Extended Abstract
Is the Motherhood Wage Penalty
Worse at the Top or Bottom?

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In this paper, we ask whether motherhood wage penalties are higher for women at the top or bottom of skill, wage, and race hierarchies. Two recent papers that address the issue of how the penalties vary by skill and wage present a puzzle. In an unpublished but widely cited NBER paper, Wilde, Batchelder, and Ellwood (2010), using the AFQT cognitive skill test as a measure of skill, find the motherhood penalty to be much higher for higher skilled women before and after controls for experience. This makes sense if we think that the jobs that high-skilled women can get are the hardest to combine with the demands of motherhood without performance being affected. Budig and Hodges (2010), using the same (National Longitudinal Analysis of Youth 1979) dataset, and deploying quantile regression, show that the penalty for motherhood (as a proportion of wage) is much larger for low wage women. Part of this is simply that low wage women drop out the most, and thus, when they re-enter, pay a penalty for their lost experience. But even after adjustments for experience, Budig and Hodges found lower wage women to have them to have higher penalties, possibly reflecting the less family-friendly firms they work for, and/or their low bargaining power on matters of flexibility. Because individuals' skills and their wages are moderately positively correlated, it is a puzzle that low skill women have lower penalties while low wage women have higher penalties. Research has also examined whether black and white women differ in

their motherhood penalties with mixed findings (e.g. Budig and England 2001 find

no difference while Waldfogel 1997 finds lower penalties for black women).

In this paper, recognizing that skill, wage, and race hierarchies are not the

same thing, but are moderately correlated, we attempt to provide a comprehensive

look at whether penalties are higher or lower at the top or bottom of these various

hierarchies. We want to know if there is a comprehensive story that can be told

about whether more advantaged women face lower or higher proportionate

penalties for motherhood and, if so, why. We examine wage penalties for

motherhood by cognitive skill level and wage quantile, as well as black/white

differences in the patterns. We also contrast effects of marital versus nonmarital

births, as well as effects of motherhood when women are married versus single in

the current year, and assess if differences help explain black/white differences in

penalties. Below, we present a sketch of past research, and preliminary findings.

BACKGROUND

Research on the wage penalty for motherhood is now quite mature. (See e.g.

Waldfogel 1997; Budig and England 2001; Anderson et al. 2002, 2003; Budig and

Hodges 2010; Correll et al. 2007; Wilde, Batchelor, and Ellwood 2010; Miller 2011.)

The main argument is that raising children interferes with labor supply, human

capital, productivity, and willingness to take on demanding jobs. Women may drop

out of the labor force for a period, cut back to part-time employment, choose

occupations that are more family-friendly, devote less effort on the job, or pass up

promotions, all of which affect their wage trajectories. It also is clear from an audit

study by Correll and her colleagues (2007) that employer discrimination is part of

the motherhood penalty; indirect references on a resume indicating that that a

woman is a mother, such as including PTA in a list of organizational affiliations, led

to fewer calls in response to job applications, when compared to calls received in

response to sending a resume with another nonprofessional organization

membership listed.

DATA

We use nationally representative panel data from the National Longitudinal

Survey of Youth 1979 Cohort (NLSY79), born between 1958 and 1965 and first

interviewed in 1979 when the cohort was age 14-21. We use data through the 2008

interview when the cohort was age 43-50.[1] This cohort is, roughly speaking, the

second half of the baby boom, and is now in middle-age, and largely through the

childbearing years. The data include detailed employment and family information

collected repeatedly throughout the adult lives of the respondents.

VARIABLES

In assessing the motherhood penalty, our key outcome measure is wages, as

in most studies. We use the natural logarithm of hourly wage in the respondent's

current job at the time of the survey. In most cases, hourly wages are obtained by

dividing the annual work-related income by the number of weeks worked and the

usual number of hours worked per week. Wages will be expressed in 2010 dollars.

The primary independent variables are various "motherhood" indicators; we

will experiment with different indicators. One strategy is a set of dummies for

whether the woman has had her first birth and, if so, how many years after the birth

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[1] Respondents in the NLSY79 were interviewed annually up to the 1994 survey and bi-annually thereafter. The latest round of data collection was 2010 but these data have not been released.

it is, with controls for how many additional children she has had. (In some analyses we include only women who eventually give birth, comparing their before- and after-birth wages; in other analyses we also include women who never give birth.) We examine both early and delayed effects of the first birth, but always enter number of higher order births in models, which allows us to assess effects of later births.

