeongnam	0.057	0.233	0.057	0.233	0.000
2004	0.295	0.456	0.295	0.456	0.000
2009	0.206	0.404	0.206	0.404	0.000
2014	0.263	0.440	0.263	0.440	0.000
2019	0.236	0.425	0.236	0.425	0.000
N	11,659		11,659		

Notes: Data is pooled in the period between 2004 to 2019. The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. The difference shows the mean comparison of two groups using an adjusted t-value clustered within individuals. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

Panel (b) of Table 3.2 demonstrates the means and standard deviations of the daily minutes spent on working, sleep, personal care, housework, informal care work, social activities, leisure activities, commuting, and travel for wives and husbands. Similar to the

weekly working hours, the time-use diary also reveals that wives work approximately 83 minutes less per day than their husbands. Both wives and husbands allocate an average of approximately 8 hours to sleep and approximately 3 hours to personal care each day. Compared with husbands, wives, on average, dedicate an additional 2.27 hours to housework and 38 minutes to informal care work per day. Wives spent 55 minutes daily on social activities, whereas husbands spent 47 minutes. Husbands tend to enjoy leisure activities approximately one hour more than their wives. On average, wives spend 45 minutes commuting daily, whereas husbands spend 75 minutes for the same activity, indicating a variance of approximately 30 minutes among them. Apart from the time spent commuting, both wives and husbands allocate 50 minutes daily for traveling between various engagements.

Moreover, the panel (c) of Table 3.2 presents the individual and family characteristics of wives and husbands. Wives, on average, are approximately 3 years younger than their husbands, and their years of schooling are approximately 5 months less than those of their husbands. According to the analysis, dual-income couples have a 33.8% probability of raising a child aged 0-6, and, on average, they are fostering one child aged 10 to 18. Additionally, 8% of these couples live with their parents or parents-in-law, and 40% of them complete their time-use diary on weekends.

3.3. Estimation Strategies

To assess the impact of relative income within dual-income couples on their time allocation, I first define the proportion of income earned by wives to the total household income as follows:

$$Actual\ share\ earned\ by\ wives_{c,r,t} = \frac{Income_{wives,r,t}}{Income_{husbands,r,t} + Income_{wives,r,t}} \qquad eq.1$$

I use the Ordinary Least Square (OLS) to estimate the following equation:

$$Timeuse_{c,r,t} = \alpha + \beta Actual\ share\ earned\ by\ wives_{c,r,t} + \rho X_{c,r,t} + \omega_r + \nu_t + \varepsilon_{c,r,t} \qquad eq.2$$

where $Timeuse_{c,r,t}$ represents the amount of time allocated by both wives and husbands for each couple c living in province r at year t, including the disparities in time distribution among them. I control for a set of couple-related covariates, denoted as $X_{c,r,t}$, along with province-fixed effects and year fixed effects represented by ω_r and ν_t, respectively. However, there is a potential endogeneity issue that arises when utilizing the actual share earned by wives to identify the effects. Specifically, the resulting estimates may be biased and inconsistent if the error term $\varepsilon_{c,r,t}$, which signify omitted factors, is correlated with both the actual contributions of wives to total household income and their time allocation behaviors. For instance, unobserved household-level heterogeneities, such as gender norms, may be correlated to both household earnings and time allocation patterns. To address this concern, I construct an alternative measure of relative income within households, capturing external variations in local labor demand.

3.3.1. Bartik-style Relative Income

The measure of relative wages that is employed to isolate exogenous labor demand shocks for male and female workers was introduced by Bartik (1991). By employing Bartik-style relative wages between men and women, various studies address potential endogeneity concerns. This Bartik instrument has been widely employed in studies on domestic violence (Aizer, 2010; Erten & Keskin, 2021), marriage, fertility, and divorce (Autor et al., 2019; Bertrand et al., 2015; Shenhav, 2021), as well as household expenditure (Ahn & Ren, 2022; Ahn & Kyo, 2022).

To analyze the impact of relative income on time allocation among spouses, I create the Bartik instrument of relative earnings that isolates the exogenous local demand for male and female labor. More specifically, by examining the gender-based differential response of a specific industry in a local area to national shocks, I create an interaction term by combining the initial industry composition of the local area with the national-level earnings for that industry, excluding the focal area. The instrument capitalizes on the fact that areas with a higher initial share of a particular industry will be more affected by shocks in that industry at the national level. For example, suppose a positive labor demand shock occurs in the female-dominated service sector at the national level. In that case, female workers in regions with a higher concentration of service sector employment will experience a larger increase in their wages compared with their counterparts in regions with lower representation.

Consistent with the approach used to formulate the relative income (Aizer, 2010; Bertrand et al., 2015; Shenhav, 2021; Ahn & Ren, 2022; Ahn & Kyo, 2022), I construct the following Bartik-style relative income measure of average earnings by gender g, education e, and province r[11] for each year t, computed as follows:

$$\bar{W}_{gert} \equiv \sum_{j} \frac{E_{gerj,1998}}{E_{ger,1998}} \times w_{gejt,-r} \qquad eq.3$$

The variable $\frac{E_{gerj,1998}}{E_{ger,1998}}$ on the right hand of Equation 3 represents the proportion of individuals with gender g and education e in province r employed in industry j during the base year 1998. Meanwhile, the variable $w_{gejt,-r}$ denotes the average wage in industry j for workers of a specific gender g and education e across the nation in year t, excluding the specified province r. Excluding this province alleviates potential bias that arise from changes in labor supply-side factors, such as changes in the inherent characteristics of workers within each province, which may be correlated with the time allocation of spouses. When examining the distribution of the Bartik measure for wives and husbands, it is evident that wives are more likely than husbands to be concentrated in the low-income brackets; however, the upper levels of income are predominantly occupied by husbands (refer to Figure C3 in the Appendix).

[11] Referring to Bertrand et al. (2015) and Shenhav (2021), I define a marriage market characterized by assortative matching, as both men and women tend to choose mates with identical educational backgrounds (less than high school; high school graduates; some college; and university graduates or higher) residing in the same province.

3.3.2. Empirical Specification

To assess the impact of relative income on time allocation in dual-earner couples, I first match the constructed Bartik-style earnings with each husband and wife in two-income couples based on gender g, education e, province r, and year t. Subsequently, the Bartik-style share earned by wives is defined as follows:

$$Bartik\ share\ earned\ by\ wives_{c,r,t} = \frac{\overline{w_{wives,e_w,r,t}}}{\overline{w_{husbands,e_w,r,t}} + \overline{w_{wives,e_w,r,t}}} \qquad eq.4$$

where c, e_h, e_w, r, t represent indices for couples, husbands' education, wives' education, province, and year, respectively. As presented in panel (a) of Table 3.2, the Bartik-style average earnings are 35.6 and 51.1 for wives and husbands, respectively. Consequently, the calculated Bartik-style share earned by wives stands at 0.395.

To address endogeneity concerns, I employ the Bartik-style share earned by wives as an instrumental variable (IV) in the Two-stage Least Squares (2SLS) estimation. In the first-stage regression, I use the Bartik-style instrument to estimate the actual share earned by wives:

$$Actual\ share\ earned\ by\ wives_{c,r,t} \qquad eq.5$$
$$= \sigma + \lambda Bartik\ share\ earned\ by\ wives_{c,r,t} + \delta X_{c,r,t} + \theta_r + \gamma_t + \eta_{c,r,t}$$

By substituting the predicted value of relative income, which was estimated in the first stage, into the structural equation, the 2SLS estimates can be derived as follows:

$$Timeuse_{c,r,t} = \alpha + \beta Actual\ share\widehat{earned\ by\ wives}_{c,r,t} + \rho X_{c,r,t} + \omega_r + \nu_t + \varepsilon_{c,r,t} \qquad eq.6$$

In this equation, my outcomes of interest, which is denoted by $Timeuse_{c,r,t}$, refer to the time spent by wives and husbands, as well as the gaps in time allocation between wives and husbands ($W - H$). I incorporate a vector of couple-level covariates, $X_{c,r,t}$, which include the working hours of both spouses, age and educational gaps between wives and husbands, household income, whether there are preschoolers in the household, the number of children aged 7 to 18, and the presence of parents or in-laws in the household. To address year-to-year variations and regional differences in outcomes, I also control for province-fixed effects ω_r and year fixed effects ν_t. The standard errors are clustered at the couple level to allow for the correlation of the error term within couples.[12]

Table 3.3. First Stage Results

	Actual share earned by wives		
	(1)	(2)	(3)
Bartik share earned by wives	0.123***	0.127***	0.123***
	(0.014)	(0.016)	(0.016)
Province-fixed effects	NO	YES	YES
Year fixed effects	NO	YES	YES
Controls	NO	NO	YES
F-statistics	74.923	65.461	58.072
R-squared	0.0130	0.0167	0.1953
N	11,659	11,659	11,659

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Standard errors clustered at the couple level in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

[12] Annually, each couple completes two sets of time diaries. In this analysis, although each time diary is treated as a single observation, standard errors are clustered at the couple level, where each couple has two records.

