# Are women penalized for being a mother? A study on the two-period motherhood penalty in the U.S.

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## I. Introduction

For all of history, women have been confined to the role of caring for their families, they have no voice, no inherent rights, and no way to even decide their own work choices, except to be a mother and a wife. The opportunity for this traditional approach to change came with the World Wars when women answered the call to enter manufacturing behind the battlefield because of the absence of men. Despite the reality that women had to return to the home as a result of the men's return, the fire for a second life choice was already engraved in the hearts of women. They knew that they could take on any profession where it was previously thought that only men could succeed. Then as the spark sprang up, the feminist movement emerged and women began to enter the labour market positively. However because women were not completely separated from the role of caring for their families, many working women had to pull out all the stops to balance family and work. Because of this, many employers often questioned whether women would return to their families in the future or, because married women had to take time off from work, deliberately offered working women lower wages to reduce the potential burden of employment costs. GANGL and ZIEFLE (2009) note that the wage gap between men and unmarried women is very slight but the wage gap between men and married women is significant. They also attribute this significant difference to the fact that women with children have more family care responsibilities, so they face significant discrimination whether it is due to reduced productivity caused by family care or whether they are perceived by their bosses as having such a possibility.

GANGL and ZIEFLE (2009) conducted a study in five birth cohorts and three countries, they point out that two factors influence whether working women will return to the

labour market after childbirth. The first is the level of labour market participation before childbirth. The higher the level of participation the more it represents women's dependence on labour, then they are more likely to return to the labour market after childbirth. The second is the completeness of maternity leave at the regional level. In regions with high levels of maternity leave, working women take longer maternity leave and delay their return to work. For example, working women in Germany have 15% less labour force participation before childbirth than working women in the US, while they have a more generous statutory childcare system. So in Germany, the employment rate for mothers is 15% less than in the US. At the same time, between 65 and 70% of American mothers return to the labour market within a year of giving birth, compared to 25 to 30% of German mothers who continue to work. Their empirical evidence suggests the motherhood penalty per child is within 10%-18%, a range that has been underestimated in previous studies because they didn't account for dynamic employment selections. England and Budig(2001) studied the labour market in the USA and concluded 4 factors that lead to 7% less wage per child for the working women population – (1) loss of job experience, (2) being less productive at work, (3) trade-off higher wages for mother-friendly jobs, or (4) be discriminated against by employers. In particular, one-third of the penalty is for dismissal for productivity discrimination. For some women, motherhood means taking a temporary break from work, going from full-time to part-time work, or even voluntarily choosing a lower-paid job to take better care of the family. All this leads to less work experience and thus to a loss of competitiveness. However, it is still shocking that two-thirds of the penalty is significant after controlling for work experience. In this essay, I aim to examine how the motherhood penalty changes over time by comparing mothers and childless women between 1985 to 1988 and 1990 to 1993. I found that the motherhood penalty on wage and salary income increased from the late 80s to the early 90s, whereas in each period gaining human capital, like education and work experience, helped drive down the income gap.

## II. Conceptual Framework

1. Data cleaning

The data came with non-respondents[1], out-of-range values[2] and individuals who are not targeted[3]. These observations or values are problematic for analysis. As a response, non-respondents and not-in-universe individuals are dropped and out-of-range values are set to missing or zero. Lastly, there are categorical values that need to be simplified. Individuals' occupations are converted into dummy variables[4] based on the characteristics of the occupation.

2. Endogeneity

Education is often treated as an endogenous factor in academic analysis. Instruments (2SLS regression) are one way to address this. There are various instruments related to educational attainment, commonly used including the distance between the individual and school, the individual's effort in learning, etc. However, in this article, the number of siblings of an individual is treated as an instrument, because other variables are not available in the database.

3. Panel Data Autocorrelation

Within each time period, there are 4 years of panel data over the same group of individuals. That being said, an individual's error term correlats with the error term in the previous year. To fix this autocorrelation problem, each regression is clustered at an individual level.

4. Methodology

*Demographic Composition Analysis*

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[1] Individuals stop participating in the survey
[2] Some individuals refuse to answer particular questions or they don't know a specific number to answer
[3] The universe of this study focuses on employed undisabled women who may or may not be a mother, either never married or married with a present spouse.
[4]For individuals, Occupations like "MANAGERIAL AND PROFESSIONAL SPECIALITIES", "TECHNICAL", "PRECISION PRODUCTION,CRAFT,REPAIR", "OPERATORS - MACHINE,ASSEMBLERS,INSPECTORS" are coded as high-skill labours while "SALES", "ADMINISTRATIVE SUPPORT/CLERICAL", "SERVICE", "FARMING,FORESTRY AND FISHING", "OPERATORS - TRANSPORTATION,MATERIAL MOVING" and "OPERATORS - HANDLERS,HELPERS,LABORERS" are coded as low-skill labours.

