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Family Life Course, Gender, and Skill Mismatch

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FAMILY LIFE COURSE, GENDER, AND SKILL MISMATCH

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Introduction

Skill mismatch, the discrepancy between the skill levels held by employees and those demanded by employers, has long been of interest to analysts of the labor market. From the perspective of income maximizing, working at a lower level of occupation relative to one's skill level is challenging to understand when considering investments into education and skill development. It may also be irrational to hire workers who lack the competencies required by their occupational positions. Such mismatches are worth exploring to better understand the processes of recruitment and career development and the role of education in the labor market.

Studies focusing on the causes of skill mismatch reveal that individual, occupational, and contextual factors are closely associated with the probability of skill mismatch (Shin & Bills, 2021). For example, workers from certain demographics are less capable of finding appropriate jobs, or have lower accessibility to jobs that align with their competence, making them more likely to be underutilized in their occupations (Sattinger, 2012; Støren & Wiers-Jenssen, 2010). In addition, empirical evidence demonstrates that workers with non-supervisory roles, part-time employment, or lower occupational level jobs are more likely to experience a disconnect between their skills and skill use (Allen et al., 2013; Krahn & Lowe, 1998; Quintini, 2011a). Furthermore, in an economic depression, workers may have difficulty in finding jobs that match their skill level due to the decrease in job openings (Quintini 2011a; Vaisey 2006).

As the literature shows, skill mismatch is a phenomenon that reflects the complexity of the labor market. However, previous studies have not fully examined skills mismatch in relation

to gender in the labor market. Some studies have reported that female workers are more likely to have jobs whose requirements do not correspond with their skill proficiencies than male workers (e.g., Desjardins & Rubenson, 2011; Quintini, 2011a). In contrast, other research has shown that male workers are more likely to be overskilled than female workers (Pellizzari & Fichen, 2017).

Although the results of prior studies are equivocal, gender differences in skill mismatch are likely linked to the family life course. Families typically proceed through phases, including marriage and childbirth, which can result in multiple gendered social roles (Macmillan & Copher, 2005). Unless living separately, married couples need to secure an appropriate place to live, which may force one person to change jobs to accommodate the other's. Neoclassical economists suggest that such couples would choose the strategy that maximizes their earnings (Bieibly & Bieibly, 1992). Women, then, are more likely to be "tied movers" and/or "tied stayers" due to preexisting structural disadvantages in the labor market (Mincer, 1978). This eventually limits possible job opportunities and increases the possibilities of female workers being mismatched, exacerbating the gender wage gap (Frank, 1978; Robst, 2007; Cooke et al., 2009).

Childbirth may also play a role in driving the skill mismatch difference between genders. There is a certain degree of conflict between roles in work and family (Martinengo, Jacob, & Hill, 2010). Couples often adjust their primary roles based on beliefs about gender norms and family identity (Masterson & Hoobler, 2015). If a dual-earner couple is prone to traditional gender role stereotypes in which men are "the breadwinner" and women are "the caregiver," women are more likely to make professional concessions for the benefit of the family that lead to overqualified employment.

Lacking from the literature is a direct examination of whether the degree of skill mismatch differs by gender in each phase of the family life course. Most research has focused on

simple relationships between skill mismatch, gender, and family factors such as marital and parental status. The examination of gender differences in skills mismatch by the family life course may provide a better understanding of the pattern of gender disadvantages in the labor market.

Thus, this study aims to analyze a specific feature of skill mismatch – gender differences in the prevalence of skill mismatch for each phase of the family life course. We also want to know if a spouse’s working status relates to the likelihood of being skill mismatched during a specific phase of the family life course. To this end, we use data from the Programme for the International Assessment of Adult Competencies (PIAAC). These data provide us with an opportunity to take crucial first steps in unraveling how skill mismatch varies by gender in each phase of the family life course. Both marital status and children’s age are important predictors of women’s employment status, and extending analysis to gender differences in skill mismatch is an important contribution of this study to the literature. In addition, as spouse’s working status is closely linked to their partner’s employment status and the family life course, we examine if the relationship between spouse’s working status and skill mismatch differs by each phase of the family life course.

In summary, we address the following research questions:

- I. How does gender (spouse’s working status) predict the likelihood of skill mismatch?
- II. Are the effects of gender (spouse’s working status) on the likelihood of skill mismatch different for each phase of the family life course?

Our findings provide significant implications for both research and policy on labor markets. Many scholars have noted the costs of excessive skill mismatching – lowered productivity, diminished job satisfaction, and stifled career opportunity (Allen & van der Velden, 2001; Green & McIntosh, 2007; Kalleberg, 2008). Others have shown the effects of marital and parental status on the relative employment prospects of men and women (Büchel & Battu, 2003; Schultheiss, 2009; Young & Schieman, 2017). Clarifying the determinants of skill mismatch might suggest means to better align the demands of the labor market with the home.

Theoretical Background: The family life course and Women’s Careers

To begin with, American families are diverse to the point that characterizing any one model as normative is unrealistic. PIAAC, of course, was not designed to capture the many combinations and permutations of contemporary families. We must make do with the level of detail that PIAAC makes available to us, while recognizing that we are missing much of the variety of family structure. Thus, in this study, we focus on families with a male husband and a female wife. In addition, we use the groups of terms interchangeably: underqualification for overutilization and overqualification for underutilization. These terms are not the same, but existing literature does not distinguish them in a strict manner due to their similarity (Allen & van der Velden, 2001). For example, underqualified workers generally have less skill or education relative to the level required for their work, and such workers may need to utilize their skills excessively than what they have.

We reviewed the literature pertaining to gender differences in skill mismatch over the family life course. As discussed, from the life course perspective, families are expected to experience life events that require them to play multiple social roles. Although there are many

ways to define the phases of the family life course, children most centrally define many major family transitions (Gangl & Ziefle, 2009; Martinengo et al., 2010). For the purposes of this review, we divided the family life course into three phases: marriage, family with younger children, and family with older children.

There have been some attempts to examine if men and women are equally likely to experience skill mismatching, and the results are mixed. While there is some evidence that women are more likely than men to be overqualified for their jobs, the difference is often marginal, or even reversed (Quintini, 2011b). Such inconclusive results reinforce that there are still many unresolved questions about the causes. It seems plausible, then, that a portion of the gender difference in the labor market derives from family gender roles.