The first-stage regressions results are displayed in Table 3.3. In each column, the positive and significant coefficients of the Bartik-style share earned by wives on the actual share earned by wives are observed. The results remain robust even with changes in sets of covariates. The scatterplot in Figure C4 of the Appendix illustrates a strong positive relationship between the Bartik-style share and the actual share earned by wives. The F-statistics of the estimated models in the initial regressions range from 58 to 75, indicating that concerns about a weak IV issue when employing this instrument in the subsequent 2SLS regressions are relatively limited.

3.4. Estimation Results

This section primarily illustrates the effects of relative income on overall patterns of time allocation within dual-earner couples. It encompasses various activities such as sleeping, personal care, housework, care work, social activities, leisure activities, commuting, and travel. I conduct a more in-depth examination of the impact of wives' relative income on specific subcategories of housework and caregiving. Afterward, I investigate the variation in the impact of relative income according to couple-level characteristics.

3.4.1. The Effects on Spousal Time Allocation

Table 3.4 displays the OLS and 2SLS estimates of the time allocated by wives and husbands to sleeping and personal care, along with the time gap between wives and husbands in duration for both sleep and personal care activities. Some of the OLS results presented may be biased, resulting in incorrect signs on the coefficients. As outlined in the preceding

section, this bias is attributable to endogeneity factors, such as omitted variable bias and measurement error. In couples with more egalitarian attitudes toward gender roles, wives tend to allocate more time to the labor market and less to nonmarket labor. OLS estimates in such cases may demonstrate a downward bias, counteracting the positive effects of increased relative income on the time wives dedicate to household labor. Additionally, attenuation bias may be introduced into the OLS estimates due to the lack of continuous income data necessary for accurately assessing relative income. For these reasons, while I report OLS results, the discussion is centered around the 2SLS outcomes.

As shown in panel (a) of Table 3.4, the point estimate indicates that a one-standard deviation increase in the share earned by wives leads to a decrease of 19 minutes,[13] which is equivalent to a decrease of 0.2 standard deviations, in the daily sleeping hours for wives. The findings suggest that the same amount of increase in wives' relative income results in a decrease of 6 and 14 minutes in husbands' sleeping hours and the gap in sleeping hours between wives and husbands, respectively. However, this estimated impact is not statistically significant. As indicated in panel (b) of Table 3.4, as relative income increases, wives allocate comparatively less time to personal care, whereas husbands allocate more time. However, these estimated effects based on the 2SLS are statistically insignificant.

[13] I standardize the 2SLS estimation's coefficient value of -123.54 by multiplying it with the ratio of the independent variable's standard deviation, 0.156, to the dependent variable's standard deviation, 91.116. Then, the standardized coefficient is approximately -0.212, and multiplying this value by the standard deviation of the independent variable, 91.116, yields an approximate estimate of -19 minutes.

Table 3.4. Effect of Relative Income on Time Spent in Sleeping and Personal Care

	(a) Sleeping					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	-6.303	-123.540*	-3.842	-35.753	-2.460	-87.787
	(6.258)	(62.524)	(7.102)	(66.465)	(7.942)	(74.354)
Average mins. per day	463.748		472.477		-8.729	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
	(b) Personal care					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	9.591*	-18.296	-10.779**	42.840	20.371**	-61.136
	(4.205)	(40.071)	(3.934)	(38.381)	(4.855)	(45.959)
Average mins. per day	179.651		182.218		-2.567	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Standard errors clustered at the couple level in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

Panel (a) in Table 3.5 illustrates the impact of relative income on the time dedicated to household chores for both wives and husbands, as well as the disparities among them. A one-standard deviation increase in relative income is associated with a two-minute reduction in wives' housework time, although the effect is not statistically significant. Conversely, husbands demonstrate a daily increase of 22 minutes in the time devoted to home chores. Although the gap in the time allocated to domestic work between husbands and wives narrows due to husbands dedicating relatively more time, the effect size is somewhat negligible. The average time that wives spend on household chores is more than

five times greater than that of husbands (i.e. 167 minutes for wives vs. 31 minutes for husbands).

Table 3.5. Effect of Relative Income on Time Spent in Housework and Care Work

	(a) Housework					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	-78.526***	-15.664	19.782***	138.786***	-98.308***	-154.450*
	(7.480)	(68.233)	(3.732)	(39.407)	(7.970)	(73.262)
Average mins. per day	166.953		30.512		136.441	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
	(b) Informal Care Work					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	-9.841	224.022***	15.717***	137.295***	-25.558***	86.727
	(5.766)	(59.776)	(3.660)	(40.604)	(6.352)	(59.227)
Average mins. per day	61.757		22.983		38.773	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Standard errors clustered at the couple level in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

The results in panel (b) of Table 3.5 provide further evidence that an increase in relative income is correlated with a greater amount of time dedicated to informal caregiving. Specifically, a one-standard deviation rise in the actual share earned by wives is associated with a 0.42-standard deviation increase in caregiving time for both wives and husbands towards their children and elderly adults in the households. This suggests that wives and husbands spend an additional 35 and 21 minutes to caregiving daily when relative income increases by one standard deviation, respectively. Because both wives and husbands spend

more time on caregiving as the relative income of wives increases, the gap in time spent on caregiving among them does not diminish.

Table 3.6. Effect of Relative Income on Time Spent in Social and Leisure Activities

	(a) Social Activities					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	-9.806	45.937	4.463	-33.174	-14.268*	79.111
	(5.557)	(54.463)	(4.832)	(46.070)	(5.632)	(58.844)
Average mins. per day	55.064		47.440		7.624	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
	(b) Leisure Activities					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	-24.887**	-7.572	-5.493	-85.672	-19.394	78.099
	(7.826)	(70.183)	(9.921)	(93.536)	(10.810)	(100.045)
Average mins. per day	135.145		198.297		-63.153	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Standard errors clustered at the couple level in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

To put these effects into perspective, the results on the division of housework time are consistent with the interpretation of increased bargaining power; as wives increase their income and thus bargaining power within families, wives devote fewer hours to house chores. In contrast, Akerlof and Kranton (2000) and Bittman et al. (2003) discovered that despite earning more than their husbands, women do not reduce their contribution to housework. Moreover, Bertrand et al. (2015) observed that even if the wife's income exceeds half of the total household income, her nonmarket work, including childcare,

increases. When considering time allocation for informal caregiving, my findings are more consistent with those of Bertrand et al. (2015).

Table 3.6 indicates that a higher relative income does not significantly increase the gaps in time devoted to social and leisure activities between wives and husbands. I find that as wives contribute more to the total household income, they tend to spend more time on social activities, whereas husbands tend to spend less. The point estimate indicates that a one-standard deviation in the relative income results to a reduction of 1 and 13 minutes in leisure activities for wives and husbands, respectively. However, these effects on social and leisure activities are statistically insignificant.

Table 3.7. Effect of Relative Income on Time Spent in Commute and Travel Time

	(a) Commute Time					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	34.501***	-22.474	4.136	53.690	30.365***	-76.164
	(3.594)	(32.441)	(5.303)	(49.503)	(6.004)	(56.548)
Average mins. per day	44.680		74.850		-30.171	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
	(b) Travel Time					
	Wives		Husbands		Gaps (W-H)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Actual share earned by wives	-8.885*	89.681*	6.009	3.471	-14.893**	86.210
	(4.362)	(42.719)	(4.472)	(43.425)	(4.942)	(50.178)
Average mins. per day	50.898		48.526		2.372	
Observations	11,659	11,659	11,659	11,659	11,659	11,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Standard errors clustered at the couple level in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.7 details the impact of relative income on the time allocated to commuting and traveling. The findings in panel (a) of Table 3.7 reveal that as the wife's income increases, a pattern emerges where couples tend to reside in proximity to the wife's workplace, resulting in a reduction in her commuting time and an increase in the husband's commuting time. However, the estimated effects are statistically insignificant. Panel (b) of Table 3.7 displays the impact of relative income on travel time, which encompasses the duration of a journey excluding commuting. When wives increase their contribution to the total household income by a one-standard deviation, they spend an extra 14 minutes on the road daily. In contrast, there is no discernible effect on husbands' travel time.

