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EXPLAINING THE MOTHERHOOD WAGE PENALTY DURING THE EARLY OCCUPATIONAL CAREER

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Abstract

Prior research shows that mothers earn lower hourly wages than women without children, and that this maternal wage penalty cannot be fully explained by differences between mothers and other women in work experience and job characteristics. This research examines whether the residual motherhood wage penalty results from differences between mothers and other women in the accumulation of work interruptions and breaks in schooling. Using longitudinal data for 486 women followed from ages 19 to 31 in the Youth Development Study, we find that accumulated months not in the labor force and not enrolled in school explain the residual pay gap between mothers and other women.

The purpose of this article is to attempt to explain why the hourly wages of mothers are approximately 5% lower (per child) than the wages of nonmothers (Avellar and Smock 2003; Budig and England 2001; Gangl and Ziefle 2009; Glauber 2007; Kalleberg, Reskin, and Hudson 2000; Korenman and Neumark 1992; Lundberg and Rose 2000; Neumark and Korenman 1994; Taniguchi 1999; Waldfogel 1997, 1998a, 1998b). The most frequently hypothesized explanation of the motherhood wage penalty is that childbearing and childrearing disrupt the acquisition of formal education and on-the-job training. However, evidence suggests that differences between mothers and other women in educational attainment and work experience do not entirely explain the monetary penalty for motherhood. The effect of motherhood on wages might also be due to employer discrimination or to differences between mothers and other women in work effort. Regarding employer discrimination, a recent audit study showed that prospective employers were less likely to call back mothers for interviews than nonmothers (Correll, Bernard, and Paik 2007). With respect to work effort, Budig and England (2001) did not find that mothers were employed in occupations that required less effort than occupations of nonmothers. However, women may still exert less effort in their jobs after having children in part because mothers are the primary caregivers during childrearing (Sayer, Bianchi, and Robinson 2004).

Longitudinal data from the Youth Development Study, a prospective panel of youths who initially resided in St. Paul, Minnesota during the fall of 1987 (see Mortimer 2003), enable us to observe wage attainments and capital-building activities of 486 women over a 13-year period (i.e., from ages 19 to 31) . We hope to extend understanding of the motherhood penalty through the estimation of models that assess cumulative combinations of capital-building activities in both work and school and cumulative time spent in the absence of such

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capital investment during the early occupational career. We estimate the relationships of hourly wages to within-individual change in number of children, cumulative investments in work and school, local labor market conditions, and educational attainment. The analyses of within-individual change control for all *time-stable* differences between mothers and nonmothers that could render the effects of work experience and family formation on wages spurious. We begin with a review of prior explanations for why motherhood is inversely related to wage attainments.

PRIOR RESEARCH

According to human capital theory (Becker 1985, 1991), parenthood diminishes the hourly wages of mothers because it impedes the development of human capital. Childbearing and childrearing detract from time that could be spent developing job skills, furthering education, or gaining experience in the workforce, especially during the early occupational career (Taniguchi 1999). Furthermore, women who intend to be mothers may invest less in human-capital activities than those who do not (Mincer and Polachek 1974; Polachek 1981). Research shows that mothers do acquire fewer years of schooling and less work experience than other women. For instance, among women in the 1979 cohort of the National Longitudinal Study of Youth (NLSY79), mothers report five months less of full-time work experience and approximately one year less of education than do nonmothers. Full-time and part-time work experience, years of schooling, and employment breaks explain approximately one-third of the wage penalty for motherhood (Budig and England 2001).

Human capital theory also predicts that women with children have lower wages than other women because motherhood makes women less productive at work (Becker 1991). It is well known that women do more housework than men and that the gender disparity in domestic labor is greatest when married women and their spouses have young children (South and Spitze 1994). Mothers may be less productive at work than other women in order to conserve energy for their children or because they are fatigued from combining employment and motherhood. Nevertheless, research shows that mothers are not employed in occupations that require less effort than the occupations of nonmothers (Anderson, Binder, and Krause 2003; Budig and England 2001).

