Motherhood Penalty for Single Women in Taiwan

Abstract

The motherhood penalty refers to working women suffering from lower earnings after having children. This often results from mothers who might take an extended leave from work to care for their children, thereby impacting later earnings when they return to their jobs. It may also result from mothers giving up a higher wage for mother-friendly jobs or suffering from employer discrimination (Budig and England, 2001; Gough and Noonan, 2013). However, different marital statuses might lead to a different degree of the motherhood penalty. Similar to married women, single women may lose earnings after having children. Single mothers might suffer a worse penalty because they are stigmatized. On the other hand, they may pay less wage penalty than married women since married women can allocate more time to their children than single mothers (Budig and England, 2001). By using the Panel Study of Family Dynamics (PSFD) from 1999-2014, I analyze the change in monthly earnings of married and single women after they have children in Taiwan. Even though there is plenty of previous literature about the motherhood penalty, few articles focus on East Asia. This study contributes to the existing research by adding an analysis of mothers in Taiwan, as well as distinguishing between the situation of single and married mothers, thereby expanding the understanding of the association between motherhood and earnings.

Szu-Min Yu
New York University

Advisor
Paula England
New York University

Introduction

This research paper examines Taiwanese data, the 1999-2014 Panel Study of Family Dynamics, to discover whether mothers in Taiwan suffer from a wage penalty and whether the effect of giving birth to children is different between married and previously married women. Most of the previous literature related to the motherhood penalty is about the United States. However, one Taiwanese paper about the motherhood penalty can provide a basic understanding of the wage penalty in Taiwan. Hsu and Chiou (2015) employ hierarchical linear models to analyze the wage penalty from 2000-2011 Panel Study of Family Dynamics. They find that on average, women with one child earn 4% less, women with two children earn 10% less, and women with more than three children earn 21% less than women with no child. Mothers who spend more time on childcare experience higher loss in earnings than mothers who spend less time on child care. They conclude that Taiwanese women pay a motherhood wage penalty. The result is consistent with the results from most previous literature focusing on the United States. However, this paper, using methods that better account for omitted variable bias, will question this conclusion for Taiwan.

Past research uses five conceptual categories to explain reasons that mothers may earn less: human capital, work effort, job characteristics, employers' discrimination, and self-selection (Gough and Noonan, 2013). Authors attempt to control these concepts in the literature to find the effect of children on maternal earnings. Marriage is a traditional social dynamic which allows couples to bear children with legal recognition. For men, having children might increase their earnings. Killewald (2012) contends that the identity of being a father shapes the fatherhood wage premium in the U.S. Married fathers with children earn higher wages than men who are single with child, cohabiting with no child, married with no child, and divorced but not residing with their children. On the contrary, U.S. women do not enjoy wage premium after having children; instead, they suffer from a wage penalty (Avellar and Smock, 2003; Budig and England, 2001; Gough and Noonan, 2013; Waldfogel, 1997). Waldfogel (1997) shows there is a negative impact of children on women's wages. She finds that the motherhood wage penalty

remains after controlling for the experience in the labor market and part-time employment (Waldfogel 1997). Built on Waldfogel (1997), Budig and England (2001) find that mothers experience a wage penalty of 7 percent per child; their analysis includes controls for experience as well as person fixed effects. Avellar and Smock (2003) find that women from two cohorts born in 1975-1985 and 1986-1998 both experience a motherhood penalty, showing that the motherhood penalty still exists in a recent U.S. cohort.

The motherhood penalty can also differ by subgroup. Using U.S. data, Glauber (2007) shows that African American and Hispanic married mothers experience a smaller wage penalty than white married mothers. She finds that among mothers with one or two children, African American married women do not pay a wage penalty; however, white married women pay 2% for one child and 8% penalty for two children. Racial disparity of earnings may explain for the result since minority women earn less than white women, and their earnings are so low that they cannot reduce any further. As for white women, all the interactions between marital status and the number of children are not significant, demonstrating that the effect is not significantly different between marital status (Glauber, 2007). Nonetheless, Budig and England (2001) find that married mothers pay a 4% penalty after controlling for human capital variables and job characteristics. On the contrary, women who never married pay a 1.9% wage penalty and divorced women pay a 3.8% wage penalty. Married mothers may suffer from a larger penalty because they have financial support from their spouses. Therefore, they can allocate their time and focus on their children more than single mothers (Budig and England, 2001).