3.4.2. Effects on Housework and Caregiving

In the previous section, I demonstrated that the relative income of dual-income couples significantly influences the distribution of time among spouses for household chores and caregiving. In this section, I investigate the impacts of relative income on sub-components of housework and care work. The coefficient estimates on share earned by wives from 2SLS regressions for each category of housework and informal care work are displayed in Figure 3.4.

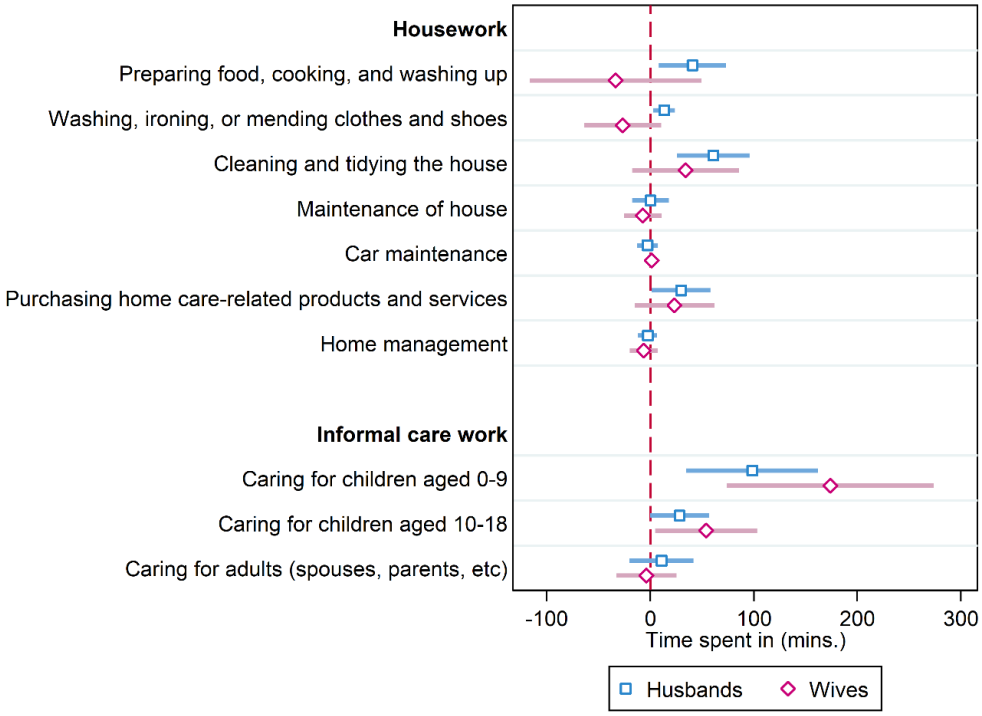

Figure 3.4. Impact of Relative Income on Different Categories of Housework and Caregiving

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. The empty square and diamond represent the values of the corresponding 2SLS regression coefficients for husbands and wives, while the horizontal bars indicate the 95% confidence intervals. Standard errors clustered at the couple level in parentheses.

First, as wives contribute more to the household income, their husbands tend to allocate more time to housework, especially in tasks such as cooking, doing laundry, cleaning the house, and purchasing home care-related products and services. Husbands allocate an additional 6 minutes daily to house chores, such as preparing food, cooking, and washing up, when the share earned by their wives increase by one-standard deviation. Simultaneously, a one-standard deviation increase in relative income is associated with

increases of 2, 9, and 5 minutes daily in household tasks such as washing, ironing, or mending clothes and shoes; cleaning and tidying the house; and buying home care-related products and services, respectively. As wives spend more time outside the home and earn higher wages, husbands tend to compensate and assume more responsibilities for nearly all household tasks that were previously performed by wives.

Moreover, a distinct pattern of time allocation emerges in informal caregiving compared to housework. Despite an increase in the relative income of wives, the additional time husbands allocate to informal caregiving does not exceed that of their wives, leading to widen time gaps in caregiving between wives and husbands. Specifically, husbands allocate an extra 15 minutes to the care of children aged 0 to 9, whereas wives dedicate an additional 27 minutes to the same task, given a one-standard deviation increase in wives' relative income. When it comes to parenting children aged between 10-18, wives dedicate twice as much time as husbands, allocating an additional 4 and 8 minutes daily, respectively.

3.4.3. Heterogenous Effects of Relative Income

After demonstrating that the relative income of wives leads to a decrease in time allocated to household activities and an increase in time devoted to family caregiving, I explore heterogeneous effects of relative income on wife's and husbands' time allocation. Figure 3.5 illustrates the heterogeneous effects of relative income on time allocation for wives and husbands, which depend on the gender norms of husbands, day of the survey, age of children, household income, and the survey year. The left panel of Figure 3.5 depicts the average time allocated to household chores by husbands and wives in each subgroup,

whereas the right panel displays the coefficient values of the preceding 2SLS analysis for housework separately for husbands and wives.

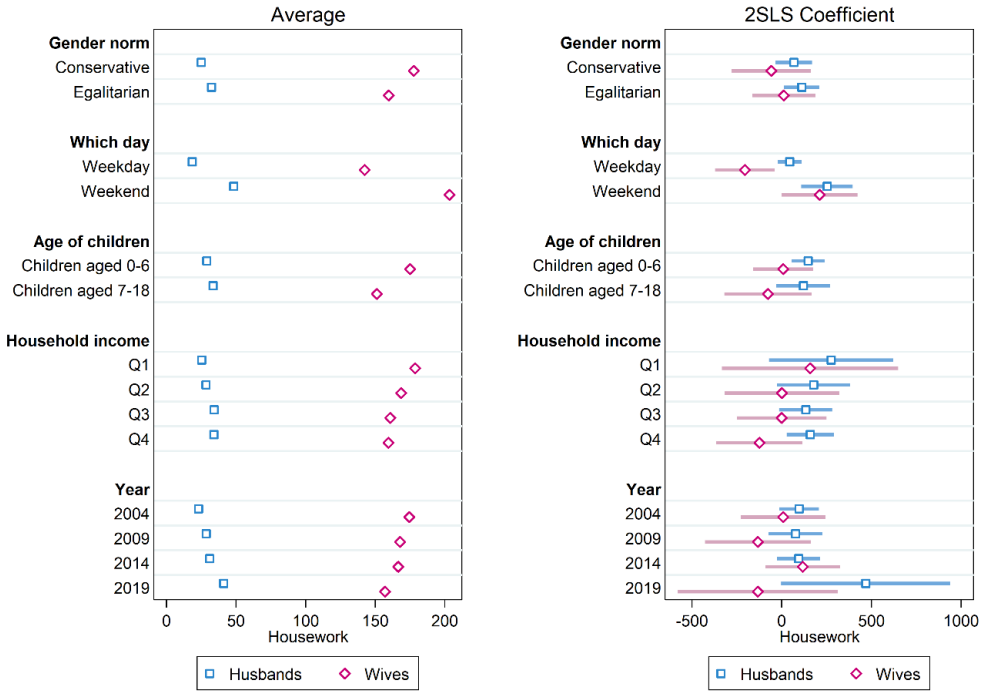

Figure 3.5. Heterogenous Effects of Relative Income on Housework

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. On the left graph, the empty square and diamond represent the means of housework. On the right graph, they each represent the values of the corresponding 2SLS regression coefficients for husbands and wives, while the horizontal bars indicate the 95% confidence intervals. Standard errors clustered at the couple level in parentheses.

Regardless of how the subsamples are divided, it is evident that wives do more household chores than husbands. When examining different subsamples, it is evident that both wives and husbands engage in more household chores on weekends than on weekdays. However, the time disparity invested in housework between the two is more pronounced

on weekends (a difference of 155 hours per day) compared to weekdays (a difference of 124 hours per day). When the wives' relative income increases by one standard deviation, husbands allocate an additional 7 and 39 minutes per day to housework on weekdays and weekends, respectively. Meanwhile, wives reduce their weekday housework by an additional 33 minutes and increase weekend housework by an extra 32 minutes per day. This pattern of responses suggests that an increase in wives' bargaining power does not extend to the weekend. Over the years, wives have reduced the time dedicated to household chores, while husbands have taken on this responsibility, despite an average time difference in housework of over 116 minutes. When examining effects across survey years, particularly in 2019, husbands notably increased the time they spent on household chores in response to the growing share earned by their wives, possibly due to the surge in remote work.

