*Kyeongah Lee**

The gender wage gap: evidence from South Korea

Abstract

Using microdata between 1998 and 2020, this study provides potential explanations for the gender wage gap in South Korea, which continues to be the largest among Organisation for Economic Co-operation and Development (OECD) countries. Although improvement in females' relative measured labor market characteristics plays an important role in the reduction of the gender wage gap, these characteristics cannot explain a large part of the gap, and wage convergence between full-time male and female workers has slowed over the period. Indeed, the unexplained gender wage gap has become larger than the explained gender wage gap. This is confirmed when a decomposition of the gender wage gap is performed across the wage distribution. This study provides evidence of the existence of a glass ceiling. In addition, this study shows that, in South Korea, where conservative gender-related norms still persist, the effects of marriage and childbirth can help to account for a dramatic increase in the gender wage gap for female workers in their 30s and 40s.

Current version: September 06, 2022
Keywords: unexplained gender wage gap, glass ceiling, impacts of marriage and children
JEL-codes: J31, J22, J16, D63
Corresponding author: Kyeongah Lee
kyeongah.lee@stonybrook.edu

Stony Brook University

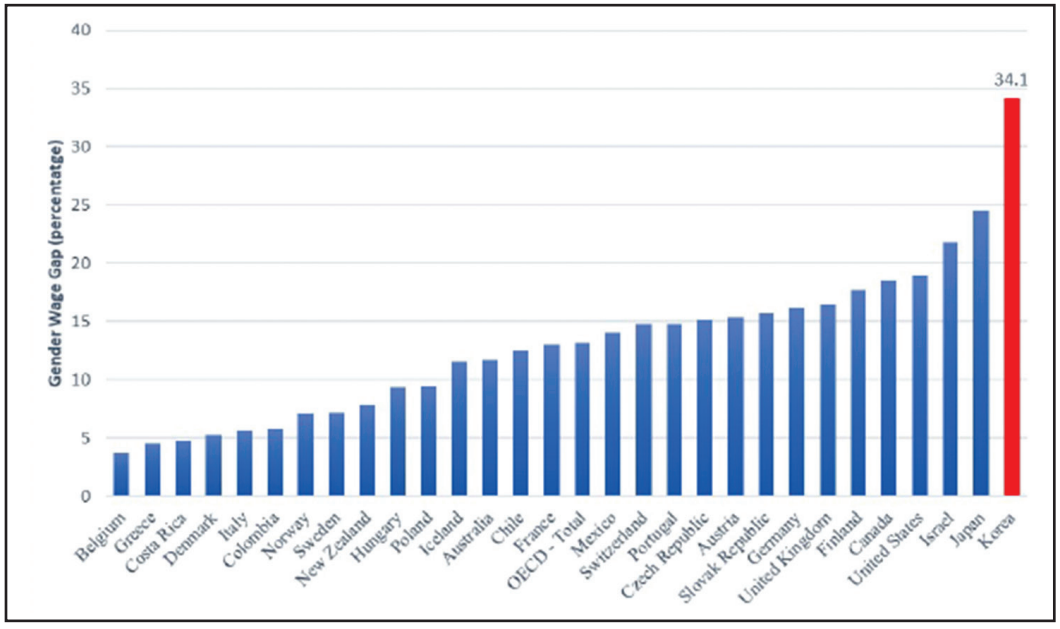
© The Author(s). 2022 Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.
Cite as: Lee. *IZA Journal of Labor Economics* (2022) 11:05.
https://doi.org/10.2478/izajole-2022-0005

1 Introduction

Almost all labor markets in developed countries have experienced a convergence of wages between male and female workers over the past few decades, due to a notable improvement in females' labor market characteristics. Although the wage gap between males and females has narrowed, the trend has slowed in recent years. A vast quantity of research on gender wage gaps has focused not only on why the gaps still exist but also on why the gaps have slowly decreased over the past several decades, particularly in the United States and in European countries (e.g., Blau and Kahn, 2006, 2017; Goldin, 2014; Card et al., 2016; Bruns, 2019). However, little research in this area has been conducted in Asian countries. Figure 1 displays the gender wage gaps for full-time workers in Organisation for Economic Co-operation and Development (OECD) countries in 2018. South Korea ranked first in the wage gap between male and female workers, with the female median wage being 34.1% below the male median wage in South Korea. In comparison, the female median wage in Japan is 24.5% below the male median wage, while the OECD average is 13.2%.

This paper is one of only a very few to discuss the gender wage gap in South Korea, which for decades has recorded the largest gap among OECD countries. South Korea has experienced the largest economic transformations since the 1960s, when it was among the world's poorest countries, from an agricultural economy to one characterized by substantial industrialization. South Korea has achieved economic growth in an unprecedentedly short period of time.[1] During its period of rapid economic growth, traditional gender norms influenced by Confucianism have persisted, and its male-dominated structure in the Korean labor market

Figure 1 Gender Wage Gap in OECD Countries, 2018.



Source: OECD Database.

Notes: This figure shows the 2018 or latest gender wage gaps in OECD countries. The gender wage gap is defined as the difference between median earnings of full-time male and female workers. OECD, Organisation for Economic Co-operation and Development.

1 South Korea ranks 10th in the world in terms of gross domestic product (GDP) (*Source*: World Economic Outlook [October 2020], International Monetary Fund [IMF]).

remains unchanged. According to the World Value Survey Wave 7 (2017–2020), which provides data about gender norms across countries, the traditional gender roles, which state that males are primary earners and females are responsible for housework and childcare, persist in South Korea. These data include responses to gender-related questions across countries. For example, to the statement "When jobs are scarce, men should have more right to a job than women.", 45.9% of South Koreas agreed, while this figure was 18.8% in Japan, 7.3% in Germany, and 5.2% in the US.[2] An increase in females' entry into the labor market, where traditional gender norms remain, has resulted in greater gender inequality than in other developed countries. Compared to Japan, which has a similar Confucian cultural tradition, South Korea has a large wage gap between large firms and small and medium-sized firms.[3] In the process of rapid economic growth and overcoming the 1997 Asian financial crisis, the South Korean industrial structure centered on large companies has been strengthened, and the wage gap between large companies and small and medium-sized firms has widened. Against an economic background where rapid economic growth and slow-moving traditional gender norms coexist, South Korea makes an extremely interesting case for the study of important factors responsible for the gender wage gap.

This paper's main goal is to suggest potential explanations for the large gender wage gap in South Korea using the Korean Labor and Income Panel Survey (KLIPS) between 1998 and 2020. To examine the phenomenon, I use Oaxaca–Blinder decomposition analysis to decompose the wages for full-time male and female workers into explained components and unexplained components. I explore the unexplained gender wage gap that constitutes a large share of the gender wage gap in South Korea, focusing in particular on glass ceiling effects and the impact of marriage and children as potential sources of the gap. I explore the glass ceiling effects by decomposing the gender wage gap into explained and unexplained components at each percentile of the wage distribution, following the methodology of Chernozhukov et al. (2013). Finally, I provide evidence of the negative effects of marriage and the presence of children on females' labor market outcomes. Furthermore, I use an event study, which has the advantage of describing the dynamic path of the effect of the event on labor market outcomes, to examine the impact of marriage or first child birth on wages, hours of work, and labor supply.

The main finding of this study is that the unexplained gender wage gap plays an important role in accounting for the total gender wage gap in South Korea. This is confirmed when a decomposition of the gap is performed across the wage distribution. It was found that, in 2020, the unexplained wage gaps at the upper end of the wage distribution are larger than those at the bottom and the middle. This suggests the possibility of the glass ceiling effect in high-level jobs. In addition, the magnitude of the unexplained gender wage gap over the wage distribution was higher than that of the explained gender wage gap in South Korea. This indicates that the unexplained factors contributed more to female workers' wages, regardless of their positions in the labor market. This may result from stereotypical gender norms in South Korea. Such gender norms may affect female labor participation and wages in the labor market, and this may lead to the large unexplained gap over the wage distribution. Lastly, I find that dramatic increases in

2 Possible answers are: (1) agree strongly, (2) agree, (3) neither agree nor disagree, (4) disagree, (5) disagree strongly, (6) don't know, and (7) no answer.

3 The wage gap between large firms and small and medium-sized firms in South Korea has been widening, while the gap in Japan narrowed between 2012 and 2017 (*Source*: Comparative analysis of the wage gap between small, medium-sized, and large firms/enterprises in South Korea and Japan (2019)).

the gender wage gap for females in their 30s and 40s can be associated with marriage and childbirth. It suggested that, on average, and unlike males, females experience significant decreases in their wages, hours of work, and labor supply if they are married or have children. The event study on birth of the first child yielded evidence that the females' monthly wages decreased, while males' wages increased. The monthly path between full-time male and female workers who have a child further diverges; the child penalty 10 years after first child birth is 33.4%. Comparing the effects of marriage and childbirth with those from previous studies (e.g., Juhn and McCue, 2016, 2017; Albrecht et al., 2018; Kleven et al., 2019), the magnitudes of the negative effects on the wages of female full-time workers in South Korea are large. Such large and negative effects of marriage and childbirth can explain why South Korea has a relatively large gender wage gap and a slow convergence of the gap compared to other developed countries.

My paper contributes to the literature in several ways. First, my study adds to the literature on gender wage gaps by providing potential explanations for the gender wage gap in South Korea, which, although it has been the largest among OECD countries, has hardly been discussed. Much of the literature has focused on the gender wage gaps in the United States and in European countries, such as studies by Blau and Kahn (2006, 2017), Goldin and Katz (2016), and Card et al. (2016). While there are a number of studies on gender wage gaps in China (e.g., Gustafsson and Li, 2000; Dong and Zhang, 2009; Lee and Wie, 2017), these have focused on how Chinese economic reform widened the gender wage gaps in urban China or examined the gender wage gap in the Chinese manufacturing industry. Compared to China, South Korea has a different social and economic system and is in a different stage of economic development. Using the decomposition approach, I examine the context of South Korea to determine the important factors accounting for the gender wage gaps. I thus offer a unique analysis of the situation in South Korea, which has experienced rapid economic growth but retains traditional gender norms.

Second, my paper continues the research on gender inequality in South Korea by discussing the unexplained gender wage gap, which cannot be accounted for by measurable labor market characteristics. For South Korea, the relevant literature has focused mainly on the relationship between female labor force participation and fertility (Hwang et al., 2018) or measured labor market characteristics such as education and work experience. Specifically, my paper focuses on the glass ceiling effect and the sticky floor effect to explain the gender difference in the unexplained wage gap in South Korea.[4] Albrecht et al. (2003) found that the wage gap at the upper end of the wage distribution increased sharply in Sweden in the 1990s. Arulampalam et al. (2007) analyzed the glass ceiling effect in European countries between 1995 and 2001. They similarly demonstrated that the wage gap widened at the top of the wage distribution, for example in Austria, Belgium, and Denmark. Christofides et al. (2013) also confirmed glass ceiling effects in some European countries (e.g., Finland, Italy, and Denmark) in 2007 as the unexplained component. I add to the literature by presenting a case in South Korea with the glass ceiling and sticky floor effects.

Lastly, my paper adds to the literature on the effects of marriage and childbirth on labor market outcomes (e.g., Bertrand et al., 2010; Adda et al., 2017; Lundborg et al., 2017;

4 The glass ceiling effect is defined as the unexplained gender wage gap that increases significantly at the top of the wage distribution. The sticky floor effect is defined as the significant increase in the unexplained gender wage gap at the bottom of the wage distribution.

Albrecht et al., 2018; Kleven et al., 2019). Akerlof and Kranton (2000) and Bertrand et al. (2015) showed that gender identity affects the economic behavior of individuals in the labor market, such as female labor force participation and occupational choice. Gender norms can influence males' preference toward their wives' participation in the labor market and females' own labor force participation. Hwang et al. (2019) found that parental gender norms affect housework time allocation among married couples who work in South Korea because parental gender norms can influence children's preferences for housework. In South Korea, the husband whose parents have conservative gender norms strongly prefers that his wife spends time on housework. My paper suggests that slow-moving traditional gender norms could be an important factor in lowering female labor force participation and in increasing the gender wage gap after marriage and the birth of a child in South Korea. My study demonstrates the negative effects of marriage and the presence of children on the labor market outcomes of full-time female workers relative to males to explain the dramatic increase in the gender wage gap for female workers in their 30s and 40s. The event study approach shows that the magnitude of the negative effects of childbirth on female workers in South Korea in terms of wages is significantly larger than that found in previous studies of developed countries with less gender-conservative views, such as Sweden and Denmark (e.g., Albrecht et al., 2018; Kleven et al., 2019).

The rest of the paper is structured as follows. Section 2 explains labor market institutions in South Korea. Section 3 describes the data sources and discusses some features of the Korean labor market. Section 4 presents the decomposition of gender wage gaps and examines the unexplained wage gap components. Finally, Section 5 concludes the research.

2 Labor Market Institutions in South Korea

In this section, I provide a brief outline of labor market institutions in South Korea. The minimum wage policy was implemented for manufacturing firms with more than 10 workers only in 1988, but was extended to all workers, regardless of establishment size and industry, from 2000 onward. In 2000, the minimum wage was 24% of the mean wage of a full-time worker. This was lower than in other OECD countries (e.g., Belgium [43%], France [50%], US [29%]).[5] The Korean government has continually increased the minimum wage since the policy was first implemented. In 2020, the minimum wage had risen to 50% of the mean wage of a full-time worker, which was relatively high among OECD countries. In South Korea, female workers are more concentrated than male workers in low-wage jobs. Increases in the minimum wage could reduce the gender wage gap at the bottom of the wage distribution over the period.

Second, South Korea's seniority-based wage system also affects the gender wage gap. In this system, a worker's experience and tenure in the labor market are the main factors used to determine his or her wage level. The longer workers stay on in the labor market, the greater are their opportunities to receive higher wages and obtain promotions. Female workers have relatively shorter work experience and tenures than males, largely because they tend to give up work upon marriage or after giving birth. Since the 2000s, Korean firms have also determined wages according to a worker's performance in the current workplace, although firms still use

5 *Source*: OECD.*Stat*.

the seniority-based system to determine a worker's basic salary. Thus, work experience and length of tenure have an impact on the gender wage gap in South Korea.

Lastly, employment status may cause the wages of male and female workers to diverge. Workers in South Korea are categorized as either regular workers or irregular workers. When South Korea recovered from the 1997 Asian financial crisis, firms performed structural adjustments and made the labor market more flexible. As a result, the number of irregular workers increased significantly, and female workers especially were over-represented in this category.[6] Irregular workers are usually employed on short-term contracts, whereas regular workers have guaranteed employment under permanent contracts. This has inevitably had an impact on work experience and tenure. Irregular workers earn less than regular workers and do not enjoy the full benefits guaranteed by Korea's labor laws, such as unemployment insurance, health insurance, occupational hazard insurance, and a national pension. The Equal Employment Opportunity and Work–Family Balance Assistance Act (Article 8) stipulates equal pay for equal work. Employers establish the standards for equal-value work based on the requisite skills, responsibilities, and working conditions. However, as there is a lack of concreteness in these standards, the gender difference in employment status is one of the factors accounting for wage gaps.