Building upon human capital theory, an additional explanation of the wage penalty maintains that mothers sacrifice their pay for jobs that are compatible with motherhood. For example, mothers may settle for jobs with lower wages after having children if the work schedules are flexible, if the employers provide childcare or insurance benefits, or if the hours of work are part-time. However, the nonstandard work arrangements that some mothers may find appealing are often associated with low-paying jobs. Kalleberg et al. (2000) have found that mothers, not fathers, are more likely to work in jobs that are part-time, temporary, or contingent, but also offer low pay, no health insurance, and no pensions. Although research shows that mothers are more likely to work in part-time jobs than other women (Waldfogel 1997), indicators of mother-friendly occupations and nonstandard work arrangements (e.g., percentage of female workers, self-employment, etc.) explain little of the residual wage penalty for motherhood (Budig and England 2001).

The Current Study

Previous studies of the motherhood wage penalty are primarily based on two cohorts of women who transitioned to young adulthood in the late 1960’s and early 1980’s (Aisenbrey et al. 2009; Avellar and Smock 2003; Budig and England 2001; Gangl and Ziefle 2009; Glauber 2007; Taniguchi 1999; Waldfogel 1997). This study uses a contemporary sample of young women to fully capture family formation behaviors that have arisen in recent years and the potential effects of these changes on the motherhood wage penalty. For instance,

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among recent cohorts of young people, marriage is increasingly delayed (Ventura and Bachrach 2000), cohabitation is more normative (Bumpass and Lu 2000), and women are more likely to be in the labor force than before (Brewster and Rindfuss 2000). In addition, the rate of nonmarital childbearing has increased dramatically in the United States (Amato et al. 2007; Ventura and Bachrach 2000), increasing the prevalence of single parenting. Although cross-cohort comparisons of older cohorts of women find a similar pay gap between nonmothers and mothers (Avellar and Smock 2003), investigations based upon more recent cohorts may find that single parenthood attenuates the motherhood wage penalty, especially because so many single mothers today are the primary financial providers for their children (White and Rogers 2000).

Furthermore, among recent cohorts in the United States, the timing and sequencing of school, work, and family roles during the transition to adulthood are more delayed, disorderly, and variable than ever before, as increasing numbers of young people are postponing marriage and parenthood, continuing their formal educations into young adulthood, and delaying career acquisition (Amato et al. 2007; Mortimer et al. 2008; Rindfuss, Swicegood, and Rosenfeld 1987). Whereas studies of attainment usually consider the first job after leaving school as the start of the socioeconomic career, typically youth combine and alternate school and work over long periods of time (Kerckhoff 2002). Although research shows that part-time work experience has diminishing returns to women's wages, part-time work experience *during school* increases future earnings and the likelihood of a baccalaureate degree (Light 2001; Staff and Mortimer 2007). Thus, mothers may benefit from part-time employment if it also involves the pursuit of post-secondary schooling. Furthermore, the transition from school to work is not unidirectional; many youth return to school after periods of full-time employment (Schoon and Silbereisen 2009; Shanahan 2000). To understand the motherhood penalty among contemporary cohorts of women, this study measures cumulative investments in various combinations of work and school to adequately capture the significant diversity in human capital acquisition during pivotal young adult years.

