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Family-Wage Gap and Highly Skilled Women

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Abstract

The paper estimates the family wage gap (FWG), which is the pay gap between women with children and women without children, among highly skilled female scientists and researchers. The paper uses a rich dataset from the longitudinal Survey of Doctorate Recipients in the US to estimate FWG and to investigate its sources. The sources evaluated include, one, human capital characteristics such as: field of majors, school quality, and years since Ph.D. Two, maternity leaves and other self-reported-career breaks adjusted experience. Three, current job characteristics such as: extent to which job is related to highest degree, authority level, tenure status, occupation major group, choice to work part-time, working outside field of research, employment type, experience in current job, average number of hours worked and average number of weeks worked in a year. Lastly, the paper examines the role of family and the demographic status of women such as: marital status, number of children, age of the youngest child, age of woman at the time of first born, and timing of first born before or after graduation. The results indicate that the family wage gap does exist among women with Ph.D. and is about 6.8 percent. However, most of the existing wage difference can be explained by differences in human capital characteristics and current job characteristics. Results indicate that this wage difference increases with the increase in number of children. The wage gap is highest for married women, women with younger children, for women who opt for early motherhood, and for women who plan children before the doctoral degree.

Key Words: High-Skilled Women, Wage-Penalty, Family Wage Gap, Children

I. Introduction

Mothers earn up to 10 percent less than women who don't have children. This wage difference between mothers and women without children is well established and extensively studied in the socio-economic literature. It is called the family wage gap (FWG) or the motherhood wage penalty[2]. An increasing number of women are investing significant resources in their education and subsequent careers. The goal of this study is to determine how motherhood affects the wages of these women. The paper evaluates the motherhood wage penalty among women with doctoral degrees (Ph.D.) in the United States. Compared to women with lower levels of education, women with this skill level often bear children far later and less often than do low skill women. They typically postpone childbearing until their late 20s and often well into their 30s. A significant minority never has children at all. Considering their investment in career and typical postponement of child bearing, motherhood wage penalty becomes an interesting topic of study among these women. The study estimates the FWG among women with doctoral degrees, and considers how the wage gap changes as controls are added.

The controls include demographic characteristics, human capital characteristics, adjusted experience and current job characteristics. Individual fixed-effects are also included in the model. The paper uses longitudinal micro-data from the longitudinal Survey of Doctorate Recipients (SDR).

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[2] Lundberg and Rose (2000), Waldfogel (1995, 1997, 1998), Budig and England (2001)

The survey was conducted once every two years from 1995 to 2010, and is a rich source of information on careers of doctoral recipients. The results indicate that the family wage gap does exist among women with Ph.Ds and is about 6.8 percent. However, most of the existing wage difference can be explained by one, human capital characteristics such as: field of majors, school quality, and years since Ph.D. Two, maternity leaves and other self-reported-career breaks adjusted experience.

Three, current job characteristics such as: extent to which job is related to the highest degree, authority level, tenure status, occupation major group, choice to work part-time, working outside field of research, employment type, experience in current job, average number of hours worked, and average number of weeks worked in a year. This wage gap increases with the number of children. Higher wage penalties are observed for married women, women with younger children, and women who have children before age 36. Though there is extensive literature on the family wage-gap, this study adds to the existing literature by examining a group of women with doctoral degrees. Estimating the FWG and the factors explaining the existence of FWG among these highly skilled women is interesting from the policy perspective. As, the former provides information on the cost of choices that are related to child bearing, and the later helps in formulation of family policies that may make motherhood lest costly for highly skilled female scientists, doctors and engineers.

II. Family Wage Gap (FWG)

The family wage gap is the pay penalty that women with children incur in relation to women without children. According to Crittenden (2001), for those under the age of 35, the pay gap between mothers and non-mothers is larger than the pay gap between men and women. Becker (1985) introduced the Human Capital Model for wage inequality; according to this model, the most important factors driving the family wage gap come from the division of domestic labor and child-care responsibilities in the family. Additionally, according to the hypothesis of Korenman and Neumark (1992), child care and other household responsibilities induce married women to seek more convenient, flexible, and less energy intensive jobs. This further leads to wage differences between mothers and non-mothers. Waldfogel (1995, 1997, 1998), Budig and England (2001), use OLS (ordinary least square regression) in a pooled cross-section of women and report wage penalties for mothers in the range of 4 percent to 10 percent for one child and 6 percent to 13 percent for two or more children. However, because of the unobserved differences between mothers and non-mothers, the creditability of these results is questionable. Korenman and Neumark (1992), and Lundberg and Rose (2000), find that the wage difference between women with children and without children persists even after taking into account endogeneity of marriage and motherhood, experience, and tenure endogeneity, selectivity in employment, and heterogeneity among the women. These studies find that the wage penalty using the fixed effects specification is comparable to those of the cross-sectional specification. Gangl and Ziefle (2009) use harmonized longitudinal data from the British Household Panel Survey, the German Socio-Economic Panel Survey, and the National Longitudinal Survey of Youth (NLSY) to estimate the wage penalty. They use fixed-effects panel data regressions for five cohorts of American, British and West German women around the 1960s. Further, to account for the dynamic sample selection around the time of childbirth that comes from factors related to child care arrangements, household economic situations, and intra-spousal division of household work, they use selectivity-corrected specification. They also obtained estimates of the wage penalty for motherhood between 10 percent and 18 percent per child. They also conduct a differentiated analysis of the sources of the motherhood wage penalty. Their estimates suggest that human capital differences and factors such as work interruption and changing employer explain most of the existing wage penalty for mothers but not all of it.

