The Returns to Work Experience and Occupational Tasks of Mothers

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Abstract

Using data from the National Longitudinal Survey of Youth 1979 we show that returns to wage growth of work experience for mothers are lower than those women with no child, when controlling for accumulated work experience and tenure. This is not fully explained by self-selection into motherhood since returns to work experience decrease after the transition to motherhood. We then show that these lower returns can be partly explained by differences in the occupational tasks of mothers (which rely more on interpersonal skills and less on cognitive skills) and the fact that mothers spend more time out of employment.

JEL Classification: J13, J24, J31

Keywords: Family Gap, Motherhood Wage Penalty, Occupational Tasks, Work Experience, Wage Growth

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I INTRODUCTION

The presence of children, especially young ones, affects household behavior. One dimension of behavior that is most likely affected is female labor supply. As reported in BLS (2013) the labor force participation rate of women with children under 18 years old is 71.3%. It decreases to 64% for women with children under 6 years old, and 61.1% for women with children under 3 years old. Since most women have their first child in their twenties or early thirties, the lower labor force participation of mothers with young children is indicative that they leave employment during the prime period for career development when returns to work experience and labor market attachment are high. Not surprisingly there is evidence that female wages are affected by motherhood. Loughran and Zissimopoulos (2009) find that a first birth lowers female wages by 2 to 3 percent.

It is this relationship between motherhood, the accumulation of work experience, and wages in the 1979 cohort of the National Longitudinal Survey of Youth (NLSY79) that is the focus of this paper. Our contribution is to carefully track the timing of both fertility and the accumulation of work experience for women and show that the rate at which accumulated hours of work increase female wages vary according to whether a woman has children and the age at which the transition to motherhood is made. We find that early mothers (women who had their first child before the age of 25) experience weaker returns to work experience relative to non-mothers (women who never transitioned to motherhood). As for late mothers (women who had their first child after the age of 25), returns to work experience accumulated *before* their transition to motherhood are stronger than the returns experienced by non-mothers. We find however that work experience accumulated *after* the transition to motherhood for late mothers brings smaller rewards.

We then investigate two possible explanations to these different returns to experience. First in a world where occupations are an amalgamation of different tasks, it is possible that mothers and non-mothers diverge in terms of the tasks they perform and at what level

they perform these. We do find evidence that mothers tend to climb the interpersonal tasks ladder at a faster rate, and that early mothers climb the cognitive tasks ladder at a slower rate. Accounting for this does not however change our finding of differential returns to work experience, although it does seem to explain part of it.

Second if time spent out of employment is associated with the costly loss of employer- or occupational- specific human capital, then mothers who tend to spend more time out of employment should be observed as experiencing weaker returns to work experience in a model that does not account for time spent out of employment, as suggested by Light and Ureta (1995). We however find that the differentials in returns to work experience are robust to controlling for time spent out of employment. Consistent with past literature we find that longer periods out of employment following a birth are associated with stronger wage decreases. Interestingly, we can link these wage losses to a decrease (increase) in cognitive (interpersonal) tasks performed at work once mothers come back to work.

We believe this differential in the returns to work experience to be important. First, it helps explain the "family wage gap", the fact that mothers have on average lower wages than non-mothers. This family gap has traditionally been explained by the fact that mothers spend on average less time working relative to non-mothers. But the differential in returns to work experience implies that even if mothers accumulated work experience at the same rate as non-mothers, they would nonetheless have lower wages.

Another common explanation for the lower wages of mother is that women with poor labor market prospects self-select into motherhood. This is somewhat at odds with our finding that late mothers experience the strongest returns to work experience *before* their transition to motherhood. The fact that we see these late mothers experiencing much weaker returns to work experience *after* their transition to motherhood suggests that another mechanism may be at play.

The difference in returns to work experience for women on the basis of motherhood and

the timing of the transition to motherhood is also relevant to the literature that jointly models labor supply and fertility.[1] In this literature it is usually assumed that motherhood is costly to women because of reduced human capital accumulation induced by weaker labor supply and because of the loss of specific human capital induced by job separations associated with the transition to motherhood. Our results suggest another channel through which having children is costly to working women, and that it is connected to differences in occupational tasks that women perform.

We study other issues such as the age of transition to motherhood as well as the accumulation of work experience and job tenure that are related to the lower wages of mothers. These issues have been raised across a number of papers in the literature and we are able to study them within one consistent wage regression framework. This wage regression framework is supported by our careful tracking of career and family developments. This is made possible by the detailed work experience and fertility information available in the NLSY79. It allows us to follow a cohort of women from their early twenties, when careers are launched and families are first formed, up until their mid to late forties, when careers are mostly established and new additions to families are unlikely.

We do not claim that our findings are causal estimates. They merely provide informative correlations between wages, work experience, and motherhood that are open to multiple interpretations. We do provide some interpretations in the conclusion but feel that further research is required to ascertain these. Another caveat is the inability to track marital status and school attendance with the NLSY79 in the same manner that we can track jointly births and career progress. These are issues that are likely strongly related to wages, work experience accumulation, and fertility that would ideally be investigated as carefully.

The next section reviews the literature to provide some context. The third section discusses the data and the construction of our main variables of interest. The fourth section is

[1] See, among others, Hotz and Miller (1988); Eckstein and Wolpin (1989); Caucutt et al. (2002); Erosa et al. (2002); Sheran (2007).

a presentation of our results. We conclude with possible interpretations of our results in the last section.

II RELATED LITERATURE

There is ample evidence that mothers earn less than women with no child. This motherhood wage penalty or "family wage gap" has been observed for both young women and older women, see for example Waldfogel (1997), Waldfogel (1998), and Loughran and Zissimopoulos (2009). This family wage gap is also found in the U.K. (Waldfogel and Harkness, 2003) and Canada (Drolet, 2002). There is however mixed evidence of a motherhood wage penalty in Australia, Germany and Scandinavian countries (Todd, 2001; Gupta and Smith, 2002; Waldfogel and Harkness, 2003; Nielsen et al., 2004; Simonsen and Skipper, 2006).

The family gap literature has taken up the research concerned with documenting and interpreting estimated coefficients on children variables in hourly wage regressions. Hill (1979) found early that controls for the presence of children (and for marital status) act as proxies for measures of labor market productivity. As a result, she found that controlling for work experience and labor force attachment greatly reduces the motherhood wage penalty. This result has been observed in all subsequent family gap studies.

Another explanation is that mothers and non-mothers somehow differ in their unobserved ability to earn. To deal with this unobserved heterogeneity researchers have used the fixed-effects estimator. Some find that it partially explains the motherhood wage penalty (Waldfogel, 1998; Budig and England, 2001) while others find that it leads to no effect of children on wages (Korenman and Neumark, 1992; Gupta and Smith, 2002).

As well as work experience and tenure, a number of papers consider in addition both time spent out of employment (Hill, 1979; Baum, 2002; Spivey, 2005) and part-time employment (Waldfogel, 1997; Joshi et al., 1999; Anderson et al., 2002, 2003). The interpretation is

that being out of employment is associated with human capital depreciation and the loss of job specific human capital, while part-time employment is usually associated with lower wages. Since part-time work and work interruptions are more prevalent among mothers, these variables are usually found to partially explain the motherhood wage penalty.

Related to work interruptions is the focus of some papers on how long mothers take before going back to work after a birth and whether they return to the same job they held pre-birth. Shorter work interruptions following a birth (Lundberg and Rose, 2000; Phipps et al., 2001; Ejrnaes and Kunze, 2013) and returning to the same pre-birth job (Waldfogel, 1998; Baum, 2002) are associated with weaker motherhood wage penalties. One exception to this is Anderson et al. (2003) which find that women who return to work with very young children at home (two years old or less) have lower wages.