3 Data and Descriptive Overview

3.1 Data

My analysis is based on the KLIPS, conducted each year by the Korea Labor Institute from 1998 to 2020. It consists of the household dataset from the household questionnaire and the individual dataset from individual questionnaires. The initial data comprises labor activities and outcomes among 5,000 urban households and all households' members aged ≥15.[7] The sample retention rate was 87.6% in 1999, 80.8% in 2000, and 77.3% in 2001. This rate fell annually by about 1% to 64.2% in 2020. To solve the attrition issue and to maintain the national representativeness of the sample, the KLIPS added 1,415 households in 2009 and 5,044 households in 2018.[8] The individual dataset provides the respondent's general demographic information, as well as other data, such as labor force participation, wages, and marital status. The variables for marital status are categorized into married, never married, separated, divorced, or widowed. I allocate married status if the report classifies the respondent as married, and single status if classified otherwise. Information about the birth years of biological children is based on the household dataset because it updates the birth year of the household members every year. I can link the birth information from the household dataset to the individual dataset using household ID and personal ID, enabling me to track parents' childbirth information, their wages, and labor supply.

The goal of this paper is to provide explanations for the gender wage gap in South Korea from 1998 to 2020. I restrict my sample to full-time workers between the ages of 20 and 59 and

6 In 2020, the ratio of irregular male workers to total male workers was 29.4%, and the ratio of irregular female workers to total female workers was 45.0% (*Source*: Korean Statistical Information Service [KOSIS]).

7 The share of the population living in urban areas was 87.5% and 91.8% in 1998 and 2020, respectively (*Source*: Ministry of Land, Infrastructure and Transport in South Korea). Most Koreans reside in urban areas.

8 5,000 households and 13,319 individuals responded to the survey in 1998 and 11,669 households and 22,964 individuals responded to the survey in 2020 (*Source*: KLIPS 1-23rd Wave User's Guide).

those who are nonfarm, nonmilitary, wage, and salaried workers.[9] Using the KLIPS, I estimate the gender wage gap by decomposing male and female wages into explained and unexplained components and examine the impact of marriage and childbirth on the gender wage gap.

Table 1 presents descriptive statistics for full-time workers by gender and year. From the table, the average age, as a proxy for work experience, has increased for both full-time male and female workers. Among full-time female workers, the average age was about 33.6 years in 1998 and about 6.8 years higher in 2020. There was a less dramatic increase among full-time male workers. The gender gap in the average age has decreased from about 3.0 years to 1.7 years. In the case of having obtained a bachelor's or advanced degree, while male workers were more likely than female

Table 1 Descriptive statistics

Korean Labor and Income Panel Study				
	1998		2020	
	Male	Female	Male	Female
Age	36.52	33.56	42.06	40.39
	(8.73)	(10.03)	(10.65)	(11.40)
Education				
Bachelor's degree	0.24	0.16	0.40	0.34
	(0.43)	(0.37)	(0.49)	(0.48)
Advanced degree	0.04	0.01	0.06	0.05
	(0.21)	(0.11)	(0.23)	(0.21)
Hours worked per month	225.70	214.15	184.23	177.58
	(55.39)	(56.56)	(33.74)	(25.61)
Tenure	6.41	4.14	9.09	7.16
	(6.64)	(5.01)	(8.66)	(6.86)
Union	0.63	0.59	0.13	0.11
	(0.48)	(0.49)	(0.34)	(0.31)
Professional job	0.12	0.18	0.21	0.24
	(0.33)	(0.38)	(0.40)	(0.43)
Married	0.75	0.52	0.56	0.50
	(0.44)	(0.50)	(0.50)	(0.50)
Children	0.72	0.55	0.54	0.55
	(0.45)	(0.50)	(0.50)	(0.50)
Log real monthly wages	7.43	6.97	7.99	7.68
	(0.46)	(0.48)	(0.45)	(0.37)
No. of observations	1,559	874	2,036	1,354

Notes: Data are from the KLIPS in 1998 and 2020. The sample is restricted to full-time workers between the ages of 20 and 59 and those who are nonfarm, nonmilitary, wage, and salaried workers. Advanced degree includes master's and doctorate degrees. Professional jobs include science professionals, computer-related professionals, engineering science professionals, health and medical professionals, teaching professionals, administration, business and finance professionals, legal, social welfare, and religion professionals, and culture, arts, and broadcasting professionals in the 5th Korean Standard Classification of Occupations (KSCO). Monthly wages are adjusted to prices in 2015. Standard deviations are in parentheses.

9 The sample excludes the following industries: agriculture and forestry (KSIC 01-02), fishing (KSIC 05), public administration and defense (KSIC 76), activities of household as employers (KSIC 95), and activities of extraterritorial organizations and bodies (KSIC 99) in the 8th Korean Standard Industrial Classification (KSIC).

workers to have a bachelor's or advanced degree in 1998 and 2020, female workers have narrowed the gender gap in having obtained a bachelor's or advanced degree over the time. The improvement in females' incidence of having obtained an advanced degree is much more pronounced. The gender gap for the advanced degree has decreased from 3 percentage points to 1 percentage point. The average working hours per month for both male and female workers decreased in 1998 and 2020. The average hours worked per month for male workers fell by approximately 41.5 h and those for female workers decreased by approximately 36.57 h over the period. The gender difference in working hours decreased from about 11.6 h to about 6.7 h. Regarding tenure at the current workplace, the average tenure for both full-time male and female workers increased, being about 2.7 years higher for male workers and about 3 years higher for female workers over the period. In 1998, full-time male workers stayed longer than full-time female workers in one workplace by about 2.3 years. By 2020, the gender gap for tenure had decreased slightly to about 1.9 years. The union coverage rate for full-time male and female workers declined significantly over this time. Among full-time male workers, the union coverage rate was approximately 0.63 in 1998, and was 0.5 lower in 2020. There was a similar decrease among full-time female workers. The gender gap in the union coverage rate decreased during the period. The gender difference in the union coverage rate fell from 0.04 in 1998 to 0.02 in 2020. As for the incidence of professional jobs, females were more likely than males to have a professional job over the period.[10] The improvement in female representation in professional jobs reflects these occupational gains. The number of females in professional jobs increased from 18% in 1998 to 24% in 2020. The gender difference in professional jobs has declined over time.

In the case of marital status and having children, full-time male workers were more likely than female workers to be married or have children over the period. For example, in the KLIPS, while 75% of full-time male workers were married and 72% had children, 52% of full-time female workers were married and 55% had children in 1998. This reflects the low labor participation of married females and females with children. Over the time, the marriage age increased and the total fertility rate decreased in South Korea. The proportion of married males and the proportion of males with children among full-time male workers narrowed significantly over time.

The average real monthly wage for males and females increased over the period.[11] The monthly wage was higher for full-time male workers than for full-time female workers. The log real monthly wage for female workers was about 6.97 in 1998 and was 0.71 log points higher in 2020. There was a smaller increase among male workers. The gender difference in monthly wages decreased from 0.46 log points to 0.31 log points over the period. In South Korea, full-time female workers have improved their labor market characteristics, and the monthly wage gap between full-time male and female workers decreased over the period.

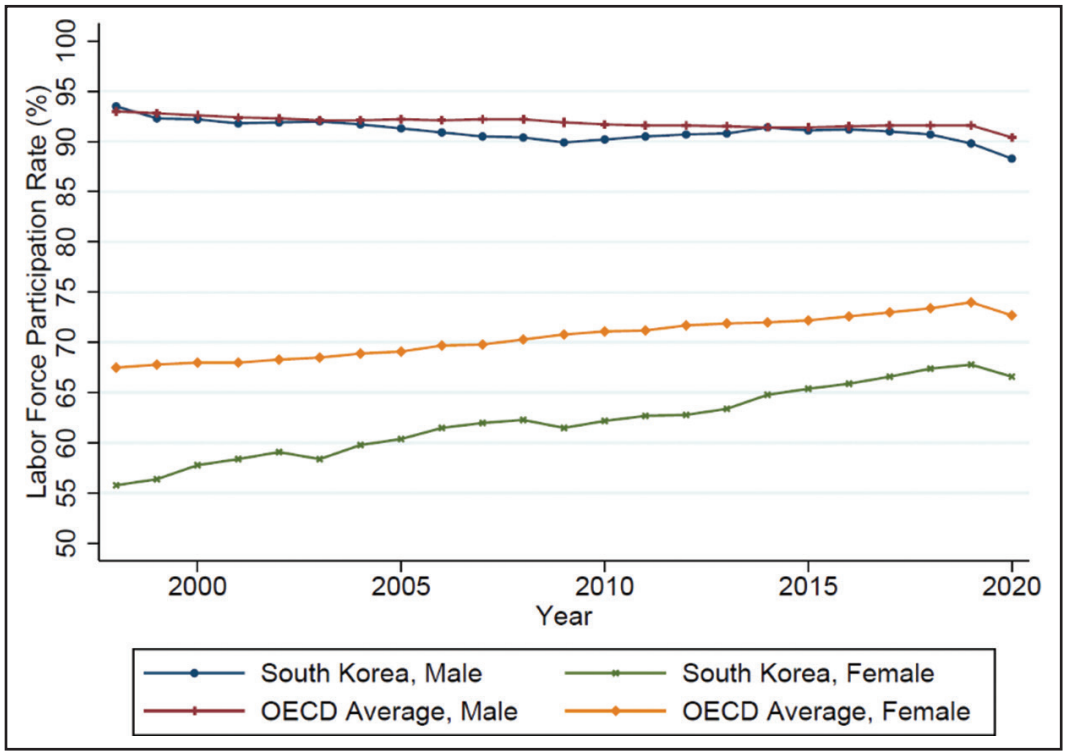
3.2 **Overview of gender gap trends in the labor market**

Figure 2 compares trends in the labor force participation rate for male and female workers from 1998 to 2020 in South Korea and includes the OECD average. The male labor

10 Professional jobs include science professionals, computer-related professionals, engineering science professionals, health and medical professionals, teaching professionals, administration, business and finance professionals, legal, social welfare and religion professionals, and culture, arts, and broadcasting professionals in the 5th KSCO.

11 There is no top coding in the KLIPS.

Figure 2 Labor Force Participation Rate (%).



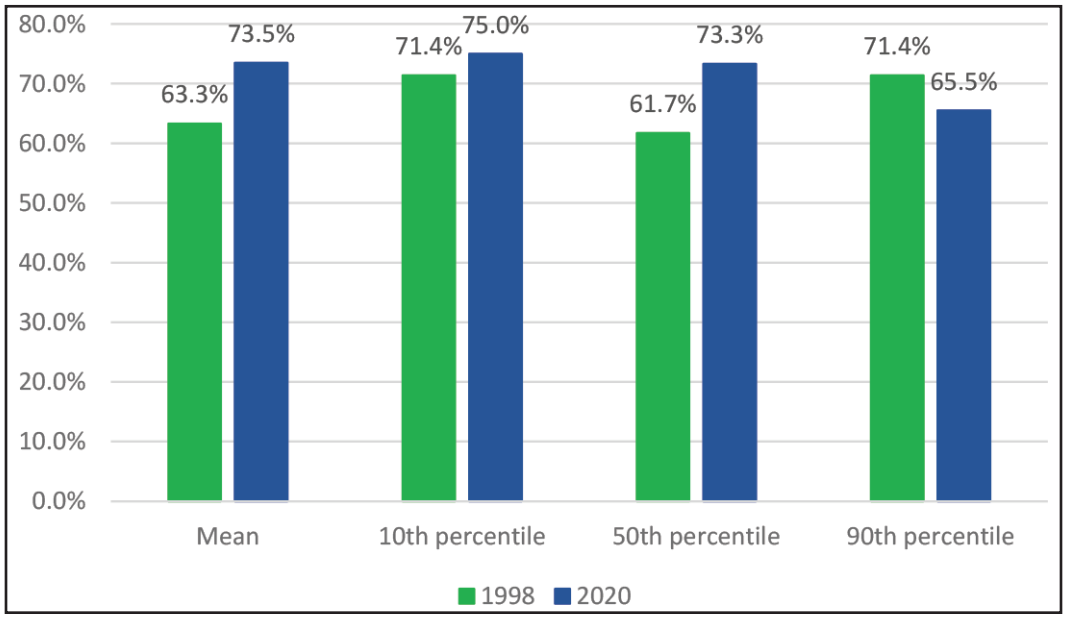
Source: OECD.*Stat*.

Notes: Sample includes male and female workers aged 25–54 from 1998 to 2020. OECD, Organisation for Economic Co-operation and Development.

force participation rate decreased from about 94% to about 88%, while the female rate rose from about 56% to 67% over the period in South Korea. Despite this increase in the female labor force participation rate, the gender gap in the participation rates is still large: about 21 percentage points in 2020. The labor force participation rate for the OECD average male workers was 93% in 1998 and about 90% in 2020, while the same rate for female workers was about 68% in 1998 and about 73% in 2020. The gender gap in labor force participation rate narrowed from about 25 percentage points in 1998 to about 17 percentage points in 2020. While the level of the male labor force participation rate in South Korea is similar to the OECD average, the level of the female labor force participation rate in South Korea is lower than the OECD average. The difference in the female labor force participation rate between South Korea and the OECD average fell from about 12 percentage points in 1998 to about 6 percentage points in 2020.

Figure 3 shows the female/male monthly wage ratio at the mean, 10th, 50th, and 90th percentiles for 1998 and 2020. Each value takes the exponential of the unconditional gender log wage gap at the mean, 10th, 50th, and 90th percentiles and obtains the female/male monthly wage ratio. For example, at the 10th percentile, this indicates a monthly wage gap between the male's wage at the 10th percentile over the male wage distribution and the female's wage at the 10th percentile over the female wage distribution. The female/male wage ratios at the mean, bottom, and middle of the wage distribution increased gradually over the period. For instance, the bottom of the wage distribution experienced a rise, with the ratio increasing from 71.4% to 75.0%. Females' relative monthly wage at the middle of the wage distribution was 61.7% in 1998 and 73.3% in 2020. Compared to the female/male wage ratio at the bottom and middle of

Figure 3 Female/Male Log Monthly Wage Ratios, Full-Time Workers.



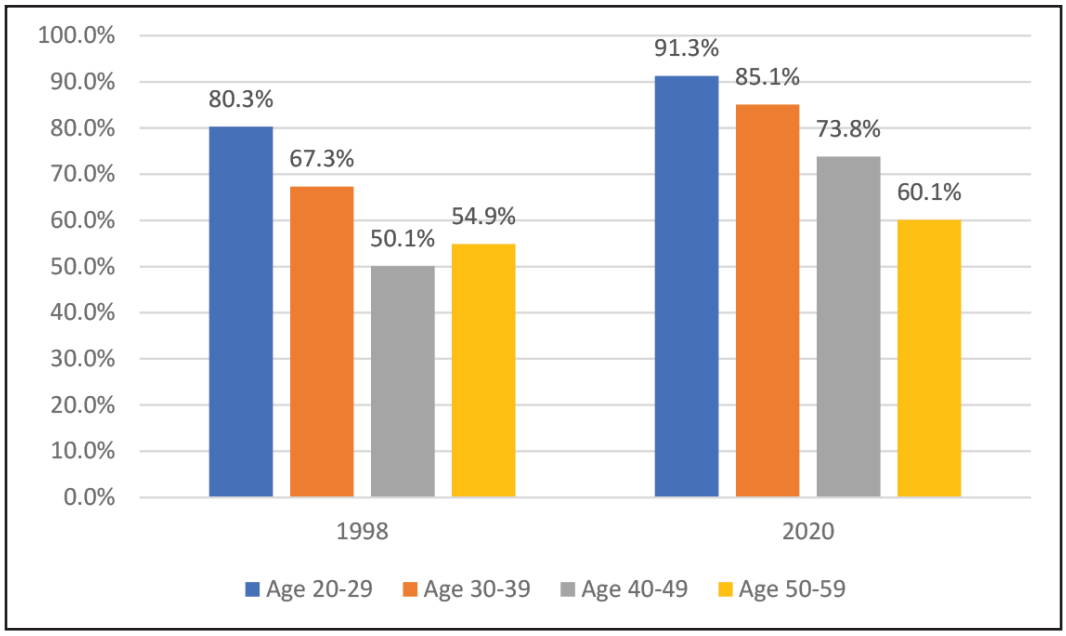
Source: KLIPS.