Aggregate measures of prior work experience do not capture the significant effects of motherhood on work interruptions (Felmlee 1995; Joesch 1994). Approximately 40% of new mothers are employed one month after the birth of their first child, yet only 15% of these mothers are actually at work, and the majority of part-time workers do not return to work after having a child (Klerman and Leibowitz 1999). Research shows that even temporary withdrawals from work can lower wage attainments (Felmlee 1995; Hofferth and Curtin 2006; Jacobsen and Levin 1995) and occupational prestige (Aisenbrey, Evertsson, and Grunow 2009). Although Budig and England (2001) and Gangl and Ziefle (2009) did not find that employment breaks explained the wage difference between mothers and nonmothers, the authors did not measure work interruptions prior to the respondent's first full-time job, the cumulative number of months spent taking time out of the labor market, work interruptions that may have occurred prior to the respondent's first childbirth, or whether the work interruption involved a return to school.[1]

Employment breaks may diminish longer-term socioeconomic attainments by removing mothers from the chain of vacancies within organizational career ladders. Employers may also perceive mothers who have discontinuous work histories as uncommitted to their jobs or to their careers. Though both school attendance and employment are inversely related to

[1]For instance, Budig and England (2001) define employment breaks as the total number of times the respondent was out of employment lasting longer than six weeks since one' s first full-time job of at least six weeks duration. Gangl and Ziefle (2009) measure work interruptions as the total number of months spent out of the labor force while the youngest biological child at home was younger than age six.

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fertility (Budig 2003), an alternative argument is that employment breaks may have little effect on future earnings among mothers who either maintain enrollment in school or who return to school after they have children. In view of these considerations, we assess the time not spent in human capital-building activities, that is, when the women were neither employed nor attending school.

Previous studies have shown that the wage penalty is greater among married than unmarried mothers. Given the dramatic increase in rates of cohabitation among recent cohorts (Oppenheimer 1997), this study considers how both marriage and cohabitation affect the wages of mothers and nonmothers. This study also considers whether the motherhood wage penalty is affected by the spouse or partner's economic contribution to the family. For instance, married and cohabitating women who become mothers may have more choice to work in a part-time job, even if it involves lower wages, because they have the additional financial support of their partners. Among single mothers, motherhood may result in increased motivation for higher earnings given the economic needs of their children. This may also be true of women whose husbands or partners have low earnings or are unemployed.

Finally, within the context of changing family and work roles during the transition to adulthood, the adverse effect of motherhood on wages may reflect preferences for work and for family that are more or less stable over time. For instance, nonmothers may have stronger commitments to work or are more motivated to have successful careers than are women who have children. By contrast, women who have children may place a stronger emphasis on family than do nonmothers (Hakim 2002). To rule out the possibility that earnings and motherhood are spuriously related, due to their joint dependence on preexisting preferences and expectations, this study uses a two-level hierarchical model to estimate the relationships of within-individual changes in hourly wages to within-individual changes in number of children and other explanatory variables (see Allison 2005; Halaby 2003; Raudenbush and Bryk 2002). This approach increases confidence in causal inferences by estimating within-individual changes in wages due to motherhood (or number of children) and other time-varying explanatory variables, while at the same time controlling for all time-stable differences in orientations between mothers and other women.

In summary, this research builds on a strong foundation of theoretical reasoning and empirical research to examine the well documented wage penalty attached to motherhood. Our research differs from prior studies in its capacity to take into account detailed configurations of educational and work activities over a lengthy period of time encompassing the transition to adulthood. It also considers the wage implications of marriage and cohabitation, and husband/partner economic contributions that can heighten or reduce mothers need for high wages.

METHOD

Data

Data for this analysis come from the Youth Development Study (YDS), an ongoing longitudinal study of teenagers and their parents residing in a greater metropolitan area of over 3 million residents. The initial participants in the study were selected from students registered as ninth graders in the St. Paul, Minnesota public school district in the Fall of 1987. At that time, St. Paul, Minnesota was similar to countrywide averages in per capita income and family income, as well as in rates of unemployment and labor force participation (Mortimer 2003; see also Staff and Mortimer 2007). For example, at the beginning of the study (i.e., in 1989) per capita income in St. Paul was $13,727, while in the nation at large it was $14,420. With 16.7% of families below the poverty line in St. Paul, poverty was slightly

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more prevalent compared to the national average of 13%. The labor market in St. Paul was similar to countrywide averages in unemployment (4.1% in St. Paul and the United States) and labor force participation (67% vs. 64% in the country at large). The percentage of non-whites residing in St. Paul was similar to nationwide estimates at the onset of the study (82.3% non-Hispanic white compared to 80.3%). However, a greater percentage of Asian or Pacific Islander (7.1% in comparison to 2.9% nationally) and fewer African Americans (7.4% compared to 12.1%) resided in St. Paul than in the United States overall.