In some recent studies there has been evidence that the FWG varies across education groups, however the results were contradictory. According to Becker's (1985) work effort hypothesis, jobs requiring more effort and skills will experience larger motherhood wage penalties. However, Anderson, Binder and Krause (2002) find that more educated mothers experience some wage losses, but these wage losses are lesser compared to medium-skilled mothers (high school graduates). In addition, Amuedo-Dorantes and Kimmel (2003) find that college educated women do not experience any penalty.

On the contrary, Detcher (2011) finds that the motherhood wage penalty does not vary much across educational levels. These results make the FWG an interesting subject of study, especially among highly educated women. The more investment a woman makes in her education, the more she signals her commitment to the labor market. I intend to restrict my study to this interesting subgroup of women. The paper exclusively evaluates the FWG among women with doctoral degrees (Ph.Ds). The completion of a Ph.D indicates a high degree of career investment and commitment among these women. The paper also thoroughly investigates the factors causing the motherhood wage-penalty among this exclusive subset of women.

III Data and Variables

The paper uses the Survey of Doctorate Recipients (SDR). This survey gathers information from individuals who have obtained a doctoral degree in science, engineering or health sciences. The SDR is conducted every 2 years and is a longitudinal survey that follows recipients from U.S. institutions until age 76.

The SDR data is available for the years 1995 - 2010. The SDR study is the only source of data on the careers of science and engineering doctorate holders from US institutions, and provides key data on the education, training, work experience, career development, and demographics of this important population. The survey is a rotational panel where some old respondents are dropped and a sample of new cohorts of doctorate recipients is added for every subsequent survey. The analysis sample in the paper is restricted to the following: (1) women between 25-55 years in age, (2) observations that are successfully followed for at least three or more times over the survey years, and (3) women that are employed fulltime/ part time for the reported survey years. There were 58,028 such observations in the sample, out of which 28,634 have complete information on demographic and human capital characteristics, and 22,685 of these have complete information for current job characteristics. The dependent variable is log hourly wages of respondent's current job[3]. The major explanatory variable is an indicator variable representing the motherhood status, where "1" represents mother and "0" otherwise. Demographic characteristics include: age, marital status, citizenship status, indicator for visa status if not citizen, dummy variable indicating spousal employment. Human capital characteristics include: field of major, indicator variable for school quality both for graduate and undergraduate degrees, years since Ph.D . Adjusted experience adjusts years since Ph.D. for maternity leaves or any other self reported career breaks or both. The controls for current job characteristics include: extent to which job is related to highest degree, authority level, tenure status, occupation major group, choice to work part-time, working outside field of research, employment type, experience in current job, average number of hours worked and average number of weeks worked in a year. Table (1) provides summary statistics of the variables discussed above for three women age intervals: age 25-35 years, age 36-45 years, and age 46 – 55 years. Some interesting things to note here are: First, mothers work fewer hours compared to other women. Second, they are less likely to switch jobs. And lastly, they are more likely to work part-time.

IV. Methodology

The paper first uses Ordinary-Least – Square (OLS) model to estimate and explain the decomposition of the family wage gap. The OLS Model used for analysis is: $\text{Log}(\text{wage}_{it}) = \beta_0 + \beta_1(\text{Mother}_{it}) + \beta_2 D_{it} + \beta_3 H_{it} + \beta_4 AE_{it} + \beta_5 CJ_{it} + S_t + u_{it}$ (1) The unit of analysis is person-year. The dependent variable is log hourly earnings. The main explanatory variable is the motherhood status. This equals to "1" for mothers and "0" otherwise. The parameter of interest here is β_1 that is the coefficient on the motherhood status. β_1 estimates the FWG. Vectors D, H, AE, and CJ indicate demographic, human capital controls, adjusted experience, and current job characteristics respectively. For full list of variables under D, H, and CJ refer to Table- 1 (Table- 1 provides the summary statistics of these control variables). Adjusted experience adjusts years since Ph.D. for observed career breaks and maternity leaves[4]. S_t are the survey fixed effects.