Notes: Sample includes full-time male and female workers aged 20–59 years. They are nonfarm, nonmilitary, and salaried workers. Each bar indicates exp(A), where A is the female mean log monthly wage, 10th, 50th, or 90th percentile log monthly wage minus the corresponding male log monthly wage for the year. KLIPS, Korean Labor and Income Panel Survey.

the wage distribution, the female/male wage ratio at the top of the wage distribution declined from 71.4% in 1998 to 65.5% in 2020. Table A1 in Appendix presents the shares of full-time male and female workers below the 10th percentile, below the 50th percentile, and above the 90th percentile of the total wage distribution that considers both male and female wages. For example, the log monthly wage at the 10th percentile was about 6.60 in 1998 and about 7.36 in 2020. The share of full-time male workers who earned below the 10th percentile was 26.72%, and that of full-time female workers was 73.28% in 1998. The share for males was 31.65% and that for females was 68.35% in 2020. The female share decreased over the period, but females accounted for a much larger share of total workers who earned below the 10th percentile. Conversely, the share of full-time female workers who earned above the 90th percentile was much lower than that of full-time male workers in 1998 and 2020. Table A2 in Appendix presents the shares of married male and female workers among full-time male and female workers by wage percentile. In 1998 and 2020, the shares of married female workers were higher than those of married male workers in the wage below the 10th percentile. For example, the ratio of married female workers to full-time female workers was 64.64% in 1998 and 67.05% in 2020. On the other hand, the shares of married male workers were higher than those of married female workers in the wage above the 90th percentile.

Figure 4 presents the female/male log monthly wage ratios by age cohort (20–29, 30–39, 40–49, and 50–59) for 1998 and 2020. Taken overall, the monthly wage ratios for all cohorts increased over time, which implies that the gender wage gaps narrowed across cohorts over the period. The largest wage ratio was for the youngest cohort of full-time workers, those aged 20–29 years, in 1998 and 2020. The gender wage gaps tended to be larger as workers aged in

Figure 4 Gender Log Monthly Wage Gaps by Age Cohort, 1998 and 2020.



Source: KLIPS.

Notes: Each bar indicates exp(A), where A is the female mean log monthly wage minus the corresponding male log monthly wage for each age group and year. KLIPS, Korean Labor and Income Panel Survey.

Table 2 Share of marital status for full-time workers by age cohort (%)

	1998		2020	
Age cohort	**Male**	**Female**	**Male**	**Female**
20–29	25.07	13.59	10.65	10.29
30–39	84.59	84.38	60.87	62.12
40–49	96.23	82.29	81.64	80.65
50–59	95.00	73.53	83.96	75.78

Notes: Sample includes full-time male and female workers aged 20–59 years in 1998 and 2020. They are nonfarm, nonmilitary, and salaried workers. Entries indicate the ratio of married male or female workers to full-time male or female workers for each age group and year.

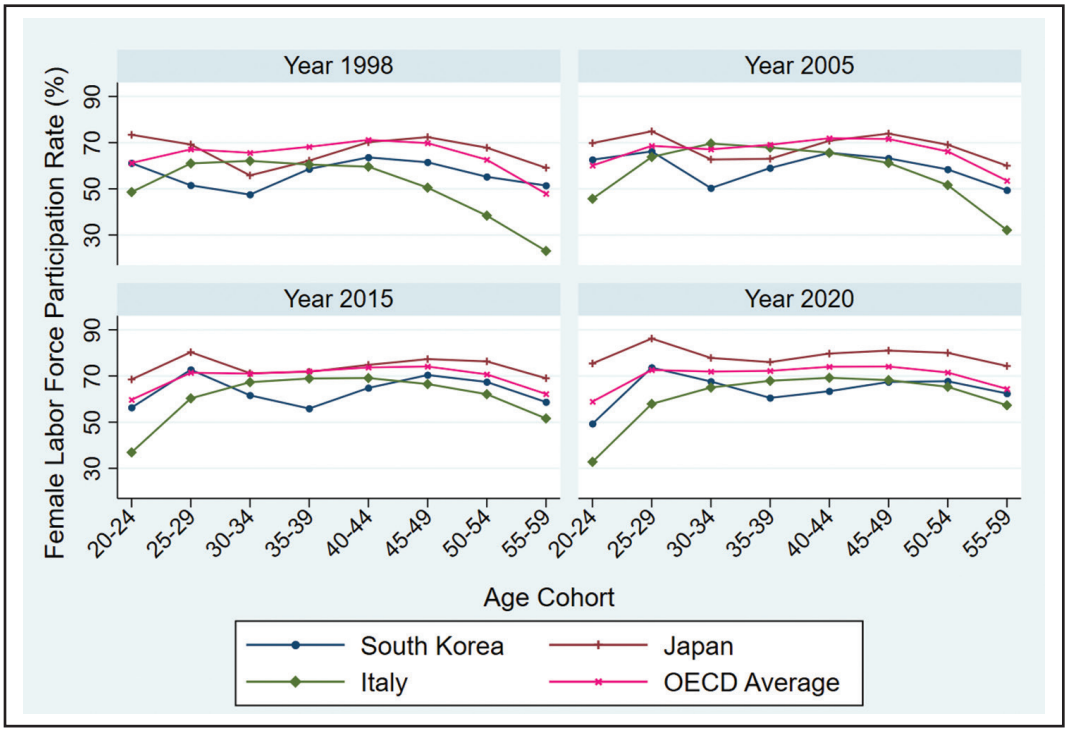
2020. From Table A3 in Appendix, among full-time workers, the shares of female workers were lower than those of male workers, except for those in the age cohort 20–29.

Under the seniority-based wage system in South Korea, older workers are paid more than younger workers because older workers have longer tenure or more work experience than younger workers. This fact may explain why the gender wage gaps for older workers are larger than those for younger workers. Since female workers are more likely to leave the labor market for a short or long period due to marriage or childcare, tenure or work experience for female workers is lower than that for male workers of the same cohort. In Table 2, the shares of married males and females increased significantly for age cohort 30–39. For example, the ratio of married females to full-time female workers aged 30–39 years was 84.38% in 1998 and 62.12% in 2020. The shares for married males and females aged 30–39 years in 2020 declined significantly compared to those in 1998, which reflects the delay in the age of first marriage in

South Korea,[12] as both males and females typically marry in their 30s. Figure 4 shows that the female/male log monthly wage ratios decreased as they aged. This means that marriage and childbirth may explain the divergent wage paths of male and female workers.

Figure 5 presents female labor force participation rates by age cohorts for South Korea, Japan, and Italy, and includes the OECD average.[13] Female labor force participation rates in South Korea are lower than those in Japan and Italy and the OECD average during the periods of marriage, childbirth, and childcare. For example, in 1998, female labor force participation rates for those aged 25–39 years in South Korea show the lowest level compared to Japan, Italy, and the OECD average. In South Korea, female labor force participation rates show the low level of female labor force participation rate for those aged 30–39 years in 2005, those aged 30–44 years in 2015, and those aged 35–49 years in 2020. Such a low female labor force participation rate implies that females in their 30s and 40s miss opportunities to accumulate their human capital in the labor market. Females still have greater responsibilities than males for housework and care for household members in South Korea, even if female workers remain in the labor market. According to Korean Statistics, hours spent on housework and care for household members are significantly different for married males and females who are both working in the labor market. In 2019, a working husband and wife spent 54 min/day

Figure 5 Female Labor Force Participation Rate by Age Cohort (%).



Source: OECD.*Stat*.

Notes: Sample data indicate female labor force participation rates by age cohort 20–59 for South Korea, Japan, Italy, and OECD in 1998, 2005, 2015, and 2020. OECD, Organisation for Economic Co-operation and Development.

12 In 1998, the male mean age at first marriage was 28.83 years and the female mean age at first marriage was 26.02 years. The age of first marriage gradually increases, and in 2020, the male mean age at first marriage was 33.35 years and the female mean age at first marriage was 31.08 years (*Source*: KOSIS).

13 In Figure 1, Japan is an Asian country among OECD countries and has the higher gender wage gap. Italy has a lower gender wage gap, but it is one of the OECD countries with a low female labor force participation rate.

and 187 min/day, respectively, on housework and household member care.[14] Married females who worked in the labor market spent three times more time on housework and care for household members than did married males who worked in the labor market. This may affect the fact that married female workers are more likely than married male workers to have less incentive to invest in their human capital or career. In Section 5, I consider the impact of marriage and childbirth as important factors to explain the significant increase in the gender wage gap.

4 Results and Discussion

4.1 Oaxaca–Blinder decomposition of the gender wage gap

In this section, I decompose the wage gap for full-time male and female workers into the explained portion, accounted for by measuring labor market characteristics, and the unexplained portion. I use the Oaxaca–Blinder decomposition of log monthly wages in 1998 and 2020. The Oaxaca–Blinder decomposition measures both the explained and unexplained components of the mean wage gap by estimating the separate male and female wage equations for individuals (e.g., Blinder, 1973; Oaxaca, 1973). The following equations present the Oaxaca–Blinder decomposition:

$$W_m = X_m\beta_m + \varepsilon_m \tag{1}$$

$$W_f = X_f\beta_f + \varepsilon_f \tag{2}$$

$$\overline{W}_m - \overline{W}_f = b_m\overline{X}_m - b_f\overline{X}_f = b_m(\overline{X}_m - \overline{X}_f) + \overline{X}_f(b_m - b_f) \tag{3}$$

where W is the log monthly wages and m and f denote male and female, respectively; X_m and X_f are vectors containing the explanatory variables and a constant, and the explanatory variables include age, age squared, level of educational attainment (middle school, high school, associate degree, bachelor's degree, and advanced degree), tenure at the current workplace, hours of work, union status, the size of the establishment, industry, and occupation[15,16]; β_m and β_f indicate the coefficients of the explanatory variables and the intercept, and ε_m and ε_f are error terms from the ordinary least squares (OLS) regressions; $\overline{W}_m$ and $\overline{W}_f$ are the mean values of log monthly wages for full-time male and female workers; $\overline{X}_m$ and $\overline{X}_f$ are the mean values of the

14 In 2004, husband and wife both working spent 32 min/day and 208 min/day on housework and household member care, respectively. In 2009, husband spent 37 min/day and wife spent 200 min/day. In 2014, husband spent 41 min/day and wife spent 193 min/day (*Source*: KOSIS).

15 I categorize the size of the establishment into 10 sectors: 1–4 workers, 5–9 workers, 10–29 workers, 30–49 workers, 50–69 workers, 70–99 workers, 100–299 workers, 300–499 workers, 500–999 workers, and over 1,000 workers. The base group is the establishment with 1–4 workers.

16 I categorize industries into 15 sectors according to the 8th KSIC: mining and quarrying (KSIC 10–12), manufacturing (KSIC 15–37), electricity, gas, steam, and water supply (KSIC 40–41), construction (KSIC 45–46), wholesale and retail trade (KSIC 50–52), accommodation and food service activities (KSIC 55), transportation (KSIC 60–63), information and communications (KSIC 64), financial and insurance activities (KSIC 65–67), real estate activities and renting and leasing (KSIC 70–71), business facilities management and business support service (KSIC 72–75), education (KSIC 80), human health and social work activities (KSIC 85–86), art, sports, and recreation-related services (KSIC 87–88), membership organizations, repair, and other personal services (KSIC 90–93). The base group for industry is mining and quarrying. I categorize occupations into nine sectors according to the 5th KSCO: legislators, senior officials, and managers (KSCO 01–03), professionals (KSCO 11–18), technicians and associate professionals (KSCO 21–29), clerks (KSCO 31–32), service workers (KSCO 41–44), sales workers (KSCO 51–53), craft and related trades workers (KSCO 71–75), plant, machine operators, and assemblers (KSCO 81–84), and elementary occupations (KSCO 91–94). The base group for occupation is legislators, senior officials, and managers.

explanatory variables; and b_m and b_f indicate the OLS estimates from Eqs (1) and (2), respectively. The first term of the right-hand side of Eq. (3) is the impact of differences between male and female workers in the explanatory variables, evaluated using the coefficients for male. The second term is the differentials not explained by the differences in measured characteristics and is equivalent to the mean female residual from the male wage equation.

Table 3 displays the results of the Oaxaca–Blinder decomposition for 1998 and 2020. First, the gender differences in age substantially contributed 0.122 log points and accounted for 29.1% of the gender wage gap in 1998. Compared to the effects of age in 1998, the much smaller gender differences in age contribute 0.017 log points or 5.1% of the gender wage gap in 2020. Age is used as a proxy for work experience because actual work experience is not available in the KLIPS. Age may overstate the years that workers actually participate in the labor market, when in fact workers may leave the market because of schooling, training, or childcare. The differences between actual and potential work experience are relatively larger for female workers. Therefore, overstating work experience may cause an underestimation of its impact on the gender wage gaps. Second, gender differences in education accounted for 3.9% and 1.3% of the gender wage gaps in 1998 and 2020, respectively. This may reflect the improvement in females' education level during this period. Table 1 shows the decrease in the gender gap in cases of obtaining the bachelor's and advanced degrees – in particular, the improvement in females' having obtained an advanced degree is much more significant. Third, the gender differences in tenure with the current workplace accounted for a substantial share of the gender wage gaps in 1998 and 2020, thus playing an important role in explaining the wage gaps. In South Korea's labor market, the seniority-based wage system is affected by tenure; this system also determines workers' wages. Female workers are much more likely than male workers to leave the labor market as they get married or have children. In Figure 6, the difference in labor force participation rates between males and females in 1998 and 2020 increased

Table 3 Decomposition of the gender wage gaps

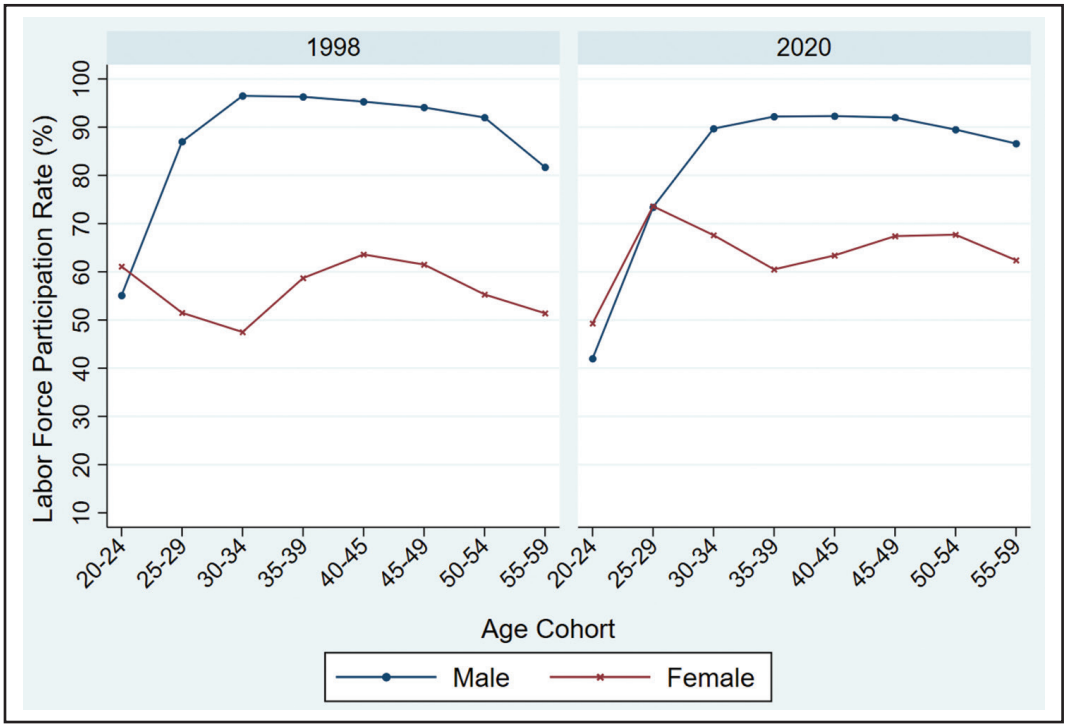
Variables	1998		2020	
	Log points	Percent of gender gap explained	Log points	Percent of gender gap explained
Age	0.1216	29.08	0.0171	5.06
Education	0.0162	3.88	0.0043	1.28
Tenure	0.0717	17.15	0.0326	9.66
Hours of work	−0.0148	−3.54	0.0135	4.01
Unionization	−0.0001	−0.02	0.0001	0.02
Business size	0.0187	4.47	0.0302	8.96
Industry	−0.0220	−5.27	0.0190	5.61
Occupation	0.0109	2.60	−0.0054	−1.60
Total explained	0.2021	48.34	0.1114	33.00
Total unexplained	0.2160	51.66	0.2262	67.00
Total wage gap	0.4181	100.00	0.3377	100.00

Source: KLIPS.