Marriage and Women's Careers

When people get married, both men and women may make labor-supply decisions in response to changes in family structure and circumstances. There are reasons to expect that within-family factors will increase the likelihood that one or both partners will face the labor market with skill mismatch. Spouses in dual-earner families, for instance, must find ways to accommodate the skills that each partner brings to the labor market with the local demand for those skills. Such households are especially vulnerable to labor market rigidities. In particular, women are more likely to be “tied movers” and/or “tied stayers” of men due to the labor market structure unfavorable to them (Mincer, 1978) and the traditional gender roles (Biebly & Biebly, 1992). Under such conditions, a husband's jobs would be prioritized, then, a wife may suffer more from skill mismatch and wage penalty (Frank, 1978; Cooke et al., 2009).

Büchel and Battu (2003) provided evidence that supports the gender differences in skills mismatch after marriage. They reported that married West German women living in rural areas were more likely to be overqualified for their work than were other combinations of gender, marital status, and region of residence. They also argued that their results implied the family responsibilities of these women tied them to areas with few job opportunities. Males in rural areas did not have a high overqualification rate, probably because of their greater ability to commute to areas of greater population density than women. This assumption was aligned with the fact that when controlling for the commuting distance, the gender difference in overqualification likelihood in rural areas became statistically non-significant.

Skills mismatch may also be related to couples' adoption of, and employers' perception of, traditional gender roles in marriage.¹ Research found that husbands with less education than their wives still tend to out-earn them in the United States (Qian, 2017) and Sweden (Chudnovskaya & Kashyap, 2020). Bertrand et al. (2015) believe that these patterns arise because wives often cut back on their labor force participation to avoid out-earning their husbands. Van Bavel et al. (2018) interpreted this phenomenon as reflecting the persistence of the “homemaker-breadwinner” model of marriage. In addition, it has been well documented in the literature that women’s careers are often disadvantaged due to glass ceilings that are partially created and maintained by employers’ perceptions of gender stereotypes and various forms of workplace discrimination (Hoobler, Wayne, & Lemmon, 2009; Purcell, MacArthur, & Samblanet, 2010).

Accommodations to the labor market and traditional gender roles, collectively, necessitate consideration of the impact of marriage on occupational opportunities. Overall, we

¹ We follow Van Bavel et al. (2018) in using the terms “wife” and “husband,” while recognizing that they do not apply in significant numbers of households.

expect that the proportion of underutilized workers will be much higher for women than for men as marriage may limit their opportunities to find and continue their jobs.

Young Children and Women's Careers

Families shift to another phase when they have children. Giving birth and caring for children requires considerable time, resources, and energy, which can create challenges with maintaining a work-life balance. Family members often need to accommodate or change their career aspirations to take care of their children. For instance, having children in the household may influence both the willingness of participants to enter the labor market and the likelihood that they accept a mismatched job.

Although the competing roles of parent and employee have an impact on both men and women, it asymmetrically affects women's career trajectories (Schultheiss, 2009). The demand of caring for a young child may force even well-educated women toward a strategy of satisficing, accepting a job which one may be overqualified for rather than optimizing one's job search by holding out for a position in which one's capabilities can be fully utilized. In families with young children, scaling back work hours and allocating less resources to work are strategies women use more often than men (Young & Schieman, 2017). Green et al. (2002) argues that family responsibilities, which fall unequally on men and women, can produce tensions between the demands of families and work that lead to mismatch in this way. In addition, while dual-earner couples are free to make family-related work decisions depending on how they perceive their family identity, "non-traditional" dual-earner couples where the husband is the primary caregiver is still relatively uncommon (Masterson & Hoobler, 2015).

This research indicates that women tend to play a primary role in raising young children while simultaneously reducing their commitment to work (Kaufman & Uhlenberg, 2000). Yet,

such transitions of married women to the primary caregiver role may depend on the job they previously held. The decision that minimizes the financial burden on their families is often to manage work hours or change the working status of the one who is not the primary economic provider. Those with less desirable jobs relative to their skill level have a higher risk of leaving their jobs or taking parental leave. In fact, overqualified workers are more likely to leave and less committed to their jobs (Maynard, Joseph, & Maynard, 2006; Verhaest & Omey, 2006; Wald, 2005). Among dual-earner couples with young children, then, women are more likely to leave the labor market due to their higher probability of overqualification, as discussed earlier.

Paradoxically, in practice of analysis, the likelihood of overqualification for women with young children is expected to lower considering the concept of skill mismatch. By the definition commonly accepted in the literature, skill mismatch only regards workers in the labor market. Skill mismatch of those who left their jobs for any reason is not straightforwardly measurable. If a certain group of people systemically leaves their jobs more often, the characteristics of the remaining group will stand out. This means that the proportion of women having desirable jobs relative to their skill level will increase because overqualified mothers are expected to leave their jobs more to take care of children. As a result, although it may possibly appear as if underqualified women are more prevalent in the labor market, this selection effect should be interpreted as the persistent disadvantages of women in the labor market proceeding from the impact of the family life course.

Older Children, Long Career Breaks, and Women's Careers

As children grow older, various factors related to skill mismatch interact and influence each other. For this reason, the pattern of skill mismatch among dual-earner couples with older

children is likely to differ from those with young children. Firstly, as children grow, parents who left the labor market may want to return. There are many workers who pursue jobs after a short break following childbirth. In the U.S., 65 percent of women who left the labor market with childbirth return to the labor market after three months. Most of these women are returning to the same job, or one of similar prestige (Aisenbrey, Evertsson, & Grunow, 2009), indicating that the pattern of skill mismatch often persists for those who stopped working for a short period of time.

Typically, it is challenging to reenter the workplace after a long career break. Ten percent of mothers are not back at work until their first-born is 6 years old in the U.S. (Aisenbrey et al., 2009). In this time, many changes occur when these mothers plan to return to work. This is because the supply of, and demand for, job-applicable skills are sensitive to both personal and social contexts that are expected to change with time. This supply and demand relationship may change depending on the workers' age, the supply of education and skills in the labor market (typically through educational expansion), and the demands of technology, work, and employers. These demands typically increase over time, although there are lively debates in the literature about the extent to which technological change is biased in favor of those with sophisticated or more routine skills. At the same time, as Azmat et al. (2006, p. 6) observed, "human capital theory predicts higher unemployment rates for women than for men, and among women, married women and those with children are likely to have accumulated less human capital." These changes may lead to a difference in the degree of matching between the supply of, and demand for, skills of those who return to work after a long absence. While there may be workers who are able to return to the jobs that they had before their career break, they may suffer from a skill shortage, even if they were well-matched before leaving their jobs.