[3] For analysis, outliers, women whose hourly wages are above $400, were omitted.

[4] Maternity leaves (on an average three months per child) and self reported career breaks (in terms of weeks worked in a year, average number of hours worked in a week and indicators for working part time) are adjusted to years since Ph.D.

There is a strong chance that the OLS –estimates are affected by bias created due to unobserved or unmeasured personal. These unobserved personal characteristics may include basic cognitive aptitude, life-cycle plans, family and work preferences, career aspirations, future orientation, and many other unmeasured human capital parameters. Because, the Survey of Doctorate Recipients (SDR) dataset provides multiple observations per individual respondents over the years, the paper next uses an individual fixed-effects regression model to estimate and decompose the family wage gap. This fixed-effects model intends to eliminate any bias due to time constant unobserved characteristics. $\text{Log (wageit)} = \beta o + \beta_1 (\text{Mother}_{it}) + \beta_2 D_{it} + \beta_3 H_{it} + \beta_4 AEt_{it} + \beta_5 CJ_{it} + S_t + V_i + u_{it}$ (2) Equation (2) is same as equation (1) but with individual fixed -effects added (V_i). Here the time-constant variables will drop out of any individual specific -demographic (D), human capital (H) or other characteristics. The identification of β_1 in the equation above comes from only those women who experienced change in motherhood status during the survey years. The paper presents results from both OLS and fixed-effects model for all the analysis. Considering that OLS models may have greater omitted variable bias, the comparison of results from two model specifications discussed above will help us to understand if women with children have lower earnings due to unobserved characteristics or not. The standard errors are clustered at individual level for both fixed effects and OLS models. Among the controls in equation (1) and equation (2), some controls such as demographic characteristics (D) and human capital characteristics (HC) are independent of fertility choices.

Table 1: Means and Standard Deviations (in Parenthesis) for Variables Used in Analysis, by Age-Interval and Motherhood Status: SDR, 1995 to 2010

Variables	Age 25-35 Years		Age 36-45 Years		Ag46-55 Years	
	Childless	Mother	Childless	Mother	Childless	Mother
Demographic Characteristics (D)						
Age	31.683 (2.169)	32.900 (1.822)	41.430 (2.908)	41.516 (2.822)	50.975 (2.534)	50.052 (2.393)
Marital Status Never Married Married Divorced[a]	. 153 (.311) .435 (.500) .504 (.493)	.005 (.082) .947 (.201) .042 (.201)	.153 (.321) .495 (.443) .469 (.477)	.005 (.071) .896 (.304) .103 (.304)	.109 (.343) .524 (.498) .457 (.498)	.010 (.104) .826 (.378) .173 (.378)
Citizenship Status	.839 (.366)	.769 (.421)	.925 (.261)	.904 (.294)	.979 (.142)	.969 (.172)
Visa Status: On Temp Work Visa	.160 (.366)	.230 (.421)	.074 (.261)	.095 (.294)	.020 (.142)	.030 (.172)
Minority Status	.156 (.363)	.145 (.352)	.163 (.369)	.134 (.341)	.142 (.349)	.148 (.355)
Married and Spouse Full Time Employed	.812 (.341)	.843 (.363)	.875 (.443)	.792 (.405)	.887 (.402)	.707 (.454)
Human Capital Characteristics (H)						
Fieldof Major Biological, agriculture and environmentallife sciences Computer and Information Mathematics and Statistics Sciences Physical Sciences Social Sciences Engineering Health	.311 (.452) .029 (.167) .043 (.205) .145 (.354) .174 (.379)	.315 (.467) .033 (.179)	.288 (.436) .025 (.147)	.319 (.412) .027 (.157)	.277 (.405) .028 (.160)	.269 (.432) .025 (.144)