Notes: Sample includes full-time male and female workers aged 20–59 in 1998 and 2020. They are nonfarm, nonmilitary, and salaried workers.

KLIPS, Korean Labor and Income Panel Survey.

Figure 6 Male and Female Labor Force Participation Rates by Age Cohort (%).



Source: KOSIS.

Notes: Sample data indicate male and female labor force participation rates by age cohort 20–59 for South Korea in 1998 and 2020. KOSIS, Korean Statistical Information Service.

significantly when they married or cared for their children.[17] Under the seniority-based wage system, leaving the labor market for a medium- or long-term period affects tenure and wages at the current workplace, even if one returns to the same workplace. Fourth, the male advantage in working hours increased the gender wage gap in 2020. The gender difference in hours worked contributed 0.014 log points, accounting for 4.0% of the gender wage gap. Table 1 shows that, compared to hours worked in 1998, working hours for full-time male and female workers decreased, and that the gender gap in hours of work also narrowed in 2020. However, among labor market characteristics, hours of work play a role in explaining the gender wage gap. Goldin (2014) explained that disproportionate rewards for working long and continuous hours can increase the wage gap between those workers who work long or continuous hours and workers who work short or flexible hours due to the high penalty for short working hours or flexibility. South Korea's working hours have been in the upper ranks of OECD countries.[18] Female workers who have shorter working hours in South Korea, which has a long working hours system, are disadvantaged because shorter working hours negatively affect their wages. In recent years, as workers prioritize a work–life balance, firms should more generously reward those who work long hours. This can explain the increase in the wage gap between male workers with relatively longer working hours and female workers with relatively shorter working hours. Fifth, the gender difference in the size of establishment substantially contributed 0.030 log points and accounted for 9.0% of the gender wage gap in 2020. Table A4 in Appendix

17 In South Korea, males and females got married in their late 20s in 1998 and in their early 30s in 2020, on average.

18 In 2020, average annual hours worked was 1,908 h in South Korea, while the OECD average was 1,668 h (*Source*: OECD. *Stat*.).

shows that, in general, the larger the size of the establishment, the higher the wages for both full-time male and female workers. The gender wage gaps in the size of establishment with 1–4 workers were 0.4 log points in 1998 and 0.1 log points in 2020, which show the gap's decline over time. The gender wage gaps in an establishment with 500–999 workers were 0.3 log points in 1998 and 0.6 log points in 2020, which imply a significant increase in the gap. The gender wage gaps at establishments with over 1,000 workers were 0.53 log points in 1998 and 0.43 log points in 2020. Overall, the wage gap between males and females in establishments with many workers (e.g., over 500 workers) is relatively larger than the gap between males and females in small establishments. Sixth, while the gender difference in employment by industry was virtually eliminated in 1998, the gender gap accounted for 5.6% of the gender wage gap in 2020. Regarding type of industry in South Korea, in 1998 the share of manufacturing accounted for 27.8% of GDP and the share of service industry accounted for 56.9%. In 2020, the share of manufacturing accounted for 27.1% and the share of service industry accounted for 62.4%.[19] In my sample data, the industry in which both full-time male and female workers worked the most in 1998 is manufacturing. In 2020, manufacturing accounted for the largest proportion of full-time male workers, while human health and social work activities accounted for the largest proportion of full-time female workers.[20] The average monthly wage for manufacturing is higher than that for human health and social work activities. This means that relatively more female workers than male workers moved to industries with lower wages over the time. Card et al. (2018) suggested that firm-level heterogeneity can give firms wage-setting power, which results in wage inequality between firms. Card et al. (2016) and Bruns (2019) suggested that firm-specific wage setting widens the gender wage gap because high-wage firms employ disproportionately more males. The firm-specific wage premium can lead to an increase in the gender wage gap. Given firm-level heterogeneity, future research could use employer–employee data to discuss how the firm-specific wage structure affects the wages for males and females differently. Lastly, the gender wage gap in employment by occupation contributed 0.011 log points in 1998 and -0.005 log points in 2020, which implies that occupation distribution was virtually eliminated. In Table A5 in Appendix, full-time female workers increased their representation in professional jobs over this time. The male advantage in professional jobs decreased from 11.66 percentage points in 1998 to 1.34 percentage points in 2020. Full-time female workers upgraded their occupations over this time, with the gender wage gaps in employment by occupation becoming smaller.

The total gender wage gap in South Korea declined from 0.418 log points in 1998 to 0.338 log points in 2020. While the explained gender wage gap decreased from 0.202 log points to 0.111 points, the unexplained gap increased from 0.216 log points to 0.226 log points. The unexplained factors accounted for a larger share of the gender wage gap in both 1998 and 2020—51.7% and 67.0%, respectively—increasing the relative importance of these unexplained factors. Based on this decomposition analysis, a substantial share of the total gender wage gap cannot be explained by measured labor market characteristics.

19 *Source*: KOSIS.

20 In the 1998 data of my sample, the ratio of full-time male workers in manufacturing to total full-time male workers was 34.53% and the ratio of full-time female workers in manufacturing to total full-time female workers was 27.38%. In 2020, the ratio of full-time male workers in manufacturing to total full-time male workers was 29.29%, the ratio of full-time female workers in human health and social work activities to total full-time female workers was 21.57%, and the ratio of full-time female workers in manufacturing to total full-time female workers was 16.69%.

4.2 **Quantile decomposition**

In this section, I examine quantile decomposition of the gender wage gap at each point of the wage distribution. I focus on the unexplained gender wage gaps across the wage distribution, following the methodology of Chernozhukov et al. (2013). This methodology offers estimation and inference procedures regarding the entire counterfactual distribution of outcome (e.g., wages) and its functions, based on quantile regressions. It estimates the empirical distribution of the characteristics and uses quantile regressions for the conditional wage distribution. The empirical study decomposes the unconditional wage gaps between males and females into explained components and unexplained components at each percentile of the wage distribution. The explained gap is attributable to the distribution of the measured labor market characteristics, and the unexplained gap is attributable to the different wage functions conditional on the labor market characteristics. Let m denote the male workers and let f denote the female workers. The variable Y_i is log monthly wages and X_i is labor market characteristics. $F_{Ym|Xm}(y|x)$ and $F_{Yf|Xf}(y|x)$ are the conditional distributions of wages to male and female workers given their characteristics, respectively. $F_{Y[m|m]}$ and $F_{Y[f|f]}$ are the unconditional distribution functions of the wages for male and female workers, and $F_{Y[m|f]}$ is the counterfactual wage distribution function for female workers if they received wages according to the male worker's wage function. F_{Xm} and F_{Xf} are the distribution of male and female characteristics, respectively.

$$F_{Y[m|m]}(y) = \int F_{Ym|Xm}(y|x)\,dF_{Xm}(x) \tag{4}$$

$$F_{Y[f|f]}(y) = \int F_{Yf|Xf}(y|x)\,dF_{Xf}(x) \tag{5}$$

$$F_{Y[m|f]}(y) = \int F_{Ym|Xm}(y|x)\,dF_{Xf}(x) \tag{6}$$

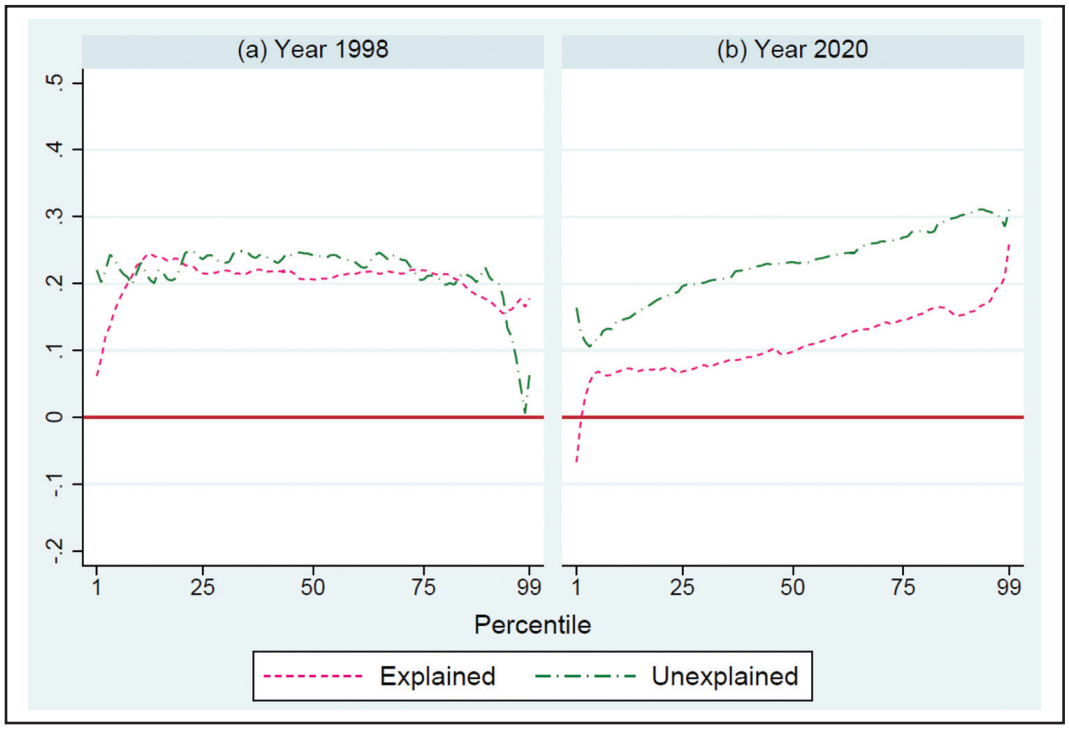
Eq. (6) is the counterfactual distribution, which is constructed by integrating the conditional distribution of male wages given the distribution of female characteristics. The assumption for the counterfactual distribution is that a change in the characteristics does not affect the parameters of the conditional distribution of wages given the characteristics. The counterfactual distribution reflects either a change in the conditional distribution of wages given the characteristics or a change in the distribution of characteristics.

$$F_{Y[m|m]} - F_{Y[f|f]} = \left\{F_{Y[m|m]} - F_{Y[m|f]}\right\} + \left\{F_{Y[m|f]} - F_{Y[f|f]}\right\} \tag{7}$$

Eq. (7) presents the decomposition of the difference in the unconditional wage distribution between full-time male and female workers. The first term on the right-hand side of Eq. (7) indicates the effect of differences in characteristics. Hence, this term demonstrates the impact of differentials in the characteristic distribution between male and female workers, given the same wage schedule for males. The second term refers to the effect of the difference in the conditional distribution of wages. Hence, this term presents the impact of the difference in male and female workers' wage schedules, given the distribution of female characteristics.

Figure 7 presents the quantile regression decompositions of the gender wage gaps in 1998 and 2020. The red dashed lines plot the explained wage gaps and the green dotted lines indicate

Figure 7 Quantile Decomposition of the Gender Wage Gap.



Source: KLIPS.

Notes: Sample includes full-time male and female workers aged 20–59 in 1998 and 2020. They are nonfarm, nonmilitary, and salaried workers. For (A) and (B), the red dashed lines plot the explained wage gap, and the green dotted lines show the unexplained wage gap. KLIPS, Korean Labor and Income Panel Survey.

the unexplained wage gaps. Figure 7A shows that the unexplained gender wage gap was much larger than the explained wage gap below the 10th percentile. The explained and unexplained portions took similar shares of the total gender wage gap, except at the bottom and top of the distribution. The unexplained gap sharply decreased at the top of the wage distribution. In 1998, the unexplained factors contributed substantially to the gender wage gap at the bottom of the wage distribution. This implies the possibility of the sticky floor effect, which means that female workers in low-paying jobs have low mobility and tend not to rise to higher wage levels unless or until they accumulate skills appropriate to such incomes.

Figure 7B shows that the magnitude of the unexplained wage gap over the wage distribution was higher than that of the explained gap. The unexplained factor contributed more to female workers' wages, regardless of their positions in the labor market. The unexplained wage gap showed an increasing pattern over the distribution. This implies the possibility of the glass ceiling in high-level jobs in South Korea, which means that female workers are more likely to face barriers to entry or promotion to high-level jobs or that they are paid less than their male counterparts in high-level jobs. This may cause a relatively higher gender wage gap at the top of the distribution.[21] It may reflect the low share of females in high-level jobs. For instance, the female share of management positions in South Korea in 2020 was 15.6% and the female share of seats on boards of the largest publicly listed companies in 2020 was 4.9%, which was the

21 A comparable pattern is found for Sweden (Albrecht et al., 2003) and several other European countries, such as Finland, Italy, and Poland (Arulampalam et al., 2007; Christofides et al., 2013).

lowest among the OECD countries.[22] The female share of members of the National Assembly in 2020 was 19.0%, which was lower than the OECD average of 32.0%.[23]

Comparing Figures 7A and 7B, we observe that the explained gender wage gap declined significantly in 2020 relative to 1998, except at the upper top of the wage distribution. This implies that full-time workers appear similar to their male counterparts in terms of the measured labor market characteristics in South Korea over this time. On the other hand, the unexplained gender wage gap in 2020 was higher than that in 1998 from the 57th percentile and above. The decline in the unexplained gap between 1998 and 2020 is smaller than that in the explained gap.

Like other Asian countries, South Korea has a long tradition of strict gender norms, such as a preference for sons over daughters, a male-dominated labor market, and a greater responsibility assigned to females for housework and childcare. Such stereotypical gender norms seem to disappear in a family and society when females enhance their education levels and become actively involved in the labor market. However, traditional gender norms persist in South Korea (Choi and Hwang, 2015; Hwang et al., 2019). Choi and Hwang (2015) demonstrated the significant son–daughter difference in parental treatment on children's time spent on housework and private education expenditure from 1998–2010 in South Korea. Sons are more likely than daughters to spend less time on housework and to receive greater support for education. This in turn reflects the son–daughter difference in parents' expectations for their child's career. Parents of sons are more likely to expect them to choose professional or high-wage jobs. Such differences are evidence of persistent stereotypical gender norms, which also manifest in the labor market in the form of lower female participation and higher gender wage gaps compared to other developed countries. This may explain why employers discriminate against female workers, regardless of their position in the workplace, leading to the relatively large unexplained gap over most of the wage distribution in South Korea.