In this paper, I will analyze the association of motherhood and earnings while controlling for human capital (seniority) and self-selection (through fixed effects). I focus on the effect of children on maternal earnings. I also focus on the interaction between marital and parental statuses, which allows me to compare the wage penalty for married and previously married mothers. This paper will contribute to the existing literature with an analysis of East Asian societies, especially focusing on Taiwan. Taiwan exceeds neighboring East-Asian countries on the improvement of gender equality. Yu (2009) compares employed married women in Taiwan

and Japan. She finds that professional married women in Taiwan are more likely to combine motherhood and employment compared to married women in Japan, who are more frequently forced to quit their jobs. Taiwan has a shrinking gender pay gap and a higher level of gender equality in pay than Japan (Yu, 2009). Therefore, this paper provides an understanding of the circumstances working mothers encounter in a developing country that is devoted to improving women's well-being. Nonetheless, Taiwan possesses essential differences from Western countries, such as the United States, so we cannot assume that findings will be the same as for the United States. For instance, according to official statistics of R.O.C (Taiwan), extended families comprise 13% to 15 % of all households in past ten years in Taiwan (Executive Yuan, 2017). Grandparents may act as the caregivers of their grandchildren, and help alleviate the stress of work-family conflicts for mothers.

Since non-marital birth only comprises around 4% of births in Taiwan,[1] I will not include single mothers who had non-marital births in my research because I do not have enough statistical power to analyze single women with nonmarital births. Formerly married women who move from married to separated, divorced, or widowed are the single mothers in this paper. This research attempts to understand whether women pay a wage penalty for childbirth and child-rearing and whether the effect is different by the change of marital status.

Why compare the motherhood penalty experienced by single and married mothers?

Marital status may play a role in the motherhood penalty. In my research, I define single mothers as mothers who are formerly married since women who became single mothers through a nonmarital birth are rare in Taiwan. Previously married mothers may experience a different degree of the motherhood wage penalty. The presence of a child or children might reduce the productivity of single mothers more than married mothers whose partners can share household work. On the other hand, single mothers may earn more than married mothers

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[1] Monthly Bulletin of Interior Statistics, 2016. Department of Statistics, Ministry of Interior, R.O.C. (Taiwan)

because they are the only breadwinners in their families, and they are more motivated than married mothers. Previous literature also finds that married women are more subject to a traditional gender division of labor than single women (Budig and England, 2001). Their husbands might not share the domestic burden even when both spouses work full-time (Killewald and Gough, 2010; Killewald, 2011). However, Glauber (2007) finds that for white women, never married, and married women pay the same wage penalty, although Budig and England (2001) find penalties higher for married women. The comparison of the level of the motherhood penalty between single and married mothers remains debated.

One reason that single mothers may face a higher penalty is that they may find it difficult to be promoted and get well-paid jobs because of employer discrimination based on their status as single mothers. They face stigma and discrimination from employers. Some employers disapprove of and do not want to work with single mothers. Some of them believe single mothers cannot perform as well as other workers who do not have family and child responsibilities or who have more family support. It is because employers believe that employees can allocate more time on the job if they do not have child responsibility or they have family support. Single mothers would face challenges finding a decent job. If this stigma means that employers discriminate against them more than married mothers, the motherhood penalty of single mothers might be high.

Most previous literature on the motherhood penalty is limited to mothers in general (Damaske et al., 2017; Ifcher and Zarghamee, 2014; Kanji, 2011; Lino, 1994; McKeever and Wolfinger, 2011; Meyer and Sullivan 2008). These pieces of literature do not focus on the effect of parental status on different marital statuses. This research will focus on the effect of rearing children on mothers' earnings in general and discuss whether the effect is different for married and formerly married women.

Past Literature

Human Capital

A mechanism that affects maternal earnings is human capital, such as education, seniority in the specific position (sometimes called "tenure"), and other work experience. Educational attainment can represent the overall skill level of workers, and it is highly correlated with fertility delay. More extended schooling and training increases individual cognitive skills. Farkas et al. (1997) find that higher cognitive skills have a positive effect on women's wages. Taniguchi (1999) examines the effect of delaying child birth on the magnitude of the motherhood wage penalty. She finds that women who give birth around 20-27 years old pay a 4% wage penalty compared to childless women. However, women who give birth after 28 years old do not pay a wage penalty (Taniguchi, 1999). Amuedo-Dorantes et al. (2005) argue that mothers with college degrees earn significantly higher than mothers whose education level is less than high school, and fertility delay may strengthen the association. Budig and Hodges (2010) find that among higher wage mothers, the postponement of motherhood is more common than lower wage mothers. That is, the delay of childbirth may increase mother's earnings and help reduce the wage penalty. This study, however, will not consider the timing of fertility since fixed-effects models control the possibility of self-selection.