Figure 3.6 illustrates the heterogeneous impacts of relative income on informal caregiving. The left panel demonstrates that, on average, wives dedicate more time to caring for their children and adults in the household relative to husbands, irrespective of husbands' gender norms, the surveyed day, the age of children, household income, and the survey year. The significant time gap between wives and husbands is noticeable in the time allocated to educating children aged 7-18: wives spend 125 minutes per day on educational activities for children aged 7-18, while husbands, in contrast, dedicate 50 minutes per day to this task. Despite the average time gap, a one-standard deviation increases in the wives' share of household income results in an additional 49 and 48 minutes per day dedicated to

caring for children aged 7-18, involving physical care, nursing, discipline, assistance with studies, and reading books.

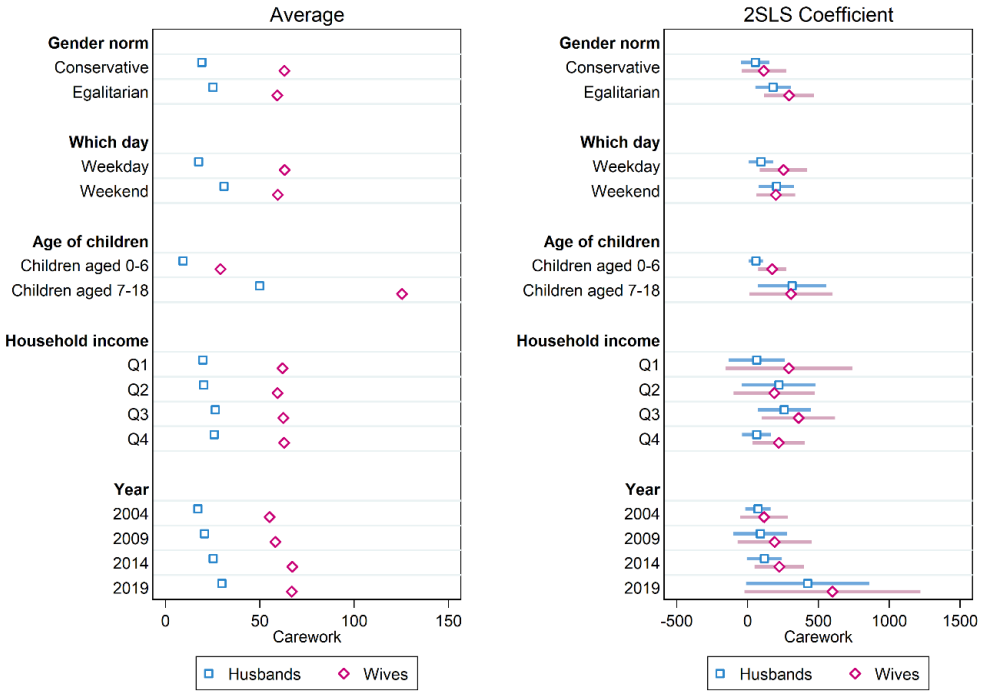

Figure 3.6. Heterogenous Effects of Relative Income on Informal Care Work

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Standard errors clustered at the couple level in parentheses. ***, **, * indicate significance at the 1, 5, and 10 percent levels, respectively.

3.5. Conclusion

This study examines the impact of spousal relative income on time allocation in dual-income households with children. I investigate the effects on wives, husbands, and the time gap between them across various activities—sleeping, personal care, housework, care work, social activities, leisure activities, commuting, and travel—using plausibly exogenous

Bartik-style earnings as instruments for the actual contribution of wives' income to total household income.

My findings offer evidence in favor of both the comparative advantage and bargaining theories when analyzing the impact of wives' relative income on their housework time. As wives' relative income increases, there is a corresponding increase in the time husbands devote to housework, while wives slightly reduce their involvement in the task. In contrast to the patterns observed for housework, the effects on family caregiving exhibits a different trend concerning the relative income of spouses. This result is consistent with the interpretation of gender norms but contradicts traditional household theories. Regardless of the relative productivity or bargaining power of wives, women specialize in caregiving activities by allocating more time per day than husbands do.

Appendix A

Appendix A1. The Impact of Marriage

Marriage and childbirth are once-in-a-lifetime events that significantly impact women's labor market outcomes. It is quite difficult to estimate the independent effect of each of these two major events. An ideal way to estimate the effect of marriage is to analyze the difference in the labor market outcome between married and single women without children. However, the effects of marriage and childbirth are hard to distinguish since the proportion of childless married women is low, and the period between marriage and the first childbirth is relatively short. In the case of South Korea, most married women give birth after marriage. The share of ex-nuptial/ out-of-wedlock births (i.e., the child's parents are not registered as married to each other at the time of birth) was 2.2 percent in 2018, which is the lowest share among OECD countries.[14] The low proportion of children born outside of marriage reflects the high propensity of couples to get married before parenthood.[15] Marriage almost always takes place before the first childbirth and has a considerable impact on women's labor market outcomes before the first childbirth.

We construct the equivalent analysis on estimating the impact of marriage on the labor market trajectories for married women relative to married men. Divorce, separation, and bereavement can affect women's labor market outcomes differently, creating a bias in estimating the true effect of marriage. Thus, we limit our sample to individuals who have

[14] The average rate across the 28 OECD countries is 40.7 percent in 2018.
[15] 'OECD Family Database', OECD, accessed June 29, 2021, www.oecd.org/els/family/database.htm.

not experienced divorce, separation, or bereavement after marriage during the sample period. Figure A1 shows the impacts of marriage on (a) labor force participation, (b) monthly earnings, (c) weekly hours worked, and (d) hourly wage rate separately for married men and women. The first aspect to highlight is that married women's labor trajectories change gradually with marriage, differing from the drastic changes after the first childbirth; in contrast, married men's trajectories do not change. For most of these outcomes, the evolutions for men and women are parallel in the pre-marriage period, but married women's trajectories start diverging and open a huge gap. Importantly, the gaps persist in the long run, perhaps combined with an additional shock from the first child's birth.

Taking the average effects from event time $\tau = 5$ to $\tau = 10$, married women's labor force participation declines by 54.7 percent, and their labor earnings fall by 86.6 percent relative to their male counterparts.[16] The results suggest that the combined negative effects of marriage and children on women's labor market outcomes are higher than the effects of childbirth alone. However, the size of the immediate decline in labor force participation after marriage is much smaller (i.e., 15 percentage points at $\tau = 0$) than the size of the decline after the first childbirth (i.e., 28.2 percentage points at $\tau = 0$).

[16] For example, 82.5 percent of women participate in the labor force a year before the first marriage, but only 36.9 and 42.8 percent of women decide to stay in the labor force at 5 years and 10 years after the first marriage, respectively. On the other hand, 89.1 percent of men participate in the labor market a year before they get married, and 90.6 and 90.8 percent of men remain working at 5 years and 10 years after their first marriage. Men and women earn 204 and 131 ten thousand KRW, respectively, a year before their first marriage. Women earn 67 ten thousand KRW less at 5 and 10 years after the first marriage; however, men earn 38.5 and 71.3 ten thousand KRW more at those times.