4.3 **Impacts of marriage and childbirth**

Traditional gender role norms decree that males are more likely to be the primary earners and females to have greater responsibility for housework and childcare. In particular, after getting married and having a child, female workers are more likely to leave the labor market or to invest less in their career so as to spend more time on their home duties (Becker, 1991; Albanesi and Olivetti, 2009; Kleven et al., 2019). Although females have improved their education, work experience, and commitment to the labor market over this period, getting married can still negatively affect their labor market outcomes (e.g., Korenman and Neumark, 1991; Antonovics and Town, 2004; Juhn and McCue., 2016). In South Korea, where traditional gender norms persist, females spend much more time than males performing home duties. Even if females work in the labor market like males, females are still much more responsible for housework (e.g., Hwang et al., 2019). Employers may expect married female workers to have less attachment to the labor force or to be more likely to leave their job. This may have negative effects on female employment and wages. Blau and Winkler (2017) suggested that mothers have fewer

22 The OECD average for the female share of management position was 34.2%, and that of the female share of seats on boards of the largest publicly listed companies was 26.3%.

23 *Source*: OECD.*Stat*.

opportunities for firm-specific training and straggle to obtain the benefits that result from being matched with appropriate jobs. Thus, females may be employed in mismatched jobs or miss out on the wage premiums offered to male workers.

Figure 4 shows that the monthly wages for full-time female workers decreased relative to their male counterparts upon reaching their 30s. This may reflect the impact of marriage and childbirth, as males and females in South Korea tend to get married, on average, in their early 30s. First, I estimate the following statistical model to examine the relationship between labor market outcomes and marital status. To examine the effects of marriage independent of the child effects, my sample data include only full-time male and female workers without children.

$$Y_{it} = \beta_0 + \beta_1 + Female + \beta_2 Married + \beta_3 Female * Married + \beta_4 X_{it} + \epsilon_{it} \quad (8)$$

where i and t index an individual and time, respectively; Y_{it} represents log monthly wage, log hourly wage, log hours of work, and labor supply as the dependent variables; the *Female* and *Married* variables are indicators for female and marital status, respectively; the interaction term, *Female * Married*, is a dummy that equals 1 if the females are married; and X_{it} is a vector of the explanatory variables and year dummy, including a quadratic in age, education, tenure at the current workplace, hours of work, union, the size of the establishment, industry, and occupation.

Table 4 indicates that marriage may be a determinant of the gender wage gap. Specification (1) shows that average full-time female workers who are single are likely to receive a monthly wage 15.1 percentage points lower than the average full-time male worker who is

Table 4 Average effects of marriage on labor market outcomes

	Log Monthly Wage (1)	Log Hourly Wage (2)	Log Hours of Work (3)	Labor Supply (4)
Female	−0.151***	−0.158***	−0.046***	0.062***
	(0.006)	(0.007)	(0.004)	(0.005)
Married	0.141***	0.173***	0.013*	0.436***
	(0.011)	(0.012)	(0.007)	(0.015)
Female ×	−0.089***	−0.117***	−0.006	−0.463***
Married	(0.017)	(0.018)	(0.010)	(0.019)
Constant	2.409***	1.597***	5.283***	0.431***
	(0.225)	(0.235)	(0.122)	(0.015)
Observations	15,068	13,742	13,744	41,670
R^2	0.430	0.521	0.196	0.024

Source: KLIPS.

Notes: Sample data for the average effects of marriage on log monthly wage, log hourly wage, and log hours of work include full-time male and female workers aged 20–59. They are nonfarm, nonmilitary, and salaried workers. Married males and females in my sample consider only those who were married after 2000. The average effects of marriage on monthly wage, hourly wage, and working hours are estimated conditional on employment. For specifications (1)–(3), the full set of controls includes a quadratic in age, education, tenure with current workplace, union, year dummy, industry dummy, and occupation dummy. The effect of marriage on labor supply is estimated unconditional on employment status. In specification (4), the control includes year dummy. Standard errors in parentheses are clustered at the individual level. Significance levels: *10%, **5%, ***1%.

KLIPS, Korean Labor and Income Panel Survey.

single. Average full-time male workers who are married without children are likely to earn a monthly wage 14.1 percentage points greater than the average single full-time male worker. The relative loss due to marriage, the difference in differences of changes in monthly wage between males and females, is 8.9 percentage points of the average monthly wage. That is, marriage leads to a monthly wage that is 8.9 percentage points less than that for full-time female workers. In specification (2), there is a 15.8 percentage point mean difference in hourly wage between single male and female workers. There is a 17.3 percentage point mean gap in hourly wage between married and single males. Average full-time female workers are likely to earn 11.7 percentage points less due to marriage. In specification (3), average single female workers who work full time are likely to work 4.5 percentage points less than average single male workers. Average married male workers are 1.3 percentage points more likely to work than average single males. There is no significant effect of marriage on females' working hours. Specification (4) shows that single females are 6.2 percentage points more likely to work than average single males. There is a 43.6 percentage point gap in labor supply between married and single males. Marriage leads to a 46.3 percentage point decrease in labor supply for females. Table 4 shows that marriage has negative effects on labor market outcomes for females.

Juhn and McCue (2017) provided evidence for the impact of marriage on earning differences among full-time married workers in the US. Married full-time male workers earned more than single male workers across 5-year birth cohorts from 1936 to 1985. Married full-time female workers earned less than single female workers for the 1936–1945, 1946–1955, and 1956-65 birth cohorts, whereas they have earned more than single female workers since the 1966 birth cohort. Juhn and McCue (2016, 2017) suggested that marriage no longer has negative effects on the wages of female workers without children. Comparing my results with those in prior studies, it appears that the negative effect of marriage on average monthly wages, hourly wages, and labor supply for females without children in South Korea can be one explanation for the large gender wage gap.

To examine the dynamic paths of labor market outcomes between married full-time male and female workers, I use an event study around the years in which the workers got married. To trace the paths of labor market outcomes between males and females after marriage, I draw on a quasi-experiment based on the event study of Kleven et al. (2019). In my event study, I use an unbalanced panel of males and females who got married at any time after 2000, focusing on the period between the 2 years prior to getting married and the 2 years following marriage. To examine the impact of marriage independent of the child effects, I restrict my sample to married males and females without children. According to the Korean Statistical Information Service (KOSIS), the fertility rate for married females in South Korea was 96% in 2010 and 91.6% in 2020, which means that most married females gave birth. In addition, the first birth interval (time interval between marriage and first childbirth) was, on average, 2 years. Hence, I analyze only the effects of marriage on labor market outcomes for the period between the 2 years before getting married and the 2 years after.

The assumption of the event study in this paper is that getting married does not depend on unobserved expectations about labor market outcomes that workers would have experienced were they not getting married. The event (e.g., marriage) may cause two effects on labor market outcomes: pre-event effect and post-event effect. For example, the pre-marriage effect means that females may have less incentive to invest in their education and career in

anticipation of getting married. The post-marriage effect is that females may change their job conditions in response to their marriage, such as moving to low-paying jobs or reducing their hours of work after getting married. The event study can identify only the post-event effect. Adda et al. (2017) and Kleven et al. (2019) suggested that the anticipation of motherhood does not have significant effects on labor market outcomes. The event is not determined by labor market outcomes, which means that the outcomes do not occur before getting married, whereas the significant changes in the outcomes occur just after getting married. Table 1 provides descriptive evidence that females improved their human capital investment over the time in South Korea. In my event graphs, I identify stable and identical pre-trends between males and females for the 2 years prior to the event. This implies that there is no significant pre-event effect.

The event study analyzes the dynamic paths of labor market outcomes, such as the monthly wage and labor supply around the event for full-time male and female workers. The estimation equation has the form:

$$Y_{ist}^{g} = \sum_{j \neq -1} \alpha_{j}^{g} \cdot \mathrm{I}[j = t] + \sum_{k} \beta_{k}^{g} \cdot \mathrm{I}[k = age_{is}] + \sum_{y} \gamma_{y}^{g} \cdot \mathrm{I}[y = s] + \eta_{ist}^{g}, \tag{9}$$

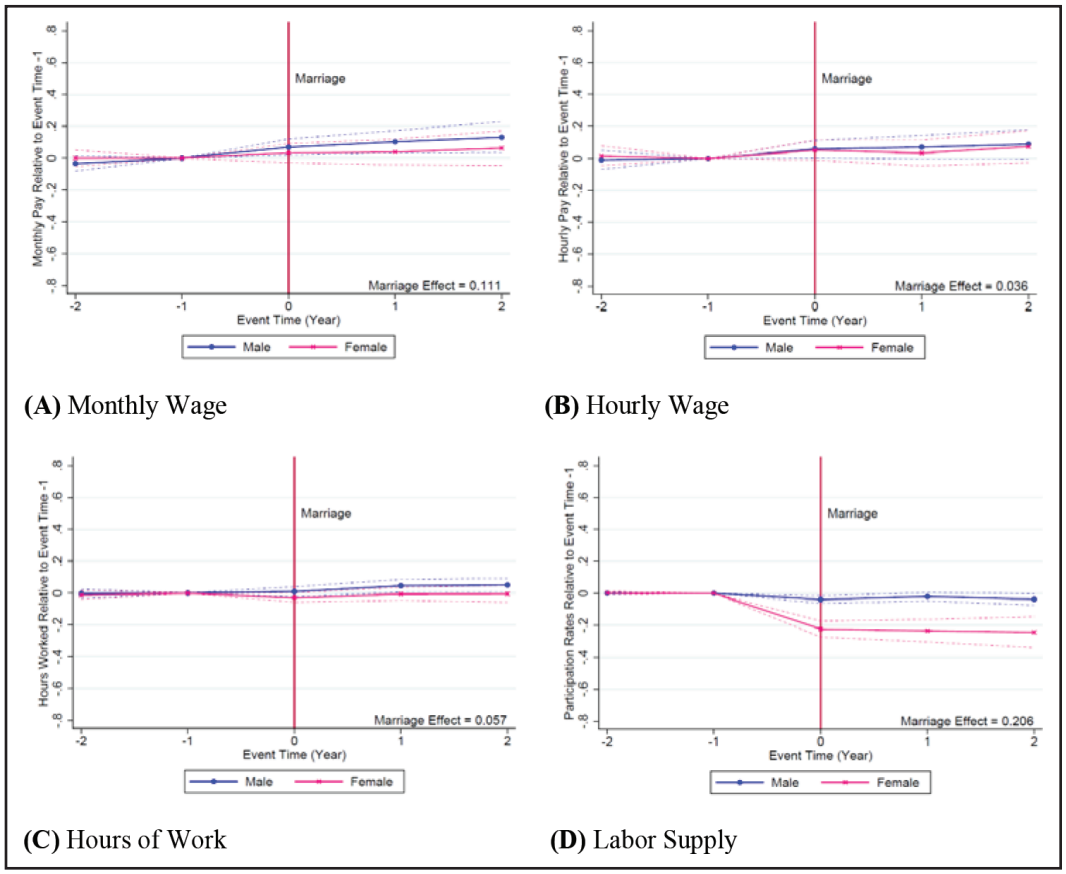
where Y_{ist}^{g} is the labor market outcome variable for individual i of gender g in year s at event time t; t indicates all years relative to getting married for $t = -2$ to $t = 2$, and $t = 0$ denotes the year in which the individual got married. The equation is estimated separately for males and females and includes full sets of event time dummies, age dummies, and year dummies to control for different age profiles and business cycles. The coefficients in Eq. (9) are normalized to 0 for each gender in the year before getting married ($t = -1$). I specify Y_{ist}^{g} in levels because one of the variables (i.e., employment) produces 0 as an output – specifically, 1 if a person is employed and 0 if a person is unemployed. Thus, I compute the percentage effect (P_{t}^{g}) by dividing each coefficient through the predicted labor market outcome of gender g when omitting the event dummies: $P_{t}^{g} \equiv \hat{\alpha}_{t}^{g} \Big/ E\left[\tilde{Y}_{ist}^{g} | t\right]$, where $\tilde{Y}_{ist}^{g} \equiv \sum_{k} \hat{\beta}_{k}^{g} \cdot \mathrm{I}[k = age_{is}] + \sum_{y} \hat{\gamma}_{y}^{g} \cdot \mathrm{I}[y = s]$. The percentage effect indicates the effect of the marriage at event time (t) as a percentage of the counterfactual labor market outcome for males and females – that is, not getting married. The impact of marriage on labor market outcomes for females relative to males at event time t is:

$$P_{t} \equiv \frac{\hat{\alpha}_{t}^{m} - \hat{\alpha}_{t}^{f}}{E\left[\tilde{Y}_{ist}^{f} | t\right]} \tag{10}$$

Eq. (10) measures the percentage by which marriage affects females' labor market outcomes (e.g., wage, labor supply) compared to males, at event time (t). Figure 8 shows graphical evidence of the effects of marriage on labor market outcomes P_{t}^{m} and P_{t}^{f}, controlling for age and year fixed effects. Each graph plots the estimated coefficients from Eq. (9) and shows how the labor market outcomes of individuals who got married are different from those who remained unmarried over the period.

Figure 8 shows the dynamic effects of marriage on labor market outcomes for full-time male and female workers. The patterns of labor market outcomes for full-time female workers are similar to the patterns for full-time male workers prior to the year in which they got married ($t = -2$ and $t = -1$). In Figures 8A–C, while the monthly wage, hourly wage, and hours of

Figure 8 Impacts of Marriage.



Source: KLIPS.

Notes: Sample includes males and females who got married at any time after 2000. The marriage effect for each panel shows the percentage difference of the labor market outcome for females than for males and is estimated at event time 2 from Eq. (10). The results for monthly wages, hourly wage, and hours of work are estimated conditional on employment. The result for the labor supply is estimated unconditional on employment status. Thin dashed lines indicate 95% confidence intervals (CIs) based on robust standard errors. KLIPS, Korean Labor and Income Panel Survey.

work for the full-time female workers fell slightly behind those for the full-time male workers after they got married, they are not statistically significant. Females' wages and working hours do not significantly change in the first few years of marriage. In other words, if females remain in the labor market after getting married, their wages and hours of work do not decrease for the 2 years after getting married. Figure 8D plots the dynamic paths of labor supply across the event time. It indicates that female workers are more likely than males to leave the labor market after marriage. The labor supply for females shows a drop of about 22.4% in the year in which they get married ($t = 0$) relative to the years prior to marriage. The negative effect of marriage for females relative to males is 20.6% in the 2 years after getting married ($t = 2$), whereas the labor supply for males does not change, regardless of marriage. My findings imply that, in the short run, there is no significant difference between males and females in the effect that marriage produces on wages and working hours, but a significant number of females leave the labor market following marriage.