Working experiences also have a positive effect on earnings. Previous research finds that the loss of experience explains a large portion of motherhood penalty (Anderson et al., 2002; Budig and England 2001; Budig and Hodge, 2010; England et al., 2016, Waldfogel, 1997; Wilde et al., 2010). Mothers lose wages because they take temporary leaves for child rearing and stop accumulating their experience and seniority, or tenure, which affects earnings after the maternity leaves (Budig and England 2001). Some researchers find that mothers with professional skills are more vulnerable to job changes than low-educated mothers (Anderson et al. 2002; Berggren and Lauster, 2014; England et al., 2016; Gough and Noonan, 2013; Yu and Kuo, 2017). For instance, England et al. (2016) find that highly skilled and paid mothers lose 10 percent of their wage per child, whereas other groups of mothers lose 4-8% of their wage. Professional women have a higher return to work, so when they lose experience and seniority if

they leave their job temporarily for childbirth and child-rearing, it has a greater impact on their later wages.

Single mothers may lose a different degree of their earnings compared to married mothers. For instance, Wolfinger (2015) finds that the improvement of education and income gains for women in general only benefited married mothers rather than single mothers. It may partially explain the reason married and single mothers pay a different penalty. In sum, I will control for the level of education and seniority in the model to control for human capital variables when assessing how marital and parenthood statuses affect earnings and interact.

Work Effort & Job Characteristics

Mothers face work-family conflicts because they need to spare energy for their families (Becker 1985). Thus, Becker (1985) argues that mothers' productivity loss at work leads to the decline in their earnings. The age of children also affects the mother's productivity since young children require more caring than adult children. Anderson et al. (2003) argue that mothers with younger children experience a higher degree of wage penalty because mothers save energy to take care of young children, who require intensive care, and they may lose productivity for their jobs. Mothers who rely on multiple ways of care arranging for preschool-age children are subject to changes of unstable arrangements (Scott et al., 2005). It might also jeopardize mothers' working productivity even if they have a stable caregiver for their young children. Avellar and Smock (2003) find that children under 12 years old have a negative association with maternal earnings in OLS models but not in fixed-effects models. Moreover, Budig and Hodges (2010) find that lower earning mothers have more and younger children at home compared to higher earning mothers. Mothers take more child responsibility when they have younger children, which may decrease or affect mothers' productivity and thereby increase the wage penalty. Moreover, mothers face a different level of wage loss based on job characteristics. Yu and Kuo (2017) argue that if the position is less competitive, requires less team-work, and gives more autonomy, the mother loses less in earnings (Yu and Kuo, 2017). This finding provides the

possible explanation of which job characteristics ameliorate the tension between work and family.

Some previous research focuses on the strategy that single mothers apply when they face the work-family conflicts (Brady, 2010; Brady and Perales, 2014). For instance, Brady and Perales (2014) point out single mothers are more likely to take advantage of various child care packages than married mothers. Single mothers used more mixed child care arrangements to work longer. Hsieh and Leung (2013) refute the assumption that single mothers tend to be unemployed and dependent on government welfare in Taiwan. They find single mothers with positive viewpoints toward employment lead to higher human capital attainment and self-fulfillment. On the contrary, some married mothers tend to stay home taking care of children because they have more negative attitudes toward being a working mother (Hsieh and Leung, 2015). These findings from Hsieh and Leung (2015) might help explain the reason single mothers have continuous employment and higher seniority than married mothers.

While my study will not have measures of productivity or job type or child care used, I will use fixed effects to control for unmeasured, unchanging characteristics of women that affect their productivity, employment continuity, and job choice.

Employer Discrimination

Since it is difficult for employers to measure the actual work effort and productivity of employees, some employers decide salaries by general stereotypes. For instance, Biebly and Baron (1986) find employers have different perceptions of female and male workers regarding skills and working productivity. Correll et al. (2007) conduct laboratory experiments as well as an audit study and find employers exhibit discrimination against mothers; however, fathers do not suffer from standards and evaluations as harsh as those for mothers. The result is consistent with the fatherhood wage premium that a father tends to earn more after childbirth (Killewald, 2012).

As regards whether employer discrimination against mothers varies by marital status, one could hypothesize that employers would expect single mothers to be more focused on earnings because they are the sole support of their children. However, the opposite might occur if enough disapproval of single motherhood overrides the perception that they care about earnings. Dejean et al. (2012) compare the general attitude toward single mothers and single fathers. They find single mothers are viewed more negatively than single fathers and blamed for not giving children an intact heterosexual two-parent family (Dejean et al., 2012). In sum, previous research about the generally negative perception of single mother helps establish the disadvantageous status of single mothers. Thus, we might expect that single mothers would face harsher discrimination than married mothers.