	.117 (.322) .125 (.331) .047 (.212)	.050 (.215) .132 (.341) .202 (.402) .097 (.297) .111 (.314) .052 (.222)	.038 (.181) .132 (.339) .181 (.383) .176 (.380) .087 (.281) .071 (.257)	.039 (.180) .134 (.341) .205 (.401) .141 (.348) .099 (.299) .063 (.243)	.035 (.174) .0932 (.292) .219 (.417) .179 (.383) .043 (.204) .127 (.333)	.024 (.149) .119 (.320) .249 (.432) .167 (.373) .057 (.233) .093 (.291)
Classification of School Awarding PhD. Very Reputed Moderately Reputed Less Reputed	.509 (.419) .316 (.299) .105 (.067)	 .511 (.502) .319 (.287) .112 (.063)	 .513 (.500) .313 (.260) .103 (.059)	 .487 (.499) .403 (.260) .013 (.055)	 .494 (.481) .315 (.218) .016 (.012)	 .457 (.441) .327 (.229) .013 (.011)
Classification of School Awarding Bachelors Very Reputed Moderately Reputed Less Reputed	.408 (.371) .332 (.367) .197 (.032)	.442 (.378) .397 (.319) .091 (.039)	.411 (.377) .333 (.305) .117 (.031)	.413 (.389) .327 (.355) .114 (.035)	.403 (.386) .346 (.399) .118 (.035)	.409 (.312) .307 (.331) .119 (.031)
Years Since PhD.	2.803 (1.835)	3.739 (2.136)	7.610 (4.315)	8.853 (4.343)	14.777 (7.466)	15.687 (6.741)
Adjusted Experience (AE)	2.794 (1.543)	3.125 (2.128)	7.114 (4.132)	7.197 (4.132)	14.243 (7.175)	13.965 (6.884)
Current Job Characteristics (CJ)						
Extent to which job is/ jobs are related to highest degree	1.954 (.621)	1.919 (.678)	1.899 (.654)	1.913 (.667)	1.754 (.887)	1.917 (.854)
Authority Level	.012 (.254)	.012 (.291)	.348 (.432)	.311 (.466)	.676 (.213)	.539 (.413)
Tenure Status	.015 (.140)	.028 (.139)	.135 (.342)	.132 (.339)	.237 (.425)	.228 (.420)
Occupation Major Group Biological, agriculture, and environmental life sciences Computer and Information Mathematics and Statistics - Sciences - Physical Sciences	 .107 (.027) .209 (.099) .004 (.069)	 .106 (.081) .245 (.207) .014 (.069)	 .102 (.047) .214 (.120) .003 (.060)	 .103 (.055) .228 (.165) .012 (.110)	 .105 (.072) .139 (.108) .015 (.075)	 .104 (.067) .132 (.143) .016 (.081)

- Social Sciences	.102 (.053)	.099 (.098)	.103 (.058)	.102 (.533)	.115 (.122)	.114 (.120)
- Engineering	.108 (.092)	.115 (.124)	.086 (.079)	.082 (.147)	.181 (.143)	.179 (.043)
	.027 (.088)	.029 (.075)	.020 (.045)	.021 (.044)	.095 (.157)	.095 (.155)
	.267 (.176)	.277 (.212)	.296 (.190)	.206 (.291)	.932 (.247)	.923 (.265)
Working Part Time	.015 (.123)	.049 (.204)	.023 (.150)	.068 (.252)	.036 (.186)	.078 (.252)
Working Outside the Field of Research	.048 (.214)	.043 (.203)	.063 (.243)	.058 (.233)	.082 (.274)	.061 (.253)
Private/ non-educational employment	.333 (.471)	.324 (.468)	.314 (.464)	.348 (.476)	.313 (.463)	.322 (.467)
Public sector employment /Educational Employment	.625 (.483)	.551 (.497)	.640 (.480)	.546 (.497)	.615 (.486)	.509 (.491)
Self employed	0.000 (0.000)	0.000 (0.000)	.052 (.223)	.092 (.417)	.107 (.309)	.113 (.317)
In job less than one year	.452 (.497)	.331 (.470)	.292 (.454)	.201 (.417)	.192 (.393)	.170 (.376)
Average number of hours worked	48.614 (11.662)	41.544 (12.420)	48.227 (12.302)	41.441 (13.321)	46.606 (13.122)	41.887 (13.263)
Average number of weeks worked in a year	48.063 (7.916)	47.760 (8.146)	47.483 (7.798)	47.146 (8.459)	47.127 (8.097)	47.021 (8.238)
Children Characteristic						
Number of Children -One Child	-	.686 (.464)	-	.525 (.498)	-	.167 (.374)
- Two Children	-	.313 (.464)	-	.461 (.498)	-	.831 (.374)
- Three or more Children	-	.001 (.085)	-	.014 (.045)	-	.011 (.044)
Age interval of the youngest child in household - Children under 2	-	.567 (.497)	-	.166 (.372)	-	.014 (.119)
- Children age 3 – age 5	-	.546 (.497)	-	.383 (.486)	-	.050 (.219)
- Children age 6 – age 11	-	.085 (.279)	-	.519 (.499)	-	.938 (.239)
- Children age 12 – age 18	-	.031 (.174)	-	.316 (.456)	-	.597 (.490)
- Children age 19 or above	-	.009 (.097)	-	.066 (.249)	-	.361 (.485)
Number of Observations	5048	2714	4947	7277	4739	3909

Notes: a) Category includes separated, divorced, and widowed.
b) Numbers in parentheses are standard errors.