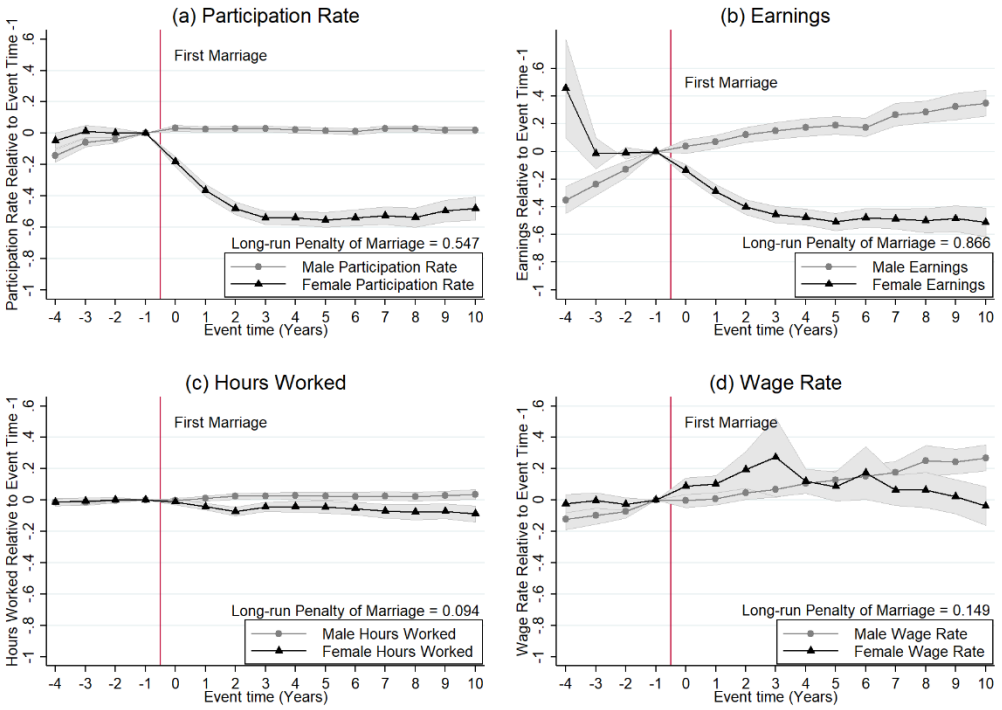

Figure A1.1. The Impact of Marriage on Labor Market Outcomes

Notes: This figure shows the impact of marriage on different labor market outcomes. Event time coefficients are estimated as a percentage of the counterfactual outcome absent marriage for married men and women separately and for different outcomes. Each panel also reports a 'long-run penalty of marriage' (the percentage by which women fall behind men due to marriage). This penalty is calculated as the average value of the penalties from event time 5 to 10. The sample is restricted to those observed at least once before and after marriage. The effects on participation and earnings are estimated unconditionally on employment status, while the effects on hours worked and wage rates are estimated conditionally on employment. The shaded areas represent 90 percent confidence intervals.

Appendix A2. Supplementary Figure and Tables

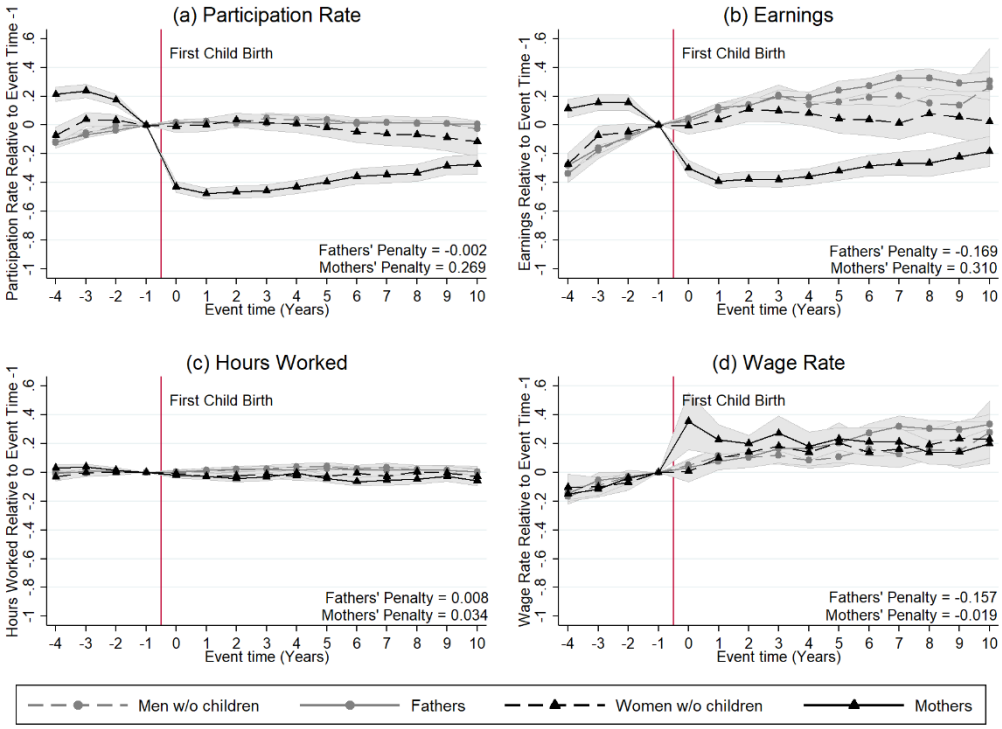

Figure A2.1. Impact of Children in the DID-Event Study

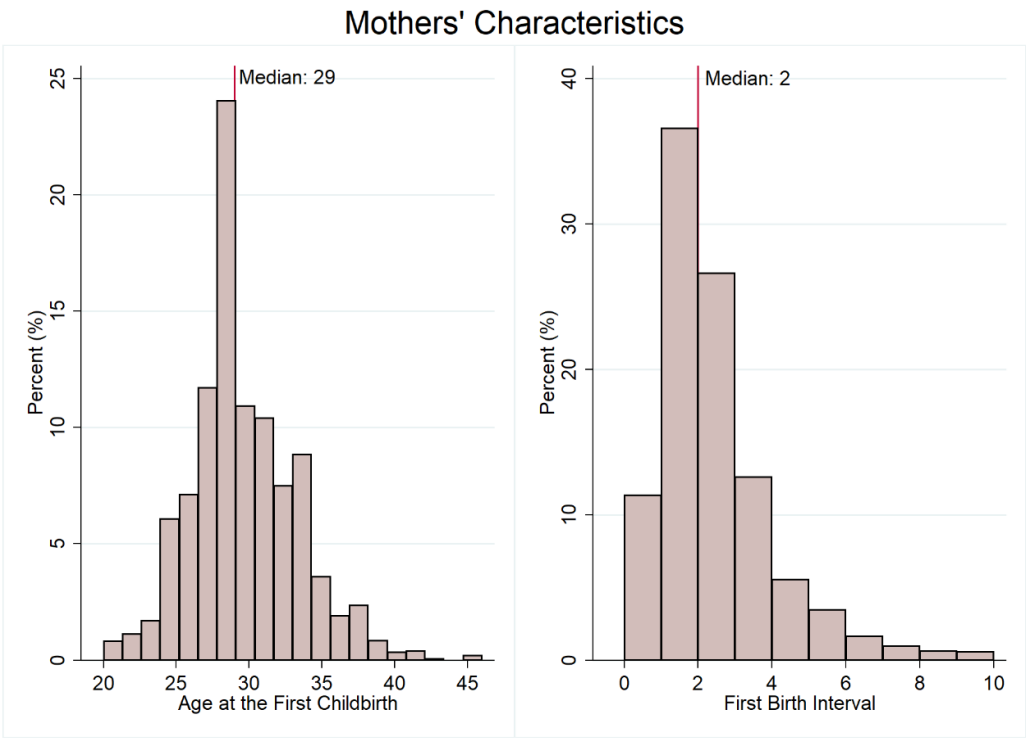

Figure A2.2. Distribution of Mothers' Characteristics

Table A2.1. Top 10 in Male- and Female-dominated Occupations and Industries

	Code	Occupation and Industry Name	Male Ratio
Male-Dominated Occupations	442	Food service-related workers	0.997
	843	Construction and other mobile device operators	0.996
	816	Workers engaged in power production and operation of related devices	0.995
	731	Transport machinery maintenance workers	0.990
	231	Architectural and civil engineering technicians	0.989
	842	Automobile drivers	0.985
	980	Military servicemen	0.980
	712	Workers engaged in building framing and related functions	0.979
	236	Ship and aircraft pilots and technicians	0.978
	912	Building management, security, and related workers	0.976
Female-Dominated Occupations	154	Kindergarten teachers	0.032
	145	Nutrition experts	0.034
	143	Nursing and midwifery specialists	0.038
	271	Social service paraprofessionals	0.038
	411	Service workers engaged in protection and related works	0.038
	241	Medical care paraprofessionals	0.060
	243	Masseur and traditional medical therapists	0.099
	181	Archivists, librarians, and related professionals	0.136
	530	Sales workers engaged in models and public relations works	0.181
	252	Non-regular education quasi-experts	0.183
Male-Dominated Industries	631	Handling of the cargo industry	0.989
	403	Steam and hot water supply industry	0.973
	465	Construction equipment operation industry	0.971
	603	Road freight transport industry	0.963
	461	Professional construction work related to civil engineering facilities and building construction	0.958
	401	Electricity industry	0.953
	27	Primary metal industry (Steel, non-ferrous metal, metal casting)	0.950
	351/352	Ship and boat building/ railway equipment manufacturing industry	0.940
	452	Building construction	0.936
	763	Foreign and defense administration	0.932
Female-	950	Housekeeping service	0.009

Dominated Industries	862	Social welfare industry	0.130
	852	Veterinary service	0.229
	523	Retail of pharmaceuticals, medical devices, and cosmetics	0.230
	801	Educational service: primary institution	0.240
	524	Retail of textiles, apparel, footwear, and leather goods	0.262
	851	Medical industry	0.263
	760	Public and social security administration	0.308
	931/939	Other service industry	0.327
	522	Retail of food, beverage, and tobacco	0.338

Notes: The male ratio is the average ratio of male workers in each occupation and industry from 1998 to 2019. We classify occupations and industries whose male ratio is above 0.6 as male-dominated occupations and industries, whereas those whose male ratio is below 0.4 as female-dominated occupations and industries.