Following previous literature, this research has two hypotheses:

H1. There is a motherhood penalty for both single women and married women.

H2a. Single mothers experience a lower penalty than married mothers.
H2b. Single mothers experience a higher penalty than married mothers.

Data

This paper will utilize data from the Panel Study of Family Dynamics (PSFD) from 1999 to 2014, conducted by Academia Sinica, a national research institute in Taiwan. PSFD used random sampling in multiple stages to sample the national population of Taiwan, and it collected the data by face-to-face interview. The questionnaire comprised topics about respondent's living and working experience, living arrangements, family status, parental status, etc. PSFD used random sampling to select respondent's children into the additional survey for children, and they can therefore provide multigenerational data. The birth year of the first two core cohorts

ranged from 1935-1954 and 1953-1967 (Questionnaire R), which were interviewed annually except for 2013 when PSFD underwent reorganization. PSFD also conducted surveys of respondent's adult children who aged 25 or above (Questionnaire RCI), which were combined into the main cohort (Questionnaire R) after the first RCI survey. PSFD also conducted surveys on teenage children who aged 16 to 24 (Questionnaire CI). Respondents' children aged below 25 were interviewed biannually using questionnaire CI. However, I will not include the data collected from the questionnaire CI because observations aged from 16 to 24 are mostly single and do not have any child. To answer my research question, I will analyze the core cohorts only, and focus on the effect of motherhood among both married and single women.

PSFD accumulated different cohorts in multiple years. The 1935-1954 cohort included the total number of 1960 individuals in the first-wave survey conducted in 2000, and respondents in this cohort were interviewed 14 times from 2000 to 2014, excluding 2013. The 1953-1964 cohort held 999 individuals in the first-wave survey at 1999, and this cohort was interviewed 15 times from 1999 to 2014, excluding 2013. The 1964-1976 cohort included 1152 individuals in the first-wave survey at 2003, and this cohort was interviewed 11 times. The 1977-1983 cohort included 2182 individuals in the first-wave survey at 2009, and the cohort is interviewed 5 times from 2009 to 2014. For my research, I only differentiate employed women by their marital status and parental status (N = 5856). These women age from 25 to 73 years old, and the average age is 43 years old. I use person/years as the unit of analysis. This research does not use human subjects and does not require an IRB review.

Variables

Outcome variable

The outcome variable will be the natural logarithm of the average monthly salary in the respondent's current job. PSFD collects monthly salary, and they are measured in New Taiwan

Dollars. I use the log transformation so that outliers are less influential, and a coefficient represents the percentage by which earnings change with each one unit change in treatment variables ($\Delta y = 1 - e^x$). Since the sample is employed women, women who do not have earnings because they are not employed will be excluded from the dataset and the research. I also exclude cases that were missing on earnings.

Treatment variables

The treatment variables will be marital status, parental status, and the interaction of the two variables.

There are multiple categories of marital status: never-married (including cohabited), married, separated, divorced, and widowed women. The dataset only has 23 person/years of non-married women who have at least one young child owing to the low rate of non-marital childbearing in Taiwan. Therefore, based on the limited observations, I will not include never-married women in my research. I create an indicator variable of marital status in two main groups after I drop never-married women: married women and previously married women, including divorced, separated, and widowed women. These two groups are mutually exclusive and collectively exhaustive. I will use married women as the reference group in the analysis. The variable is cleaned by cross-referencing other variables/questions, such as "Did you change your marital status last year?" Single mothers with young or adult children comprise 22 percent of all observations (1303 person/years). It may be difficult to generalize the result to a broader scope beyond my research.

The indicator variable for parental status includes women with no children, women have at least one young child, and women have children who are all adults. Young children are defined as children under 18, and adult children are defined as children equal to or above 18. Since I focus on the association of having children and maternal earnings, young children are a

useful category; mothers of young children tend to be primary caregivers and take child responsibilities. In the analysis, I will use no children as the reference group.

Moreover, I will add the interaction terms of marital and parental status to show the association of being in different groups according to both variables.