Another important determinant of the family gap is the timing of the transition to motherhood. Women who make their transition to motherhood earlier in their career are found to have lower wages (Taniguchi, 2000; Drolet, 2002; Amuedo-Dorantes and Kimmel, 2005). Herr (2016) finds that the returns to delaying a first birth are larger when the timing of transition to motherhood is defined relative to labor market entry instead of age. She also shows that having a first child before labor market entry is associated with higher wages for high school graduates. Wilde et al. (2010) find that the opportunity cost of motherhood is much larger for more educated and more skilled women, so that they have an increased incentive to delay having children. In other papers that considered the impact of education, it is found that the motherhood wage penalty varies by level of education whereas more educated mothers suffer from weaker wage penalties (Todd, 2001; Anderson et al., 2002, 2003). These two issues are somehow related as more educated mothers are on average older when they make their transition to motherhood.

Another possible explanation for the motherhood wage penalty is that they may suffer from weaker wage growth either because mothers-to-be face lower rewards to improving labor

market productivity, or because mothers have less time to do so. Loughran and Zissimopoulos (2009) finds no evidence that mothers suffer from lower wage growth. Similarly Waldfogel (1997) finds no differential returns to part-time work experience, more prevalent among mothers, relative to full-time work experience. However Gupta and Smith (2002) find some evidence that wage-experience profiles are significantly flatter for mother with two or more children. Mincer and Polachek (1978) find that a longer work interruption following a birth is associated with weaker wage growth for women.

III NLSY79 DATA

We use data on wages, work experience, and household composition from the NLSY79. It is a longitudinal survey of a representative sample of 12,686 young men and women aged 14 to 21 on December 31st 1978. It provides data on labor market experience, income, household and fertility for 6,283 women who were interviewed annually from 1979 to 1994 and every two years since then, with 2010 being the most recent survey year used in this study. We focus on the 3,108 women of the cross-sectional sample of the NLSY79 and exclude the supplemental samples of blacks, hispanics, and economically disadvantaged whites. Our main wage regression sample includes multiple wage observations for 3,005 women.

We record the real hourly wage (in 2010 dollars) for the job held at that the time of each completed survey interview. If an individual holds more than one job, we select the job with the highest weekly hours of work. Only hourly wages above $4 and below $150 are considered. To exclude summer jobs and part-time student jobs, we start tracking wages at age 18 (age 21) for individuals whose final years of schooling is 12 or less (13 or more).

The NLSY79 Work History Data contain weekly arrays that track employment status and hours worked starting January 1st 1978. We use these arrays to create actual work experience variables (total weeks worked, total hours worked) as well as time spent out of employment

(total weeks out of employment) at each interview date. As with wages, we start tracking work experience and time out of employment at age 18 (age 21) for individuals whose final years of schooling is 12 or less (13 or more).

For individuals who have children, the NLSY79 provides the date of birth and date of death (if applicable) of each child born to an individual.[2] After computing week of birth and death for each child, we can use the weekly arrays of employment status and hours worked to separate work experience accumulated with and without children. We do not count any child aged 18 or more, so that an individual is considered to have no child if all their children are 18 years old or more.

Table 1 presents basic descriptive statistics for the sample. The first row represents the individuals distribution according to their final level of education. About 47% of women in the sample have high school or less (12 years of schooling or less), while 26% have some college (13 to 15 years of schooling), and about 27% are college graduates (16 years of schooling or more). Note that the race distribution within each educational category suggests that white women are over-represented among college graduates, while minorities are over-represented among individuals with less than 16 years of schooling.

About 80% of women in our sample have children at some point between 1979 and 2010. There is however a slightly negative correlation between motherhood status and educational achievement. At each survey we record the number of children aged 18 years old or less. Mothers have on average a maximum of two children across all these survey years. Mothers have on average their first child by the age 24 years old, but age at first birth is much higher for college graduates.

Figure 1 provides the age profile of hourly wages by educational achievement. As expected wage growth is stronger as education increases, leading to sizeable wage gaps as this cohort reaches the early forties. Figure 2 graphs the age profile of accumulated hours of work by

[2]Note that only month and year of birth and death are provided in the NLSY79. To identify the week these events took place we assume that birth and death always take place on the 15th of the month.

educational achievement. These profiles are fairly similar across schooling levels, but the more educated workers have steeper profiles, suggesting that they have higher annual hours of work.

Figure 3 presents age profiles of number of children for mothers by educational achievement. The profile for women with 16 years of schooling or more is clearly to the right of less educated women, consistent with their higher average age at first birth. It is also noteworthy that these profiles start decreasing as children turn 18 years old when mothers reach their late thirties and early forties.

IV WAGE PROFILE ANALYSIS

IV.1 The Returns To Work Experience and Motherhood

The main analysis presented here is based on a sample of about 38,500 log-wage observations for 3,005 women (out of 3,108 women in the NLSY79 cross-sectional sample). This is an unbalanced panel with an average of 13 log-wage observations per individual, ranging from a minimum of one observation to a maximum of 24 observations.

Figure 4 presents wage-age profiles based on the age at which a mother had her first child. Here we distinguish between mothers whose age at first birth was less than 25, and those who had their first child after the age of 25.[3] Panel A shows that mothers who have their first child later in their career (green line) have a wage progression very similar to that of non-mothers (blue line). Women who become mothers at an early age (red line) have much slower wage growth. Panels B to D present the same wage profiles separately for each level of schooling. They reveal weaker wage growth for early mothers as seen in Panel A but the distinction between early mothers and other women is more muted. This suggests that the

[3]We also considered more categories for age at first birth, each covering a shorter age range. Results for all categories at age 25 or below were very similar to the results presented here in our age 25 or less category. At the same time, the category that includes all mothers who had their first birth after the age 25 presents results very similar to those displayed by the few more restrictive categories in that age at first birth range.

differences in wage profiles found in Panel A are in part due to compositional effects: early mothers are more likely to be less educated workers with weaker wage growth whereas late mothers are more likely to be more educated workers with strong wage growth. It is worth noting that average wages in the early career are very similar across all panels of Figure 4.

The weaker wage growth of early mothers is consistent with their slower accumulation of work experience. Figure 5 shows that their age profile of accumulated hours of work is consistently below that of late mothers and non-mothers. But these profiles also suggest that late mothers of all schooling levels decrease their labor supply in their late twenties and early thirties. This would explain why wage profiles for late mothers in Figure 4 seem to flatten in the late twenties and early thirties. Our analysis indicates so far that wage differentials between mothers and non-mothers are almost non-existent in the early career. However, we find that the wage growth of mothers, especially early mothers, is weaker and leads to a gap in average wage between mothers and non-mothers. Part of this slower wage growth is due to mothers accumulating less work experience.

We investigate further whether the accumulation of work experience explains the differences in wage profiles of non-mothers, early mothers and late mothers. Table 2 contains estimates of a fixed-effects wage regression that controls for actual work experience, measured by accumulated hours of work. Since an important focus of this paper is to investigate differences in returns to work experience we do not want to use measures such as years or weeks of employment that potentially hide a large amount of variance in accumulated work experience. We also control for years of tenure with a specific employer, and years since labor market entry.[4] As expected we find the returns to work experience, tenure, and years since labor market entry are positive and decreasing. In the early career, a year of full-time time work (about 2,000 hours of work) is associated with a wage growth of about 3.4%. Columns two to four reveal that this returns varies based on years of schooling, with college graduates

[4] Given our assumption that workers with no college (at least some college) enter the market at age 18 (age 21), years since labor market entry is just age minus 18 (21).

enjoying a 4.6% wage increase in their first year of full-time work. Wage growth after a year at the same job is about 3%, and the first year since labor market entry is associated with about 2.6% wage growth.

We also allow the returns to work experience to vary based on whether mothers had their child before or after the age of 25. These interactions should be statistically insignificant if wage profile differences are fully explained by differences in work experience profiles. But what we find is that across all schooling levels, mothers who have their first child after the age of 25 enjoy *higher returns to work experience*. At the same time mothers who have their child before age 25 enjoy *lower returns to work experience*, although this seems to be mostly an issue for early mothers with a college degree.[5] These estimates imply that within the 0 to 50,000 accumulated hours of work range (in which 95% of our sample is located) the average quadratic wage-experience profile of late mothers is above that of non-mothers, which is itself above that of early mothers, for all schooling levels.