The selected YDS sample also accurately reflects the character of ninth graders in St. Paul at the initiation of the study. In 1988, the selected sample was drawn from all ninth grade students enrolled in the St. Paul School district. The 1,139 parents and their children who consented to participate represented 64% of eligible invited cases. These respondents did not systematically differ in socioeconomic background or racial status from those who refused (based on information from the 1980 U.S. Census tracts of neighborhoods). Participation in the study was not related to family composition, household income, receipt of public assistance, educational and occupational standing, and racial status, although boys and older students were less likely to participate than girls and those who were the same age as most of their classmates (Finch et al. 1991). Approximately 9% of the initially-selected sample were recent Hmong immigrants who required special data collection procedures. Findings from the separate Hmong sample focus on issues of adaptation and acculturation, and have been reported elsewhere (e.g., Hutchison and McNall 1994; McNall, Dunnigan, and Mortimer 1994). Hmong respondents are not included in the analyses reported here.

From 1988 to 1991, questionnaires were administered annually in high school classrooms. Large batteries of questions focused on paid work, school performance, educational aspirations, and behavioral adjustment. The YDS also administered surveys to the respondents parents in the first year of the study to obtain accurate information about socioeconomic status and other family background characteristics (at least one parent responded for 96% of the participating children).

In the 13-year period following high school completion (1992–2004), respondents were mailed annual surveys about their past work experiences, monthly investments in work and school, family formation behaviors, and residential arrangements. Respondents completed up to 11 follow up surveys at ages 19, 20, 21, 22, 24, 25, 26, 27, 29, 30, and 31. Men are excluded from the analyses presented here because men do not suffer a wage penalty for fatherhood (Correll et al. 2007; Lundberg and Rose 2000). We also exclude 15 women from the study who were not employed at any point during the 13-year period. Approximately 81% of female panel members participated through the 2004 survey, when the respondents were 31 years of age. Socioeconomic background, educational promise in the ninth grade, family structure, mental health, and delinquency did not significantly predict survey completion in 2004, although white women were more likely than non-white women to complete the last survey (results not shown but available upon request; see also Staff and Mortimer 2007). Importantly, as we describe more fully below, our strategy of analysis does not require observations across all waves of the study (Raudenbush and Bryk, 2002). Thus, a woman does not have to be present in our study through age 31 to be included in the analyses.

Measures

The surveys recorded hourly wages, family formation behaviors, educational attainment, work experience, and local labor conditions yearly from 1992 to 2004, except during the years 1996 and 2001 when no surveys were obtained. However, the surveys recorded prior work experience in both full and part-time jobs monthly via life history calendars during the entire 13-year observation period, including work experiences accumulated during the years

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1996 and 2001. Table 1 provides descriptive statistics for non-mothers and mothers (before and after first birth) based on the pooled data set (including 3,263 occasions of measurement in the person-year data set from 1992 to 2004).

Although not shown in Table 1, 9% of women in the pooled sample are African American, 5% Hispanic, 77% White, and 9% other race (including multi-race). Approximately 94 percent of respondents were born in the United States, 71% resided in a two-parent family at the onset of the study (1988), and 20% of the respondents mothers had received a four-year college degree or higher by 1988.