Table 1. Monthly Earnings of for Sample of Employed, Ever Married Women (New Taiwan Dollars)

Monthly Earnings	Mean	SD	Min	Max
All Women	35544	39610	180	1000000
Marital Status				
Married women	35684	38623	180	1000000
Previously women	34502	46302	417	800000
Parental Status				
No child	38350	17932	10000	200000
At least one young child	35922	31310	1000	800000
All adult children	34304	51612	180	1000000
Marital Status by Parenthood Status				
Married women with no child	38299	18007	10000	200000
Married women with at least one young child	35827	28194	1000	600000
Married women with all adult children	34677	53481	180	1000000
Previously married women with no child	39139	16938	15000	70000
Previously married women with at least one young child	36970	55137	5000	800000
Previously married women with all adult children	32612	42113	417	390000
N				5856

Figure 1. Comparison of Log Earnings for Sample of Employed, Ever Married Women
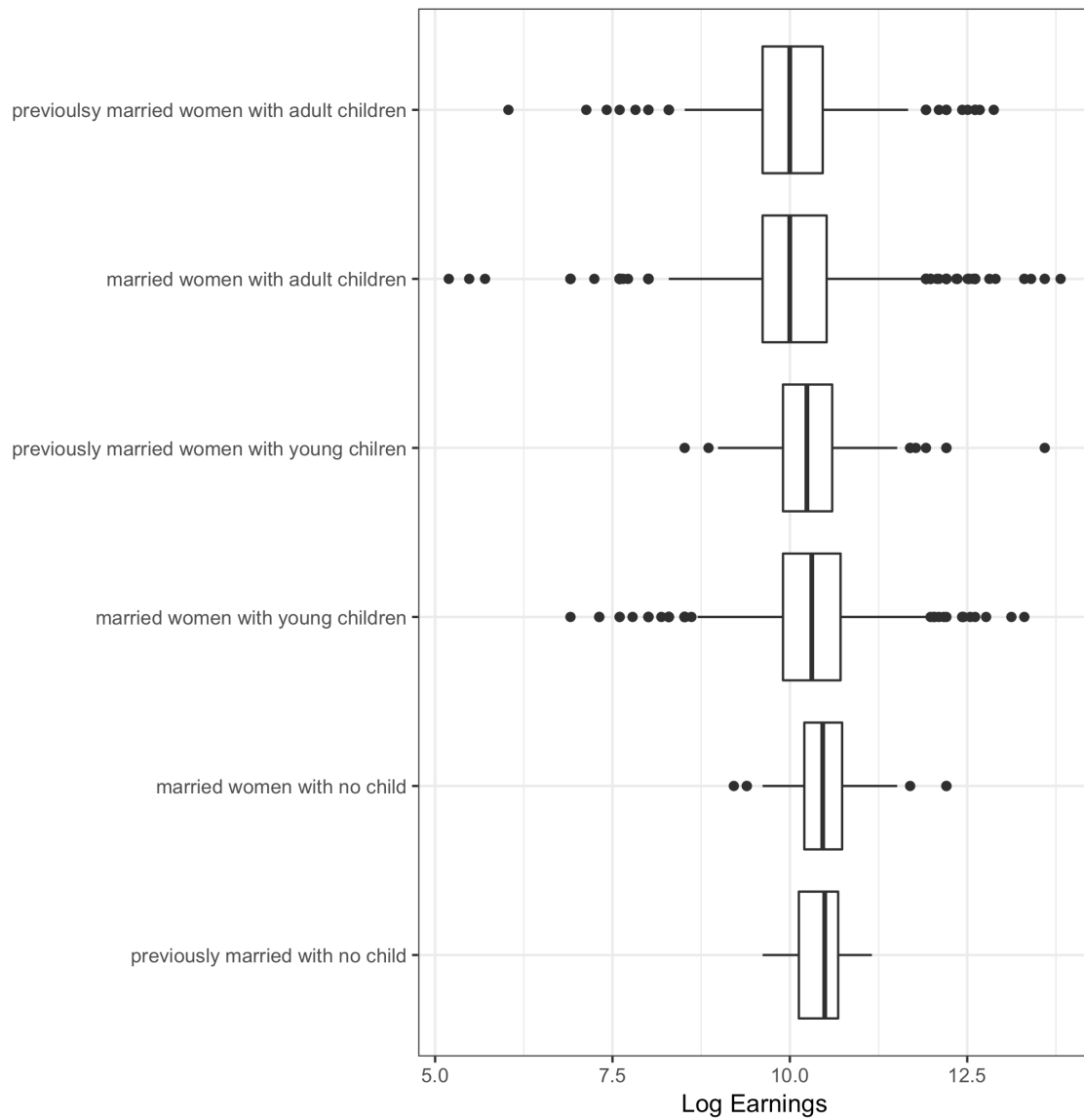
Table 2. Key Descriptive Statistics for Sample of Employed, Ever Married Women