Table 2 also reveals an apparent wage penalty associated with becoming a mother. Indeed this wage penalty seems especially large for late mothers. However it is worth noting that (in results not shown here) we find similar wage penalties when we *exclude non-mothers* from the estimation sample. We believe this is due to the fact that in a fixed-effects model these penalties are identified off of workers in our sample who make the transition into motherhood (in the early career when wages are lower and wage growth is strong) and out of motherhood (in the late career when wages are higher and wage growth is weaker). We could also obtain similar results if mothers tend to make the transition into motherhood when hit with bad labor market shocks that translate into lower wages.

In Table 3 we investigate whether the higher returns to work experience for late mothers is related to the timing of the transition to motherhood. To do so, we distinguish work

[5] This seems to contradict Loughran and Zissimopoulos (2009) which find no difference in wage growth for mothers relative to non-mothers. If like them we do not distinguish mothers on the basis of the timing of their transition to motherhood, we find no difference in the returns to work experience between mothers and non-mothers.

experience of late mothers based on whether it was acquired *before or after* the first birth. In Panel *a.* of Table 3 the coefficient for hours of work accumulated by late mothers before the first birth is found positive and statistically significant for all schooling levels. This suggests that when comparing the wage of two mothers with the same total amount of work experience, we would find that the wage is higher for the mother who has waited the longest before having her first child. This is compounded by the fact that we find the returns to hours worked by late mothers after the first birth to be lower, especially for mothers who have at least 13 years of schooling.

It could be argued that hours of work before the first birth capture the stronger wage growth in the early career. We investigate this in Panel *b.* of Table 3 where we differentiate work experience based on whether it was acquired before the age of 25, or from ages 25 to 35. If returns to work experience are higher during the early career, then the coefficients associated with these two measures of work experience should be positive. And we do find that work experience has a higher return for workers of all schooling levels if it is acquired before age 25. But we still find that late mothers experience stronger wage growth before their transition to motherhood, although the coefficients appear smaller than those found in Panel *a.*

IV.2 Occupational Tasks Requirements and Wage Growth

We next investigate whether differences in wage growth can be explained by non-mothers, early mothers, and late mothers having career progressions that take them through different occupations. Whereas past literature has differentiated jobs on the basis of occupational codes, we instead follow Ingram and Neumann (2006), Poletaev and Robinson (2006), and Black and Spitz-Oener (2010) in describing occupations as a vector of tasks requirements. In our case occupations are described by how much cognitive, interpersonal, motor, and strength tasks they involve. These tasks requirements are not available in the NLSY79

but we can match its 1970 census occupational classification codes to the Dictionary of Occupational Titles (DOT). The DOT describes a large number of jobs on the basis of more than fifty different characteristics categorized as worker functions, educational requirements, temperaments, and aptitudes used for a job. We apply principal component analysis on four mutually exclusive subsets of these characteristics to build our cognitive, interpersonal, motor, and strength occupational tasks requirements. As an example, surgeons would have relatively high values for cognitive and motor tasks requirements, whereas salespersons would have relatively high interpersonal tasks requirement.

We regress these four different tasks requirements on linear and quadratic terms in accumulated work experience, years since leaving the labor market and tenure, as well as interactions of these variables with indicator variables for early mothers and late mothers. The average age profile predicted by this model for each tasks requirement is plotted in Figure 6. They show that all women see their required cognitive and interpersonal tasks increase throughout their careers, whereas motor and strength tasks tend to decrease with career progression. Late mothers have on average age profiles that are very similar to that of non-mothers. We also see that late mothers appear to move up the cognitive and interpersonal tasks ladders at a faster rate, and to lose motor tasks requirement at a faster rate. Therefore if cognitive and interpersonal tasks are associated with higher wage, then we would expect stronger wage growth for late mothers.

Table 4 shows that these tasks requirements are related to wages. Women who hold job with higher cognitive and strength requirements tend to earn more. However jobs that require more interpersonal tasks, for the same levels of cognitive and strength tasks, are associated with lower wages. Despite this effect of tasks requirements on wages we still find that late mothers enjoy higher returns to work experience. Although late mothers climbing the cognitive tasks ladder faster could explain their stronger wage growth, their faster climb of the interpersonal tasks ladder should tamper this effect. As a result we still find that the

interaction between accumulated work experience and being a late mother is positive and statistically significant at all schooling levels.

IV.3 Work Interruptions and Wage Growth

We then study the relationship between work interruptions (time spent out of employment) and female wages. These work interruptions obviously lead to less work experience accumulation, so our accumulated work experience variable should already account for that effect. However work interruptions might also lead to lost specific human capital and the depreciation of more general human capital, and these losses might be heavier as more time is spent out of employment. If non-mothers and late mothers spend less time out of employment, they suffer less from this loss of specific human capital relative to early mothers, and may look like they enjoy stronger wage growth if work interruptions are not accounted for.

Table 5 shows that time spent out of employment is associated with significantly lower wages for all women at all levels of schooling. It is interesting to note however that this effect is less negative for mothers relative to non-mothers. This may be due to mothers having a higher reservation wage and leaving unemployment only when they find a job with a sufficiently high wage. It is also worth noting that accounting for weeks of unemployment seems to make the indicator variables for having at least one child insignificant. So it seems that part of the negative effect of having children on wages that we found in Table 2 can be explained by mothers spending more time out of employment. This is in line with results presented in Baum (2002).

We however still find differential returns to work experience despite controlling for time out of employment. Early mothers experience lower returns to work experience whereas late mothers have higher (lower) returns to experience before (after) their transition to motherhood.

IV.3.1 Wages and Birth Related Work Interruptions.

To understand better the how time spent out of employment affects the wages of mothers we study how birth related work interruptions impact the wage and occupational tasks requirements upon returning to the labor market. In this section we rely on a sample of periods out of employment observed around the time of any birth. For any of these periods we record the hourly wage and tasks requirements before and after the interruption. We also record the length, the birth order, and at what time during the career it took place. Mothers who have more than one birth have multiple observations in this sample.

We first report the impact of birth related work interruptions on wages and occupational tasks requirements in Table 6. We find that birth related work interruptions lead to mothers going back to work with lower wages on average. But this negative impact is felt mainly by late mothers and mothers with a college degree. Work interruptions are associated with drops in cognitive and motor occupational tasks requirements, and increases in interpersonal and strength tasks requirements.

In Table 7 we look at the determinants of wage changes following a birth related work interruption. We find that the most important determinants in explaining the change in wage following a work interruption is the change in cognitive and interpersonal tasks requirements. Work interruptions associated with a decrease in cognitive tasks lead to significant wage losses for mothers. At the same time, increases in the interpersonal tasks are associated with lower wages. These results are consistent with those of Table 4 where we find that a higher (lower) cognitive (interpersonal) tasks requirement is associated with a higher hourly wage. Table 7 also shows that the length of the work interruption seems to have little significant impact on wages once changes in tasks requirements are accounted for.

V CONCLUSION

In this paper we study the relationship between motherhood and wage growth. We pay particular attention to how returns of work experience to wage growth vary depending on whether a woman has children and when she made the transition to motherhood. We find that the returns to work experience are weaker for early mothers (women who had their first child before the age of 25) relative to non-mothers (women who never transitioned to motherhood). Late mothers (women who had their first child after the age of 25) experience stronger returns to work experience relative to non-mothers. This raises the question of whether returns to work experience are lower because of the transition to motherhood or whether both returns and motherhood are driven by unobserved characteristics. The fact that we find returns to work experience decreasing for late mothers after their first birth suggests that changes to labor market behavior due to new family commitments may play a role. A possible explanation is that mothers have to decrease their effort at work (Becker, 1985; Dechter, 2014). Instead of reducing their effort in terms of productivity, mothers may reduce their effort in producing human capital so that hours of work are associated with weaker wage growth. But if investment in human capital is the mechanism through which returns to work experience vary, then it raises the question of why late mothers would invest so much in their early career (giving them large returns to work experience) despite the fact that they reduce their labor supply after their transition to motherhood.