Before jumping into regression analysis, I used mean comparison t-tests to examine changes between groups for each period and changes for the same group between periods. A significant result between groups within each period would suggest the fact that there is a demographic characteristics difference between groups and vice versa. A significant result for groups between periods would suggest the fact that the same group developed with different demographic characteristics over time and vice versa.

*Regression Analysis*

I constructed 3 specifications, 6 models in total for 2 time periods. The first model aims to quantify the total income penalty between mothers and childless women, including differences due to loss in human capital and other, discrimination against motherhood and other inequalities. It estimated a pooled regression of wage and salary income on independent variables for having one, two and three or more children. The coefficient of which gives the level effects of the income difference between mothers and childless women. I controlled marital status, occupation, region and age to account for shifts in the demographic composition of mothers and childless women. I didn't control for education and work experience, in this model, I assumed that income differences due to differences in human capital are taken into account at the time of childbirth. I estimated two additional models, controlling for differences in human capital to quantify the extent of income inequality between mothers and childless women and to estimate the contribution of human capital to the income gap in each period. Comparing different specifications with the reduced model provides a measure of the contribution of human capital to the income gap. The larger the decrease in estimations across different specifications, the greater the impact of education and labour market experience on the income gap and vice versa. The main variable of interest would be the coefficient

5. Limitation

There are three main limitations of the above setup. First, endogeneity is still a problem. It is impossible to find all exogenous instruments for education. The instrument I chose, the number of siblings, despite being the best choice among variables in the database still might be endogenous itself because other factors contribute towards how many children a family has. Similarly, the number of children an individual has may be impacted by other social factors such as what kind of community an individual grew up with. I tried to fix this by using the number of children desired by the individual as an instrument and the results weren't significant. I had to drop the instrument as a result. The above endogeneity would lead to biased coefficients. Third, the fixed effects of individuals were not taken into account. As discussed by England and Budig(2001), it would be possible for mothers to positively select themselves for motherhood as hardworking women think they are more capable of handling the responsibility. It can also be the case that less hardworking women choose motherhood as an exit path from the industry. The inclusion of positive selection effects would underestimate the motherhood penalty and vice versa. A solution to this is to include individual fixed effects to account for the unobserved productivity. An alternative is to use the first difference to cancel out the effect of the individual fixed effect. Due to time constraints, solutions were not realized into models, I concluded my inference based on assumptions that the model gives unbiased coefficients and standard errors in the later session, but keep in mind that these assumptions were limited.

## III. Economic Model

Specification 1: Pooled OLS the gross income penalty

$$Income_{0,i,t} = \beta_0 + \beta_1 MARSTAT_{0,i,t} + \beta_2 Occupation_{0,i,t} + \beta_3 REGION_{0,i,t} + \beta_4 AGE_{0,i,t} + \beta_5 NUMCH_{0,i,t} + \varepsilon_{0,i,t}$$

$$Income_{1,i,t} = \beta_0 + \beta_1 MARSTAT_{1,i,t} + \beta_2 Occupation_{1,i,t} + \beta_3 REGION_{1,i,t} + \beta_4 AGE_{1,i,t} + \beta_5 NUMCH_{1,i,t} + \varepsilon_{1,i,t}$$

Specification 2: Pooled 2SLS, the income penalty net of education

$$Income_{0,i,t} = \beta_0 + \beta_1 MARSTAT_{0,i,t} + \beta_2 Occupation_{0,i,t} + \beta_3 REGION_{0,i,t} + \beta_4 AGE_{0,i,t} + \beta_5 NUMCH_{0,i,t} + \beta_{iv6} HGCREV_{0,i,t} + \varepsilon_{0,i,t}$$

$$HGCREV_{0,i,t} = \beta_0 + \beta_1 NUMSIB_{0,i,t} + \varepsilon_{0,i,t}$$

$$Income_{1,i,t} = \beta_0 + \beta_1 MARSTAT_{1,i,t} + \beta_2 Occupation_{1,i,t} + \beta_3 REGION_{1,i,t} + \beta_4 AGE_{1,i,t} + \beta_5 NUMCH_{1,i,t} + \beta_{iv6} HGCREV_{1,i,t} + \varepsilon_{1,i,t}$$

