Economics Bulletin

Volume 34, Issue 2

The motherhood wage penalty and non-working women

Xiaoyan Chen Youderian
Xavier University

Abstract

There is substantial evidence that women with children bear a wage penalty due to their motherhood status. This wage gap is usually estimated by comparing the wages of working mothers to childless women after controlling for human capital and individual characteristics. This method results in selection bias because non-working women are excluded from the sample. Using a model of fertility and working decisions, I examine how excluding non-working women affects the measurement of the motherhood wage penalty. The model shows that mothers face different reservation wages due to variance in non-labor income and preference for child care. Given the same non-labor income, a mother with a relatively high wage may choose not to work because of her strong preference for time with children. In contrast, a childless woman who is not working simply faces a relatively low wage. Thus, empirical analyses that focus only on employed women may overestimate the motherhood penalty.

I thank Philippe Belley, William Blankenau, Hasan Faruq, Bree Lang, Matthew Lang, Zijun Luo and Christopher Youderian for valuable comments and suggestions.
Citation: Xiaoyan Chen Youderian, (2014) "The motherhood wage penalty and non-working women", *Economics Bulletin*, Vol. 34 No. 2 pp. 757-765.
Contact: Xiaoyan Chen Youderian - youderianx@xavier.edu.
Submitted: December 31, 2013. **Published:** April 04, 2014.

1. Introduction

It is well documented that mothers, on average, earn lower wages than women without children. The traditional human capital model (Mincer and Polachek, 1974) suggests that mothers may have less human capital due to child-related interruptions in work and/or lower investment in education. However, after controlling for educational attainment, work experience and individual heterogeneity, the wage gap remains positive and significant (Budig and Hodges, 2010, Budig and England, 2001, Phipps et al., 2001, Glauber, 2007, and Waldfogel, 1998). Most empirical studies on the child penalty estimate the wage difference between employed mothers and employed non-mothers, excluding non-working women due to the lack of wage data.[1] However, if this selection is systematically different between mothers and non-mothers, the observed wage difference is not representative of the wage gap between all mothers and non-mothers. Therefore, any analysis that excludes the non-working population may incur a selection problem and lead to biased estimates of the motherhood effect.

This paper develops a simple model of fertility and work decisions to address this selection issue. The model shows that given the same non-labor income, all childless women face the same reservation wage and the ones who choose not to work are the lower wage earners in the group. In contrast, the reservation wage of mothers is not only related to non-labor income, it also varies by individual motherhood preferences. A mother with a strong preference for time with children faces a higher reservation wage and she may not work even if her wage is relatively high.

A large body of literature examines the effects of childbearing on labor supply. Many studies find that childbirth lowers a woman's probability of working (Miller, 2011, Wilde et al., 2010, and Troske and Voicu, 2010, 2012). Loughran and Zissimopoulos (2009) use U.S. data to estimate the size of this effect. Their results indicate that having a first child reduces women's working probabilities by 9.4 percentage points in the NLSY79 and by 14.3 percentage points in the NLSYW.

How much would the "drop-out" mothers make compared to whose who stay? Ejrnæs and Kunze (2013) use data from Germany and find "negative selection" back to full-time work after births. They calculate the predicted wage profiles for non-returning mothers and show that their wage, on average, is higher than returning mothers. My proposed model has two explanations for this result. First, due to marriage sorting, women with a higher wage are more likely to marry a high-wage earner. This leads to higher non-labor income (spousal income in this case) and a higher reservation wage for these women. Second, women with a high wage may choose not to work if they have a strong preference for time with children. Their opportunity cost of working is high and high wages may not necessarily compensate for the reduced time with children.

My model suggests that mothers who do not work may have higher reservation wages. Therefore, when non-working women are excluded from empirical analyses, the excluded mothers may have higher potential wages than excluded non-mothers. If this is the case, the wage difference between mothers and others will be overestimated.

2. The model

[1] For example, Loughran and Zissimopoulos (2009) eliminate women observations by 25 percent due to missing wages. In Miller (2011), women's wage observations drop by 50 percent after ten years into their career.

2.1 A model of fertility and labor supply

Consider a model where women choose time allocation among work, child care and leisure. Time spent on work, children and leisure is denoted by t_w, t_c, and t_l, respectively. If a woman chooses not to work, $t_w = 0$. If a woman chooses not to have children, $t_c = 0$. A positive t_c denotes the total time a woman spends with children. If a woman has more than one child, t_c can be distributed across multiple children. Women gain utility from consumption, time spent with children and leisure. The utility function is concave in these three inputs as shown below

$$U = \ln(wt_w + n) + \ln(t_c + \rho) + \ln(t_l)$$

where w is the wage rate which is determined by human capital (i.e. educational attainment and on-job training), labor market environment (i.e. the wage premium of certain occupations and contracts), and demographic characteristics (i.e. race and age). Term wt_w is labor income. Consumption has a second part, $n \geq 0$, which is non-labor income, i.e. transfer payment from government, spouse or parents. Term $\rho > 0$ denotes women's preference for motherhood. This motherhood preference can be affected by marital status, family background and the age of children. A lower ρ indicates more interest in having and raising children. Consider the extreme case where $\rho \to 0$, the marginal utility of having children is close to infinite when $t_c = 0$, so a woman chooses to be a mother and $t_c > 0$.