Next, I discuss how the presence of children can affect the labor market outcomes for full-time workers. As per the Korean parental leave and childcare leave system according to

the Labor Standards Act in South Korea, an employer must provide a pregnant female with a total of 90 days of maternity leave. The female receives a payment equivalent to her ordinary wages for the period of maternity leave. In addition, the Equal Employment Opportunity and Work-Family Balance Assistance Act of 2008 introduced paternity leave. The Act stipulated 3 days of paternity leave, extended in 2012 to 5 days and in 2019 to 10 days. A male worker on paternity leave receives his normal pay for the duration of the leave. According to the Equal Employment Opportunity Act in South Korea, the introduction of childcare leave has been in effect since 1988.[24] Only female workers with infants aged <1 year could use the childcare leave for 1 year. Since 1995, male workers have also been able to use the childcare leave. Starting with parents with infants (children aged <1 year), the applicants were expanded in 2008 to include parents with children aged <3 years, parents with children aged <6 years in 2010, and parents with children aged <8 years in 2014. The period of childcare leave is within 1 year. Since 2001, applicants can receive 200,000 won per month, a figure that has gradually increased, and reached 80% of the ordinary wage in 2020.[25] The share of male workers among total applicants using the childcare leave has increased every year, from 2.1% in 2002 to 24.5% in 2020, but it is still much lower than that of female workers.[26]

First, I analyze the following specifications to examine the relationship between labor market outcomes and the presence of children.

$$Y_{it} = \beta_0 + \beta_1 Female + \beta_2 Children + \beta_3 Female * Children + \beta_4 X_{it} + \epsilon_{it} \tag{11}$$

where i and t index an individual and time, respectively; Y_{it} represents labor market outcomes as the dependent variable; the *Female* and *Children* variables are indicators for female and the presence of children, respectively; the interaction term is a dummy that equals 1 if the female has a child; and X_{it} is a vector of the explanatory variables and year dummy, as in Eq. (8).

Table 5 shows the average effects of the presence of children on wages, hours of work, and labor supply. In specification (1), there is an 18.0 percentage point mean difference in the monthly wage between males and females without children. Average full-time male workers with children are more likely to earn a monthly wage 16.0 percentage points higher than average full-time male workers without children. The relative loss due to the presence of children, the difference in differences of the changes in the monthly wage between males and females, is 23.8 percentage points of the average monthly wage, which means that full-time female workers who have children suffer negative effects on their monthly wage. In specifications (2)–(4), the presence of children negatively affects females' hourly wage, working hours, and labor supply. The presence of children results in a decline of 4.1 percentage points in the hours of work for full-time female workers. Full-time female workers with children experience a relatively small drop in the average hours of work. Such a small decrease in hours of work reflects the fact that the hours of work for full-time workers in the Korean labor market can hardly be adjusted. In South Korea, childcare costs are expensive because of high expenditures on private childcare

24 The Equal Employment Opportunity Act was amended to the Equal Employment Opportunity and Work-Family Balance Assistance Act in 2007.

25 In 2001, applicants for childcare leave were paid 200,000 won per month (about $200). In 2020, they received 80% of the ordinary wage, of which the upper limit is 1,500,000 won per month and the lower limit is 700,000 won.

26 *Source*: Ministry of Employment and Labor.

Table 5 Average effects of children on labor market outcomes

	Log monthly wage (1)	Log hourly wage (2)	Log hours of work (3)	Labor supply (4)
Female	−0.180***	−0.191***	−0.046***	0.029***
	(0.006)	(0.006)	(0.003)	(0.004)
Children	0.160***	0.172***	0.016***	0.374***
	(0.005)	(0.006)	(0.003)	(0.004)
Female × Children	−0.238***	−0.238***	−0.041***	−0.490***
	(0.007)	(0.008)	(0.004)	(0.006)
Constant	2.154***	1.544***	5.448***	0.420***
	(0.116)	(0.122)	(0.062)	(0.007)
Observations	39,821	35,802	35,807	112,205
R^2	0.598	0.647	0.174	0.131

Source: KLIPS.

Notes: Sample data for the average effects of children on log monthly wage, log hourly wage, and log hours of work include full-time male and female workers aged 20–59 years. They are nonfarm, nonmilitary, and salaried workers. In my sample, males and females with children include only those who experienced childbirth after 2000. The average effects of children on monthly wage, hourly wage, and working hours are estimated conditional on employment. For specifications (1)–(3), the full set of controls includes a quadratic in age, education, tenure with current workplace, union, year dummy, industry dummy, and occupation dummy. The average effect of children on labor supply is estimated unconditional on employment status. In specification (4), the control includes year dummy. Standard errors in parentheses are clustered at the individual level. Significance levels: *10%, **5%, ***1%.

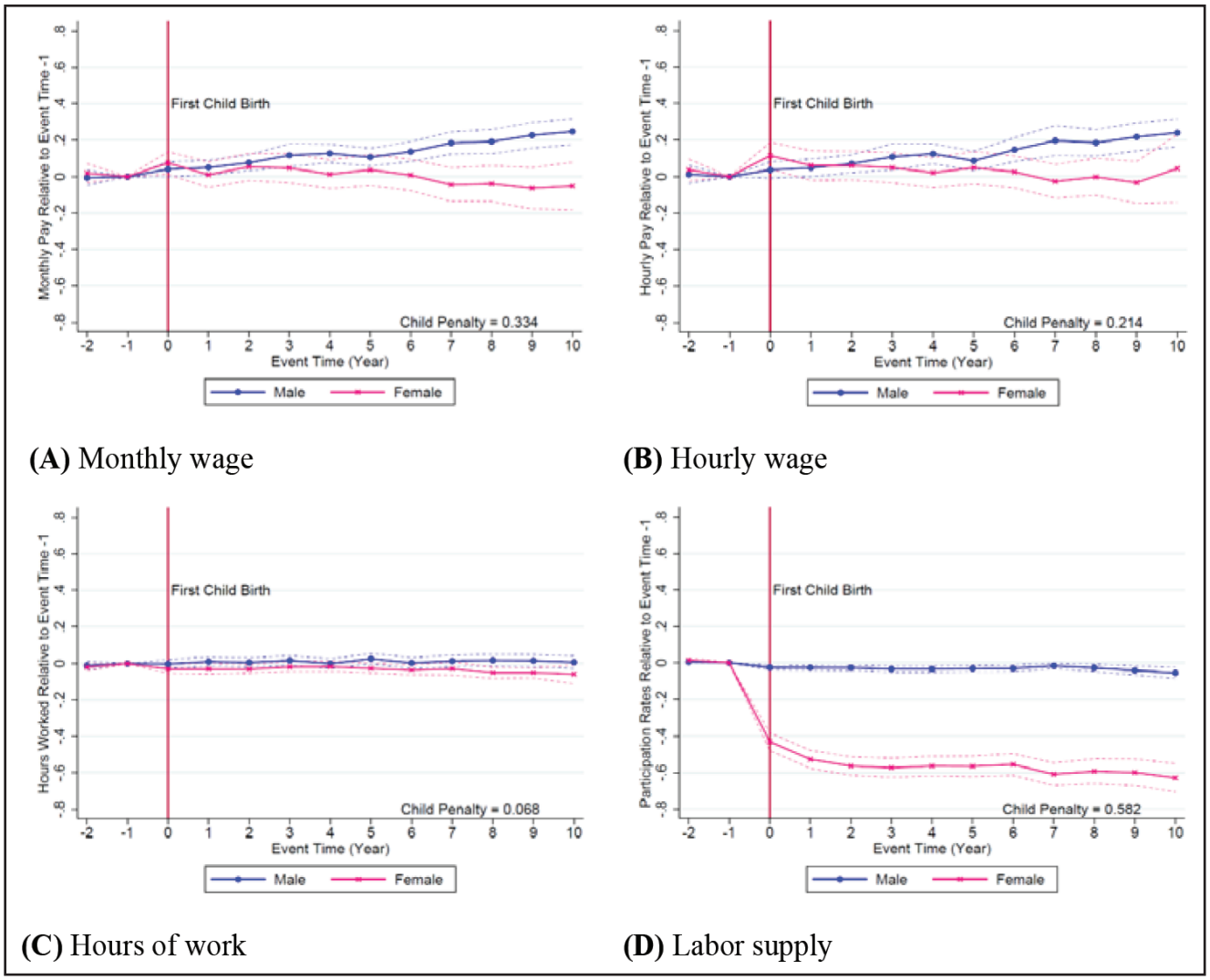
KLIPS, Korean Labor and Income Panel Survey.

services and fewer public childcare programs.[27] Hwang et al. (2018) noted that the increase in substitutability between maternal time and market childcare increases both female labor supply and the fertility rate. In South Korea, with its inflexible work system, expensive market childcare service, and the traditional gender norms that dictate that females are more responsible for childcare, full-time female workers choose to leave their jobs as they have children.

I use the event study around the years in which full-time workers give birth to their first child to examine the dynamic trajectory of labor market outcomes. This event study focuses on an unbalanced panel of full-time workers who had their first child any time after 2000. Figure 9 shows the effects of childbirth on monthly and hourly wage, hours of work, and labor supply. Figure 9A shows that, while the monthly wages of the full-time male workers who had their first birth experience increased, the full-time female workers experienced a decrease in their wages. The monthly wage between males and females diverges after first childbirth; in particular, the monthly wage gaps from event time 7 to event time 10 are significant, and the full-time female workers fall behind about 33.4% relative to the full-time male workers 10 years after childbirth. The magnitude of the negative effects on the wage gap in South Korea is much larger than the gaps in Sweden and Denmark (Albrecht et al., 2018; Kleven et al., 2019). For example, the earning gap between males and females in Denmark is 19.4% 10 years after

27 Although the Korean government has increased public spending on childcare and early childhood education over the last decade, public spending on family benefits—including child-related cash transfers, services for families with children, and financial support for families through the tax system—is still low compared to other OECD countries. South Korea spent 1.2% of its GDP on family benefits in 2018, which is much lower than the OECD average (2.1%) (*Source*: OECD Family Database).

Figure 9 Impacts of Children.



Source: KLIPS.

Notes: Sample includes males and females who have their first childbirth at any time after 2000. The child penalty for each panel shows the percentage difference of the labor market outcome for females compared to males and is estimated at event time 10 from Eq. (10). The results for monthly wages, hourly wages, and hours of work are estimated conditional on employment. The result for the labor supply is estimated unconditional on employment status. Thin dashed lines indicate 95% CIs based on robust standard errors. CIs, confidence intervals; KLIPS, Korean Labor and Income Panel Survey.

the first childbirth. Figure A1 in Appendix expands the event time to include 15 years after the first childbirth.[28] The monthly path between full-time male and female workers who have a child further diverges; the child penalty at event time 15 ($t = 15$) is 45.5%. In Figure 9B, the path of the hourly wage between males and females tends to diverge from event time 6, but it is only significant between 7 years and 9 years after the first childbirth. When expanding the event time to 15 years after birth, as in Figure A1 in Appendix, the hourly wage gender gap increases, and the child penalty at event time 15 is 42.4%. In Figure 9C, there is no significant gap in the hours of work for full-time workers with the birth of a child. This may reflect the inflexible working hour system of full-time jobs in the Korean labor market. Figure 9D presents

28 15 years after birth is the period during which children complete middle school in South Korea.

a significant drop in the employment of females commencing from the year of their first childbirth.[29] Males experience no change in their employment, while females experience an immediate decline in labor supply of 43.0%. The child penalty in labor supply is 58.2% 10 years after the first childbirth.[30] In Figure A1 in Appendix, females' labor supply increases starting at 11 years after birth, but the child penalty is still large. Female labor supply falls behind 42.9% relative to male labor supply at event time 15 ($t = 15$), which is similar to the rate that they experience in the year following their first childbirth. In Figures 8 and 9, I show that the drop in South Korea's female labor supply results from females leaving their jobs upon marriage and childbirth. The Ministry of Gender Equality and Family in South Korea conducts a survey on the economic activities of career-break women and reports the results every 3 years. According to the analysis, about half of the females who leave the labor market owing to marriage or childbirth are white-collar females with a college or higher degree.[31] Such females tend to have a high interest in the parenting and education of their children. However, private childcare is expensive and public childcare service is in short supply. Under these circumstances, better-educated females often choose to leave the labor market, which implies that they may miss opportunities to accumulate their human capital through the workplace and to obtain the skilled wage premium. Even if they return to the labor market, a career break affects their wages and may eventually serve to widen the gender wage gap in South Korea. Unlike the patterns of female labor force participation rates in other countries, as shown in Figure 5, Korean females aged 30–44 years leave the labor market and return to the labor market in their late 40s. Such a career break can play an important role in explaining the large negative impact of childbirth on females' wages in South Korea.

While my event study for child effects on full-time workers starts at the birth of the first child, it is possible to include the effects of the birth of a second or third child, which may cause a further decrease in wages and labor supply for female workers. According to the OECD database, the total fertility rate in South Korea gradually decreased over the period, from about 1.5 in 2002, to about 1.2 in 2010, and to about 0.8 in 2020.[32] In my sample data, about 58% of those who have a first child give birth to a second child. My findings include the total effects of all children on labor market outcomes.

Further, I discuss the effects of childbirth on wages, hours of work, and labor supply depending on the wage distribution and occupation. Based on the monthly wage 1 year before the first childbirth, I classify the full-time workers into those whose monthly wages were less than the 50th percentile of the wage distribution in Figure 2 in Appendix, and those more than the 50th percentile in Figure 3 in Appendix. Figure 2 in Appendix shows that the child penalty for the monthly wage is 54.1% and that of working hours is 14.8% 10 years after the first childbirth. The supply of female labor from women workers whose wages were below the 50th percentile of the distribution shows an immediate drop in the year of childbirth and falls behind 60.4% relative to males in the same group at event time 10 ($t = 10$). In Figure 3 in Appendix, females whose wages were above the 50th percentile of the distribution have the

29 The full-time workers who are on maternity leave, paternity leave, and childcare leave are considered employed.

30 Female labor supply is 13.0% below relative to male labor supply 10 years after the birth of first child in Denmark (Kleven et al. [2019]).

31 *Source*: Analysis of Survey on Economic Activities of Career-Break Women (2013, 2016, 2019).

32 It is the lowest total fertility rate among the OECD countries. The OECD average total fertility rate was about 1.7 in 2000 and about 1.6 in 2020 (*Source*: OECD.*Stat*.).

negative effect of having child on the labor supply, except for wages and hours of work. The negative magnitude of the effects of having a child for females whose wages were above the 50th percentile of the distribution is smaller than that for those whose wages were below the 50th percentile of the distribution. In Figure A4 in Appendix, my event study focuses on full-time workers in professional occupations, and shows that females experience an immediate and significant decline in their labor supply just after giving birth. My findings suggest no negative effects of childbirth on the wages and hours of work for full-time female workers with relatively high wages or those in professional occupations. However, many of these females leave the labor market after they give birth, like those in Figure 9, and Figures A1 and A2 in Appendix.

The findings show that Korean females' labor market outcomes are significantly and negatively affected by childbirth, while males' labor market outcomes are not. Bertrand et al. (2021) classified South Korea as a high-sexism group, which means that South Korea is a country characterized by a gender-conservative society.[33] In South Korea, where traditional norms of gender roles persist, restrictions on females' economic activities in the labor market may still be substantial. In particular, marriage or giving birth would significantly affect their labor market outcomes compared to other developed countries with less gender-conservative societies. Therefore, strict gender norms can increase gender wage inequality or slow the convergence of wage inequality in South Korea.

5 Conclusion

The wage gap between male and female workers has narrowed in most labor markets of developed countries over the past few decades, thanks to female workers' enhanced human capital and labor market commitment. South Korea, like other developed countries, exhibited a narrowing gender wage gap for a few decades. Although the gender wage gap in South Korea has a similar pattern to that of other developed countries, the absolute size of the gap is much larger than those in other countries, and the convergence between male and female wages has slowed.