We examine whether motherhood affects women's earnings differently depending on their marital status. We measure motherhood two ways. One way is to create separate dummies for nonmarital and marital first births (separate by groups of years past the birth). The other way is to create an indicator for whether the woman is married in the person-year in which wage is measured, and interact this with motherhood variables. Here we are interested in whether differential penalties by marital status explain some of the black/white difference in penalty.

In order to examine race differences in motherhood penalties, we interact motherhood measures with race. For these models, we limit ourselves to blacks and whites to have sufficient power for analysis. We are also interested in whether the higher proportion of black women's births that are outside of marriage, and the greater proportion of their child rearing lives they spend outside marriage lowers their motherhood penalty because they are less likely in a gendered division of labor with a husband.

A key focus of the analysis is on different effects of motherhood at different points of the skill distribution. With the NLSY79, we have a measure of cognitive skills, the AFQT score of the woman when she was age 15-22 (in 1980). (We will

also experiment with measuring skill in terms of a year-varying predicted score for education, regression-predicted as a function of parental level of education, AFQT, and educational attainment and expectations to date. This is better than actual education, as its construction from exogenous variables makes it more arguably exogenous to births, and it captures the fact that many young women know before they are 18 that they are likely to become college graduates.) These measures of skill will be interacted with motherhood to assess how effects differ by women's skill level.

The most important other variable is cumulative work experience, which allows for the extent to which dropping out of employment or cutting back hours worked is the mechanism of the motherhood penalty, or whether penalties persist net of experience and past or present part-time work status.   Other measures that we will explore include years of seniority (experience with current employer), and an indicator of current full- or part-time school enrollment. Other socio-demographic and geographic variables will enter models as controls.

METHODS

We will estimate effects of motherhood on wages using fixed effects models with person/years as units of analysis. We capture early and late effects of having a child by including indicator variables for whether the year in question is prior to any birth, or follows the birth by up to 4 years, 5 -9 years, and 10 or more years after the birth.[2] We then also include dummies for number of additional children. (We are experimenting with various specification of motherhood variables.) By

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[2] Although Wilde et al. (2010) exclude women who never gave birth by the end of the data panels, we will include them, although sensitivity tests show this doesn't not affect results much.

estimating separate models for women with low, medium and high test scores, we

can derive estimates of the slowing of wage growth after having children and can

pinpoint whether it is greater for high and low skill women. Interacting test score

groups with motherhood variables provides us with the significance of such

contrasts.

We also use quantile regression to explore whether wage penalties are

greater at the top, middle or bottom of the earnings distribution (Koenker 2005).

Following Budig and Hodges (2010), we use a semi-parametric quantile regression

approach that enables the simultaneous estimation of the motherhood penalty at

different points in a conditional distribution of earnings and is particularly

appropriate for non-normal distributions, such as wage distributions with outliers

in the upper tail (Kuan 2007). Like Budig and Hodges (2010), we propose to

analyze seven quantiles: the lowest fifth percentile (.05), tenth percentile (.1), the

lowest quartile (.25), the median (.5), the top quartile (.75), the ninetieth percentile

(.9), and the ninety-fifth percentile of the income distribution (.95). The logarithmic

transformation of the dependent variable, the natural logarithm of hourly earnings,

enables a comparison of these proportionate effects across the earnings

distribution. For some analyses we will combine quantile regression with fixed

effects.

Because we have multiple time-point observations, we structure the data

into person-year files, fix effects across time by including N-1 dummy variables for

year of interview, and use a statistical package to fix effects across individuals.

(Coefficients are what would be obtained if a dummy variable for each person—save one—was included.)

To deal with the potential autocorrelation of the error term resulting from multiple observations for each respondent, we obtain estimates of the standard errors by bootstrapping the residuals of the quantile regression. As developed for quantile regression by Gould (1992) and Hahn (1995), bootstrapping estimates the entire variance-covariance matrix of the estimators and corrects for heteroskedasticity.