	Mean	SD	Min	Max
Marital Status				
Married women	.8809403	.3238861	0	1
Previously married women	0.1186817	0.3234412	0	1

Parental Status				
No child	.1033316	.3044173	0	1
At least one young child	.502114	.5000378	0	1
All adult child	.3945544	.4887961	0	1
Confounding Variables				
Seniority	10.5684	8.8895	0.5	51
Weekly working hours	45.1221	14.4932	1	90
Education	3.0002	1.5077	0	5
Age	43.09375	10.1192	25	73
N				5856

Confounding variables

Because the relationship between treatment and outcome variables might be spurious, this research will control for extraneous variables to help clarify the association. I control for seniority, weekly working hours, the education level, and age in OLS regression models. In fixed-effects models, I control for seniority and weekly working hours. Education level represents the highest education respondent has earned. Education is a categorical variable that contains five different groups: not educated, primary school and junior high school, senior high school, some college, and college and advanced degrees. Due to the characteristics of observations, the education level does not change much over time. Since fixed-effects models examine how changes in treatment variables affect changes in earnings, I do not control for education in fixed-effects models. Also, I do not control for age in fixed-effects models because age changes in a constant number every year; however, fixed-effects models already capture the effect of the time change because I specify them with indicators for year.

Seniority represents years that respondents work in the same organization. Seniority of those individuals who work under one year is set to 0.5. I clean the data by correcting the inaccuracies and replacing the estimated year of seniority by referencing other variables, such as the question about whether the respondents had changed their jobs last year. Errors which cannot be referenced and corrected is set to missing. For instance, according to Labor Standard Act in Taiwan, people can start working when they reach 15 years old. Respondent's seniority will be set to missing if their seniority plus 15 is larger than their age. Seniority has 23.3 % missing values before cleaning and 35.7% after cleaning. These inaccuracies demonstrate the possibility that respondents did not understand the question correctly or interviewers did not state the question clearly; it might decrease the construct validity of the measure of seniority, and thus bias coefficients on seniority downward. Working hours per week represents respondent's average weekly working hours. Weekly working hours exceed 90 hours is top-coded and set to the value of 90.

Models

OLS Regression

I use OLS regression to examine the association between treatment and outcome variables. OLS regression models can act as sensitivity tests for my main fixed-effects models. In all models below "Marital Status" and "Parental Status" each refers to the relevant pair of indicator variables described above representing these constructs.

Model One: Bivariate OLS model

$Log\ Earnings = \beta_0 + \beta_1 Marital\ Stauts + \varepsilon$

Model Two: Bivariate OLS model

$Log\ Earnings = \beta_0 + \beta_1 Parental\ Status + \varepsilon$

Model Three: Multivariate OLS model

$$Log\ Earnings = \beta_0 + \beta_1 Marital\ Status + \beta_2\ Parental\ Status + \beta_3 Marital\ Status \\ * Parental\ Status + \varepsilon$$

Model Four: Multivariate OLS model

$$Log\ Earnings = \beta_0 + \beta_1 Marital\ Status + \beta_2\ Parental\ Status + \beta_3 Marital\ Status \\ * Parental\ Status + \beta_4 Education + \varepsilon$$

Model Five: Multivariate OLS model

$$Log\ Earnings = \beta_0 + \beta_1 Marital\ Status + \beta_2\ Parental\ Status + \beta_3 Marital\ Status \\ * Parental\ Status + \beta_4 Education + \beta_5 Seniority \\ + \beta_6 Weekly\ Working\ Hour + \beta_7 Age + \varepsilon$$

Fixed-Effects Model

A fixed-effects model is one of the control strategies for panel data because it controls for idiosyncratic characteristics of different individuals, purging their otherwise confounding effects. The model essentially compares individuals with themselves in different survey years rather than comparing different individuals; the latter may be biased by unmeasured personal characteristics and self-selection. Therefore, I will not control a variable that does not change over time or change by constant numbers every year because it is controlled by the fixed-effect.