Most of the variables under these groups either precede fertility choices or are un-affected by fertility choices. Thus, for estimation of family wage gap we include these two set of controls. The wage differences between mothers and non-mothers may occur due to differences in productivity between these women or differences in career choices or could be an outcome of wage-discrimination. The paper uses controls such as adjusted experience (AE) and current job characteristics (CJ) to explore what differences contributes most to the family wage –gap.

Adjusted experience (AE) and current job characteristics (CJ) are often jointly determined with fertility decisions of women. These controls are not completely exogenous to the family wage gap estimation. Adding these controls will allow us to explore whether and to what extent the wage gap exists because of differences in productivity, differences in job characteristics or discrimination between mothers and non-mothers for highly skilled women with Ph.D.s. In order to further investigate sources of the FWG and to identify which women from this sample are affected most by the wage gap, the paper extends the equations (1) and (2) using various interaction- terms. The important questions evaluated here include: (1) which women have the largest FWG based on relationship status? Here, the model interacts with the relationship status of women with motherhood status. (2) What is the impact of number of children on the Family Wage Gap ? Here, dummy variables indicating number of children (one child, two children, three or more children) are used as explanatory variables. (3) Do women with younger children have more wage penalty? Here, dummy variables indicating age intervals of the youngest child are used as explanatory variables. (4) Whether postponing motherhood affects the FWG? Here, first the sample is divided into three age categories, 25-35 years, 36-45 years and 46- 55 years. Then, in each sample, regression model, includes indicators for: first child before Ph.D., first child after Ph.D. and before age 35, and first child age 36 or after.

V. Results

Table 2: Estimating the FWG: Motherhood Wage Penalty

Control Variables in the Model	Fixed–Effects Model	OLS-Model
Gross (No Controls) N= 28,634	-.112** (.009)	-0.117** (.007)
Demographic and Human Capital Characteristics (H) N= 28,634	-.068*** (.009)	-.071** (.007)
Adjusted Experience (AE) N= 28,634	-.043** (.006)	-.041** (.006)
Adjusted Experience (AE) on the Current Job Characteristics (CJ) sample N= 22,685	-.049** (.006)	-.045** (.006)
Current Job Characteristics (CJ) N= 22,685	-.024** (.004)	-.022** (.005)

Notes: The coefficients reported above are estimations of β_1 using Equation (1) for the OLS model and Equation (2) for the fixed-effects model. That is the coefficient on indicator variable for motherhood status, which equals to "1" for mothers and "0" otherwise. Table (2) above reports the list of the variables under all sequentially added controls. *p < .05 **p < .01. The dependent variable here is hourly wage (ln). Numbers in parentheses are standard errors. The estimates are based on SDR, 1995 -2010 + $u_{it.}$

Table (2) presents coefficient estimates from equation (1) and (2). The fixed-effects model (row -1) captures the "gross" effect of motherhood with no controls other than person-specific and year-specific fixed effects. The results here indicate that wage penalty on mothers is 11.2 percent. The OLS model (row -1) show slightly higher gross-wage penalty, at 11.7 percent. This suggests only slight negative selectivity into having children on unmeasured pay-relevant characteristics[5]. Adding demographic and human capital characteristics in the second row diminishes the wage-penalty for women with children to 6.8 percent and 7.1 percent for fixed-effects and OLS regression specifications respectively. This is equivalent to a reduction of about 40 percent of the gross wage penalty for both fixed -effects and OLS regression specifications.

[5] Buding and England (2001) using data from the 1982-1993 National Longitudinal Survey of Youth also found slight selectivity into having (more) children on unmeasured pay-relevant characteristics.

The paper refers the results from this iteration for the fixed-effect model as FWG from here on. The next three rows consider: One, what is the impact of adjusted experience on the FWG? Two, if FWG is within a job (that is these wage differences are present for women with the same job characteristics) or between jobs (that is these wage difference arise because these women have different job characteristics)? In row 3, controlling for adjusted experience, the coefficient on motherhood indicator further reduces to 4.3 percent for the fixed-effects model and 4.1 percent for the OLS model by adding adjusted experience.