Wage attainments—During each survey year from 1992 to 2004, respondents reported their hourly wages in their current jobs from ages 19 to 31 with the exception of ages 23 and 28. We adjusted the hourly wage rate to the value of a dollar in 1992 (age 19) and used the natural logarithm to transform the wage rate. To minimize the influence of outliers, we deleted a small number of cases (less than 1%) each year when respondents reported earning more than 5 times the median wage. Bottom-coding was not applied to the wage variable. If a respondent was employed in a full-time and part-time job, we considered only the wages of the full-time job. In addition, we coded the wages of respondents who were not working during a particular year as missing during that year only. Thus, we still included in the analysis women who were not continuously employed during the survey period. As mentioned before, 15 women were not employed at any point during the survey period and are not included in the analyses. As shown in Table 1, the average hourly wage rate during the observation period was $7.77 (i.e., exp[2.05]) for non-mothers and $7.46 for mothers (before and after first birth). Though not shown, mean hourly wages increased from ages 19 to 31. For example, in 1992 (age 19) the mean wage rate for working women was $4.79 per hour (s.d.= 1.22); by 2004 (age 31) it had increased to $11.75 (s.d.=4.84).

Number of children—The survey asked respondents each year whether they currently had children and the dates of birth for each child. We created time-varying measures of number of children based on this information. We verified the date(s) of childbirth with prior surveys to ensure accuracy. Because less than 1% of mothers had four or more children, number of children ranged from *0* to *3 or more children*. Overall, the average number of children during the response period was 0.62. Note that Gangl and Ziefle (2009), using data from the NLSY79, reported a similar average number of children (i.e., 0.69) in their analyses.

Union formation—Because increasing numbers of women today have children outside of marriage and cohabit (Bumpus and Lu 2000; Wu, Bumpass, and Musick 2001), a time-varying measure of whether the respondent was married or cohabiting is included.

Accumulated months of work and school—Work experience measures are based on monthly records of part-time and full-time employment from the spring of 1991 (the scheduled date of high school graduation) to the fall of 2004. Six mutually exclusive combinations of work and school represent the respondent's human capital investment each month. "Part-time work" references employment of less than 35 hours per week while neither attending school nor working full-time. "Full-time work" involves working 35 or more hours per week with no school attendance. "Full-time work during school" signifies school attendance combined with working 35 or more hours per week. Likewise, "part-time work during school" involves attending school but working less than 35 hours. "School only" indicates attendance in school during a particular month while not working full-time or part-time. Finally, a category indicating "no work or school" indicates no school attendance and no employment during a particular month. From yearly intervals from the Spring of 1991 to the Fall of 2004, the *cumulative* number of months was calculated for each

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of the six combinations of post-secondary schooling and work. For example, the mean cumulative months of full-time work experience in the absence of school, across all years of observation, was 37.

Part-time work status—During each year we coded the average hours of work as either *1* (part-time work) or *0* (full-time work). As Table 1 shows, women on average reported working in part-time jobs (i.e., less than 35 hours per week) during approximately 33% of the 13-year period.

Highest educational degree—In prior research on the motherhood wage penalty, educational attainment is measured based upon the respondent's years of education (Anderson et al. 2003; Avellar and Smock. 2003; Budig and England 2001; Gangl and Ziefle 2009; Glauber, 2007; Taniguchi,1999; Waldfogel 1997). However, a relatively large number of youth today attend college but do not earn a degree (only 57 percent of youth who initially enter four-year colleges receive a degree within six years; Knapp, Kelly-Reid, and Ginder 2010). Using "years of education" as a proxy for educational attainment may miss young people who are comprising this growing subbaccalaureate population (Kerckhoff 2002). Instead, our measure of educational attainment is comprised of eight dummy variables recorded yearly: (a) High school dropout; (b) High school graduate (reference category); (c) Some college attended but no certificate or degree; (d) Vocational degree or technical certificate; (e) Associate's degree; (f) Baccalaureate degree; (g) Master's degree; and (h) Ph.D. or professional degree. We also included a time-varying measure of whether the respondent had attended school in the prior year (coded 1=yes; 0=no).