Some people reenter the labor market with new jobs. It is very difficult to predict the direction of skill mismatch among these workers. This is because their capabilities are reevaluated in the labor market and these workers also expect to redefine the value of their labor. For example, some might want to change jobs because they want to find work that provides more flexibility. Green et al. (2002) has presented evidence that workers with families, and especially part-time workers, tend to be overqualified. In contrast, some might decide to return to the labor market only when they are employed for occupations with good conditions. These results suggest there is a sizeable probability of both upward and downward mobility within the labor market following reentry (Aisenbrey et al., 2009).

Methods

Data

We used the combined U.S. PIAAC data collected in 2012 and 2014 by the National Center for Education Statistics (NCES). The PIAAC survey was designed to help scholars understand adult skills and skill use in the workplace. Results include information about adults' background, skills, and experience, allowing researchers to examine how gender and spouse's working status are associated with the degree of skill mismatch in each phase of the family life course. Among 8,670 participants, we focused on full-time employees who live with their spouses at the time of data collection. There were 1,717 participants who met these criteria. Among them, we included prime working age participants aged 20-65 ($n=1,674$). Lastly, we excluded workers who had missing information about their occupations or whose occupations do not have enough cases. These were occupations primarily classified as Armed Forces and skilled agricultural and fishery workers. These specifications resulted in 1,631 participants, but some

participants had missing information about their spouse's working status, occupational level, and income. By removing such participants, we had 1,538 cases in our analytic samples. Removing those with missing values cut only 93 cases, less than 6 percent of the initial analytic sample, which includes full-time employees who fall into sizable occupational classifications, are between ages 20 and 65, and live with their partners (n=1,631).

We conducted all data analyses with STATA using the PV module with all 10 plausible values (PV) and sampling and replicate weights. This module was developed to correctly compute population estimate and variance, accounting for both sampling and measurement error (Macdonald, 2014).

Measurement

Dependent variable (Skill mismatch): There are many fundamentally different ways to operationalize skill mismatch, reflecting different theoretical motivations and purposes (Kalleberg, 2008; Shin & Bills, 2021). Differing measures often lead to different empirical findings and conclusions, and no specific measurement is unambiguously the “correct” one. Our conceptualization and measurement departs from that adopted throughout much of the PIAAC literature (see, for example, Pellizzari & Fichen, 2017). We adopt the concept suggested by Allen et al. (2013). In this approach, skill mismatch is defined as the degree of discrepancy between one's skill proficiencies and skill utilization in their occupational positions. An individual's standardized skill proficiency is compared with his or her standardized skill utilization in the workplace. For this comparison, we first standardized literacy (PVLIT1~10) and numeracy skill (PVNUM1~10) proficiencies for each plausible value. The standardization was based upon paid workers who are in the same occupations (two-digit level International Standard Classification of

Occupations: ISCO2C). Second, the values of items on reading and writing activities (literacy skill: G_Q01a~G_Q02d) and numeracy activities (numeracy skill: G_Q03b~G_Q03h) were averaged to measure each domain of skill utilization. These averaged values were also standardized based on workers in paid employment who are in the same occupations (ISCO2C). Third, each standardized skill proficiency was subtracted from each skill utilization (e.g., standardized literacy skill proficiency based on PVLIT1 – standardized literacy skill use in workplace). This process was performed for all plausible values, which generated 20 values (10 for each skill domain). Lastly, we combined each pair of derived values (plausible value 1~10), which generated 10 values. We used this variable as a continuous variable to avoid information loss that often occurs when a variable is converted to categorical. The positive values of this variable indicate that the level of utilization is lower than that of one's skill level (underutilization). When it has negative values, it means that the level of utilization is higher than that of one's skill level (overutilization).

Independent variables (Gender and Spouse's working status): We mainly focus on factors impacting skill mismatch in relation to the family life course: gender and spouse's working status. In this study, gender was dummy coded as men (0) and women (1). We also included a variable for spouse's work situation (J_Q02c²). This variable was also dummy coded (full-time = 0 and part-time or other types = 1). We expected family factors to be variably associated with the probability of working at jobs that match skill levels in each phase of the family life course.

Family life course: This variable was measured by both the number of children and their age. PIAAC provides information on the number of children in the household (J_Q03b_C) and

² This represents the variable name drawn from PIAAC data files. For more detailed information on the PIAAC background questionnaire and variables, see the following: https://nces.ed.gov/surveys/piaac/final_en_bq.htm.

the age of the youngest child (J_Q03d1US_C for those with two or more children & J_Q03cUS_C for those with 1 child). As this study focused on the pattern of gender differences in skill mismatch by each phase of the family life course, based on these variables, we created a variable including four groups: phase 1 (no children) = 0; phase 2 (age of the youngest child under 6) = 1; phase 3 (age of the youngest child between 6 to 17) = 2, and; phase 4 (age of the youngest child over 17) = 3. This classification may best reflect the characteristics of each phase of the family life course. Indeed, the U.S. Bureau of Labor Statistics provides statistics in relation to labor force participation of mothers and fathers by two categories: under age 6 and ages 6 to 17.

Control variables: The relationship between family and employment is complex; these variables interact with one another and with other variables. To control external variables which may influence our study, we added three sets of control variables. We included variables related to one's skill level and skill requirements for one's job in our models.

The first group of variables consisted of individual background characteristics such as workers' age and level of education. PIAAC provides respondents' ages in groups of 5-year bands (20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, and 60-65). We classified level of education into eight levels: 1) primary or less, 2) lower secondary, 3) upper secondary, 4) post-secondary non-tertiary, 5) short-cycle tertiary, 6) bachelor's or equivalent, 7) master's or equivalent, and 8) doctoral or equivalent level of education (see UNESCO Institute for Statistics (2012) for more information).