Table A2.2. Summary of Heterogeneous Effects in Motherhood Penalties

	LFP	Earnings
Impacts of children by educational attainment		
Mothers with some college or high school diploma−	0.354	0.794
Mothers with bachelor's degree+	0.279	0.434
Impacts of children by age at the first childbirth		
Before the age of 29	0.447	0.685
After the age of 29	0.297	0.573
Impacts of children by birth spacing		
First birth interval ≤ 2	0.444	0.753
First birth interval > 2	0.255	0.757
Impacts of children by family size		
One-child mothers	0.172	0.485
Two-child mothers	0.362	0.702
Mothers with 3+ children	0.551	0.906

Notes: Child penalties are defined as the percentage by which mothers fall behind fathers due to children. The long-run child penalty is calculated as the average value of the penalties from event time 5 to 10.

Appendix B

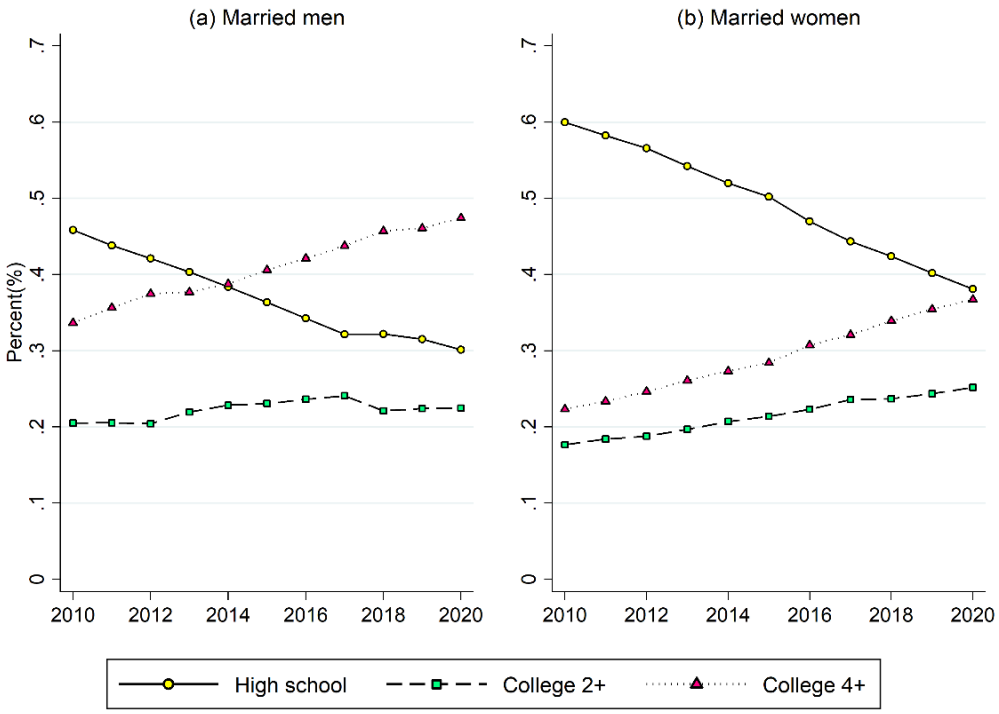

Figure B1. Average Educational Attainment of Married Men and Women

Figure B2. Adjusted Average LFP Rates by Gender and Educational Attainment

Notes: We calculate the probability of labor force participation for each education group while holding other covariates: spousal education, spousal earnings, age, square term of age, whether having children aged under 6 years, whether having children aged between 7 and 18, and location of residence to its average.

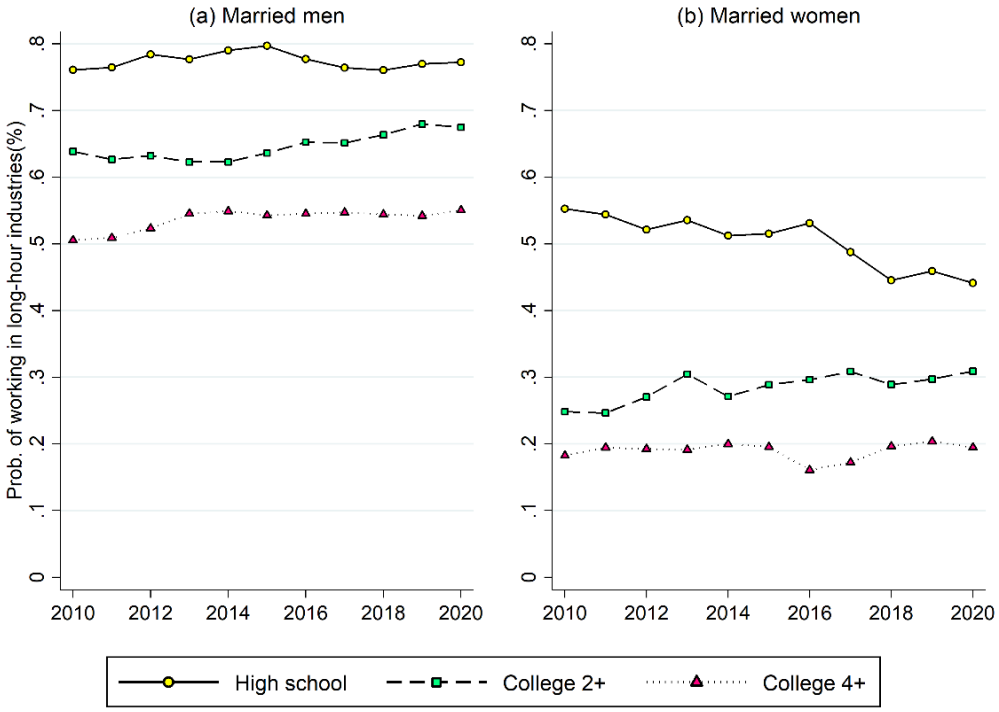

Figure B3. Probability of Working in Long-hour Industries by Educational Attainment

Notes: The sample is restricted to wage and salary workers whose ages vary between 25 and 54. Long-hour industries are defined as industries with longer working hours per week than the average working hours of the total industries over the sample period. For instance, long-hour industries include manufacturing, sales, and transportation. Estimates are adjusted using cross-sectional sampling weights.

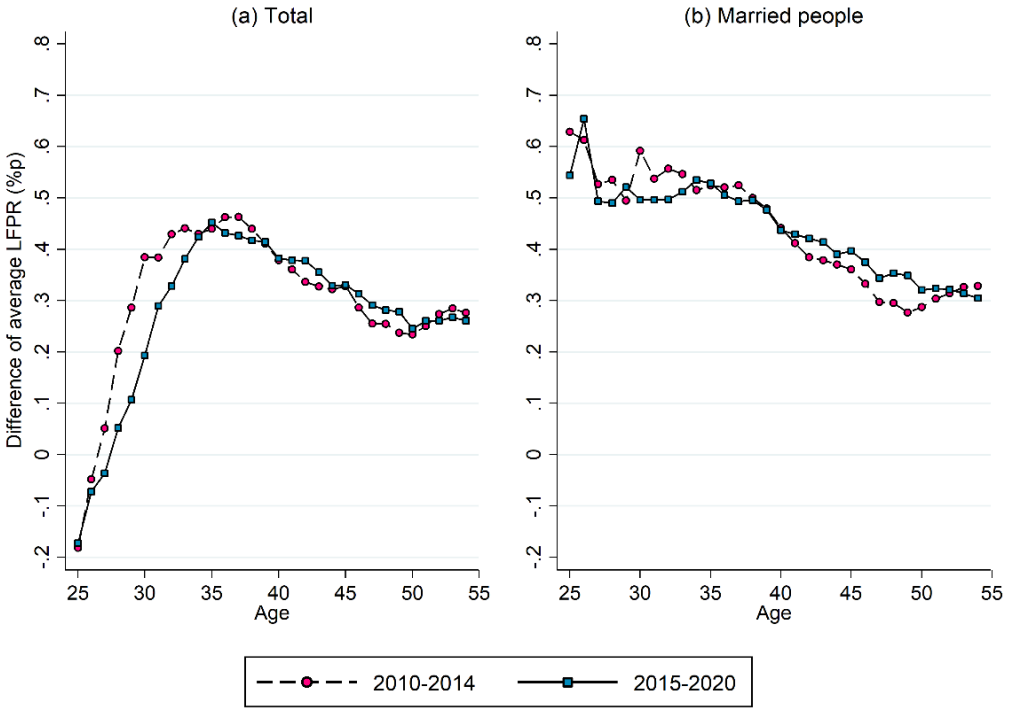

Figure B4. Age-LFP Gender Differential Profile

Note: Gender difference is defined as the average LFPR of men minus the average LFPR of women.