PRELIMINARY FINDINGS

How Penalties Differ by Skill and Wage Quantile

We start with the puzzle of whether it can be true, as Wilde et al. (2010) argue, that motherhood penalties are higher for higher skill women, *and*, as Budig and Hodges (2010) say, that the penalties are lower for high wage women. These claims seem in a tension with each other given the positive correlation between cognitive skills and earnings. Our first finding is that, at least for whites, perhaps surprisingly, both papers appear correct, ceteris paribus. As an initial exploration of this question, we used quantile regression and operationalized motherhood simply as "number of children," with both of these procedures following Budig and Hodges (2010); but we also divided the sample into thirds of the AFQT distribution, running separate regression models for each third, following Wilde et al. (2010). We controlled for age, marital status, spouses earnings (0 if no spouse), the respondent's usual weekly hours, and how many weeks the respondent worked last year, but not cumulative experience. We limit this to whites, as Budig and Hodges did. Table 1, below shows results:

Table 1. Coefficients for Effect of # Kids on LN Wage by Quantile and AFQT Third

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                 0.05    0.1   0.25    0.5   0.75    0.9   0.95
Bottom Third  -0.048 -0.032 -0.021 -0.020 -0.018 -0.010 -0.005
Middle Third  -0.119 -0.058 -0.050 -0.042 -0.035 -0.033 -0.011
Top Third     -0.146 -0.103 -0.065 -0.058 -0.063 -0.074 -0.081
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Table 1 shows that, 1) in every AFQT third, penalties are higher at lower wage percentiles, but 2) at every wage percentile, penalties are higher at higher AFQT levels. In the PAA paper we will explore the following: As Table 1 shows, the increased motherhood penalties at low wages are really concentrated at the very bottom rather than reflecting a smooth, quasi-linear gradient (except in the bottom AFQT third). 1) Is there some artifact driving this, such that we would be better to remove it and conclude that proportionate penalties vary little by quantile? 2) How much of the higher penalties for those at low wages is explained by their lower levels of experience? 3) If we specify motherhood differently, focusing on number of years since the first birth, while controlling additional births, do we get the same gradient?

Differences by Race

As Figure 1, below, shows, the story really differs by race, both in the size of penalties, and how they vary by wage percentile. In Figure 1, measured along the Y axis is the coefficient for the proportionate effect of each child, and the X axis is which quantile (percentile) of the wage distribution the woman earns. (We also vary some procedures of how to do the quantile regression, but these don't make much difference. All contain, in essence, fixed effects.) Quantiles are race-specific, as are AFQT thirds. (We will also explore using a pooled quantile model with race-motherhood interactions so the wage cut points for quantiles won't be race-specific, and AFQT-thirds models that use sample-wide rather than race-specific cut points, which are quite different.)