The second set of controls were occupational factors, which included occupational levels, supervisory roles, work hours, and hourly income. All these controls have been shown to differentiate between men and women. For occupational levels, we utilized the variable

ISCOSKIL4, which divides occupations into four levels depending on the types of skill required to perform the jobs. These divisions are: 1) skilled, 2) semi-skilled white-collar, 3) semi-skilled blue-collar, and 4) elementary occupations.

Supervisory role ties into job status. Employees who did not have the responsibility of supervising served as the reference group. This group was compared with two groups of employees: those who supervise fewer than 5 people and those who supervise more than 5 people. Work hours simply indicated the number of hours of work per week. Lastly, for measuring income, we used ‘EARNHRBONUSPPPUS_C’ and converted this variable into a natural logarithmic form because the distribution of the variable was skewed, which generally reflects the characteristics of income change in our lives (Heckman & Polachek, 1974; Grodsky & Pager, 2001).

Table 1. *Description of variables*

	Variable	Description
Dependent Variable	Skill mismatch	Overutilization (-) to underutilization (+) (continuous variable)
Independent variables	Gender	Men (reference group) / women
	Spouse’s working status (J_Q02c)	Full-time worker (reference group) / non-full-time workers
The family life course	The phases of the family life course (J_Q03b_C & J_Q03d1us_C & J_Q03cus_C)	Phase 1 (no children) / phase 2 (with children under 6) / phase 3 (with children aged 6-17) / phase 4 (with children aged 18 or older)
Control Variables	Individual backgrounds	Age (AGEG5LFSEXT) Age in 5-year bands (20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, and 60-65)
		Education (EDCAT8) primary or less / lower secondary / upper secondary / post-secondary non-tertiary / short-cycle tertiary / bachelor’s or equivalent / master’s or equivalent / doctoral or equivalent level of education
	Occupational factors	Occupational level (ISCOSKIL4) Skilled / Semi-Skilled white collar / Semi-Skilled blue collar / Elementary
	Supervisory role (D_Q04_T)	No supervisory role (reference group) / Fewer than 5 people / More than 5 people
	Work hours (D_Q10_T)	Working hours per a week

	Hourly income (EARNHRBONUSPPPUS_C)	The natural logarithm of the hourly earnings. ³
Skill proficiencies	Literacy proficiency (PVLIT1~10)	Plausible values of literacy proficiency
	Numeracy proficiency (PVNUM1~10)	Plausible values of numeracy proficiency

The third set of controls was skill proficiencies. Among three types of skills (literacy, numeracy, and problem-solving skills), we utilized literacy and numeracy skill proficiencies (the pair of plausible values in a raw data format) in our analysis. We were not able to control for problem-solving proficiency⁴ because many participants did not have information (Please see Table 1 for details and Table 2 for descriptive statistics of these variables).

Table 2. *Descriptive statistics (weighted)*

	Variable	Mean	Std. Dev.	Min	Max
Dependent variable	Skill mismatch	-0.212	2.318	-8.770	6.098
Independent variable	Gender	men (56.894%) / women (43.106%)			
	Spouse's working status	full-time worker (63.240%) / non-full-time workers (36.760%)			
The family life course	The phases of the family life course	phase 1 (17.902%) / phase 2 (24.861%) / phase 3 (30.201%) / phase 4 (27.036%)			
Individual backgrounds	Age	20-24 (3.627%) / 25-29 (11.120%) / 30-34 (14.026%) / 35-39 (14.180%) / 40-44 (12.615%) / 45-49 (13.768%) / 50-54 (11.991%) / 55-59 (10.294%) / 60-65 (8.380%)			
	Education	primary or less (1.931%) / lower secondary (5.307%) / upper secondary (35.439%) / post-secondary non-tertiary (9.371%) / short-cycle tertiary (10.354%) / bachelor's or equivalent (20.600%) / master's or equivalent (15.021%) / doctoral or equivalent level of education (1.975%)			
Occupational factors	Occupational level	Skilled (57.527%) / Semi-Skilled white collar (20.888%) / Semi-Skilled blue collar (17.447%) / Elementary (4.138%)			
	Supervisory role	no supervisory role (60.704%) / supervising fewer than 5 people (17.402%) / supervising more than 5 people (21.894%)			
	Work hours	45.273	8.738	35	119
	Hourly income	3.066	0.610	0	5.259
Skill proficiencies	Literacy proficiency	279.996	51.880	87.037	449.729
	Numeracy proficiency	270.228	55.592	66.519	415.803

³ Wage income by itself may not include some important non-wage sources of income that vary over the life cycle and are interrelated with employment choices, which is not accounted for by our data.

⁴ Problem-solving skill proficiency was measured only when participants took the assessment on a computer.

Note. Hourly income is the result of applying the natural logarithm. The average of hourly income in the US dollar format is 26.267.

Analytic strategy and model

Our analytic strategy was based on a multiple regression model across groups (different phases of the family life course). Using a linear model with a stepwise approach, we analyzed the relationship between independent variables (gender and spouse's working status) and skill mismatch across the phases of the family life course, net of other variables. Our analyses were separately conducted for each phase of the family life course, but the analysis steps were identical. We expected this way of analyzing the data to reflect patterns of skill mismatch by gender and spouse's working status across the family life course. In Model 1, individual background variables such as one's age and educational level⁵ were included in order to account for covariance of those variables. The equation of Model 1 is given below.

Model 1

$$y = b_0 + b_1(\textit{gender}) + b_2(\textit{spouse's working status}) + b_3(\textit{age}) + b_4(\textit{education}) + e$$

Using a stepwise approach, we further accounted for two sets of control variables - occupational factors and skill proficiencies. Model 2 aimed specifically to account for the impact of occupational factors. Based on Model 1, occupational level, role in workplace, work hours, and hourly income were added. The equation of Model 2 is given below.

⁵ In this study, we consider age and education variables as if they were continuous. While acknowledging that such treatment lacks realism under certain circumstances, employing these variables as categorical variables might be burdensome because age and education variables possess 9 and 8 categories respectively. Therefore, we opt for a pragmatic approach by maintaining these variables in their continuous form, primarily utilizing them as control variables within the analytical framework.