The impact of adjusted experience is similar if we drop the observations with incomplete information on current job characteristics (row 4). Adding current job characteristics (row 5) reduces this penalty further to 2.4 percent and 2.2 percent for the fixed-effects and the OLS specification respectively. This indicates that most of these wage differences are between the jobs –that is job characteristics differ between mothers and non-mothers.

Table 3: Estimating impact of Number of Children on the FWG

Control Variables in the Model	**Fixed – Effects Model**			**OLS-Model**		
	One Child	Two Children	Three or More Children	One Child	Two Children	Three or More Children
Gross (No Controls) N = 28,634	-.069** (.010)	-.137** (.010)	-.143** (.014)	-.066** (.010)	-.133** (.009)	-.141** (.009)
Demographic and Human Capital Characteristics (H) N= 28,634	-.044** (.010)	-.069** (.010)	-.101** (.009)	-.049** (.010)	-.065** (.009)	-.117** (.009)
Adjusted Experience (AE) N = 28,634	-.039** (.010)	-.053** (.010)	-.087** (.009)	-.037** (.010)	-.047** (.009)	-.103** (.009)
Adjusted Experience (AE) on the Current Job Characteristics (CJ) ample N= 22,685	-.040** (.010)	-.057** (.013)	-.095** (.009)	-.034** (.009)	-.052** (.009)	-.098** (.009)
Current Job Characteristics (CJ) N = 22,685	-.020* (.010)	-.029** (.010)	-.020** (.009)	-.016 (.010)	-.031** (.009)	-.044** (.010)

Notes: The OLS-Model used here is the transformation from equation (1): Log ($wage_{it}$) = β_o +$\sum_{i=1}^{3}\beta_i$(Number of Children Interval) + β_4 D_i + β_5 H_{it} + $\beta_6 AE_{it}$ + $\beta_7 CJ_{it}$ + S_t + u_{it}. The fixed-effect model used here is the transformation from equation (2): Log ($Wage_{it}$) = β_o + $\sum_{i=1}^{3}\beta_i$(Number of Children Interval) + β_4 D_i + β_5 H_{it} + $\beta_6 AE_{it}$ + $\beta_7 CJ_{it}$ + S_t + $\mathbf{v}_i$ + e_{it}. The coefficient's β_1, β_2, and β_3 on the indicator variable representing number of children are reported above. Both the model specifications include survey fixed effects. *p < .05 **p < .01. Numbers in parentheses are standard errors. The dependent variable here is hourly wage (ln).

Table (3) uses three indicator variables (one child, two children and three or more children) to check if motherhood wage-penalty is monotonic with number of children. The table indicates that the FWG (Demographic and Human Capital adjusted) increases with increase in the number of children, from 4.4 percent for one child to 6.9 percent for two children, and 10.1 percent for three or more children each relative to reference category of no children. We do observe that most of this wage penalty is explained by adding additional controls for adjusted experience and current job characteristics for mothers in all categories. Next, the paper explores the heterogeneity in the FWG. Table (4) estimates the interaction of marital status and motherhood status. It is evident here that the FWG is highest for married women compared to other women with children.

Controlling for demographic and human capital characteristics, it is about 6.3 percent for married women, whereas 5.4 to 4.9 percent for divorced and never-married. We do observe that the coefficients shrink by 52 to 73 percent after adding controls for adjusted experience and current job characteristics.

Table 4: Which Relationship –Status Women have the Largest FWG

Control Variables in the Model	Fixed – Effects Model			OLS-Model		
	Never-Married	Married	Divorced[a]	Never-Married	Married	Divorced[a]
Gross (No Controls) N = 28, 634	-.099*** (.009)	-.128** (.008)	-.097** (.007)	-.095** (.009)	-.121** (.008)	-.099** (.007)
Demographic and Human Capital Characteristics (H) N = 28, 634	-.049** (.009)	-.063** (.008)	-.054** (.007)	-.053** (.009)	-.069** (.008)	-.055** (.007)
Adjusted Experience (AE) N = 28, 634	-.031** (.009)	-.049** (.008)	-.044** (.007)	-.039** (.009)	-.048** (.008)	-.042** (.007)
Adjusted Experience (AE) on the Current Job Characteristics (CJ) sample N= 22,685	-.033** (.009)	-.051** (.007)	-.040** (.007)	-.041** (.009)	-.051** (.008)	-.038** (.007)
Current Job Characteristics (CJ) N = 22, 685	-.019* (.009)	-.029** (.007)	-.015* (.007)	-.017 (.009)	-.021* (.008)	-.019** (.007)