Local labor market conditions—The local labor market may influence both the likelihood of employment and of earnings. To measure local labor market conditions, we first obtained local area unemployment statistics that the U.S. Department of Labor derived from zip codes recorded yearly. We then linked these local unemployment statistics to the respondents addresses each year during the 13-year period.

Strategy of Analysis

This study uses a two-level hierarchical model (Raudenbush and Bryk 2002) to estimate the effects of within-individual changes in family formation behaviors, work experience, educational attainment, and labor market conditions on changes in log wages. This strategy of analysis has two primary advantages. First, this model addresses selection processes by using an analysis of within-individual changes to control for all time-stable individual differences (see Halaby 2003). Second, the hierarchical model is suitable for data sets in which respondents do not provide data for some occasions (Raudenbush and Bryk 2002). Importantly, women who are not continuously employed during the duration of the study still contribute to the analyses.

The two-level hierarchical model treats multiple observations over time as nested within persons. In our study, the first level of the hierarchical model estimates log wage rates as a function of variables referencing time and time-varying covariates. In the second level, the first-level parameters become outcome variables; as a result, the level-2 parameters address the between-person variation in change.

The general form of the level-1 model can be written as:

$$Y_{it}=\beta_{0i}+\beta_{1i}T_{it}+\beta_{\mathrm{X}i}X_{it}+e_{it} \quad (1)$$

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where Y is the log wages for individual i at time t, and parameters β are specific to each individual i. β_{0i} refers to the individual's log wages when $t = 0$ (i.e., during the year immediately following the scheduled date of high school graduation), β_{1i} is her rate of change in log wages per year, T represents year, and β_{Xi} is the influence of time-varying explanatory variables X (e.g., number of children, educational attainment, cumulative combinations of capital-building activities, and family formation behaviors) that may affect log wages for individual i at time t.

The initial level-2 equations are written as:

$$\beta_{0i}=\gamma_{00}+u_{0i} \quad (2)$$

$$\beta_{1i}=\gamma_{10}+u_{1i} \quad (3)$$

$$\beta_{xi}=\gamma_{x0} \quad (4)$$

where γ_0 indicates mean log wages for the population when year equals 0, γ_1 indicates the estimated mean rate of change per year, and γ_x indicates the estimated effect of time-varying variables on log wages. Unlike traditional "fixed-effects" models, our hybrid models include person-specific random slope effects (Allison 2005). In this illustration, u_{0i} and u_{1i} indicate the individual variation around the intercept and linear components, or the deviations between women from the mean growth trajectory in log wages during the 13-year period. Because Equation 4 has no residual term (u), the coefficients for the effects of the time-varying measures in Equation 4 (β_x) are fixed rather than random at the second level. Preliminary analyses show that adding random coefficients did not improve the fit of the model (not shown but available upon request).

The effects of the time-varying covariates may be biased and inconsistent if they are associated with residual person-level factors that influence the outcome variable (Halaby 2003:518–523; Raudenbush and Bryk 2002:183). To minimize this potential source of bias, we included the individual means from each time-varying covariate, ($\overline{X_i}$), as predictors in the level-2 intercept equation. The resulting level-2 intercept equation is then written as:

$$\beta_{0i}=\gamma_{00}+\gamma_{0x}\overline{X_i}+u_{0i} \quad (5)$$

where γ_{0x} reflect the effects of between-person differences in time-varying covariates. The inclusion of $\overline{X_i}$ in Equation 5 limits the estimates of the time-varying variables (β_{xi}) on log wages to within-person changes. This hybrid model, when it assesses within-individual changes in number of children and wage attainments, controls for all time-stable differences in orientations and preferences between mothers and other women, and thus "yields the same estimators of key parameters as a fixed effects model" (Halaby 2003:519). Note that the coefficients in the level-2 equation (γ_{0x}) are not of interest in their own right, as their main purpose is to control for time-stable observed and unobserved factors when estimating the effects of time-varying predictors on wage attainments.