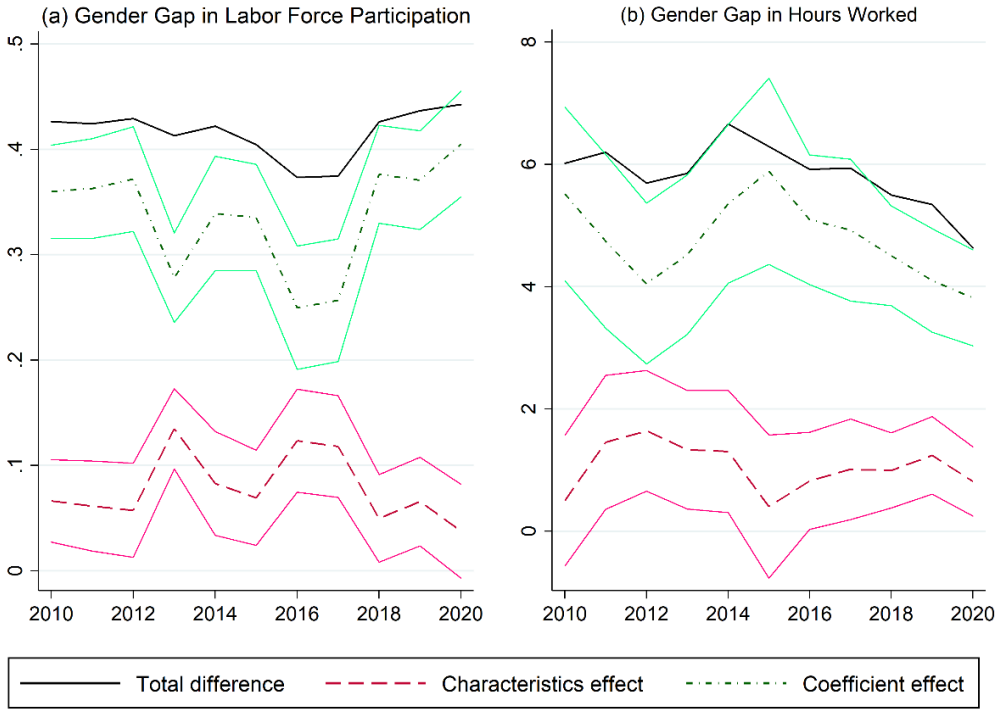

Figure B5. Coefficient Plots of Total Difference, Characteristics Effect, and Coefficients Effect

Note: The green and red solid lines denote 95 percent confidence intervals.

Appendix C

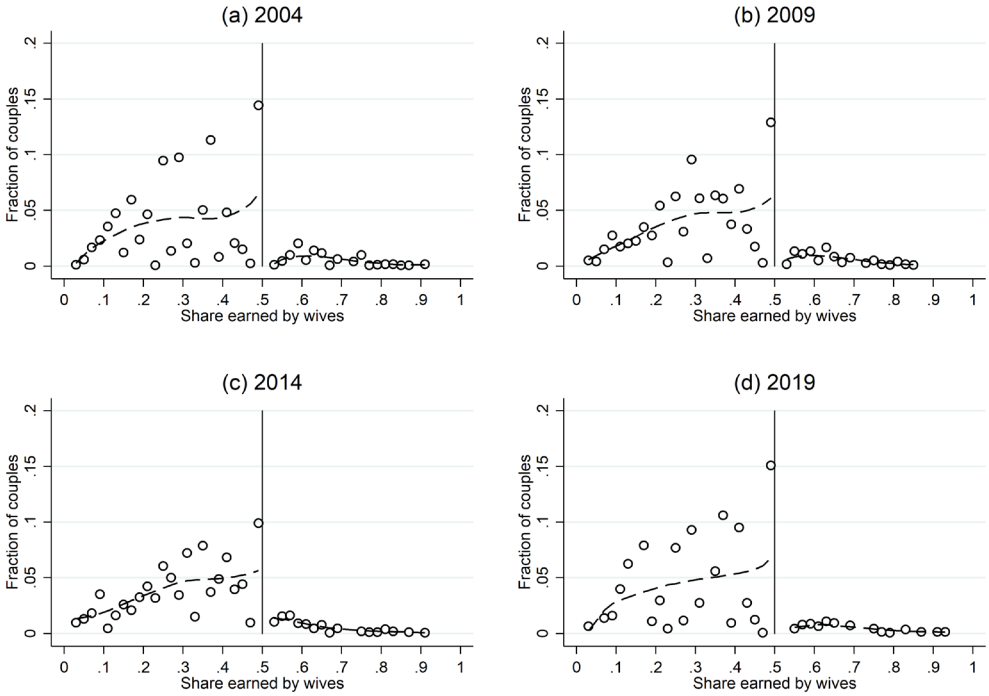

Figure C1. Distribution of Relative Income over Time

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Each dot indicates a fraction of couples in a 2 percent relative income bin; bins are right closed. The dashed line is the lowess smoother applied to the distribution allowing for a break at 0.5.

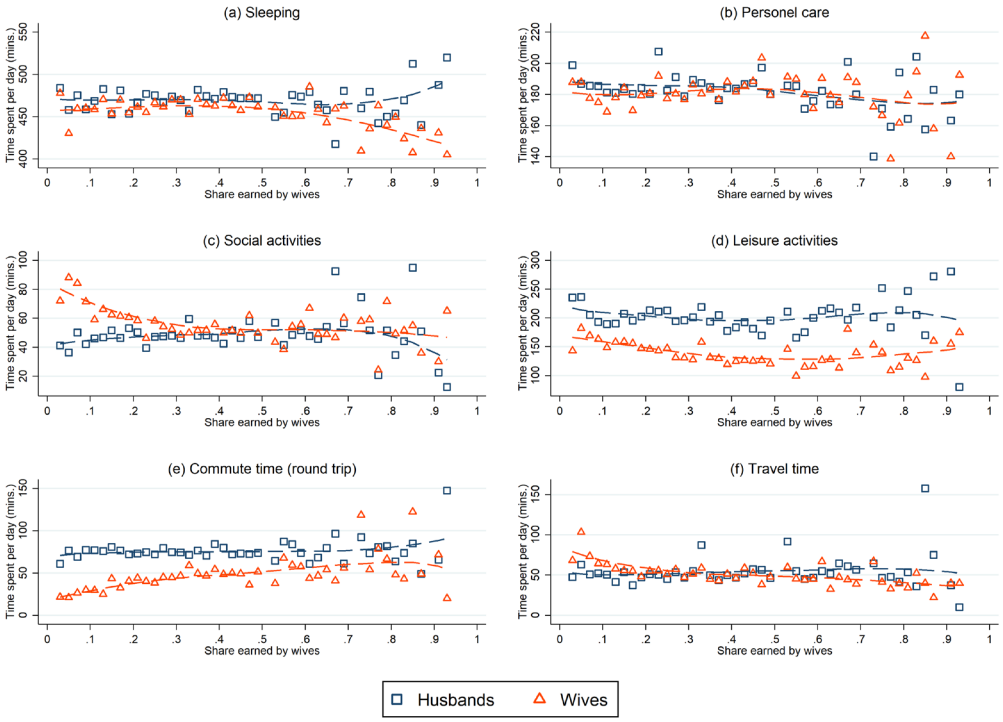

Figure C2. Time-use Patterns by Gender and Relative Income

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Each dot indicates a fraction of couples in a 2 percent relative income bin; bins are right closed. The dashed line is the lowess smoother applied to the distribution allowing for a break at 0.5.