Using microdata for South Korea between 1998 and 2020, my findings suggest that the unexplained gender wage gap takes a larger share of total gender wage gaps, which means that a substantial share of the gender wage gap in South Korea cannot be explained by measured labor market characteristics during this period. Furthermore, the unexplained wage gap over the wage distribution in 2020 was greater than the explained gap, which implies that the unexplained factor contributed more to females' wages and that there is the possibility of glass ceiling effects in South Korea. Lastly, my paper suggests the average effects of marriage and the presence of children on wages, hours of work, and labor force participation. Full-time female workers who are married or have children are more likely than male workers to leave their jobs. Even if they continue to work after marriage or giving birth, average full-time female workers experience decreases in their wages and working hours, on average. The event study approach

33 Bertrand et al. (2021) used 26 developed countries as their sample: Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong, Hungary, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Taiwan, the UK, and the US. They used the gender-related statements from the Integrated Values Survey and the 2020 and 2012 International Social Survey Program to measure conservativeness of gender norms as sexism index. In Appendix Table 4 of Bertrand et al. (2021), Sweden, Denmark, and the US are classified as a low sexism group and Japan as a medium sexism group.

identifies the negative impact of childbirth on females' wages, hours of work, and labor supply. The dynamic paths of labor market outcomes between full-time male and female workers are found to diverge after they have children. These findings help to explain the larger gender wage gaps in South Korea relative to those in other developed countries.

The gender wage gap may dampen females' motivation or incentive to enter and actively work in the labor market. The government of South Korea has implemented various policies to reduce gender inequality in the labor market, such as a family–work balance policy and policies for equal employment among males and females. For instance, in order to help workers achieve work–life balance, the government has started to take action to increase public childcare programs and to expand the flexible work system by subsidizing the cost of its implementation to employers. Future research will examine whether these policies have had significant effects on the convergence of the total gender wage gap and decreased the unexplained gaps.

Declarations

Availability of data and material

The Korean Labor and Income Panel Survey (KLIPS) is available in the Korea Labor Institute, https://www.kli.re.kr/klips_eng/index.do. The dataset used during the current study are available from the corresponding author on reasonable request.

Competing interests

The author declares that I have no competing interest.

Funding

No funding

Author contribution

This paper is solo authored.

Acknowledgements

I thank the editor, anonymous referees, and session participants at the Korean Economic Review International Conference, August 13-14, 2020, at the 12th EconWorld Conference on Economics, August 26-28, 2020, at the North East Universities Development Consortium (NEUDC), November 6-7, 2020, at the 47th annual conference of the Eastern Economic Association, February 25-28, 2021, and at the Asian Economic Development Conference, July 14–15, 2022, for valuable comments and suggestions. Any errors in this paper are the author's sole responsibility.

References

Adda, Jérôme; Christian Dustmann; Katrien Stevens (2017): The Career Costs of Children. Journal of Political Economy 125(2), 293-337.

Akerlof, George A.; Rachel E. Kranton (2000): Economics and Identity. Quarterly Journal of Economics 115(3), 715-753.

Albanesi, Stefania; Olivetti Claudia (2009): Home Production, Market Production and the Gender Wage Gap: Incentives and Expectations. Review of Economic Dynamics 12(1), 80-107.

Albrecht, James; Anders Björklund; Susan Vroman (2003): Is There a Glass Ceiling in Sweden? Journal of Labor Economics 21(1), 145-177.

Albrecht, James; Marry Ann Bronson, Skogman Thoursie Peter (2018): The Career Dynamics of High- Skilled Women and Men: Evidence from Sweden. European Economic Review 105, 83-102.

Antonovics, Kate; Robert Town (2004): Are All the Good Men Married? Uncovering the Sources of Marital Wage Premium. American Economics Review 94(2), 317–321.

Arulampalam, Wiji; Alison L. Booth; Mark L. Bryan (2007): Is There a Glass Ceiling over Europe? Exploring the Gender Pay Gap Across the Wage Distribution. Industrial and Labor Relations Review 60(2), 163–186.

Becker, Gary S. (1991): A Treaties on the Family. Cambridge, MA: Harvard University Press.

Bertrand, Marianne; Claudia Goldin; Lawrence F. Katz (2010): Dynamics of the Gender Gap for Young Professionals in the Financial and Corporate Sectors. American Economic Journal: Applied Economics 2(3), 228–255.

Bertrand, Marianne; Emir Kamenica; Jessica Pan (2015): Gender Identity and Relative Income within Households. Quarterly Journal of Economics 130, 571-614.

Bertrand, Marianne; Patricia Cortes; Claudia Olivetti; Jessica Pan (2021): Social Norms, Labour Market Opportunities, and the Marriage Gap Between Skilled and Unskilled Women. Review of Economic Studies 88, 1936-1978.

Blau, Francine D.; Lawrence M. Kahn (2006): The U.S. Gender Pay Gap in the 1990s: Slowing Convergence. Industrial and Labor Relations Review 60(1), 45-66.

Blau, Francine D.; Lawrence M. Kahn (2017): The Gender Wage Gap: Extend, Trends, and Explanations. Journal of Economic Literature 55(3), 789-865.

Blau Francine D.; Anne E. Winkler (2017): Women, Work, and Family. NBER Working Paper Series No. 23644.

Blinder, Alan S. (1973): Age Discrimination: Reduced Form and Structural Estimates. Journal of Human Resources 8(4), 436-455.

Bruns, Benjamin (2019): Changes in Workplace Heterogeneity and How They Widen the Gender Wage Gao. American Economic Journal: Applied Economics 11(2), 74-113.

Card, David; Ana Rute Cardoso; Patrick Kline (2016): Bargaining, Sorting, and the Gender Wage Gap: Quantifying the Impact of Firms on the Relative Pay of Women. Quarterly Journal of Economics 131(2), 633-686.

Card, David; Ana Rute Cardoso; Joerg Heining; Patrick Kline (2018): Firms and Labor Market Inequality: Evidence and Some Theory. Journal of Labor Economics 36(S1), S13-S70.

Chernozhukov, Victor; Iván Fernández-Val; Blaise Melly (2013): Inference on Counterfactual Distributions. Econometrica 81(6), 2205-2268.

Choi, Eleanor Jawon; Jisoo Hwang (2015): Child Gender and Parental Inputs: No More Son Preference in Korea? American Economic Review: Papers & Proceedings 105(5), 638-643.

Christofides, Lous N.; Alexandros Polycarpou,; Konstantinos Vrachimis (2013): Gender Wage Gaps, 'Sticky Floors' and 'Glass Ceilings' in Europe. Labour Economics 21, 86-102.

Dong, Xiao-Yuan; Liqin Zhang (2009): Economic Transition and Gender Differentials in Wages and Productivity: Evidence from Chinese Manufacturing Enterprises. Journal of Development Economics 88, 144-156.

Goldin, Claudia (2014): A Grand Gender Convergence: Its Last Chapter. American Economic Review 104(4), 1091-1119.

Goldin, Claudia; Katz Lawrence F. (2016): A Most Egalitarian Profession: Pharmacy and the Evolution of a Family-Friendly Occupation. Journal of Labor Economics 34(3), 705-746.

Gustafsson, Björn; Shi Li (2000): Economic Transformation and the Gender Earnings Gap in Urban China. Journal of Population Economics 13, 305-329.

Hwang, Jisoo; Seonyoung Park; Donggyun Shin (2018): Two Birds with One Stone: Female Labor Supply, Fertility, and Market Childcare. Journal of Economic Dynamic Control 90, 171-193.

Hwang, Jisoo; Chulhee Lee; Esther Lee (2019): Gender Norms and Housework Time Allocation among Dual-Earner Couples. Labour Economics 57, 102-116.

Juhn, Chinui; Kristin McCue (2016): Evolution of the Marriage Earnings Gap for Women. American Economic Review: Papers Proceedings 106(5), 252-256.

Juhn, Chinhui; Kristin McCue (2017): Specialization Then and Now: Marriage, Children, and the Gender Earnings Gap across Cohorts. Journal of Economic Perspectives 31(1), 183-204.

Kleven, Henrik; Camille Landais; Jakob Egholt Søgaard (2019): Children and Gender Inequality: Evidence from Denmark. American Economic Journal: Applied Economics 11(4), 181-209.

Korenman, Sanders; Neumark David (1991): Does Marriage Really Make Men More Productive? Journal of Human Resources 26(2), 282-307.

Lee, Jong-Wha; Dainn Wie (2017): Wage Structure and Gender Earnings Differentials in China and India. World Development 97, 313-329.

Lundborg, Petter; Erik Plug; Astrid Würtz Rasmussen (2017): Can Women Have Children and a Career? IV Evidence from IVF Treatments. American Economic Review 107(6), 1611-1637.

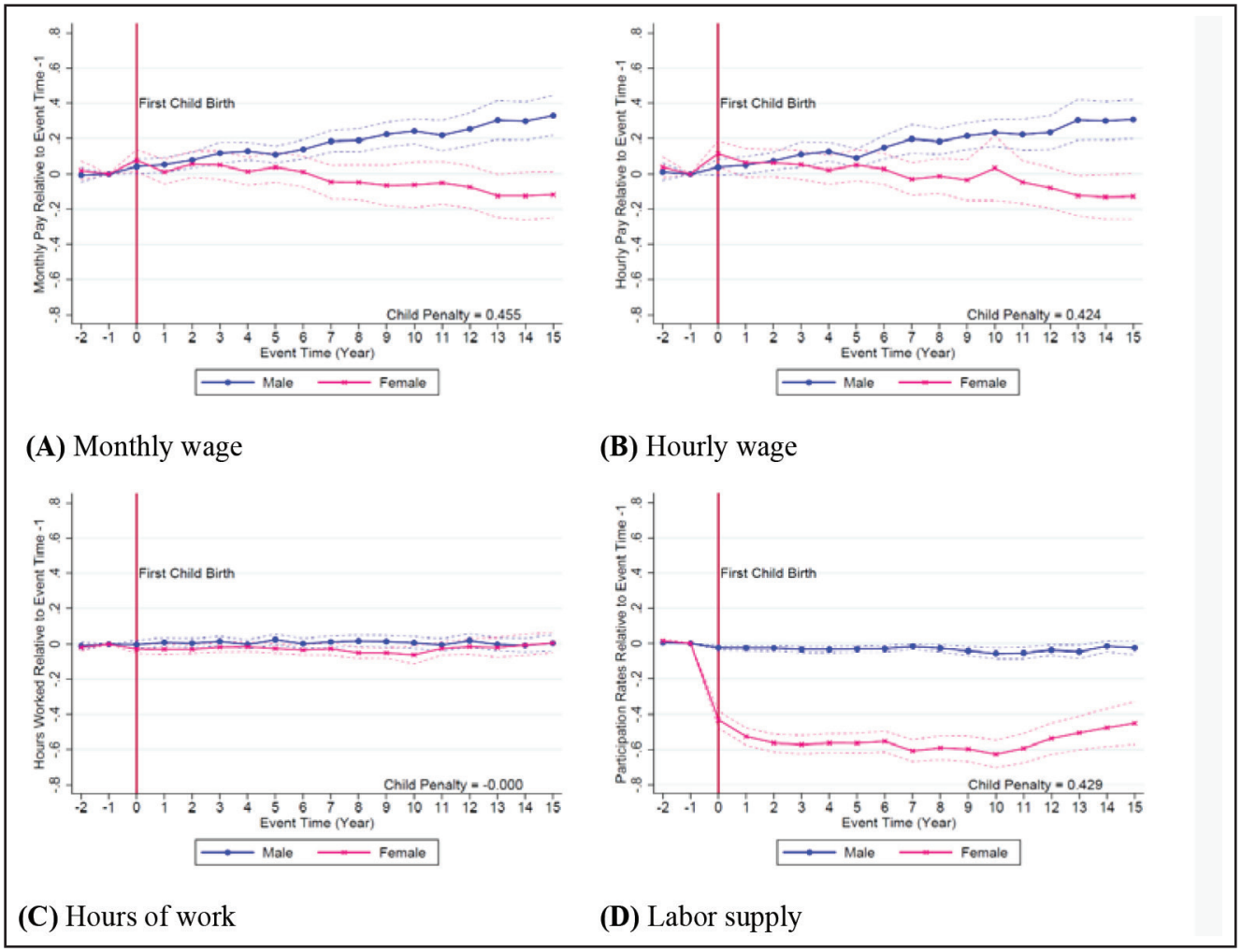
Ministry of Gender Equality and Family (2013, 2016, 2019): Analysis of Survey on Economic Activities of Career-break Women.

Noh, Min-sun (2019): Comparative Analysis of the Wage Gap between Small, Medium-sized, and Large Firms/enterprises in South Korea and Japan. Korean Small Business Institute.

Oaxaca, Ronald L. (1973): Male-Female Wage Differentials in Urban Labor Markets. International Economic Review 14(3), 693-709.

Appendix

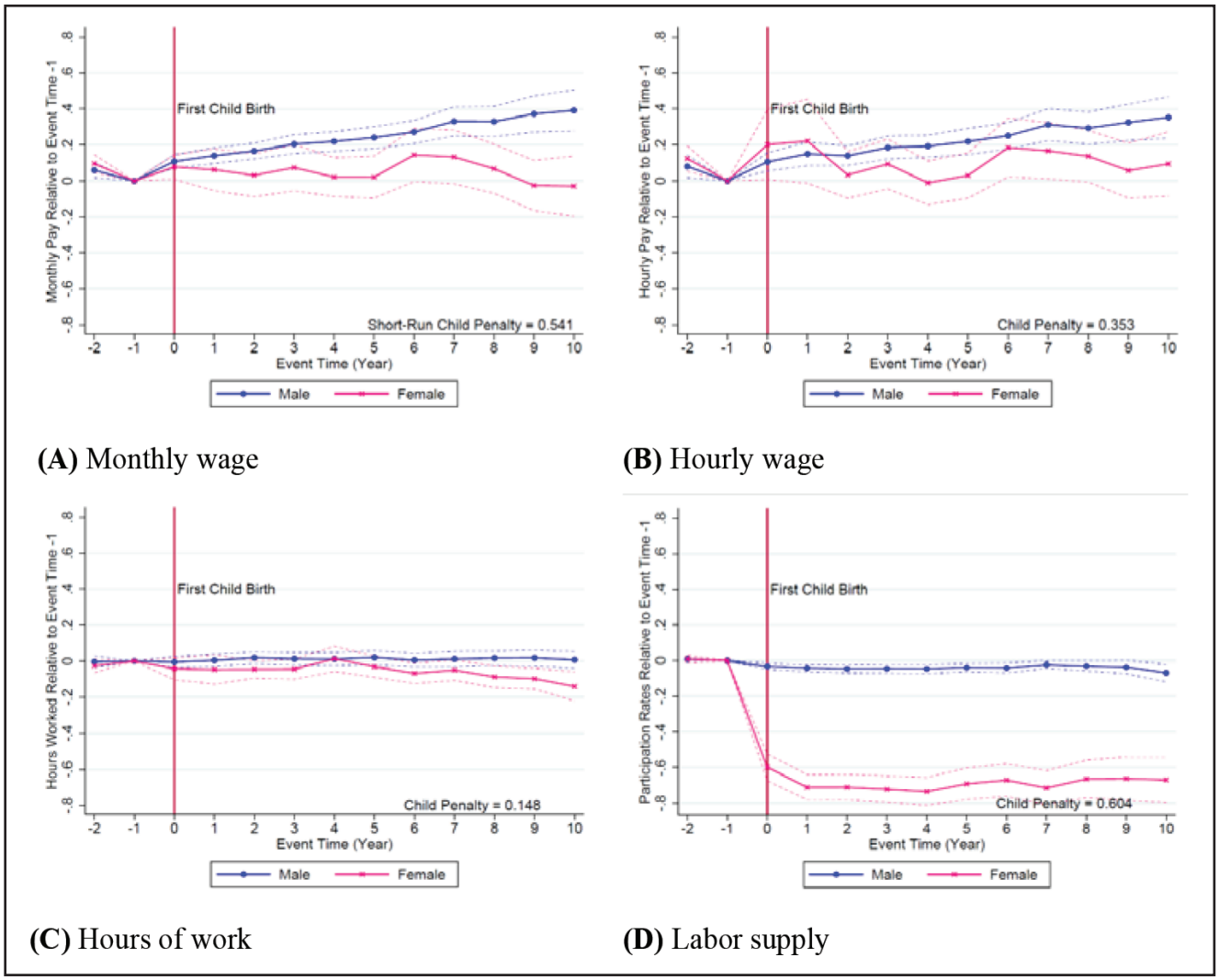
Figure A1 Impacts of Children in the Long Run.