Comparing Estimators
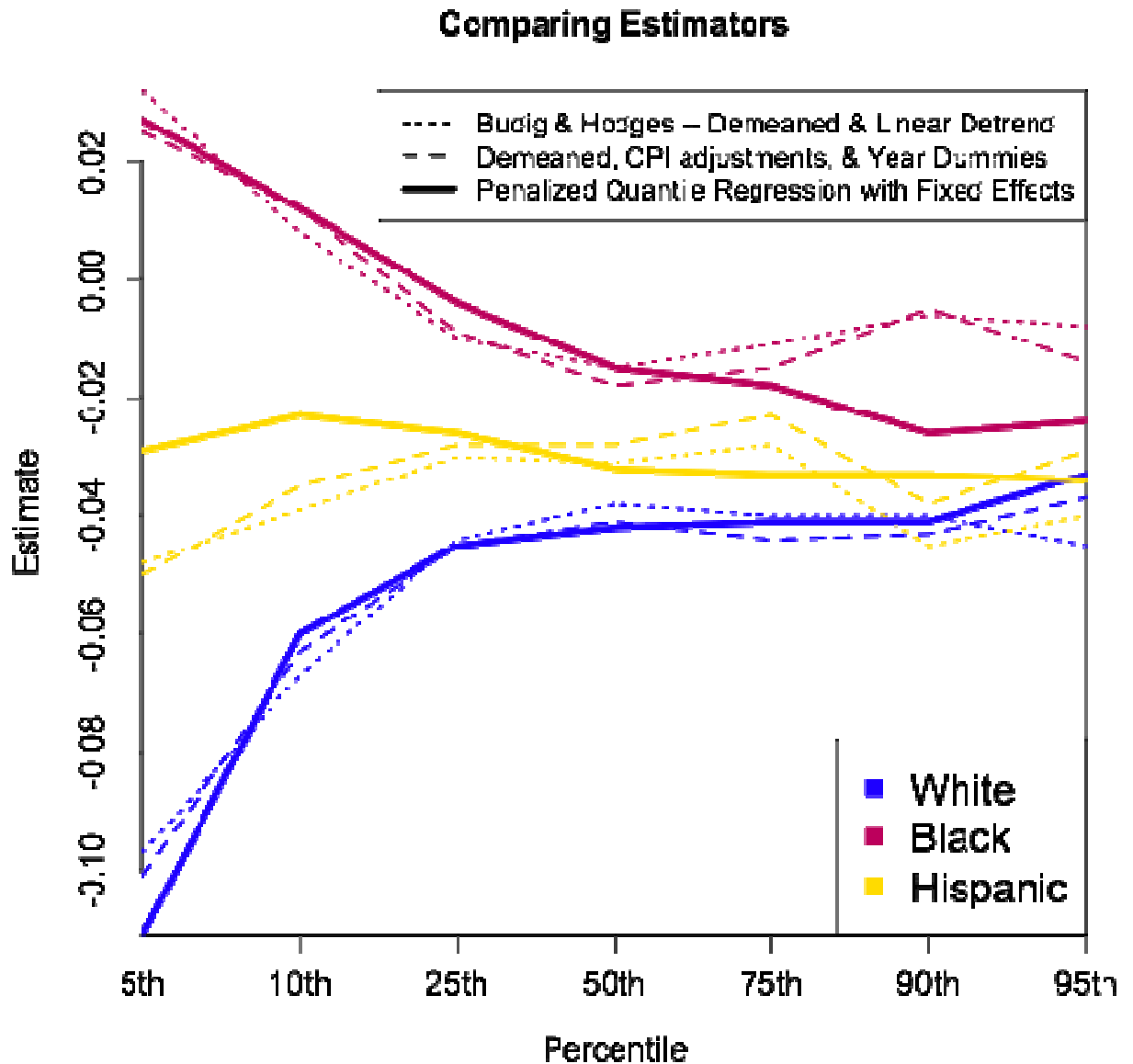
It is clear that motherhood penalties are highest for whites (larger negative effect), intermediate for Hispanics, and lowest, indeed, largely nonexistent, for Blacks. Also, the gradient whereby the penalty gets proportionately larger as the wage gets smaller is only true for whites. But, while it trends the opposite way for blacks, because it moves from tiny premia to tiny penalties (often neither is significant), we take the more important race story to be simply the nonpenalty for blacks, compared to penalties for whites.

Given the small N for Hispanics, in the PAA paper, we will ignore Hispanics and focus on the black/white difference in penalties. We start with sensitivity tests to see if the lack of penalties for blacks is also true at most AFQT levels, or if high cognitive-skill black women have penalties more like white women—which would suggest that skill differences in part explain the difference in penalty.

In thinking about why white women may experience proportionately higher wage penalties for children, an obvious black/white difference that suggests itself as relevant is the higher proportion of black women who have nonmarital births, and the larger proportion of black women's lives as mothers spent outside of marriage. To the extent that the explanations of the motherhood penalty are on the supply side, entailing women having discontinuous experience or downshifting jobs after birth if they have husbands providing income, this response would be much less likely among single women. Indeed, past research has found the penalty higher for married women (e.g. Budig and England 2001). We have made preliminary calculations specifying this two ways. In one case, we simply create separate dummies for whether a woman has had a first birth that was marital, a first birth that was nonmarital, or neither (each dummy is repeated for various years of duration past birth). The other way interacts dummies for various durations past the first birth with whether the woman is currently married (in the person year in which her wage is being measured). The latter specification appears to more clearly show higher penalties for the married. Our further explorations of this will assess whether 1) this is true at varying skill and wage levels, and 2) differences in marital status explain the black/white penalty difference.

We already have substantial analysis done on the project, so we are confident that we can have an effective presentation for the PAA. We will focus in on clarifying the bigger picture and choose for the final paper the subanalyses that we think give us the clearest summary of how skill, wage, and race affect the wage penalty for motherhood and why.

REFERENCES

Aisenbrey, S., M. Evertsson, and D. Grunow. (2009) "Is there a career penalty for mothers' time out? Germany, Sweden and the US compared." *Social Forces 88(2):* 573-605.