Model 2

$$y = b_0 + b_1(\text{gender}) + b_2(\text{spouse's working status}) + b_3(\text{age}) + b_4(\text{education}) + b_5(\text{occupational level}) + b_6(\text{supervisory role} = \text{fewer than 5 people}) + b_7(\text{supervisory role} = \text{more than 5 people}) + b_8(\text{work hours}) + b_9(\text{hourly income}) + e$$

Finally, Model 3 had the purpose of controlling for the impact of skill proficiencies on skill mismatch. This model was built on Model 2 by adding both literacy and numeracy proficiencies. Its equation is given below.

Model 3

$$y = b_0 + b_1(\text{gender}) + b_2(\text{spouse's working status}) + b_3(\text{age}) + b_4(\text{education}) + b_5(\text{occupational level}) + b_6(\text{supervisory role} = \text{fewer than 5 people}) + b_7(\text{supervisory role} = \text{more than 5 people}) + b_8(\text{work hours}) + b_9(\text{hourly income}) + b_{10}(\text{literacy proficiency}) + b_{11}(\text{numeracy proficiency}) + e$$

Results

Descriptive results

This study derives the mean of the degree of skill mismatch for each group of workers before conducting a multiple regression analysis across groups to examine whether the degree of skill mismatch varies by gender or spouse's job situation. Figure 1 shows gender differences in the degree of skill mismatch by each phase of the family life course. The results among employees without children and those with children were differently characterized. Regardless of gender, on average, employees who did not have children exhibited positive values of skill mismatch, indicating that their level of skill utilization was lower than that of skill level.

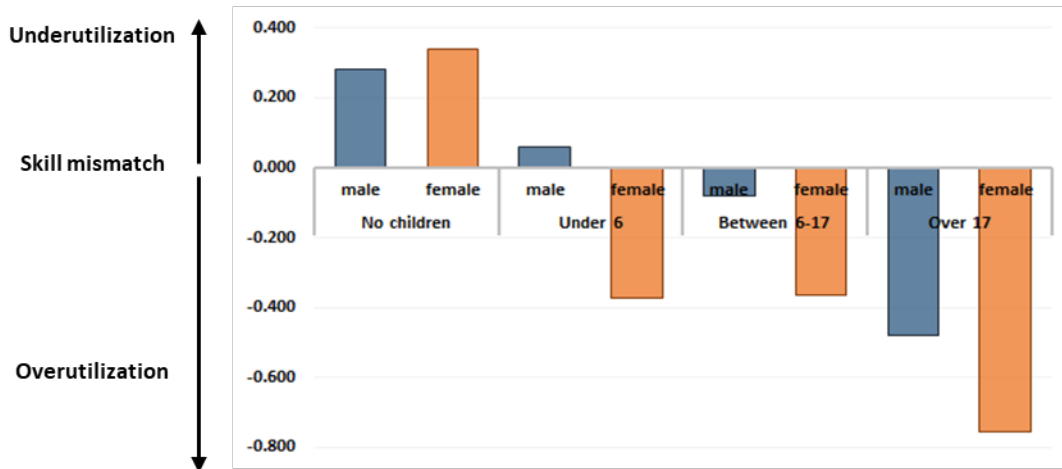


Figure 1. *The degree of skill mismatch by the family life course and gender (weighted)*

In contrast, for employees with children, the average value of skill mismatch was generally negative. This result reveals that workers with children tend to utilize their skill more than their skill levels. However, when their youngest child’s age was lower than 18, men relative to women did not seem to experience a severe skill mismatch. Gender-specific differences were the largest among workers whose children were under the age of 6. It raises the possibility that women with children may hold jobs that relatively overutilize their skills.

Figure 2 describes the differences in skill mismatch by spouse’s working status across each phase of the family life course. Similar to results in Figure 1, the degree of skill mismatch of workers without children was on the positive scale (underutilization), and in other cases, it was generally on the negative scale (overutilization). In addition, the difference by the spouse's working status was most salient for families with children under the age of 6. This result was consistent with the results of gender differences in skill mismatch across each phase of the family life course. These results suggest that the dynamics within the family may be closely linked to selecting a job and/or skill use in workplace.

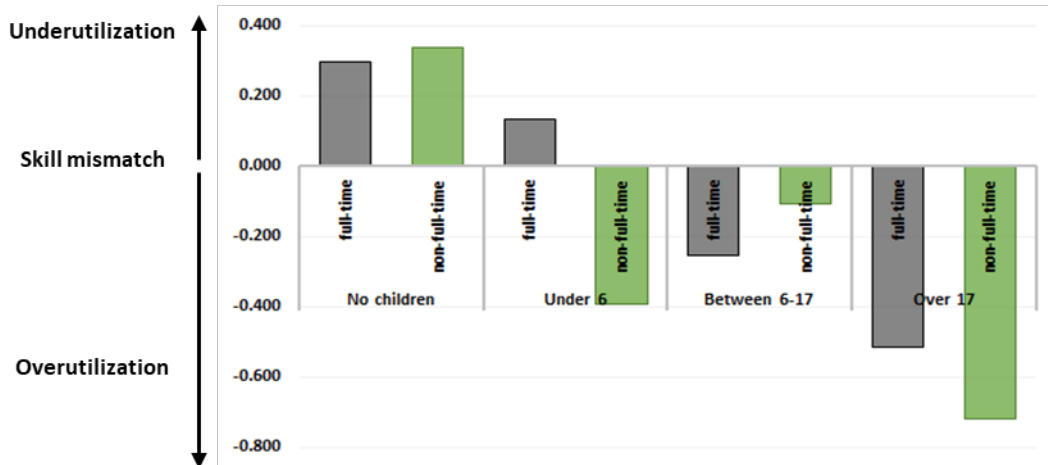


Figure 2. The degree of skill mismatch by the family life course and spouse's working status (weighted)

Table 3 reports correlations between pairs of continuous variables in our model. Skill mismatch, a dependent variable of this study, had a weak correlation with age, educational level, and hourly income, while it had a strong correlation with both literacy and numeracy proficiencies in a positive way. In order to observe how the results of variables of interest change when other factors are introduced control variables were added stepwise in groups of individual background, occupational factors, and skill proficiencies.