Model Six: Bivariate FE model

$$Log\ Earnings_{it} = \alpha_{it} + r_1 Marital\ Status_{it} + u_{it}$$

Model Seven: Bivariate FE model

$$Log\ Earnings_{it} = \alpha_{it} + r_1 Parental\ Status_{it} + u_{it}$$

Model Eight: Multivariate FE model

$Log\ Earnings_{it} = \alpha_{it} + r_1 Marital\ Status_{it} + r_2 Parental\ Status_{it} + r_3 Marital\ Status *$
$Parental\ Status_{it} + u_{it}$

Model Nine: Multivariate FE model

$Log\ Earnings_{it}$
$$= \alpha_{it} + r_1 Marital\ Status_{it} + r_2 Parental\ Status_{it}$$
$$+ r_3 Marital\ Status * Parental\ Status_{it} + r_4 Seniority_{it}$$
$$+ r_5 Weekly\ Working\ Hour_{it} + u_{it}$$

The variable, seniority, possesses the highest number of missing values. Therefore, I perform

multiple imputations by assuming missing values are Missing At Random (MAR). The

probability of a particular value being missing is not random, but is dependent of what I

observe in my dataset. I run OLS regressions and FE models after imputation. The results are

quite similar to the results without imputation, which are shown below.

Propensity Score Matching

Propensity score matching acts as a sensitivity test for my main models. It estimates the effect of

parenthood on maternal earnings by comparing women in the control group and the treatment

group who might have similar propensities after receiving the treatment. In this paper, I use

women with no child as the control group and women with a child or children as the treatment

group. Propensity score matching simulates the scenario that the treated and untreated have

similar baseline characteristics. Then it predicts the average treatment effect among the treated

(ATT) to see whether childbearing is a significantly associated with earnings.

Results

Main Findings

Table 3 shows the result of OLS regressions, which provide insights into differences between the earnings of mothers and nonmothers but cannot be treated as causal effects of having children. Without considering other factors, previously married women earn 12.08% (1- $e^{0.114}$= 0.1208) less than married women in model one, and the difference is significant. In model two, women having one or multiple young children earn 18.29% (1- $e^{0.168}$= 0.1829) less than women who do not have children, and the result is significant. The coefficient for women who have at least one young child moves from a more substantial negative effect which is significant to a small positive effect after controlling for education in model four. After controlling for education, seniority, working hours, and age in model five, the coefficient of women who have at least one young child is not significant. The interaction between women who are previously married and have at least one young child is not significant in model three to model four. It demonstrates that married and previously married women who have at least one young children are not significantly different in pay. However, OLS regression models cannot ameliorate the problem of self-selection, i.e., women who choose to get married or become a mother are already different on characteristics that affect earnings. Therefore, I will apply fixed-effects models for partially solving the problem of self-selection.

Table 3. OLS Regression Predicting Log Earnings

	Model One N = 5856	Model Two N = 5856	Model Three N = 5856	Model Four N = 5856	Model Five N = 5856
Treatment Variables					
Marital Status (Ref: Married Women)					
Previously Married Women	-0.114***		0.007	0.138	-0.012
	[0.028]		[0.115]	[0.098]	[0.096]
Parental Status (Ref: No Children)					
At Least One Young Child		-0.168***	-0.164***	0.07*	0.013
		[0.030]	[0.031]	[0.027]	[0.027]
All Adult Children		-0.399***	-0.386***	0.246***	0.047

		[0.031]	[0.032]	[0.031]	[0.037]
Previously Married * At Least One Young Child			-0.044	-0.026	0.109
			[0.123]	[0.106]	[0.103]
Previously Married * All Adult Children			-0.077	-0.137	-0.006
			[0.121]	[0.103]	[0.100]
Confounding Variables					
Education (Ref: Not Educated)					
Primary School				0.344***	0.368***
				[0.043]	[0.042]
Junior High School				0.558***	0.599***
				[0.048]	[0.046]
Senior High School				0.893***	0.944***
				[0.044]	[0.043]
Some College				1.202***	1.265***
				[0.046]	[0.046]
College and Advanced Degree				1.427***	1.499***
				[0.045]	[0.045]
Seniority					0.009***
					[0.001]
Weekly Working Hours					0.009***
					[0.001]
Age					0.007***
					[0.001]
Constant	10.242***	10.469***	10.469***	9.202***	8.483***
	[0.010]	[0.027]	[0.028]	[0.049]	[0.074]
AIC	12268.496	12054.971	12056.792	10195.801	9757.736

Note: p < 0.05 *; p < 0.01 **; p < 0.001***

In table 4, models six to nine use fixed-effects models by including controls for each person and each year. The coefficients from these models reveal the changes in earnings when individuals move within different marital and parental statuses. We can trust FE models more to remove selection bias since FE models eliminate additive effects of any unobserved time-invariant variables from the coefficients of interest (marital and parental statuses). Table 4 shows that none of the coefficients for parental or marital status are significant. I conclude that after eliminating self-selection on unchanging variables, there is no causal relationship between

marital and parental statuses and maternal earnings. Seniority and weekly working hours have positive coefficients; they predict higher earnings.