$$HGCREV_{1,i,t} = \beta_0 + \beta_1 NUMSIB_{1,i,t} + \varepsilon_{1,i,t}$$

Specification 3: Pooled 2SLS, the income penalty net of education and working experience

$$Income_{0,i,t} = \beta_0 + \beta_1 MARSTAT_{0,i,t} + \beta_2 Occupation_{0,i,t} + \beta_3 REGION_{0,i,t} + \beta_4 AGE_{0,i,t} + \beta_5 NUMCH_{0,i,t} + \beta_{iv6} HGCREV_{0,i,t} + \beta_7 WRKEXP_{0,i,t} + \varepsilon_{i,t}$$

$$HGCREV_{0,i,t} = \beta_0 + \beta_1 NUMSIB_{0,i,t} + \varepsilon_{0,i,t}$$

$$Income_{1,i,t} = \beta_0 + \beta_1 MARSTAT_{1,i,t} + \beta_2 Occupation_{1,i,t} + \beta_3 REGION_{1,i,t} + \beta_4 AGE_{1,i,t} + \beta_5 NUMCH_{1,i,t} + \beta_{iv6} HGCREV_{1,i,t} + \beta_7 WRKEXP_{1,i,t} + \varepsilon_{i,t}$$

$$HGCREV_{1,i,t} = \beta_0 + \beta_1 NUMSIB_{1,i,,t} + \varepsilon_{1,i,t}$$

Where i,t indexes individuals and the survey years and the first subscript is equal to 0 if in the year from 1985 to 1988 and 1 if in the year from 1990-1993. $Income_{,t}$ is a continuous dependent variable and takes the value of an individual's wage and salary income in calendar year t from 1985 to 1988. $MARSTAT_{i,t}$ is a binary variable equal to one if the individual is married with a spouse present and zero if never married. $Occupation_{i,t}$ is a binary variable equal to one if an individual is a high-skilled labour and zero if an individual is a low-skilled labour in year t. $REGION_{i,t}$ is an indicator variable equal to one if an individual resides in the northeast region, two if in the north-central region, three if in the south region and four if in the west region in year t. $AGE_{i,t}$ records an individual's age in year t. $NUMCH_{i,t}$ is an indicator variable for having one, two, and three or more children in the household in year t, with adopted children included. $\beta_5$ is the main coefficient of interest that measures the

magnitude of the motherhood penalty for mothers of one, two and three or more children compared to childless women in the same period. $HGCREV_{i,t}$ is the highest educational attainment of an individual in year t. This variable is regressed on exogenous variable NUMSIB the number of siblings the individual has to account for the endogeneity. WRKEXP is the individual accumulative working hours in year t. The variable $\varepsilon_{i,t}$ is an individual-specific error term in year t with mean zero and constant variance. $NUMSIB_{i,t}$ is a continuous variable of how many siblings an individual had in year t.

## IV. Data Description

To better understand the impact the motherhood penalty has on women's income, I decided to examine data across two time periods(1985-1988, 1990-1993) as I wanted to compare the change in motherhood penalty over time. I used data from the National Longitudinal Survey of Youth 1979 (NLSY79) in the National Longitudinal Surveys (NLS) dataset. NLSY97 contains data on labour market behaviour and educational experiences of individuals across the U.S.A.

The original cohort (the survey year 1979) has 12,686 individuals including men and women. After dropping non-respondents and those not in the universe I have around 3,000 observations per year and in total 21,775 observations for 8 years.

As illustrated in Table 1, the dependent variable Income has a mean of $15,522.31, over 8 years, with a standard deviation of 11,869.35. The average number of children an individual has is approximately one with a standard deviation of 1.1. Some women have 9 children(maximum) in the sample.

## V. Result

*Demographic Composition Analysis*

The mean comparison results of the groups' characteristics are shown in Table 2. In each period, mothers earned less on average than childless women. In the 1985 to 1988 period, mothers earned 4,043.48 less than childless women, despite that the average