Table 3. A correlation matrix of variables (weighted)

	Skill mismatch	Age	Educational level	Occupational level	Work hours	Hourly Income	Literacy proficiency	Numeracy proficiency
Skill mismatch	1.000							
Age	-0.101	1.000						
Educational level	0.190	0.009	1.000					
Occupational level	-0.035	-0.037	-0.535	1.000				
Work hours	-0.002	0.036	0.178	-0.129	1.000			
Hourly Income	0.109	0.208	0.447	-0.384	0.132	1.000		
Literacy proficiency	0.657	-0.120	0.537	-0.438	0.195	0.388	1.000	
Numeracy proficiency	0.660	-0.081	0.545	-0.399	0.221	0.422	0.887	1.000

Regression results

A multiple regression model across the family life course was conducted. Table 4 provides the entire results of analysis. We first reviewed the results of individual backgrounds, occupational factors, and skill proficiencies. Then, we focused on the pattern of skill mismatch by gender and spouse's working status across the family life course. In general, the associations between skill mismatch and variables in our analyses became more evident when we controlled for skill proficiencies. This result indicates that our understanding about the determinants of skill mismatch would be limited unless we compared workers with similar levels of skill proficiencies. Therefore, for the sake of parsimony, this study focuses primarily on the results from Model 3, in which all control variables were included unless the pattern of results was abnormal.

Table 4. *Skill mismatch of full-time workers living with spouse*

The family life course	Full-time workers living with spouse											
	Phase 1 (No children)			Phase 2 (With children under 6)			Phase 3 (With children between 6-17)			Phase 4 (With children over 17)		
	Model	M1	M2	M3	M1	M2	M3	M1	M2	M3	M1	M2
Individual backgrounds												
Gender (women)	-0.052 (0.293)	0.086 (0.309)	0.396* (0.158)	-0.716* (0.276)	-0.721* (0.288)	-0.442* (0.221)	-0.350 (0.253)	-0.381 (0.273)	-0.044 (0.170)	-0.298 (0.305)	-0.167 (0.292)	-0.028 (0.247)
Spouse's working status (non-full-time)	0.119 (0.326)	-0.015 (0.345)	0.147 (0.164)	-0.579* (0.243)	-0.527* (0.243)	-0.501** (0.167)	0.113 (0.255)	0.086 (0.267)	-0.014 (0.167)	-0.187 (0.341)	-0.222 (0.333)	0.082 (0.188)
Age	-0.080 (0.084)	-0.099 (0.081)	0.071+ (0.040)	-0.167 (0.108)	-0.167 (0.115)	0.054 (0.082)	-0.089 (0.068)	-0.104 (0.071)	0.090+ (0.051)	-0.073 (0.130)	-0.113 (0.130)	-0.003 (0.070)
Educational level	0.152 (0.099)	0.260* (0.112)	-0.093+ (0.048)	0.314*** (0.060)	0.296** (0.091)	-0.187* (0.074)	0.410*** (0.066)	0.396*** (0.100)	-0.155** (0.057)	0.051 (0.077)	0.092 (0.094)	-0.264*** (0.061)
Occupational factors												
Occupational level		0.578* (0.232)	0.859*** (0.128)		0.033 (0.173)	0.348** (0.123)		-0.023 (0.199)	0.366*** (0.104)		0.159 (0.219)	0.620*** (0.131)
Supervising fewer than 5		-0.283 (0.340)	-0.353 (0.243)		-0.920** (0.310)	-0.411+ (0.225)		-0.635* (0.275)	-0.724*** (0.202)		-0.509 (0.341)	-0.384+ (0.204)
Supervising more than 5		-0.280 (0.410)	-0.138 (0.252)		-0.720* (0.307)	-0.420* (0.173)		-0.601* (0.264)	-0.526** (0.176)		-1.027* (0.500)	-0.568* (0.281)
Work hours		-0.015	-0.037*		-0.008	-0.037***		0.004	-0.029*		0.000	-0.028*

		(0.014)	(0.015)		(0.013)	(0.009)		(0.012)	(0.013)		(0.023)	(0.013)
Hourly income		0.257	-0.562**		0.296	-0.618**		0.197	-0.221		0.447	-0.521**
		(0.279)	(0.177)		(0.266)	(0.199)		(0.377)	(0.161)		(0.387)	(0.167)
<i>Skill proficiencies</i>												
Literacy proficiency			0.025***			0.022***			0.017***			0.021***
			(0.004)			(0.004)			(0.004)			(0.004)
Numeracy proficiency			0.021***			0.019***			0.021***			0.021***
			(0.004)			(0.004)			(0.004)			(0.004)
Constant	-0.174	-1.576	-11.204	-0.449	-0.675	-7.429	-1.434	-1.778	-8.619	-0.057	-1.286	-8.714
	(0.639)	(1.456)	(0.981)	(0.485)	(1.043)	(0.940)	(0.487)	(1.283)	(0.707)	(1.104)	(1.616)	(1.252)
Average R-Squared	0.021	0.064	0.639	0.085	0.117	0.544	0.099	0.117	0.600	0.009	0.049	0.629
Observations	315			454			428			341		

Note. Standard errors in parentheses.

*** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.10 (two-tailed tests).

Among individual backgrounds, educational level consistently had a significant relationship with skill mismatch. However, the patterns of its relationship transformed from Model 2 to Model 3. Before controlling for skill proficiencies, the result shows that workers with higher levels of education tend to be underutilized. In contrast, highly educated workers were less likely to be underutilized once the covariance of skill proficiencies is accounted for. This finding indicates that educational level may be a proxy for one's skill proficiencies, but educational level cannot perfectly reflect one's skill proficiencies. In addition, having higher educational attainment is likely to play a role in finding an appropriate job matching their skill level. Worker's age is often regarded as an important predictor of skill mismatch, but we did not find numerous significant relationships with age in our analysis. This might be partially because age is correlated with the family life course phase ($r=0.718$, $p<0.001$). The relationship between age and skill mismatch was significant only in Model 3 within the first and third phases of the family life course. Older workers tended to be underutilized.

Workplace characteristics seem to differentiate levels of skill mismatch. First, occupational level and supervisory role had an association with skill mismatch. Workers in less skilled occupations were more likely to be underutilized. Employees who were in positions that

required supervisory responsibilities were less likely to be underutilized. Exceptionally, the impact of supervisory responsibilities was not pertinent to workers at the first phase of the family life course (having no children). Second, the number of work hours tended to show an association with skill mismatch. Employees who work more hours tended to be overutilized. In other words, they were less likely to be underutilized. Third, regarding hourly income, those earning higher hourly incomes tend to be less underutilized, meaning that they are more likely to be overutilized. This result may also imply that occupations offering relatively higher income require workers to utilize their skills to a high degree in their work.