I define $T = (t_w, t_c, t_l)$ and let the time endowment equal to 1. Women choose T to solve the following problem

$$\max_T \ln(wt_w + n) + \ln(t_c + \rho) + \ln(t_l)$$

subject to

$$t_w + t_c + t_l \leq 1$$
$$t_c, t_w \geq 0, t_l > 0.$$

Each woman's problem can be rewritten as the following Lagrangian

$$\max_T L = \ln(wt_w + n) + \ln(t_c + \rho) + \ln(t_l) + \lambda(1 - t_w - t_c - t_l).$$

The time constraint always binds, $\lambda > 0$, since utility is increasing in all time inputs. The Kuhn-Tucker conditions are

$$t_w : \frac{w}{wt_w + n} - \lambda \leq 0, t_w \geq 0, \text{and } (\frac{w}{wt_w + n} - \lambda)t_w = 0 \tag{1}$$

$$t_c : \frac{1}{t_c + \rho} - \lambda \leq 0, t_c \geq 0, \text{and } (\frac{1}{t_c + \rho} - \lambda)t_c = 0 \tag{2}$$

$$t_l : \frac{1}{t_l} = \lambda \text{ and } t_l > 0 \tag{3}$$

$$\lambda : 1 - t_w - t_c - t_l = 0. \tag{4}$$

The model can be solved analytically and there are four cases regarding women's choice of t_w and t_c. I adopt superscript * to indicate a positive value. For example, solution

$T = (t_w^*, 0, t_l^*)$ shows a woman's choice of positive work time, zero time investment in children and positive leisure time. This solution suggests that a woman is working, but chooses not to have children. Since $t_l \in (0, 1]$, I remove term t_l^* in all cases with the understanding that leisure time is positive. The four cases are listed below and they are linked to observed employment and motherhood status:

Case 1: Working childless women. Let $T = (t_w^*, 0)$, substituting equations (1) and (3) into equation (4) and the assumption $t_c = 0$ give

$$t_w = t_w^* = \tfrac{w-n}{2w}; \quad t_c = 0; \quad t_l = t_l^* = \tfrac{w+n}{2w}.$$

Case 2: Working mothers. Let $T = (t_w^*, t_c^*)$, substituting equations (1)$-$(3) into equation (4) gives

$$t_w = t_w^* = -\tfrac{2n}{3w} + \tfrac{1+\rho}{3}; \quad t_c = t_c^* = \tfrac{n}{3w} + \tfrac{1-2\rho}{3}; \quad t_l = t_l^* = \tfrac{n}{3w} + \tfrac{1+\rho}{3}.$$

Case 3: Non-working mothers. Let $T = (0, t_c^*)$, substituting equations (2) and (3) into equation (4) and the assumption $t_w = 0$ give

$$t_w = 0; \quad t_c = t_c^* = \tfrac{1-\rho}{2}; \quad t_l = t_l^* = \tfrac{1+\rho}{2}.$$

Case 4: Non-working childless women. Let $T = (0, 0)$, substituting equation (3) into equation (4) and the assumption $t_w = t_c = 0$ give

$$t_w = 0; \quad t_c = 0; \quad t_l = t_l^* = 1.$$

2.2 Predictions

The model yields the following results.

Proposition 1: *A sufficient condition for the choice of being a mother is $\rho \le \frac{1}{2}$; a sufficient condition for the choice of being childless is $\rho \ge 1$; When $\rho \in (\frac{1}{2}, 1)$, a woman chooses to be a mother only if the wage is low enough, $w \le \frac{n}{2\rho-1}$.*

Proof: Consider conditions for working mothers (Case 2): $t_w = -\frac{2n}{3w} + \frac{1+\rho}{3} \ge 0$ and $t_c = \frac{n}{3w} + \frac{1-2\rho}{3} \ge 0$. Using $\rho > 0$, these constraints can be written as $w \in [\frac{2n}{\rho+1}, \frac{n}{2\rho-1}]$ and $\rho \in (\frac{1}{2}, 1]$; or $w \ge \frac{2n}{\rho+1}$ and $\rho \in (0, \frac{1}{2}]$. Next consider conditions for non-working mothers (Case 3): $t_c = \frac{1-\rho}{2} \ge 0$ and $\frac{w}{wt_w+n} - \lambda \le 0 \mid t_w = 0$. Combining $\lambda = \frac{2}{1+\rho}$ into these constraints, $w \le \frac{2n}{\rho+1}$ and $\rho \le 1$. If $\rho \le \frac{1}{2}$, a woman chooses to be a mother (Case 2 or Case 3) regardless of her wage. This proves the first line in proposition 1.