We also show that mothers and non-mothers differ in terms of their occupational tasks. Late mothers and non-mothers tend to climb the cognitive tasks ladder at about the same pace, and more demanding cognitive tasks are associated with higher wages. This is consistent with the lower wages of early mothers and the fact that they climb the cognitive ladder at much slower pace than late mothers and non-mothers. But late mothers and non-mothers do differ in terms of how much interpersonal tasks they perform at work; late mothers tend to climb the interpersonal tasks ladder at a faster rate than non-mothers. This seems to

explain in part their lower returns to work experience after their transition to motherhood, as interpersonal tasks are associated with lower wages once holding constant cognitive tasks requirements. However, controlling for occupational tasks does not remove all of the variation in returns to work experience associated with motherhood and the timing of the transition to motherhood.

We find evidence that birth related work interruptions may in part explain why mothers seem to perform jobs with less demanding cognitive tasks and stronger interpersonal tasks. Indeed, when comparing the jobs that mothers go back to after a work interruption to those they held before, we find that they tend to require less cognitive work and more interpersonal skills. Less surprisingly we also find that the jobs they preform after birth related work interruptions pay lower wages. Although we find that longer periods out of employment are associated with larger wage losses, we show that when work interruptions are birth related, these wage losses are explained by larger drops in cognitive tasks and increases in interpersonal tasks. This seems to suggest that mothers who go back to cognitively demanding jobs can avoid the wage losses associated with long work interruptions. But it could be that human capital specific to cognitive tasks depreciates at a faster rate than that of other types of tasks. As a result mothers may have no choice but to go back to jobs with less cognitively demanding tasks after long work interruptions.

The lower wages of mothers have traditionally been explained by weaker labor supply (leading to less accumulated work experience), increased time spent out of employment (leading to human capital depreciation and lost specific human capital), and self-selection into motherhood (women with poorer career prospects face a lower opportunity cost of motherhood). Our results suggest another channel through which mothers have lower wages: they experience lower returns to work experience. Although these results are descriptive, we hypothesize that once they transition to motherhood, women may have to reduce their effort in on-the-job human capital investment. This reduced effort may be reflected in the different type of

occupational tasks women complete at work. Indeed we find that mothers tend to climb the cognitive (interpersonal) tasks ladder at a slower (faster) rate than non-mothers. In turn, cognitive (interpersonal) tasks are associated with higher (lower) wages once other occupational tasks are accounted for. We hope that future research will benefit from our finding in explaining the relationship between motherhood, wage growth, and occupational tasks.

References

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 Houshold 3*(1), 17–48.

Anderson, D. J., M. Binder, and K. Krause (2002). The motherhood wage penalty: Which mothers pay it and why? *American Economic Review 92*(2), 273–294.

Anderson, D. J., 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*(2), 273–294.

Baum, C. L. (2002). The efffect of work interruptions on womens wages. *Labour 16*(1), 1–37.

Becker, G. S. (1985). Human capital, effort, and the sexual division of labor. *Journal of Labor Economics 3*(1), S33–S58.

Black, S. E. and A. Spitz-Oener (2010). Explaining women's success: Technological change and the skill content of women's work. *The Review of Economics and Statistics 92*(1), 187–194.

BLS (2013). Women in the labor force: A databook. BLS Reports 1040, US Bureau of Labor Statistics.

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

Caucutt, E. M., N. Guner, and J. Knowles (2002). Why do women wait? matching, wage inequality, and the incentives for fertility delay. *Review of Economic Dynamics 5*(4), 815–855.

Dechter, E. K. (2014). Maternity leave, effort allocation, and postmotherhood earnings. *Journal of Human Capital 8*(2), 97–125.

Drolet, M. (2002). Wives, mothers and wages: Does timing matter? Analytical studies branch research paper series, Statistics Canada, Analytical Studies Branch.

Eckstein, Z. and K. I. Wolpin (1989). Dynamic labour force participation of married women and endogenous work experience. *Review of Economic Studies 56*(3), 375–361.

Ejrnaes, M. and A. Kunze (2013). Work and wage dynamics around childbirth. *The Scandinavian Journal of Economics 115*(3), 856–877.

Erosa, A., L. Fuster, and D. Restuccia (2002). Fertility decisions and gender differences in labor turnover, employment, and wages. *Review of Economic Dynamics 5*(4), 856–891.

Gupta, N. D. and N. Smith (2002). Children and career interruptions: The family gap in denmark. *Economica 69*(276), 609–629.

Herr, J. L. (2016). Measuring the effect of the timing of first birth on wages. *Journal of Population Economics 29*(1), 39–72.

Hill, M. S. (1979). The wage effects of marital status and children. *Journal of Human Resources 14*(4), 579–594.

Hotz, V. J. and R. A. Miller (1988). An empirical analysis of life cycle fertility and female labor supply. *Econometrica 56*(1), 91–118.

Ingram, B. F. and G. R. Neumann (2006). The returns to skill. *Labour Economics 13*(1), 35–59.

Joshi, H., P. Paci, and J. Waldfogel (1999). The wages of motherhood: Better or worse? *Cambridge Journal of Economics 23*(5), 543–564.

Korenman, S. and D. Neumark (1992). Marriage, motherhood, and wages. *Journal of Human Resources 27*(2), 233–255.

Light, A. and M. Ureta (1995). Early-career work experience and gender wage differentials. *Journal of Labor Economics 13*(1), 121–154.

Loughran, D. S. and J. M. Zissimopoulos (2009). Why wait? the effect of marriage and childbearing on the wages of men and women. *Journal of Human Resources 44*(2), 505–545.

Lundberg, S. and E. Rose (2000). Parenthood and the earnings of married men and women. *Labour Economics 7*(6), 689–710.

Mincer, J. and S. Polachek (1978). Women's earnings reexamined. *Journal of Human Resources 13*(1), 118–134.

Nielsen, H. S., M. Simonsen, and M. Verner (2004). Does the gap in family-friendly policies drive the family gap? *Scandinavian Journal of Economics 106*(4), 721–744.

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

Poletaev, M. and C. Robinson (2006). Human capital specificity: Evidence from the dictionary of occupational titles and displaced worker surveys, 1984-2000. *Journal of Labor Economics 26*(3), 387–420.

Sheran, M. (2007). The career and family choices of women: A dynamic analysis of labor force participation, schooling, marriage and fertility decisions. *Review of Economic Dynamics 10*(3), 97–125.

Simonsen, M. and L. Skipper (2006). Does the gap in family-friendly policies drive the family gap? *Journal of Applied Econometrics 21*(7), 919–934.

Spivey, C. (2005). Time off at what price? the effects of career interruptions on earnings. *Industrial and Labor Relations Review 59*(1), 119–140.

Taniguchi, H. (2000). The timing of childbearing and women's wages. *Journal of Marriage and the Family 61*(4), 1008–1019.

Todd, E. L. (2001). Educational attainment and family gaps in womens wages: Evidence from five industrialized countries. Technical report, Unpublished Manuscript.

Waldfogel, J. (1997). The effect of children on women's wages. *American Sociological Review 62*(2), 209–217.

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.

Waldfogel, J. and S. Harkness (2003). The family gap in pay: Evidence from seven industrialized countries. In S. W. Polachek (Ed.), *Research in Labor Economics*, Volume 22, pp. 369–413. Emerald Group Publishing Limited.

Wilde, E. T., L. Batchelder, and D. T. Ellwood (2010). The mommy track divides: the impact of childbearing on wages of women of differing skill levels. *NBER Working Paper Series* (16582).