The results of our independent variables are summarized in Table 5. The relationship between skill mismatch and gender varied by the family life course. In particular, the difference between women without children and women with young children was salient. Compared to men, women without children were less likely to fully utilize their skills in their occupations, while women with young children under the age of 6 showed opposite results. This result suggests that changes in work due to childbirth and parenting of young children might be more drastic for women. Among families with older children over 6 years old, the difference in the degree of skill mismatch by gender was not found to be significant.

Table 5. *Estimated associations between independent variables and the degree of skill mismatch by the family life course*

Full-time workers living with spouse				
<i>the family life course</i>	Phase 1 (No children)	Phase 2 (With children under 6)	Phase 3 (With children between 6-17)	Phase 4 (With children over 17)
Gender (women)	0.396* (0.158)	-0.442* (0.221)	-0.044 (0.170)	-0.028 (0.247)
Spouse work (non-full-time worker)	0.147 (0.164)	-0.501** (0.167)	-0.014 (0.167)	0.082 (0.188)
Observations	315	454	428	341

Note. Standard errors in parentheses.

All control variables were included.

Gender and Spouse work are dummy variables; positive (negative) value in coefficient can be interpreted as underutilization (overutilization).

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$ (two-tailed tests).

The spouse's working status was statistically significant only for families with young children under the age of 6. If their spouse was not a full-time worker, their level of skill utilization was expected to be much higher than the level of their skills. In other words, they were more likely to be overutilized relative to workers whose spouses had a full-time job, which suggests that such workers may play the primary role of economic provider.

Discussion

The literature on gender gaps in the labor market has drawn attention to differences in wage and career development and suggested that women are still disadvantaged in the labor market (Azmat & Petrongolo, 2014; Budig, Misra, & Boeckmann, 2012; Hoobler et al., 2009; Purcell et al., 2010). By proceeding marriage and childbirth in the family life course, women tend to focus more on family responsibilities than on career development compared to men (Kaufman & Uhlenberg, 2000; Young, & Schieman, 2018). This study aimed to contribute to such literature by examining if the degree of skill mismatch is associated with gender and spouse's working status and if such relationships varied by the phases of the family life course. We focused on full-time workers living with their spouses and divided them into four groups based on the family life course. We then ran a stepwise regression across the family life course.

Exploration of the pattern of skill mismatch in relation to the family life course revealed multiple findings. Firstly, among couples without children, women had a higher probability of underutilizing their skills at their jobs. This result provides evidence supporting the theory of

differential qualification that married women were more prone than men to overqualification because they frequently look for a job in a locally restricted labor market. This result also may confirm the persistence of the “homemaker-breadwinner” model privileges their husband’s job and consequentially undervalues their own labor (Frank, 1978). It suggests that the structural and cultural disadvantages in the labor market might still be relevant for married women, even if they do not have children.

Secondly, among couples in the second phase of the family life course (with young children under 6 years old), women tended to have jobs that require greater skill utilization than their own skill level. At first glance, this result seems to be contrary to the results of gender differences in skill mismatch among couples without children. However, it is necessary to consider the difficulty of estimating the degree of skill mismatch for those not participating in the labor market. Since skill mismatch relates to workers in the labor market, the concept is not measurable for those who have left their jobs for any reason. If a certain group systemically leaves their jobs more often, the characteristics of the remaining group will become prominent. In other words, reversed gender differences in skill mismatch may have been caused by the combination of both the higher probability of underutilized women leaving the labor market and the lower probability of overutilized women leaving the labor market after childbirth.

In fact, figure 4 shows the distribution of the economically inactive population due to family responsibility or childcare⁶ by gender and the phases of the family life course. It confirms that women who are economically inactive due to family responsibilities or childcare outnumber men. In particular, the proportion of women with children under 6 years old accounted for 57.8% (family responsibility) and 42.3% (childcare) of the entire economically inactive population due

⁶ This result is based the population that responded either "I give up work cause of family response or childcare" or "I was looking after the family or home" from each item, E_Q10 and C_Q03, respectively.

to these respective reasons. These results reveal that, during the family life course, there are many obstacles hindering women's career development.

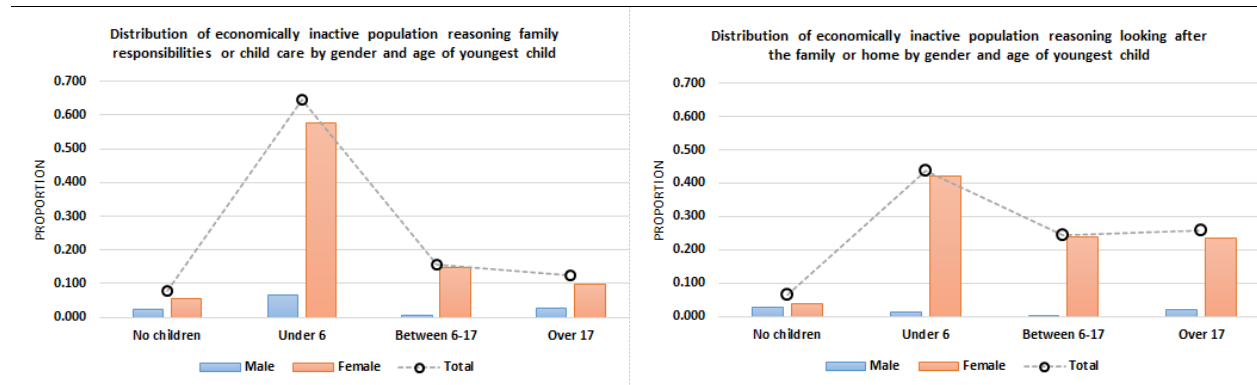


Figure 3. *Distribution of economically inactive population reasoning family issues by gender and age of youngest child*

Third, it was estimated that, among families with children less than 6 years old, when their spouse was not a full-time worker, their level of skill utilization was higher than their own skill level. Although there are differences depending on the analytic methods and comparison groups, in general underqualified workers are more financially advantaged than well-matched workers with similar skill levels (Hamersma, Edzes, & van Dijk, 2015; Quintini, 2011b). As their occupations are decent and attractive relative to their skill level, they might play the primary economic provider role while their spouses remain responsible for parenting rather than co-providing. Furthermore, some positions may be demanding enough to prevent them from being involved in housekeeping and childcare at home. Consequently, their spouses may have to spend energy and time to meet family responsibilities.