One of my research questions is to ascertain whether any penalties for motherhood, if present, are larger for single or married mothers. The difference between married and single mothers is tested with the interaction effects in model eight and nine. Both models show insignificant results, demonstrating the effect of being a mother is not different for married and single women. There is no significant effect for either group.

Table 4. Fixed-effects Model Predicting Log Earnings

	Model Six	Model Seven	Model Eight	Model Nine
	N = 5856	N = 5856	N = 5856	N = 5856
Treatment Variables				
Marital Status (Ref: Married Women)				
Previously Married Women	0.038		0.06	0.091
	[0.039]		[0.135]	[0.132]
Parental Status (Ref: No Children)				
At Least One Young Child		-0.01	-0.013	-0.016
		[0.035]	[0.035]	[0.035]
All Adult Children		0.016	0.027	0.023
		[0.044]	[0.044]	[0.043]
Previously Married Women * At least One Young Child			0.043	0.012
			[0.145]	[0.141]
Previously Married Women * All Adult Children			-0.073	-0.098
			[0.143]	[0.139]
Confounding Variables				
Seniority				0.013***
				[0.002]
Weekly Working Hours				0.006***

					[0.001]
Years		√	√	√	√
_cons		10.172***	10.183***	10.179***	9.828***
		[0.024]	[0.039]	[0.040]	[0.046]
AIC		2310.733	2312.295	2310.981	2056.582

Note: p < 0.05 * ; p < 0.01 **; p < 0.001 ***

Sensitivity Test

I use propensity score matching as a sensitivity test. I differentiate between two main groups: women who do not have child and women who do have child or children. Propensity score matching estimates the effect of parenthood on maternal earnings by comparing women in the control group with the treatment group who have similar propensities of having children. Propensity score matching simulates the scenario that the treated and untreated have similar baseline characteristics, and I use education, seniority, weekly working hours, and age as baseline variables. Then it predicts the average treatment effect among the treated (ATT) to see whether there is a significant effect of having children.

Table 5 shows that this method of estimating the treatment effect, i.e., having children, finds that the earnings of the treated, mothers, are not significantly different from the untreated, nonmothers. It supports the conclusion that I cannot reject the null hypothesis that there is no motherhood penalty, based on this analysis of panel data on Taiwanese women.

Table 5. Propensity Score Matching

Sample	T-test
Unmatched	-9.15 [0.30]
ATT	-0.24 [0.11]

Discussion

My research focuses on finding the effect of being a mother on earnings in Taiwan, and whether the effect of being a mother is different between married and single mothers. Fixed-effects models demonstrate how the change in motherhood status affects changes in earnings, and partially solve the problem of self-selection compared to OLS regression models. For the motherhood penalty in general, the coefficients of parental status in model seven to nine are not significant, suggesting that there is no effect of being a mother on earnings. Further, this effect is not significantly different between married and previously married women according to the coefficients of interaction terms in model six, eight, and nine. Among all fixed-effects models, model nine performs better than other fixed-effects models by controlling for seniority and working hours. That is, I would emphasize the result from model nine; all independent variables including marital status, parental status, and the interactions in model nine are not significant. In sum, there is no effect of having children on women's earnings and the effect is not different between marital statuses. However, consistent with past studies, seniority has a positive effect on earnings.

Fixed-effects models can only partially solve the problem of self-selection. It eliminates the unchanged variants over time. However, if wage trajectories rather than wage levels lead women to change their marital or parental statuses, then the problem of self-selection would still exist, and fixed-effects cannot solve it. For instance, if women anticipate career downturns, and then decide to have a child, fixed-effects model estimates of the effect of motherhood will be biased toward returning larger negative effects than the true causal effect. In this case, their anticipation of wage decline causes the birth of the child. Had I found a negative effect of motherhood, I would need to worry about this bias. But given that I find no effect of motherhood, this concern is not as great.

The results of FE models counter findings from the previous literature about the motherhood penalty in other affluent nations. This research also contradicts the finding from Hsu and Chiou (2015). However, I employ person-fixed-effects models to partially solve the problem of self-selection problem, which Hsu and Chiou (2015) did not. Thus, my analysis casts substantial doubt on their conclusion of a motherhood penalty in Taiwan. One possible explanation for these insignificant results is that being a woman rather than a man in Taiwan has such a large earnings penalty that no further penalty accrues by motherhood or marital statuses. Further research might usefully explore whether other surveys of Taiwanese women also find no motherhood penalty, whether Taiwan's sex gap in pay is unusually large, and whether there is a relationship across countries between the gender gap and the motherhood penalty.

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