Figure 1:
Women Age Profile of Hourly Wage by Educational Achievement
(With 95% Confidence Interval)

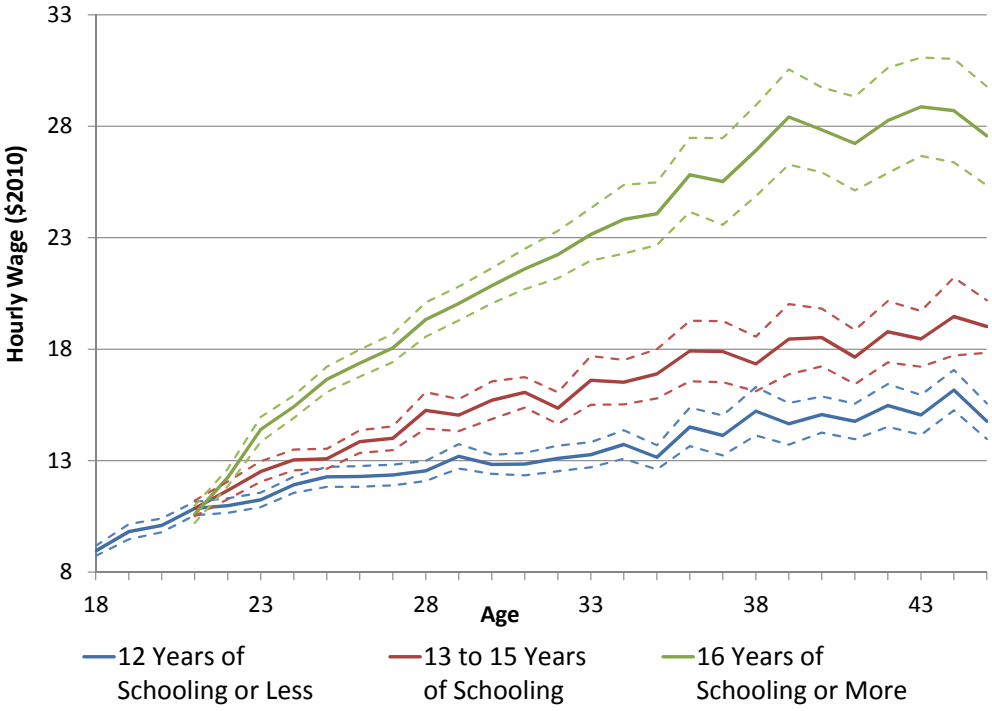

Figure 2:
Women Age Profile of Accumulated Hours of Work by Educational Achievement
(With 95% Confidence Interval)

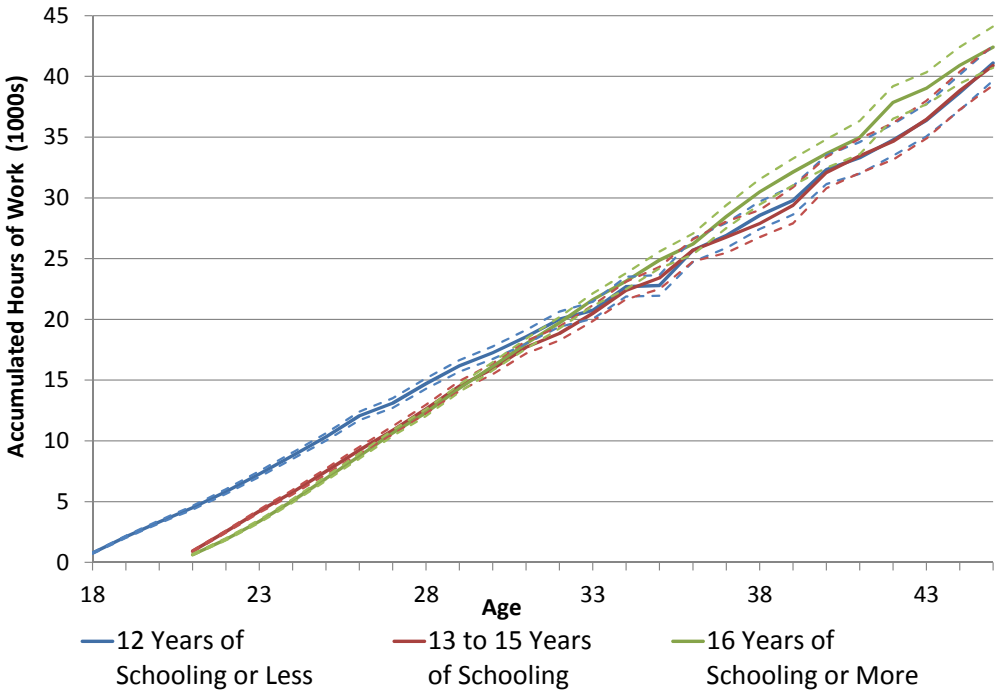

Figure 3:
Women Age Profile of Number of Children for Mothers by Educational Achievement
(With 95% Confidence Interval)

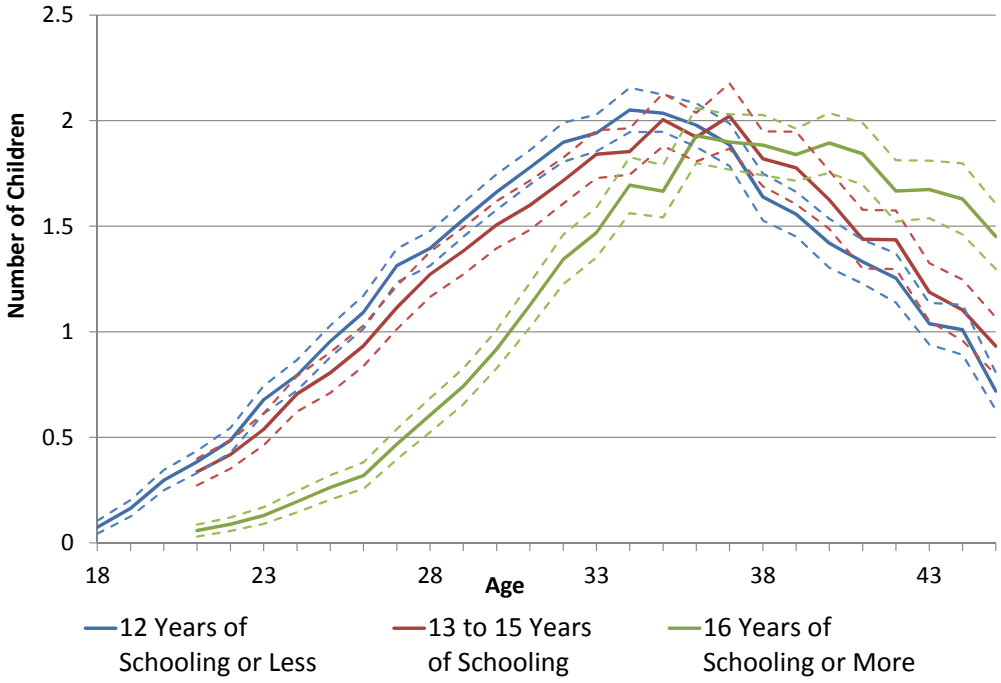

Figure 4:
Women Age Profile of Hourly Wage by Age at First Birth
(With 95% Confidence Interval)