Amuedo-Dorantes, C. and J. Kimmel. 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.

Anderson, D., M. Binder, and K. Krause. 2002. "The Motherhood Penalty: Which Mothers Pay and Why?" *American Economic Review, Papers and Proceedings,* 92(2): 354-358.

Anderson, D., M. Binder, and K. Krause. 2003. "The Motherhood Wage Penalty Revisited: Experience, Heterogeneity, Work Effort, and Work-Schedule Flexibility." *Industrial and Labor Relations Review* 56:273-94.

Avellar, S. and P. Smock. 2003. "Has the Price of Motherhood Declined over Time? A Cross-Cohort Comparison of the Motherhood Wage Penalty." *Journal of Marriage and the Family* 65:597-607.

Bailey, M.. 2006. "More Power to the Pill: The Impact of Contraceptive Freedom on Women's Life Cycle Labor Supply." *Quarterly Journal of Economics,* 121(1): 289-320.

Baumol, W. J. 1967. "Macroeconomics of unbalanced growth: The anatomy of urban crisis." *American Economic Review* 57:415–426.

Blackburn, M. L., D. E. Bloom, and D. Neumark. 1993. "Fertility timing, wages, and human capital." *Journal of Population Economics* 6:1-30.

Budig, M. 2003. "Are Women's Employment and Fertility Histories Interdependent? An Examination of Causal Order Using Event History Analysis." *Social Science Research* 32:376-401.

Budig, M. and M. Hodges. 2010. "Differences in Disadvantage: How the Wage Penalty for Motherhood Varies Across Women's Earnings Distribution." *The American Sociological Review,* vol. 75(5):705-728.

Budig, M. and P. England. 2001. "The Wage Penalty for Motherhood." *American Sociological Review* 66:204-25.

Chaudry, A. 2004. *Putting Children First: How Low-Wage Working Mothers Manage Child Care.* New York: Russell Sage.

Correll, S., S. Benard, and I. Paik. 2007. "Getting a Job: Is There a Motherhood Penalty?" *American Journal of Sociology* 112:1297-1338.

Crittenden, A.. 2002. *The Price of Motherhood: Why the Most Important Job in the World Is Still the Least Valued.* New York: Metropolitan Books.

Davies, H., H. Joshi, and R. Peronaci. 2000. "Foregone income and motherhood: What do recent British data tell us?" *Population Studies* 54:293-305.

England, P. 2005. "Emerging Theories of Care Work." *Annual Review of Sociology* 31:381-99.

England, P., and N. Folbre. 1999. "The cost of caring." *Annals* 561:39–51.

Estes, S. B., and J. L. Glass. 1996. "Job Changes Following Childbirth." *Work and Occupations* 23(4):405 - 436.

Folbre, Nancy, Suzanne Bianchi, Laura Braswell, Paula England, Janet Gornick, Candace Howes, Carrie Leana, Kristin Smith, and Douglas Wolf. 2011. For Love and Money: Care Provision in the U.S. Unpublished manuscript.

Gangl, M. and A. Ziefle. 2009. "Motherhood, Labor Force Behavior, and Women's Careers: An Empirical Assessment of the Wage Penalty for Motherhood in Britain, Germany, and the United States." *Demography* 46:341-69.

Glauber, R. 2007a. "Marriage and the Motherhood Wage Penalty among African Americans, Hispanics, and Whites." *Journal of Marriage and the Family* 69:951-61.

Glauber, R. 2007b. "Race and Gender in Families and at Work: The Fatherhood Wage Premium." *Gender and Society* 22: 8-30.

Gould, W. 1992. "Quantile Regression with Bootstrapped Standard Errors." *Stata Technical Bulletin* 9:19-21.

Hahn, J. 1995. "Bootstrapping Quantile Regression Estimators." *Econometric Theory* 11:105-21.

Hao, L. and D. Naiman. 2007. *Quantile Regression*. Sage Publications.

Harkness, S. and J. Waldfogel. 2003. "The Family Gap in Pay: Evidence from Seven Industrialized Countries." *Research in Labor Economics* 22:369-414.

Henly, J. and S. Lyons. 2000. "The negotiation of child care and employment demands among low-income parents." *Journal of Social Issues* 56:683-706.

Hewlett, S. A. 2002. *Creating a Life: Professional Women and the Quest for Children.* New York: Talk Miramax.