income of mothers increased by 6,178.98 (around 60%) between 1985 to 1988 and 1990 and 1993 periods, they still earn 7451.74 less. The income gap worsened. Mothers were older on average than childless women in both periods, which intuitively reflects that motherhood occurs later in a woman's life course. From 1985 to 1988 and 1990 and 1993 periods, more and more women stayed childless in the late 80s, childless women are 24 years old on average compared to 29 years old in the early 90s. Motherhood is also postponed to 30 years old in the early 90s compared to 24 years old in the late 80s. There was also a trend of an increase in investment in human capital for both mothers and childless women. Mothers invested more in education and there was a 4.6% increase in the average highest educational attainment compared to only a 3.2% increase in that of childless women across periods. Yet, the improvement in human capital didn't close the income gap discussed above. That is because there is another human capital factor – work experience. Mothers were older on average but they had less working experience due to more or less shifting duties towards the family. From the late 80s to the early 90s, both mothers and childless women increased their working experience significantly. Mothers' work experience increased by 80% and that of childless women increased by 92%. The social norm in the 90s encouraged women to actively participate in the workforce but mothers fell behind their childless peers due to a  slower human capital accumulation. In each period, mothers are more likely to be married with a spouse present. Mothers in each period were more likely to be in low-skill jobs which was consistent with evidence that mothers fall onto a low-earning track by shifting towards part-time and low-paying jobs, which likely to be low-skilled (Fernández-Kranz, Lacuesta & Rodríguez-Planas, 2013).

*Regression Analysis*

Table 3 shows estimated coefficients from the pooled OLS regression of level wage and salary income on variables for having one, two and three or more children. In each period, education and work experience explained some extent of the income gap between childless women and mothers because there was a larger improvement in the income gap when controlling for human capital variables. In each specification, the income penalty

increased as the number of children increased, as expected. Considering the income penalty for having one child, the gross wage penalty was $3,517 from 1985 to 1988 and $5,306 from 1990 to 1993. The penalty net of education was $1,399 from 1985 to 1988 and $3,607 from 1990 to 1993, and the penalty net of education and work experience was $1,599 from 1985 to 1988 and $2,855 from 1990 to 1993. The increase in the estimation of the net income difference between the late 80s and early 90s suggests that there is no improvement in the income of mothers of one child relative to childless women with similar education and work experience. I found a similar pattern when comparing the income penalty for mothers of two and three or more children to childless women across periods. It suggests that the discrimination against motherhood had gotten worse from the late 80s to the early 90s. One noticeable fact is that the income penalty for having one child decreased and that of having two children increased when comparing the specification net of education and specification net of education and work experience from 1985 to 1988. It suggests that there was greater discrimination against new mothers regardless of comparable human capital relative to the childless women, whereas for mothers having two children the work experience played a huge effect in terms of driving down the income gap. The only insignificant coefficient throughout all models and specifications is the income penalty for mothers of three or multiple children from 1985 to 1988. In other words, when comparing mothers and childless women with the same level of education and work experience, having three or more children is not a contributing factor to the income gap.

## VI. Conclusion

I looked at how the motherhood penalty reduces wages through various channels. The main focus of this study is on how human capital explains the income difference between mothers and childless women, Instead of drawing a conclusion based on the unexplained part of the gap between them. From 1985 to 1988 to 1990 to 1993, women and mothers improved their highest educational attainment and work experience. This may suggest that over time the motherhood penalty should have been reduced, but this did not happen.

In this study, I found that the motherhood penalty is related to the number of children, the more children a mother has the more penalty she confronts. The only exception is that in the late 80s when mothers with the same level of education and work experience had three or more children, the effect of the motherhood penalty was not statistically significant.
A possible explanation might be that mothers know how to balance work and family when they are experienced with multiple children, or they just simply don't face discrimination because employees start to believe that they have adequate education levels and work experience. New mothers with the same level of education face a bigger income penalty when controlling for work experience, which implies that new mothers face greater discrimination. Mothers of multiple children face a smaller motherhood penalty if their educational level and work experience are considered. Overall, education is more influential for mothers in terms of closing the wage gap. The motherhood penalty is now a social issue that cannot be ignored. While mothers struggle daily to balance family and career, fathers, on the other hand, do not have such a dilemma. Behind every father who has both a career and a family is a mother who has been forced to devote herself to her family in one way or another. As Engels argues in his book The Origin of the Family, Private Ownership and the State, female domesticity loses its communal character and becomes a "private service". As a result, women were "excluded from social production" and became "domestic servants". There is still a long way to go in liberating women's productivity. Still, perhaps we can start by encouraging and creating the conditions for mothers to return to the workforce, like more affordable daycares, subsidies for mothers' education, anti-discrimination laws, etc.