Notes: The OLS-Model used here is the transformation from equation (1): Log ($wage_{it}$) = β_o +$\sum_{i=1}^{3} \beta_i$[(Marital $Status_i$)× (Mother)] + $\beta_4 D_i + \beta_5 H_{it} + \beta_6 AE_{it} + \beta_7 CJ_{it} + S_t + u_{it}$. The fixed-effect model used here is the transformation from equation (2): Log ($Wage_{it}$) = β_o + $\sum_{i=1}^{3} \beta_i$[(Marital $Status_i$)× (Mother)] + $\beta_4 D_i + \beta_5 H_{it} + \beta_6 AE_{it} + \beta_7 CJ_{it} + S_t + \mathbf{v}_i + e_{it}$. The coefficient's β_1, β_2, and β_3 on the interaction term of marital status and motherhood status are reported above. Both the model specifications include survey fixed effects. *p < .05 **p < .01.The dependent variable here is hourly wage (ln). Numbers in parentheses are standard errors. The estimates are based on SDR, 1995 -2010. [a] Includes separated, divorced, or widowed.

Table (5) estimates FWG by age intervals of the youngest child. The table evaluates whether women with younger children have more wage penalty. The table demonstrates that for both fixed-effects model and OLS model the FWG is highest for women with youngest child in age interval 0-5 years. The table also shows that there are no evidences of wage-penalty for women with grown up children (youngest child age 18 or older). These findings are consistent with the findings of the existing literature in the subject. According to Waldfogel (1998), Blau & Kahn (1999), Budig and England (2001), the family gap is more prominent for women with younger children compared to others because younger children often demand more time and effort than older ones. After adding adjusted experience and current job characteristics for women with children age 6 years or older the FWG is no more significant, and for women with children age 5 or younger the coefficient shrinks by 65 percent.

Table 5: The Age of Youngest Child and the Family Wage Gap

Control Variables in the Model	Fixed – Effects Model				OLS-Model			
	Youngest Child Age 0-5 years	Youngest Child Age 6-11 years	Youngest Child Age 12- 17 years	Youngest Child Age 18+ years	Youngest Child Age 0-5 years	Youngest Child Age 6- 11 years	Youngest Child Age 12- 17 years	Youngest Child Age 18+ years
Gross(No Controls) N = 28,634	-.139** (.010)	-.102** (.010)	-.062** (.012)	.005 (.016)	-.153** (.011)	-.102** (.010)	-.46** (.011)	.019 (.016)
Demographic and Human Capital Characteristics (H) N= 28,634	-.066** (.010)	-.052** (.010)	-.047** (.012)	.001 (.016)	-.059** (.010)	-.054** (.010)	-.37** (.011)	.014 (.016)
Adjusted Experience (AE) N = 28, 634	-.039** (.010)	-.025* (.010)	-.032** (.012)	.002 (.016)	-.053** (.011)	-.025** (.010)	-.029** (.011)	.005 (.016)
Adjusted Experience (AE) on the Current Job Characteristics (CJ) sample N= 22,685	-.041** (.010)	-.021** (.010)	-.037** (.012)	.007 (.016)	-.045** (.011)	-.027** (.010)	-.021 (.011)	.011 (.016)
Current Job Characteristics (CJ) N = 22, 685	-.023* (.010)	-.011 (.010)	-.014 (.012)	.011 (.016)	-.021 (.010)	-.005 (.010)	-.007 (.011)	.014 (.016)

Notes: The OLS-Model used here is the transformation from equation (1): Log ($wage_{it}$) = $\beta_o + \Sigma_{i=1}^{4} \beta_i$ [Age Interval of the youngest $child_i$] + $\beta_5 D_i + \beta_6 H_{it} + \beta_7 AE_{it} + \beta_8 CJ_{it} + S_t + u_{it}$. The fixed-effect model used here is the transformation from equation (2): Log ($Wage_{it}$) = $\beta_o + \Sigma_{i=1}^{4} \beta_i$ [Age Interval of the youngest $child_i$)]+ $\beta_5 D_i + \beta_6 H_{it} + \beta_7 AE_{it} + \beta_8 CJ_{it} + S_t + \mathbf{v}_i + e_{it}$. The coefficient's β_1 , β_2, , β_3 and β_4 on the indicator variable for age interval of the youngest child are reported above. Both the model specifications include survey fixed effects. *p < .05 **p < .01. The dependent variable here is hourly wage (ln). Numbers in parentheses are standard errors. The estimates are based on SDR, 1995 -2010.