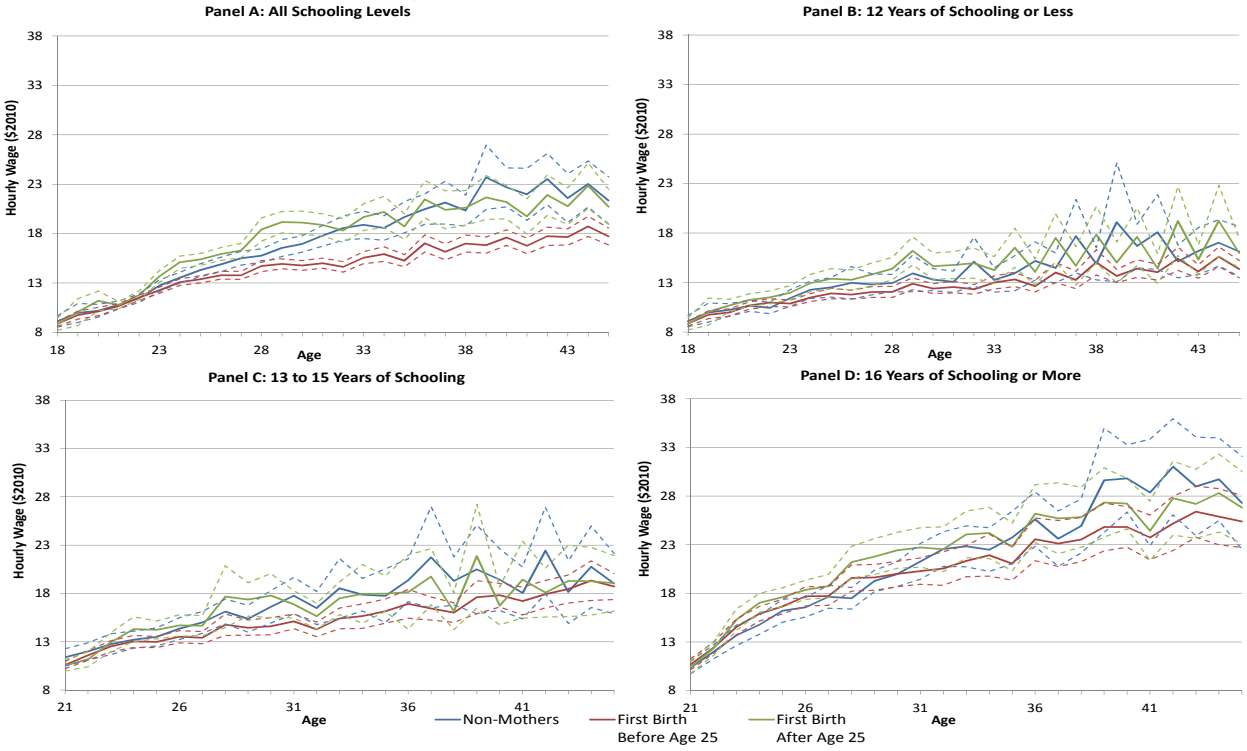

Figure 5:
Women Age Profile of Accumulated Hours of Work by Age at First Birth
(With 95% Confidence Interval)