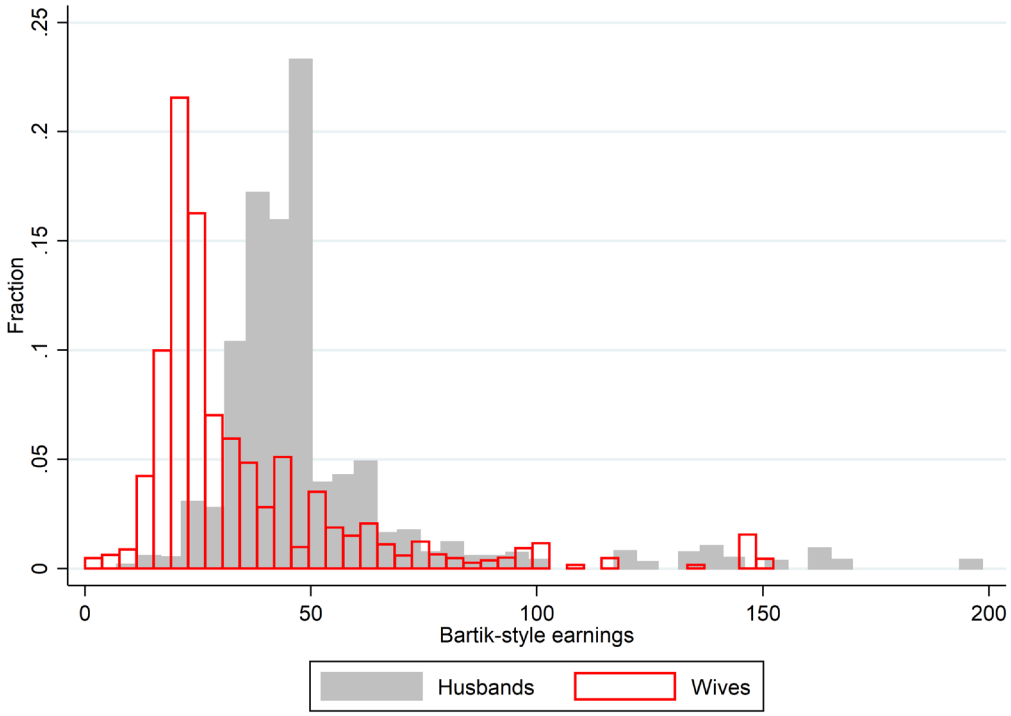

Figure C3. Distribution of Constructed Bartik-style Earnings by Gender

Note: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18.

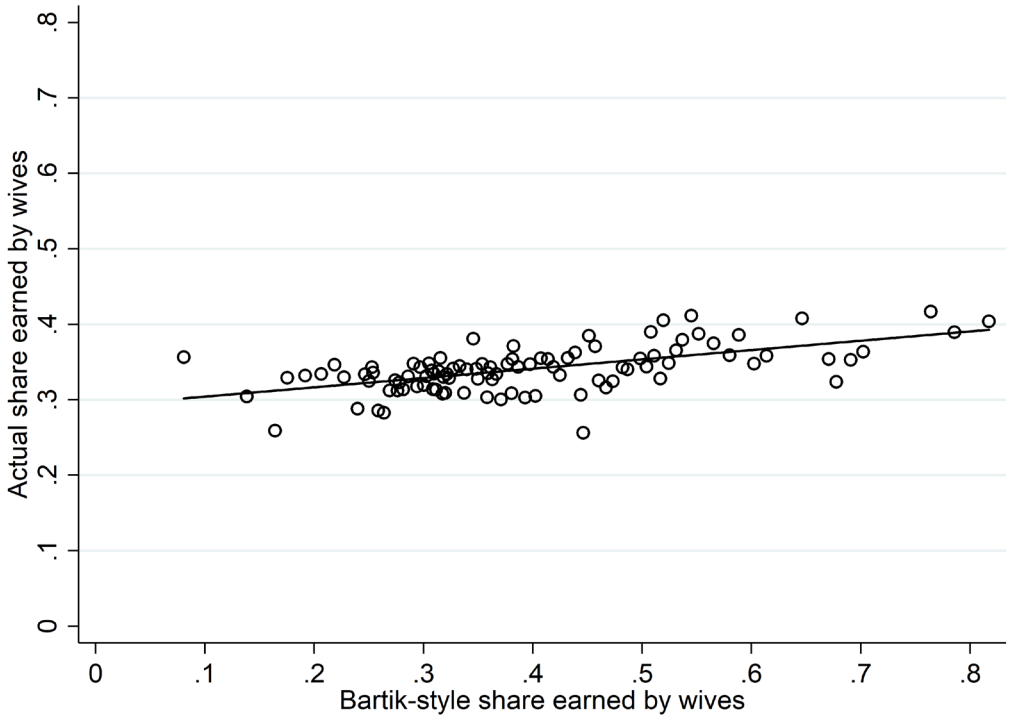

Figure C4. Scatterplot of the Actual and Bartik-style Relative Income

Notes: The sample is restricted to married couples with both partners aged from 25 to 54 years, receiving positive earnings, and raising at least one child aged 0-18. Each dot indicates a fraction of couples in a 2 percent relative income bin; bins are right closed. The dashed line is the lowess smoother applied to the distribution allowing for a break at 0.5.

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국문요약

성별에 따른 노동시장 성과 및 시간 배분 격차 연구

연세대학교

일반대학원 경제학과

김안나

첫 번째 논문에서는 한국에서 첫 출산 직후 남성 대비 여성의 상대적인 노동 시장 성과가 어떻게 변화하는지를 측정하였다. Event-study 방법론을 사용하여 남성은 출산에 큰 영향을 받지 않는 반면, 여성의 소득은 긴 시간에 걸쳐 66.2% 감소하였으며, 이는 대부분 노동시장으로의 참여 감소로 인한 것임을 밝혔다. 또한 출산직후 휴직없이 연속적으로 일하는 여성들에게는 첫아이 출산이 남성중심직종 및 산업에 진입할 확률을 낮추고, 여성중심직종 및 산업에서 종사할 확률을 높여주고 있는 것으로 나타났다. 마지막으로, 첫아이 출산의 모성 페널티는 교육 수준이 낮은 여성, 젊은 여성, 결혼 후 두 해 이내에 첫 자녀를 출산한 여성, 그리고 세 아이 이상을 가진 여성에게 더 강하게 작용하는 것으로 나타났다.

두 번째 논문에서는 한국의 남성과 여성 간 노동공급격차를 Oaxaca-Blinder 분해 분석 방법을 활용하여 교육 및 배우자 소득의 역할을 중점을 두고 분석하였다. 기혼남성-기혼여성 간 교육 수준의 차이는 노동시장참여 격차를 증가시키지만, 한국 여성들의 교육 수준이 증가함에 따라 부정적인 효과는 감소하고 있다. 또한 성별

노동공급격차를 설명하는 중요한 변수로 배우자의 소득이 있음을 확인했다. 이는 기혼남녀 간의 소득이 동일해질수록 노동 공급에서의 성별 격차를 줄일 수 있음을 시사한다. 마지막으로 앞선 선행연구들과 일관되게 성별 노동공급격차의 상당 부분이 관측 가능한 인적자본 및 일자리 특성만으로는 설명되지 않음을 보여준다.

세 번째 논문에서는 18 세 미만 자녀가 있는 맞벌이가구인 경우 배우자의 상대적 소득이 부부의 수면, 개인유지, 가정관리, 가족 돌보기, 참여활동, 여가활동, 이동, 통근 시간 분배에 미치는 영향을 분석하였다. 이 분석은 생활시간조사와 한국노동패널조사 2004 년, 2009 년, 2014 년 및 2019 년의 매칭 데이터를 활용하여 부부 간 상대적 소득의 외생적 Bartik-style 도구변수를 사용하였다. 이 값은 각 지역의 산업 고용 변동과 해당 지역을 제외한 다른 지역 전체에서 각 산업의 소득 증가를 곱하여 정의했다. 주요결과로는 총 가구소득 중에 아내가 차지하는 비중이 1 표준 편차만큼 증가할 때, 남편과 아내가 가사 일에 투입하는 시간 차이는 하루에 24 분씩 감소한다는 것으로 나타났다. 더불어 아내의 소득이 앞과 동일한만큼 증가함에 따라 남편과 아내 모두 육아를 포함한 가족 돌봄에 더 많은 시간을 할당함을 확인하였다.

핵심어: 첫아이 출산, 성별격차, 모성 페널티, 직종 분리, 노동시장참여, 근로시간, 노동공급, 선형 및 비선형 Oaxaca-Blinder 분해방법, 시간 사용, 가사 노동, 배우자의 상대적 소득, 성별 역할