Consider conditions for working childless women (Case 1): $t_w = \frac{w-n}{2w} \ge 0$ and $\frac{1}{t_c+\rho} - \lambda \le 0 \mid t_c = 0$. Using $\lambda = \frac{2w}{w+n}$, I rewrite the conditions as $w \ge \max(n, \frac{n}{2\rho-1})$ and $\rho \ge \frac{1}{2}$. The conditions for non-working childless women (Case 4) are $\frac{w}{wt_w+n} - \lambda \le 0 \mid t_w = 0$ and $\frac{1}{t_c+\rho} - \lambda \le 0 \mid t_c = 0$. Given $\lambda = 1$, these constraints can be combined into $w \le n$ and $\rho \ge 1$. So if $\rho \ge 1$, a woman chooses not to have children (Case 1 or Case 4) no matter what the wage is. This proves the second line in proposition 1.

The conditions for all cases discussed above show that the wage is relevant to a woman's fertility decision when ρ falls in the middle range. When $\rho \in (\frac{1}{2}, 1)$, if $w \leq \frac{n}{2\rho-1}$, a woman chooses to have children. Otherwise, she chooses to be childless. This proves the third line in proposition 1.

Proposition 1 indicates the importance of women's preference for motherhood for their fertility choice. With little preference, $\rho > 1$, women choose to have no children regardless of their wage. When the motherhood preference is strong enough, $\rho < \frac{1}{2}$, women with all possible wages choose to be a mother. The wage rate is relevant to women's fertility choice only when ρ is in the middle range, i.e. $\rho \in (\frac{1}{2}, 1)$.

Proposition 2: *For a mother, the reservation wage is* $\frac{2n}{\rho+1}$. *For a childless woman, the reservation wage is* n.

Proof: The reservation wage for mothers is derived from the conditions for working mothers (Case 2) and non-working mothers (Case 3). If the wage exceeds $\frac{2n}{\rho+1}$, she chooses to work. Otherwise, she stays out of the labor force. The reservation wage, $\frac{2n}{\rho+1}$, is increasing in non-labor income and the preference for children. This proves the first line in proposition 2.

The conditions for working childless women (Case 1) and non-working childless women (Case 4) together show that the reservation wage is n for a woman with no children. This proves the second line in proposition 2.

Notice that the reservation wage of all women is positively related to non-labor income, n. This result is consistent with empirical findings. For example, Troske and Voicu (2010) show that husband's wage and other non-labor income negatively affect women's labor market involvement. In addition to non-labor income, the child preference term, ρ, also plays a role in the working decisions of mothers. Mothers with a stronger preference for children (i.e. ρ is small) face a higher opportunity cost of working, so their wages must exceed a higher threshold for them to work. As a result, a non-working mother may have a higher wage than a working mother but choose not to work, because she prefers time with children. Also notice that the reservation wage of a mother is greater than that of a childless woman if $\rho < 1$. Since this condition holds for all mothers, we can conclude that on average, mothers face a higher reservation wage than others.

Figure 1 helps to illustrate this finding. Each of the four areas in figure 1 represents the combinations of wage, w, and preference parameter, ρ, that correspond to women's employment and fertility choices. For example, area A shows that when both the wage and preference parameter are large enough, a woman chooses to work and have no children. Compare areas A and B which correspond to working and non-working childless women, respectively. All points in B are below area A, which means all non-working childless women face a lower wage compared to any working childless woman. The same is not true for areas C and D which correspond to working and non-working mothers, respectively. There are points in D that are above some points in C. It suggests that some non-working mothers face a higher wage than some working mothers but they choose not to work due to a low value of ρ and/or a high value of n.

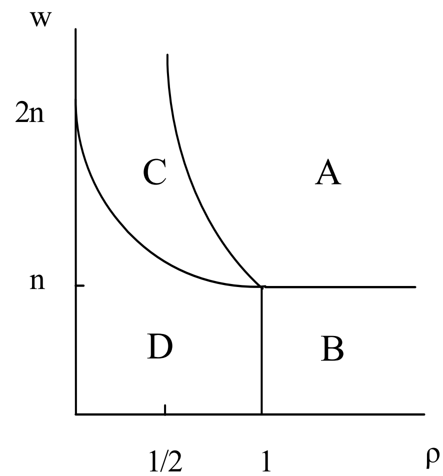

Figure 1 shows the wage and preference range in which a woman chooses certain work and motherhood status, i.e. A-working childless women; B-non-working childless women; C-working mothers; D-non-working mothers.