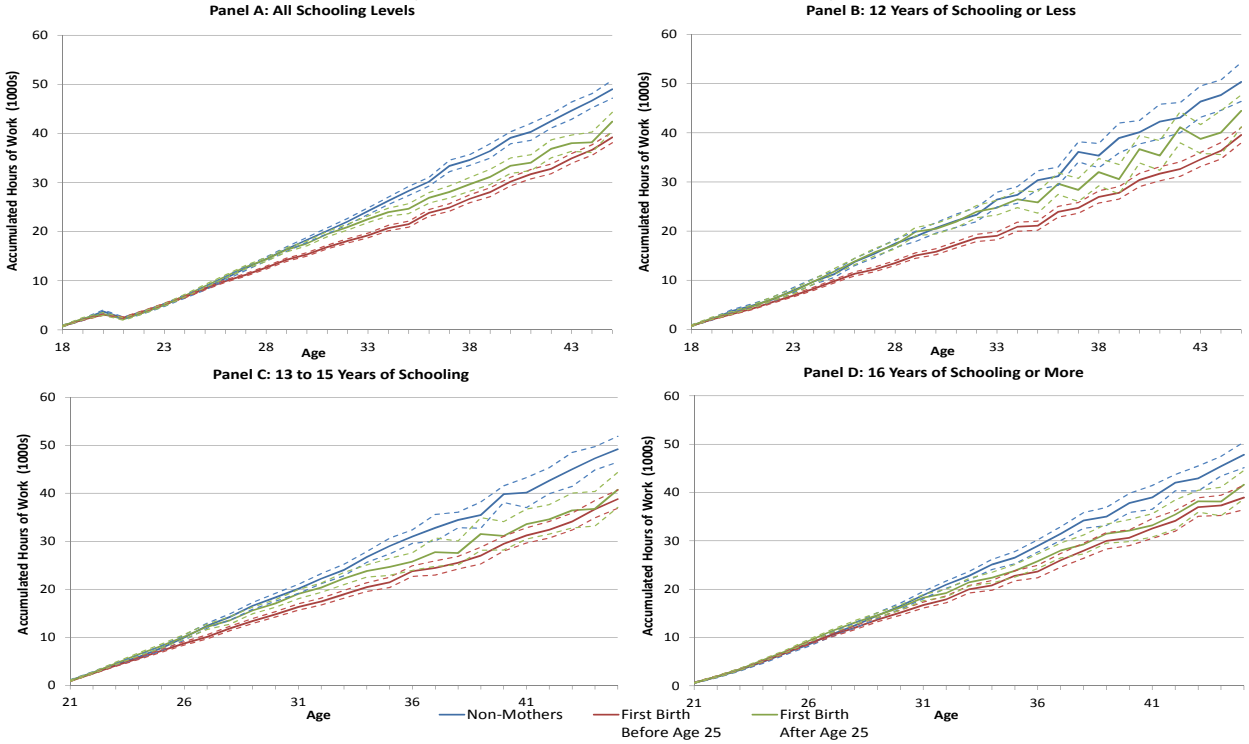

Figure 6:
Average Predicted Women Age Profile of Occupational Task Requirements

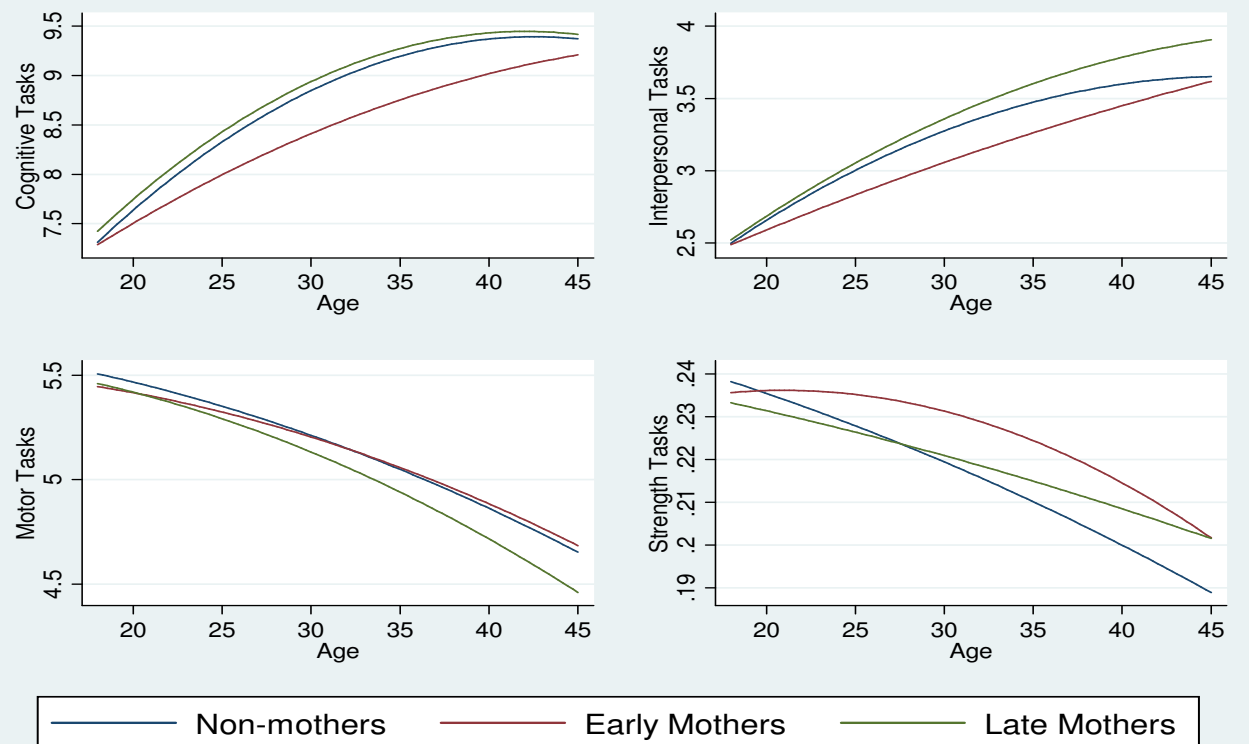

Table 1:
Descriptive Statistics

	All	By Years of Schooling		
		12 or Less	13 to 15	16 or More
Distribution Education (%)		46.7	25.9	27.4
		(49.9)	(43.8)	(44.6)
Black (%)	12.6	13.1	16.6	7.9
	(33.2)	(33.8)	(37.3)	(27.0)
Hispanic (%)	7.1	8.5	8.0	4.0
	(25.7)	(27.9)	(27.1)	(19.7)
White (%)	80.3	78.4	75.4	88.1
	(39.8)	(41.2)	(43.1)	(32.4)
Mothers (%)	80.6	85.9	79.9	72.2
	(39.6)	(34.8)	(40.1)	(44.8)
Number of Children (Mothers)	2.3	2.3	2.2	2.2
	(1.1)	(1.1)	(1.0)	(1.0)
Age at First Birth (Mothers)	24.1	22.2	23.9	28.2
	(5.8)	(5.1)	(5.3)	(5.3)
Sample Size	2,999	1,402	776	821

Standard deviation in parenthesis. Sample includes women from the cross-sectional sample of the NLSY79 who have at least one valid wage observation from 1979 to 2010, and available information to build fertility and actual experience variables. The row "Number of Children (Mothers)" reports for mothers the maximum of number of children aged less than 18 at any survey year from 1979 to 2010.

Table 2:
The Returns to Work Experience For Non-Mothers, Early Mothers, And Late Mothers

	All	By Years of Schooling		
		12 or Less	13 to 15	16 or More
At Least One Child (1st Birth Before Age 25)	-0.0285	-0.0121	-0.0454	-0.0333
	(0.0078)	(0.0093)	(0.0157)	(0.0256)
At Least One Child (1st Birth After Age 25)	-0.0431	-0.0581	-0.0498	-0.0211
	(0.0078)	(0.0118)	(0.0161)	(0.0138)
Accumulated Hours of Work (/1,000)	0.0172	0.0132	0.0152	0.0235
	(0.0010)	(0.0015)	(0.0019)	(0.0022)
Accumulated Hours of Work Squared	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours X 1st Birth Before Age 25	-0.0020	-0.0007	-0.0007	-0.0053
	(0.0009)	(0.0013)	(0.0016)	(0.0022)
Accumulated Hours Squared X 1st Birth Before Age 25	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours X 1st Birth After Age 25	0.0045	0.0034	0.0061	0.0041
	(0.0009)	(0.0015)	(0.0019)	(0.0016)
Accumulated Hours Squared X 1st Birth After Age 25	0.0000	0.0000	-0.0001	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Years of Tenure At Current Job	0.0298	0.0291	0.0296	0.0293
	(0.0010)	(0.0014)	(0.0019)	(0.0021)
Years of Tenure At Current Job Squared	-0.0009	-0.0008	-0.0009	-0.0009
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Years Since Labor Market Entry	0.0260	0.0199	0.0337	0.0242
	(0.0054)	(0.0075)	(0.0108)	(0.0114)
Years Since Labor Market Entry Squared	-0.0006	-0.0007	-0.0004	-0.0003
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Sample Size	38,071	17,113	9,972	10,966

Standard errors in parenthesis. See footnote to Table 1 for sample description. The dependent variable is log hourly wage for a job held at the time of interview. All regressions include dummy variables for years of schooling and calendar year. "At Least One Child" is an indicator variable for women who have at least one child aged 0 to 18 when the wage is reported.

Table 3:
The Returns to Work Experience Before and After the Transition to Motherhood

	All	By Years of Schooling		
		12 or Less	13 to 15	16 or More
a. Returns to Experience Before and After Motherhood				
Accumulated Hours of Work (/1,000)	0.0169	0.0129	0.0161	0.0228
	(0.0010)	(0.0014)	(0.0019)	(0.0021)
Accumulated Hours of Work Squared	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours X 1st Birth Before Age 25	-0.0019	-0.0004	-0.0019	-0.0045
	(0.0008)	(0.0012)	(0.0016)	(0.0021)
Accumulated Hours Squared X 1st Birth Before Age 25	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours Before 1st Birth X 1st Birth After Age 25	0.0112	0.0089	0.0125	0.0110
	(0.0013)	(0.0022)	(0.0030)	(0.0021)
(Accumulated Hours Before 1st Birth)^2 X 1st Birth After Age 25	-0.0001	-0.0001	-0.0002	-0.0001
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Accumulated Hours After 1st Birth X 1st Birth After Age 25	-0.0036	-0.0008	-0.0047	-0.0032
	(0.0010)	(0.0016)	(0.0020)	(0.0018)
(Accumulated Hours After 1st Birth)^2 X 1st Birth After Age 25	0.0001	0.0000	0.0001	0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
b. Returns to Experience Before and After Motherhood, and in the Early Career				
Accumulated Hours of Work (/1,000)	0.0198	0.0102	0.0177	0.0282
	(0.0013)	(0.0020)	(0.0027)	(0.0030)
Accumulated Hours of Work Squared	-0.0001	0.0000	-0.0001	-0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours of Work Before Age 25 (/1,000)	0.0169	0.0181	0.0352	0.0626
	(0.0033)	(0.0047)	(0.0092)	(0.0100)
Accumulated Hours of Work Before Age 25 Squared	-0.0012	-0.0004	-0.0035	-0.0067
	(0.0002)	(0.0002)	(0.0008)	(0.0009)
Accumulated Hours of Work Ages 25 to 35 (/1,000)	-0.0033	0.0000	0.0050	-0.0038
	(0.0016)	(0.0024)	(0.0037)	(0.0041)
Accumulated Hours of Work Ages 25 to 35 Squared	0.0000	0.0000	-0.0003	-0.0001
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Accumulated Hours X 1st Birth Before Age 25	-0.0024	0.0002	-0.0029	-0.0048
	(0.0008)	(0.0012)	(0.0016)	(0.0021)
Accumulated Hours Squared X 1st Birth Before Age 25	0.0000	0.0000	0.0001	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours Before 1st Birth X 1st Birth After Age 25	0.0092	0.0051	0.0099	0.0078
	(0.0014)	(0.0023)	(0.0031)	(0.0023)
(Accumulated Hours Before 1st Birth)^2 X 1st Birth After Age 25	-0.0001	-0.0001	-0.0002	0.0000
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Accumulated Hours After 1st Birth X 1st Birth After Age 25	-0.0034	-0.0001	-0.0044	-0.0027
	(0.0010)	(0.0016)	(0.0020)	(0.0018)
(Accumulated Hours After 1st Birth)^2 X 1st Birth After Age 25	0.0001	0.0000	0.0001	0.0000
	(0.0000)	(0.0000)	(0.0001)	(0.0000)
Sample Size	38,014	17,109	9,947	10,958

Standard errors in parenthesis. See footnote to Table 1 for sample description. The dependent variable is log hourly wage for a job held at the time of interview. All regressions include dummy variables for: years of schooling, calendar year, having at least one child aged 0 to 18 and becoming a mother before age 25, and having at least one child aged 0 to 18 and becoming a mother after age 25. Regressions also include controls for years of tenure and years since labor market entry.