**Reference**

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## Appendix

*Table 1 Data Description of main variables*

| Main Variable | Data Description | Mean | Min | Max | Standard Deviation | Summary |
|---|---|---|---|---|---|---|
| Income | Annual wage and salary Income | 15,522.31 | 0 | 10,1653 | 11,869.35 | Total: 21,220 |
| MARSTAT | 0, if Never Married | 0.5900344 | 0 | 1 | 0.49 | Never Married: 8,927 |
| | 1, if Married Spouse Present | | | | | Married (Spouse Present): 12,848 |
| Occupation | 0, if Low Skill Labour | 0.3754529 | 0 | 1 | 0.38 | Low Skill: 13,444 |
| | 1, if High Skill Labour | | | | | High Skill: 8,082 |
| REGION | 1, if resided in the NorthEast | 2.584394 | 1 | 4 | 1 | NorthEast: 4,079 |
| | 2, if resided in the North Central | | | | | North Central: 4,947 |
| | 3, if resided | | | | | South: |

| | | | | | | |
|---|---|---|---|---|---|---|
| | in the South | | | | | 8,691 |
| | 4, if resided in the West | | | | | West: 4,056 |
| AGE | Age of the Individual | 27.54705 | 20 | 36 | 3.58 | Total: 21,775 |
| WRKEXP | Accumulative hours individuals have worked | 13,643.61 | 0 | 46,483 | 7,382.73 | Total:18,307 |
| HGCREV | Highest Grade Completed | 13.36674 | 0 | 20 | 2.20 | Total: 21,732 |
| NUMCH | Number of Children individuals have | 0.920597 | 0 | 9 | 1.1 | Total: 21,775 |

*Table 1.1 Data Description of instrument variables*

| IV Variable | Data Description | Mean | Min | Standard Deviation | Summary |
|---|---|---|---|---|---|
| NUMSIB | Numbers of Siblings of the Individual | 3.621607 | 0 | 2.50 | Total: 21,734 |

*Table 2 Estimates of mean characteristics of mothers and childless women*

| Variable | 1985-1988 | | 1990-1993 | |
|---|---|---|---|---|
| | Childless | Mother | Childless | Mother |
| Income | 14257.74 | 10214.26[1] | 23853.98[2] | 16402.24[12] |
| | ( 111.57) | (112.78) | ( 257.13) | (157.66 ) |
| MARSTAT | 0.33 | 0.78[1] | 0.44[2] | 0.83[12] |
| | (0.01) | (0.01) | (0.01) | (0.00) |
| Occupation | 0.38 | 0.31[1] | 0.46[2] | 0.37[12] |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| NorthEast | 0.23 | 0.16[1] | 0.21 | 0.14[12] |
| | (0.01) | (0.01) | (0.01) | (0.00) |
| North Central | 0.23 | 0.22 | 0.2 | 0.25[12] |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| West | 0.37 | 0.44[1] | 0.38[2] | 0.41[12] |
| | (0.01) | (0.01) | (0.01) | (0.01) |

| | | | | |
|---|---|---|---|---|
| South | 0.18 | 0.18 | 0.2[2] | 0.2[2] |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| AGE | 24.75 | 26.02[1] | 29.74[2] | 30.75[12] |
| | (0.03) | (0.04) | (0.04) | (0.03) |
| WRKEXP | 10254.05 | 9906.02[1] | 19690.15[2] | 17829.23[12] |
| | (63.73) | (82.11) | (121.78) | (107.27) |
| HGCREV | 13.86 | 12.42[1] | 14.30[2] | 13.00[12] |
| | (0.02) | (0.03) | (0.04) | (0.03) |

Note: The sample includes women from age 20 to 36 with wage or salary income, excluding those who are unemployed, disabled or married without a present spouse. [1] Mean for mothers is statistically different from mean for childless women, at a 5% significance level. [2]Mean for the group is statistically different from mean in the previous period.

*Table 3 Wage penalty for mothers of one, two and three or more children compared to childless women*

| Control Variables | Number of Children | 1985-1988 | 1990-1993 |
|---|---|---|---|
| Marital status, occupation, region, age | One | -3,517*** | -5,306*** |
| | | (266.4) | (567.1) |
| | Two | -5,626*** | -8,492*** |
| | | (311.5) | (576.7) |
| | Three + | -7,625*** | -10,286*** |
| | | (467.1) | (665.9) |
| Above + Education | One | -1,399*** | -3,607*** |
| | | (505.5) | (648.1) |
| | Two | -2,270*** | -5,642*** |
| | | (739.3) | (859.3) |
| | Three + | -2,560** | -6,369*** |
| | | (1,123) | (1,133) |
| Above + Education + Experience | One | -1,559*** | -2,885*** |
| | | (472.9) | (697.0) |
| | Two | -1,591** | -3,499*** |
| | | (740.4) | (901.9) |
| | Three + | -462.9 | -2,379* |
| | | (1,151) | (1,255) |

Robust standard errors in parentheses, clustered by individual

*** p<0.01, ** p<0.05, * p<0.1