In estimating the wage gap between mothers and non-mothers, excluding the non-working population is equivalent to removing both areas B and D out of the picture. This may cause selection bias, because some high wage earners among mothers are excluded while only low wage earners among childless women are excluded. Consequently, the wage gap between mothers and non-mothers may be overestimated. In an attempt to empirically address this selection issue, Amuedo-Dorantes and Kimmel (2005) adopt a Heckman selection model to account for work decisions. When they include the inverse Mills ratio in the wage regression, the motherhood effect is reduced by more than 40 percent. Ejrnæs and Kunze (2013) account for return to work decisions and find smaller wage declines due to child birth. Both findings confirm the prediction of the model.

3. Conclusion

Previous studies estimate the motherhood wage penalty using wage data on working mothers and working non-mothers. Such analysis excludes non-working women and potentially leads to biased estimates due to sample selection. To characterize the potential effects of this bias, I develop a simple model of employment and fertility choices and show that the reservation wages of mothers and non-mothers have different forms. A higher non-labor income leads to a lower probability of working for all women. However, mothers may have an additional reason for not working. If they have strong preferences for time with children, they choose to exit the labor market even though they face a high potential wage. Excluding them in empirical analyses underestimates the average productivity of mothers. This finding further implies that the wage gap observed in the labor market may be an overestimated measure of the child wage effect.

This paper's findings are particularly helpful in understanding wage inequality among women and the wage gap between men and women. Recent studies on the child penalty provide evidence that having children has a negative effect on a woman's wage (Budig and

Hodges, 2010 and Anderson et al., 2003). Motherhood choices may also be responsible for the lower wages of women as a group (Erosa et al., 2002). I show that the decisions by some high-earning mothers not to work partly explain the observed lower wage of mothers. This consequently overstates the severity of the gender wage gap. If these findings are corroborated by future work, it has important policy implications for the way we view and address wage inequality.

References

[1] Amuedo-Dorantes, C., and Kimmel, J. (2005) "The motherhood wage gap for women in the United States: the importance of college and fertility delay" *Review of Economics of the Household* 3, 17–48.

[2] Anderson, D.J., Binder, M., and Krause, K. (2003) "The motherhood wage penalty revisited: experience, heterogeneity, work effort, and work schedule flexibility" *Industrial and Labor Relation Review* 56(2), 273-294.

[3] Budig, M.J., and England, P. (2001) "The wage penalty for motherhood" *American Sociological Review* 66(2), 204-225.

[4] Budig, M.J., and Hodges, M.J. (2010) "Differences in disadvantage: variation in the motherhood penalty across white women's earnings distributions" *American Sociological Review* 75(5), 705-728.

[5] Ejrnæs, M., and Kunze, A. (2013) "Work and wage dynamics around childbirth" *The Scandinavian Journal of Economics* 115(3), 856-877.

[6] Erosa, A., Fuster, L., and Restuccia, D. (2002) "Fertility decisions and gender differences in labor turnover, employment, and wages" *Review of Economic Dynamics* 5, 856-891.

[7] Glauber, R. (2007) "Marriage and the motherhood wage penalty among African Americans, Hispanics, and Whites" *Journal of Marriage and Family* 69, 951-961.

[8] Loughran, D.S., and Zissimopoulos, J.M. (2009) "Why wait?: the effect of marriage and childbearing on the wages of men and women" *Journal of Human Resources* 44(2), 326–349.

[9] Miller, A.R. (2011) "The effects of motherhood timing on career path" *Journal of Population Economics* 24(3), 1071–1100.

[10] Mincer, J., and Polachek, S. (1974) "Family investments in human capital: earnings of women" *The Journal of Political Economy* 82(2) Part 2: Marriage, family human capital, and fertility, S76-S108.

[11] Phipps, S., Burton, P., and Lethbridge, L. (2001) "In and out of the labour market: long-term income consequences of child-related interruptions to women's paid work" *The Canadian Journal of Economics* 34(2), 411-429.

[12] Waldfogel, J. (1998) "The family gap for young women in the United States and Britain: can maternity leave make a difference?" *Journal of Labor Economics* 16(3), 505-545.

[13] Wilde, E.T., Batchelder, L., and Ellwood, D.T. (2010) "The mommy track divides: the impact of childbearing on wages of women of differing skill levels" NBER Working Paper No. 16582.

[14] Troske, K.R., and Voicu, A. (2012) "The effect of the timing and spacing of births on the level of labor market involvement of married women" *Empirical Economics* 45(1), 483-521.

[15] Troske, K.R., and Voicu, A. (2010) "Joint estimation of sequential labor force participation and fertility decisions using Markov chain Monte Carlo techniques" *Labour Economics* 17(1), 150-169.