Hill, M. 1979. "Wage Effects of Marital Status and Children." *Journal of Human Resources* 14:579-94.

Hoffman, S. D. 1998. "Teenage Childbearing Is Not So Bad After All...Or Is It? A Review of the New Literature." *Family Planning Perspectives,* 30(5): 236-239.

Hotz, V. J., S. Williams McElroy, and S. G. Sanders. 2005. "Teen Childbearing and Its Life Cycle Consequences." *Journal of Human Resources,* 45(3): 683-715.

Hotz, V. J., and R. A. Miller. 1988. "An Empirical Analysis of Life Cycle Fertility and Female Labor Supply." *Econometrica,* 56(1): 91-118.

Kalist, D. 2008. "Does Motherhood Affect Productivity, Relative Performance, and Earnings?" *Journal of Labor Research,* 29: 219-235.

Kilbourne, B., P. England, G. Farkas, K. Beron, and D. Weir. 1994. "Returns to skill, compensating differentials, and gender bias: Effects of occupational characteristics on the wages of white women and men." *American Journal of Sociology* 100:689–719.

Klerman, J. A., and A. Leibowitz. 1999. "Job Continuity among New Mothers." *Demography* 36(2):145-155.

Koenker, R. 2005. *Quantile Regression.* New York: Cambridge University Press.

Koenker, R. and G. Bassett. 1978. "Regression Quantiles." *Econometrica* 46:33-50.

Korenman S. and D. Neumark. 1992. "Marriage, Motherhood and Wages." *Journal of Human Resources* 27:233-55.

Kuan, C. 2007. "An Introduction to Quantile Regression." Institute of Economics Academica Sinica (http://idv.sinica.edu.tw/ckuan/pdf/lec-qr.pdf).

Leibowitz, A. and J. Klerman. 1995. "Explaining Changes in Married Mothers' Employment Over Time." *Demography* 32:365-78.

Mandel, H. and M. Semyonov. 2005. "Family Policies, Wage Structures, and Gender Gaps: Sources of Earnings Inequality in 20 Countries." *American Sociological Review* 70(6): 949-967.

Mandel, H. and M. Semyonov. 2006. "A Welfare State Paradox: State Interventions and Women's Employment Opportunities in 22 Countries." *American Journal of Sociology* 111(6): 1910-1949.

Miller, Amalia. 2011. "The Effects of Motherhood Timing on Career Path," *Journal of Population Economics,* 24(3): 1071–1100.

Neumark, D. and S. Korenman. 1994. "Sources of Bias in Women's Wage Equations: Results Using Sibling Data." *Journal of Human Resources* 29:379-405.

Scott, E, A. London, and A. Hurst. 2005. "Instability in Patchworks of Child Care When Moving from Welfare to Work." *Journal of Marriage and the Family* 67:370-86.

Sigle-Rushton, W. and J. Waldfogel. 2007. Motherhood and Women's Earnings in Anglo-American, Continental European and Nordic Countries. *Feminist Economics* 13(2), April 2007, 55 – 91

Todd, E. 2001. "Educational Attainment and Family Gaps in Women's Wages: Evidence From Five Industrialized Countries." Luxembourg Income Study No. 246. Differdange, Luxemburg: Center for the Study of Population, Poverty, and Public Policy/International Networks for Studies in Technology Environment, Alternatives, Development (INSTEAD).

Usdansky, M. and D. Wolf. 2008. "When child care breaks down: mothers' experiences with child care problems and resulting missed work." *Journal of Family Issues* 20:1-26.

Waldfogel, J. 1995. "The price of motherhood: family status and women's pay in a young British cohort." *Oxford Economic Papers* 47:584–610.

Waldfogel, J. 1997. "The Effect of Children on Women's Wages." *American Sociological Review* 62:209-17.

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* 16:505-39.

Waldfogel, J. 1998. "Understanding the "Family Gap" in Pay for Women With Children." *The Journal of Economic Perspectives,* 12 (1): 137-156.

Wilde, E.T., L. Batchelder. And D. Ellwood. 2010. "The Mommy Track Divides: The impact of childbearing on wages of women of differing skill levels." NBER Working Paper 16582.

Williams, J. 2001. *Unbending Gender: Why Family and Work Conflict and What to Do About It.* Oxford, UK: Oxford University Press.