Table (6 – panel A, B and C) explores impact of motherhood timings on the women of various age groups Here, first the sample is divided into three age categories, 25- 35 years, 36-45 years and 46- 55 years. Then, in each sample, OLS- regression model includes indicators for: first child before Ph.D., first child after Ph.D. and before age 35, and first child age 36 or after. The purpose of this table is to explore two things: One which women age group is affected most by the FWG. Two, how is FWG affected by fertility timings. The table indicates that first among all age groups; the FWG is most prominent for women in age group 36-45 years for all motherhood timing categories. Next, for all age groups, FWG is greatest for women who plan children before Ph.D. or before age 35. Lastly, for women in age group 25-35 who become mothers after Ph.D. or after age 35, there are no significant indications of the FWG. These results indicate that for the women who plan motherhood after Ph.D. or after age 36 in age-groups 25-35, we do not observe any significant FWG in the initial career years. However, once they become mothers, the FWG becomes significant. Table (6) also suggests that most of the wage penalty both in the fixed-effect model and the OLS model is explained by adding adjusted experience, and current job characteristics.

Table 6: Analyzing if Postponing Motherhood affects the FWG

Control Variables in the Model	OLS – Estimation		
	First Child Before PhD.	First Child After PhD. Before Age 35	First Child Age 36 or after
Panel A : Women Age Group 25- 35 years			
Gross (No Controls) N= 7,519	-.097** (.010)	-.017 (.009)	-.009 (.009)
Demographic and Human Capital Characteristics (H) N= 7,519	-.063** (.009)	-.005 (.009)	-.003 (.009)
Adjusted Experience (AE) N= 7,519	-.044** (.009)	-.014 (.009)	-.011 (.009)
Current Job Characteristics (CJ) N = 6,108	-.027* (.009)	-008 (.009)	.012 (.009)
Panel B : Women Age Group 36- 45 years			
Gross (No Controls) N= 10,879	-.117** (.012)	-.071** (.013)	-.059** (.012)
Demographic and Human Capital Characteristics (H) N= 10,879	-.057** (.012)	-.040** (.013)	-.033** (.012)
Adjusted Experience (AE) N= 10,879	-.045** (.012)	-.033** (.013)	-.029** (.012)
Current Job Characteristics (CJ) N = 8,321	-.024* (.012)	.015 (.013)	-.011 (.012)
Panel C : **Women Age Group 46- 55 years**			
Gross (No Controls) N= 9,768	-.051** (.011)	-.049** (.014)	-.029** (.012)
Demographic and Human Capital Characteristics (H) N= 9,768	-.039** (.011)	-.038** (.014)	-.019 (.012)
Adjusted Experience (AE) on the Current Job Characteristics (CJ) sample N= 8,256	-.034** (.011)	-.031** (.014)	-.011 (.012)
Current Job Characteristics (CJ) N = 8,256	-.019 (.011)	-.013 (.014)	.013 (.012)

Notes: The OLS-Model here is: Log ($wage_{it}$) = $\beta_o + \beta_1$(Child before PhD- B_i)+ β_2 (Child after PhD before age35- A_i) + β_3(Child after PhD after age35- C_i) + $\beta_4 D_i + \beta_5 H_{it} + \beta_6 AE + \beta_7 CJ_{it} + S_t + u_{it}$. The model specifications include survey fixed effects. *p < .05 **p < .01.The dependent variable here is hourly wage (ln). Numbers in parentheses are standard errors. The estimates are based on SDR, 1995 -2010.

VI. Conclusion

The results indicate that the family wage gap does exist among women with PhDs and is 6.8 percent. However, most of the existing wage difference can be explained by differences in human capital characteristics, adjusted experience, and current job characteristics between mothers and non-mothers for these women with Ph.D.s. This implies that there is no significant presence of wage discrimination for these high skilled women with Ph.D.s working on same/similar jobs. However, if the jobs (current job characteristics) that these women land on is because of discrimination is still questionable and out of scope for this study. It will be an interesting area to explore for upcoming studies in this domain.

Results also show that the wage difference is monotonic in number of children; it increases with the increase in number of children. The wage gap is highest for married women. The wage difference is most evident for women in age interval 36-45 years. Lastly, the wage-penalty is higher for women, who plan children before the completion of the degree or age 36. Though there is extensive literature on the family wage-gap, this study adds to the existing literature by examining a group of women who have substantially invested in acquiring advanced skills that are typically used in careers promising high wages. Further, both the FWG and the factors explaining the existence of FWG among these highly skilled women are interesting from a policy perspective.

The former provides information on the cost of choices that are related to child bearing, and the later helps in formulation of family policies which could make motherhood less costly for highly skilled women scientists, doctors and engineers. The paper intends to contribute to an emerging body of socio-economic science research, which stringently assesses contextual and institutional determinants of women's careers.

Note

"The use of NSF data does not imply NSF endorsement of the research, research methods, or conclusion contained in this report."

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