Source: KLIPS.

Notes: This figure was created in the same way as Figure 9, but expands the event time to include 15 years after first childbirth. The child penalty for each panel shows the percentage difference of the labor market outcome for females compared to males and is estimated at event time 15 from Eq. (10). The results for the monthly wages, hourly wages, and hours of work are estimated conditional on employment. The result for the labor supply is estimated unconditional on employment status. Thin dashed lines indicate 95% CIs based on robust standard errors. CIs, confidence intervals; KLIPS, Korean Labor and Income Panel Survey.

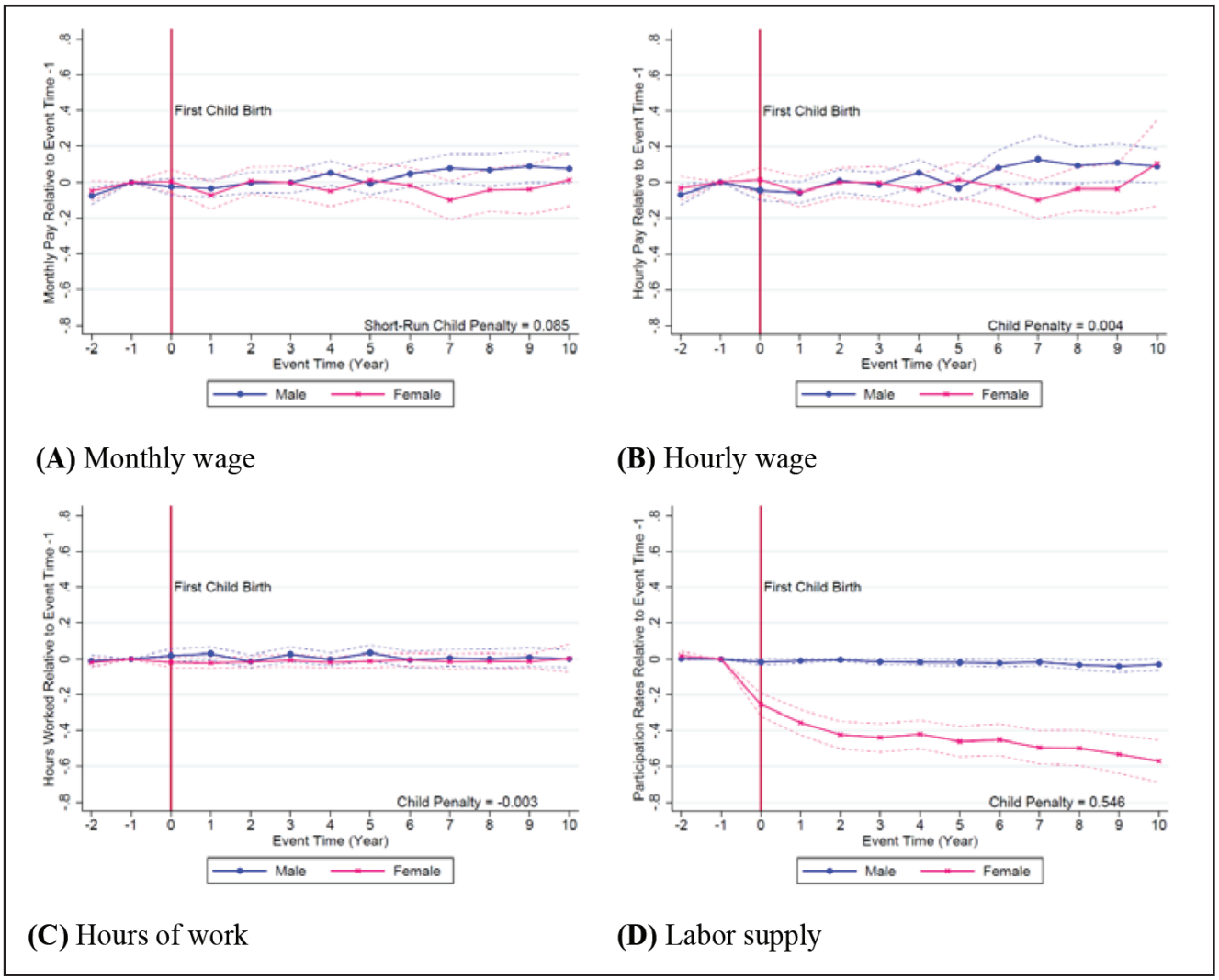
Figure A2 Impact of Children Below the 50th Percentile of the Wage Distribution.



Source: KLIPS.

Notes: This figure was created in the same way as Figure 9, but focuses only on those males and females whose monthly wages are below the 50th percentile of the wage distribution 1 year before marriage ($t = -1$). The child penalty for each panel shows the percentage difference of the labor market outcome for females compared to males and is estimated at event time 10 from Eq. (10). The results for the monthly wages, hourly wages, and hours of work are estimated conditional on employment. The result for the labor supply is estimated unconditional on employment status. Thin dashed lines indicate 95% CIs based on robust standard errors. CIs, confidence intervals; KLIPS, Korean Labor and Income Panel Survey.

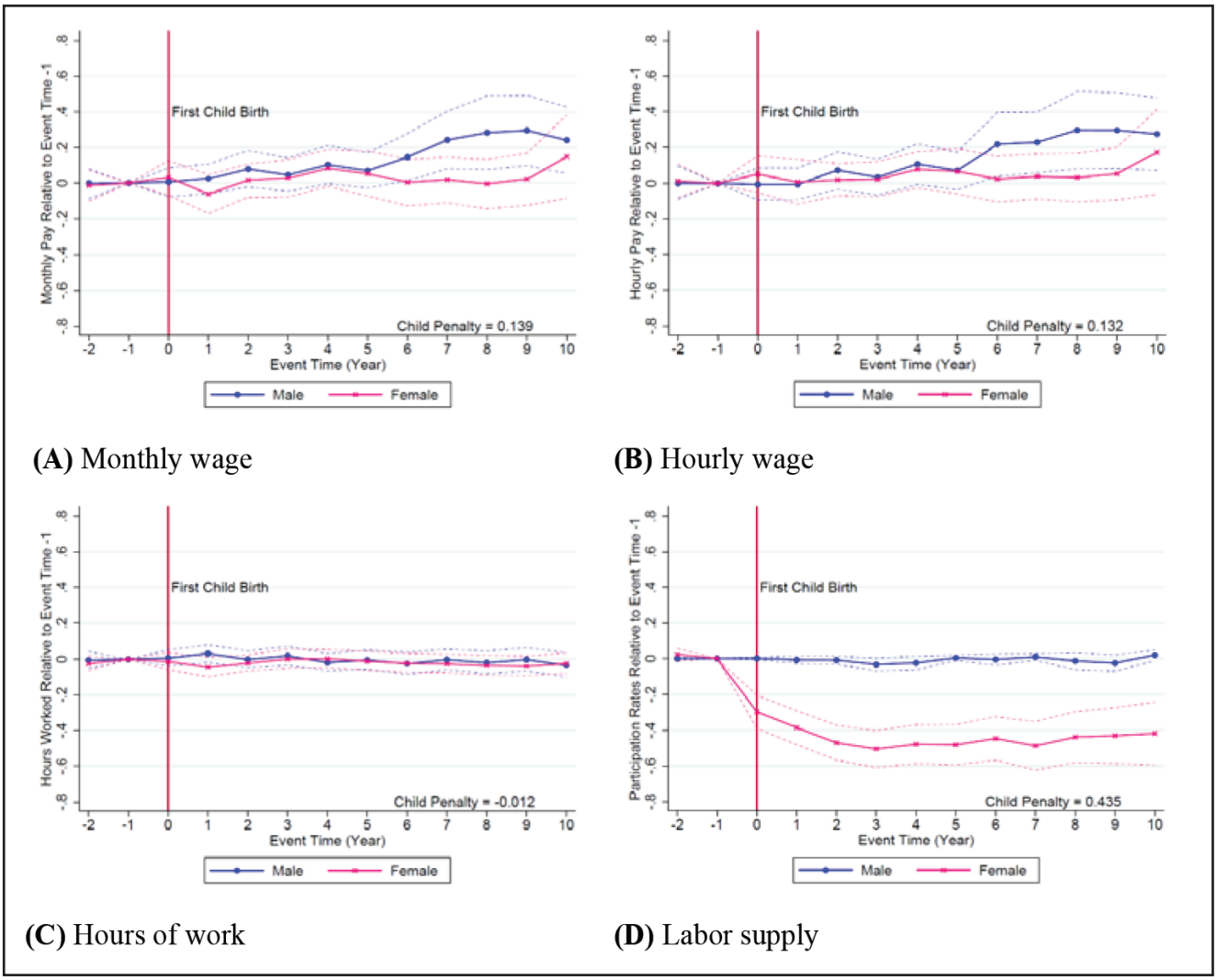
Figure A3 Impact of Children Above the 50th Percentile of the Wage Distribution.



Source: KLIPS.

Notes: This figure was created in the same way as Figure 9, but focuses only on those males and females whose monthly wages are above the 50th percentile of the wage distribution 1 year before marriage (t = –1). The child penalty for each panel shows the percentage difference of the labor market outcome for females compared to males and is estimated at event time 10 from Eq. (10). The results for the monthly wages, hourly wages, and hours of work are estimated conditional on employment. The result for the labor supply is estimated unconditional on employment status. Thin dashed lines indicate 95% CIs based on robust standard errors . CIs, confidence intervals; KLIPS, Korean Labor and Income Panel Survey.

Figure A4 Impact of Children in Professional Occupations.



Source: KLIPS.

Notes: This figure was created in the same way as Figure 9, but focuses only on those males and females who work in professional occupations. Professional jobs include science professionals, computer-related professionals, engineering science professionals, health and medical professionals, teaching professionals, administration, business, and finance professionals, legal, social welfare, and religion professionals, and culture, arts, and broadcasting professionals in the 5th KSCO. The child penalty for each panel shows the percentage difference of the labor market outcome for females compared to males and is estimated at event time 10 from Eq. (10). The results for the monthly wages, hourly wages, and hours of work are estimated conditional on employment. The result for the labor supply is estimated unconditional on employment status. Thin dashed lines indicate 95% CIs based on robust standard errors. CIs, confidence intervals; KLIPS, Korean Labor and Income Panel Survey.

Table A1 Share of full-time male and female workers at wage distribution percentile (%)

	1998		2020	
Percentile	**Male**	**Female**	**Male**	**Female**
Below 10th percentile	26.72	73.28	31.65	68.35
Below 50th percentile	46.86	53.14	39.63	60.37
Above 90th percentile	87.22	12.78	89.32	10.68

Notes: Sample includes full-time male and female workers aged 20–59 in 1998 and 2020. They are nonfarm, nonmilitary, and salaried workers. Entries indicate the shares of full-time male and female workers who earn below the 10th percentile, below the 50th percentile, and above the 90th percentile of the total wage distribution.

Table A2 Share of marital status for full-time workers at wage distribution percentile (%)

	1998		2020	
Percentile	**Male**	**Female**	**Male**	**Female**
Below 10th percentile	54.55	64.64	36.81	67.05
Below 50th percentile	57.84	48.85	44.70	60.65
Above 90th percentile	95.26	88.24	94.57	84.42

Notes: Sample includes full-time male and female workers aged 20–59 in 1998 and 2020. They are nonfarm, nonmilitary, and salaried workers. Entries indicate the shares of full-time male and female workers who earn below the 10th percentile, below the 50th percentile, and above the 90th percentile of the total wage distribution.

Table A3 Share of full-time male and female workers by age cohort (%)

	1998		2020	
Age cohort	**Male**	**Female**	**Male**	**Female**
20–29	49.28	50.72	42.58	57.42
30–39	74.34	25.66	62.91	37.09
40–49	65.90	34.10	65.90	34.10
50–59	70.18	29.82	59.67	40.33

Notes: Sample includes full-time male and female workers aged 20–59 in 1998 and 2020. They are nonfarm, nonmilitary, and salaried workers. Entries indicate the shares of male and female workers among full-time workers for each age group and year.

Table A4 Log monthly wage and share of males and females by size of establishment

	1998				2020			
	Male		Female		Male		Female	
No. of workers	Log monthly wage	Share of full-time male workers (%)	Log monthly wage	Share of full-time female workers (%)	Log monthly wage	Share of full-time male workers (%)	Log monthly wage	Share of full-time female workers (%)
1–4	7.17 (0.40)	49.62	6.77 (0.42)	50.83	7.59 (0.41)	45.28	7.48 (0.31)	54.72
5–9	7.29 (0.34)	56.82	6.90 (0.37)	43.18	7.75 (0.43)	49.52	7.57 (0.26)	50.48
10–29	7.38 (0.42)	62.19	6.85 (0.33)	37.81	7.95 (0.31)	57.19	7.58 (0.27)	42.81
30–49	7.35 (0.45)	70.39	6.89 (0.33)	29.61	7.97 (0.40)	66.66	7.68 (0.33)	33.34
50–69	7.39 (0.45)	70.09	6.95 (0.52)	29.91	8.03 (0.35)	53.25	7.70 (0.30)	46.75
70–99	7.40 (0.42)	72.86	6.86 (0.27)	27.14	7.91 (0.39)	55.68	7.80 (0.36)	44.32
100–299	7.39 (0.51)	74.07	7.03 (0.46)	25.93	8.11 (0.33)	47.65	7.78 (0.30)	52.35
300–499	7.54 (0.43)	66.27	6.98 (0.30)	33.73	8.15 (0.28)	58.16	7.78 (0.18)	41.84
500–999	7.50 (0.38)	67.55	7.19 (0.37)	32.45	8.32 (0.43)	65.16	7.72 (0.29)	34.84
over 1,000	7.65 (0.41)	69.82	7.12 (0.56)	30.18	8.33 (0.43)	65.03	7.90 (0.50)	34.97

Source: KLIPS.

Notes: Sample includes full-time male and female workers aged 20–59 years. They are nonfarm, nonmilitary, and salaried workers. The size of the establishment is categorized into 10 sectors, based on the number of workers: 1–4, 5–9, 10–29, 30–49, 50–69, 70–99, 100–299, 300–499, 500–999, and over 1,000. Standard deviations are in parentheses.

KLIPS, Korean Labor and Income Panel Survey.

Table A5 Share of full-time male and female workers in professional jobs (%)

	1998		2020	
	Male	Female	Male	Female
Professional jobs	55.83	44.17	50.67	49.33
Male professional jobs	62.41	37.59	58.81	41.19

Source: KLIPS.

Notes: Sample includes full-time male and female workers aged 20–59 years in 1998 and 2020. Each entry indicates the share of full-time male and female workers in each category. Professional jobs include science professionals, computer-related professionals, engineering science professionals, health and medical professionals, teaching professionals, administration, business and finance professionals, legal, social welfare, and religion professionals, and culture, arts, and broadcasting professionals in the 5th KSCO. Male professional jobs are professional jobs excluding teaching professionals. KLIPS, Korean Labor and Income Panel Survey.