Table 4:
The Returns to Work Experience and Occupational Tasks Requirements

	All	By Years of Schooling		
		12 or Less	13 to 15	16 or More
Cognitive Tasks Requirements	0.0358	0.0236	0.0455	0.0497
	(0.0014)	(0.0020)	(0.0028)	(0.0028)
Interpersonal Tasks Requirements	-0.0168	-0.0186	-0.0258	-0.0128
	(0.0018)	(0.0028)	(0.0036)	(0.0031)
Motor Tasks Requirements	-0.0007	-0.0045	0.0015	0.0028
	(0.0010)	(0.0013)	(0.0019)	(0.0021)
Strength Tasks Requirements	0.1061	0.0313	0.1787	0.0955
	(0.0152)	(0.0209)	(0.0294)	(0.0322)
At Least One Child (1st Birth Before Age 25)	-0.0232	-0.0066	-0.0377	-0.0347
	(0.0079)	(0.0095)	(0.0159)	(0.0256)
At Least One Child (1st Birth After Age 25)	-0.0378	-0.0511	-0.0452	-0.0185
	(0.0078)	(0.0120)	(0.0160)	(0.0137)
Accumulated Hours of Work (/1,000)	0.0169	0.0135	0.0143	0.0229
	(0.0010)	(0.0015)	(0.0019)	(0.0022)
Accumulated Hours of Work Squared	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours X 1st Birth Before Age 25	-0.0024	-0.0010	-0.0018	-0.0048
	(0.0009)	(0.0013)	(0.0016)	(0.0022)
Accumulated Hours Squared X 1st Birth Before Age 25	0.0000	0.0000	0.0000	0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours X 1st Birth After Age 25	0.0046	0.0032	0.0065	0.0042
	(0.0009)	(0.0015)	(0.0019)	(0.0016)
Accumulated Hours Squared X 1st Birth After Age 25	-0.0001	0.0000	-0.0001	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Sample Size	36,458	16,436	9,512	10,510

Standard errors in parenthesis. See footnote to Table 1 for sample description. The dependent variable is log hourly wage for a job held at the time of interview. All regressions include dummy variables for years of schooling and calendar year. "At Least One Child" is an indicator variable for women who have at least one child aged 0 to 18 when the wage is reported. Regressions also include controls for years of tenure and years since labor market entry.

Table 5:
The Returns to Work Experience and Weeks Spent Out of Employment

	All	By Years of Schooling		
		12 or Less	13 to 15	16 or More
Weeks Out of Employment	-0.0006	-0.0006	-0.0007	-0.0007
	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Weeks Out of Employment X 1st Birth Before Age 25	0.0005	0.0005	0.0004	0.0006
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Weeks Out of Employment X 1st Birth After Age 25	0.0002	0.0003	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0001)
At Least One Child (1st Birth Before Age 25)	-0.0135	-0.0069	-0.0249	-0.0063
	(0.0081)	(0.0097)	(0.0170)	(0.0261)
At Least One Child (1st Birth After Age 25)	-0.0284	-0.0330	-0.0264	-0.0249
	(0.0092)	(0.0139)	(0.0190)	(0.0164)
Accumulated Hours X 1st Birth Before Age 25	-0.0052	-0.0033	-0.0029	-0.0097
	(0.0009)	(0.0014)	(0.0018)	(0.0024)
Accumulated Hours Squared X 1st Birth Before Age 25	0.0001	0.0000	0.0001	0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Accumulated Hours Before 1st Birth X 1st Birth After Age 25	0.0104	0.0088	0.0109	0.0095
	(0.0014)	(0.0024)	(0.0031)	(0.0023)
(Accumulated Hours Before 1st Birth)^2 X 1st Birth After Age 25	-0.0001	-0.0002	-0.0002	-0.0001
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Accumulated Hours After 1st Birth X 1st Birth After Age 25	-0.0043	-0.0023	-0.0042	-0.0047
	(0.0011)	(0.0017)	(0.0022)	(0.0020)
(Accumulated Hours After 1st Birth)^2 X 1st Birth After Age 25	0.0001	0.0001	0.0001	0.0001
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Sample Size	34,504	15,935	8,775	9,794

Standard errors in parenthesis. See footnote to Table 1 for sample description. The dependent variable is log hourly wage for a job held at the time of interview. All regressions include dummy variables for: years of schooling, calendar year, having at least one child aged 0 to 18 and becoming a mother before age 25, and having at least one child aged 0 to 18 and becoming a mother after age 25. Regressions also include controls for accumulated hours of work, years of tenure and years since labor market entry.

Table 6:
Birth Related Work Interruptions and Average Changes in Wages and Occupational Tasks Requirements

	All	By Age at First Birth	
		25 Or Less	More Than 25
Log Wage Change	-0.0050	0.0212	-0.0433
	(0.3771)	(0.3535)	(0.4064)
Cognitive Tasks Requirements Change	-0.0539	-0.0041	-0.1289
	(1.9462)	(2.0105)	(1.8439)
Interpersonal Tasks Requirements Change	0.0512	0.0531	0.0483
	(1.2582)	(1.2456)	(1.2778)
Motor Tasks Requirements Change	-0.1708	-0.1803	-0.1565
	(2.1701)	(2.2324)	(2.0740)
Strength Tasks Requirements Change	0.0160	0.0161	0.0158
	(0.1468)	(0.1553)	(0.1331)
Sample Size	1,955	1,162	793
	By Years of Schooling		
	12 or Less	13 to 15	16 or More
Log Wage Change	-0.0028	0.0071	-0.0251
	(0.3460)	(0.3865)	(0.4352)
Cognitive Tasks Requirements Change	-0.0318	-0.1276	-0.0217
	(1.9960)	(1.7774)	(2.0136)
Interpersonal Tasks Requirements Change	0.0554	0.0584	0.0321
	(1.1671)	(1.1500)	(1.5654)
Motor Tasks Requirements Change	-0.1753	-0.2636	-0.0498
	(2.2805)	(2.0480)	(2.0235)
Strength Tasks Requirements Change	0.0138	0.0253	0.0102
	(0.1601)	(0.1363)	(0.1219)
Sample Size	1,032	508	415

Standard deviations in parenthesis. Log wage change is log-wage after birth related work interruption minus log-wage before work interruption. The same applies to each occupational tasks requirements.

Table 7:
Birth Related Work Interruptions and The Impact of Occupational Tasks Requirements Changes on Wages

	All	By Age at First Birth	
		25 Or Less	More Than 25
Weeks Out of Employment	0.0001	0.0004	-0.0004
	(0.0002)	(0.0002)	(0.0004)
Cognitive Tasks Requirements Change	0.0718	0.0664	0.0769
	(0.0147)	(0.0169)	(0.0270)
Interpersonal Tasks Requirements Change	-0.0414	-0.0755	-0.0001
	(0.0194)	(0.0231)	(0.0347)
Motor Tasks Requirements Change	0.0038	0.0019	0.0058
	(0.0081)	(0.0092)	(0.0155)
Strength Tasks Requirements Change	0.2546	0.3593	-0.3448
	(0.1428)	(0.1555)	(0.3073)
Sample Size	1,822	1,095	727
	By Years of Schooling		
	12 or Less	13 to 15	16 or More
Weeks Out of Employment	0.0003	-0.0002	-0.0004
	(0.0002)	(0.0005)	(0.0006)
Cognitive Tasks Requirements Change	0.0634	0.1274	0.0176
	(0.0172)	(0.0342)	(0.0407)
Interpersonal Tasks Requirements Change	-0.0733	-0.0660	0.0538
	(0.0246)	(0.0448)	(0.0557)
Motor Tasks Requirements Change	-0.0009	0.0162	0.0343
	(0.0086)	(0.0188)	(0.0350)
Strength Tasks Requirements Change	0.2268	0.5475	-0.2597
	(0.1515)	(0.3518)	(0.5294)
Sample Size	970	462	390

Standard errors in parenthesis. The dependent variable is log-wage after birth related work interruption minus log-wage before work interruption. All regressions include dummy variables for years of schooling and birth order. Regressions also include controls for years since labor market entry at time of birth.