Finally, skill mismatch did not vary by gender or spouse's working status when the youngest children were at least grade-schoolers. Similar to findings that motherhood penalties tend to decrease with age (Kahn, García-Manglano, & Bianchi, 2014), the negative impacts on

women's labor force participation seem to no longer be maintained in phase 3 and 4 of the family life course. The combination of changes in individual and occupational levels might be relevant to these non-significant results. Skill mismatch is often explained by career trajectory (McGuinness & Wooden, 2009). The degree of mismatch for workers who remained in the labor market will be adjusted as they progress their career. At the same time, the group of workers who left the labor market after childbirth reenters the labor market in various ways as their children grow up, resulting in dynamics in the balance between the supply of, and demand for, skills. Nevertheless, it is worth exploring in further research, as the literature often shows that the impact of parental leave still affects in various ways during long-run career (Abendroth, Huffman, & Treas, 2014; Evertsoon & Duvander, 2011).

In summary, the results of the analysis show that women's labor participation is limited to those with relatively high-skilled jobs, and many women still experience motherhood penalties when it comes to labor participation. In the early phases of the family life course, the cultural norm of "homemaker-breadwinner" limits women's opportunities to find jobs that best match their skills and drive them to leave the labor market.

Implications and limitations

Changes in attitudes toward gender roles and the expansion of educational opportunities for women have brought many changes to the labor market. Not only do more women participate in the labor market, but mothers with young children also return to the labor market quickly. However, in the family life course, women still encounter more barriers to career development than men. Job optimization often gives priority to the husband's job, which results in many women working lower-level jobs than their skills allow. After childbirth, having less attractive

job prospects leads them to devote themselves to family responsibilities, and depreciation of human resources and/or wage penalties are expected with a long employment absence. Policy support is crucial in breaking this cycle.

Firstly, supplying decent jobs and offering flexible working conditions is likely to increase the likelihood that both husbands and wives can find well-matching jobs regardless of their place of residence. In addition, it will be helpful to provide resources and support for job seekers who are uncertain about which job will be a good fit for them, especially if they are in a limited labor market. It is possible to consider reducing the risk of skill mismatch by creating new systems or adding new services in existing organizations (e.g., job centers, work source office) to provide sufficient information about jobs and job opportunities.

Second, an employment gap tends to negatively affect career development, regardless of background. When a husband or wife cannot sufficiently meet their responsibilities as a co-provider due to family demands, their spouse, as a breadwinner, also carries a burden to provide through their work. Efforts to improve social awareness and policy support need to be accompanied so that family together can design the work and life balance.

Lastly, there are many difficulties in returning to the labor market after spending significant time in childcare. Someone could return to their original job, but they might need time to adapt to the changes in their jobs while they were absent. Returning workers commonly need help to respond to changes in their working environment. As such, job preparation programs and employer sponsored trainings could be practical tools that minimize skill mismatch.

Gender differences in skill mismatch are likely to become more complicated in the future because the educational opportunities of women have expanded more rapidly than those of men.

American women (as well as women throughout much of the world) now enter the labor market more highly educated than men, on average (DiPrete & Buchmann, 2013; Schofer & Meyer 2005). This reverses a long demographic trend in which men entering the labor market were likely to have educational advantages over female labor market entrants.

The reversal of the gender gap in education (what Van Bavel et al. 2018 refer to as “RGE”) has taken place concurrently with cultural changes to traditional family structure. Of particular importance is the growth in educational homogamy. Both men and women have grown more likely to have partners whose schooling is comparable to their own. At the same time, as RGE has progressed, women are now more likely than men to “out-school” their spouses. This is particularly the case in younger families. Gihleb and Lifshitz (2016), using National Longitudinal Survey of Youth 1979 (NLSY79) data, reported that women out-schooled men in 30 percent of young American couples, which is an increase from 20 percent only a few years earlier. Thus, the combination of the educational upgrading of women and trends in educational assortative mating have led to greater educational homogamy, but also to more couples in which women are the more highly educated spouses⁷. More educated people are more likely to be over-educated and less likely to be undereducated simply due to ceiling effects. All else being equal, we might expect growing incidences of women with levels of schooling beyond the secondary education, once associated with specific jobs or occupations.

Unfortunately, even with its extensive measurements, PIAAC does not permit us to examine the impact of RGE on skill/educational mismatch as fully as we would like. We are constrained to some degree by information that is not available in PIAAC. In particular, PIAAC

⁷ Gihleb and Lang (2016) dispute the consensus among both economists and sociologists that educational homogamy and assortative mating have increased. They maintain that empirical analyses of these trends have been improperly conducted. We are not completely persuaded by their argument, but note this as an area where more research is needed.

lacks a measure of the occupation and education of the respondent's spouse, prohibiting us from addressing some interesting questions about the effects of trends in educational homogamy. Further, because our analysis is necessarily restricted to currently working people, we are unable to capture women who are not in jobs explicitly because of their family responsibility. Thus, an indirect approach is the only option we could use to measure the motherhood penalty of female workers with young children. In addition, our results may have limitations in generalization because our analytical sample does not fully cover and/or reflect the whole U.S. population; non-traditional family structures and occupations with small number of survey participants were unable to be included in our sample. It may be beneficial if future research considers using research methods that allow for the collection of data that reflects the whole U.S. population.

As we argued earlier in the paper, a great strength of the PIAAC data is its wealth of detail about education and skills. Our empirical findings show statistically significant associations between the family variables of interest to us and skill mismatch. We also find robust findings for the influence of workplace factors on mismatch. We believe that leveraging other data sets with PIAAC will allow for a deeper understanding of the issue of mismatch. In particular, the incidence of skill mismatch can be expected to vary across societies with different institutional, labor market, and cultural characteristics. Thus, an international comparison study shall contribute to the literature.

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