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RESULTS

Table 2 presents a series of unstandardized coefficients for within-individual regressions of log hourly wages on number of children estimated by using the two-level hierarchical model presented above on the pooled data set (1992–2004). Model 1 included a time-varying measure of number of children. Subsequent models included time-varying measures of union formation (Model 2); educational attainment, cumulative full-time and part-time work experience, local labor market conditions, part-time work status, and current student status (Model 3); and cumulative months of school only, work during school, and neither school nor work (Model 4). In addition, Table 2 shows the non-linear effects of age on log wages; hourly wages increased during young adulthood, with some evidence of a slowdown subsequently. To control for unobserved differences between mothers and nonmothers, all of the models reported in Table 2 include the mean values of each explanatory variable ($\overline{X_i}$) as predictors of the intercept component, thus limiting the models to analyses of within-individual change (estimates not shown in Table 2 but available upon request). [2] Furthermore, in all our models, the variance components showed statistically significant variation in rates of change over time.

As shown in Model 1 of Table 2, mothers paid a 6% penalty to their hourly wages per child ($\gamma = -0.057$, s.e. = 0.013, $p < 0.001$).[3] In Model 2, we included an indicator of union formation (i.e., marriage or cohabitation). Women's wages increased by approximately 4% when they married or cohabitated (Model 2), in comparison to when they were single, though the inclusion of union formation does not diminish the motherhood wage penalty. In other analyses, we did not find that the inclusion of marriage and cohabitation as separate variables explained more of the motherhood wage penalty than the combined measure of marriage or cohabitation shown in Model 2, nor was the effect of marriage stronger on wages than cohabitation ($\gamma = 0.033$, s.e. = 0.019, for marriage; $\gamma = 0.027$, s.e. = 0.015, for cohabitation). We also did not find that union formation conditioned the effect of number of children on wages. We also considered whether the motherhood wage penalty was affected by the spouse or partner's economic contribution to the family. Each year, married and cohabiting respondents reported whether their spouse or partner was attending school, unemployed and looking for work, in the military service, a full-time homemaker, working part-time (less than 35 hours per week), or working full-time (35 hours or more per week). In analyses not shown, during each year we categorized married or cohabiting respondents by five dummy variables: (a) Spouse employed full-time or in military; (b) Spouse employed part-time; (c) Spouse not employed and attending school; (d) Spouse unemployed; and (e) Spouse full-time homemaker. Though not shown in Table 2, the inclusion of these variables did not explain the effect of number of children on wages ($\gamma = -0.054$, s.e. = 0.013, $p < 0.001$), though women earned significantly higher hourly wages when their spouse or cohabitating partner was employed full-time ($\gamma = 0.046$, s.e. = 0.019, $p < 0.01$), compared to when they were single.[4]

[2]Because the slope parameters in our two-level hierarchical models were specified as random, in supplemental analyses, we included the individual means from each time-varying covariate $\overline{X_i}$ as predictors in the level-2 slope equation to assess whether unobserved slope-effects might be biasing our findings (Halaby 2003:522–523). Introducing $\overline{X_i}$ to the slope equations did not substantively change the findings we report in this paper, and thus were not included in the models shown in Tables 2 and 3.

[3]In analyses not shown, the inclusion of the number of children squared in Model 1 was not statistically significant ($p > .10$). We also included dummy variables to assess whether the effect of number of children on wages was non-linear. We found that women's wages declined by 3% for one child, by 10% for two children, and by 22% for 3 or more children. Consistent with recent research (Budig and England 2001:217), number of children has a monotonic and essentially linear effect on the hourly wages of women.

[4]This finding might be due to women having a higher reservation wage (i.e., the point at which they are willing to return to the labor market) when their spouse or cohabitating partner is employed full-time compared to when they are single. We thank an anonymous reviewer for this interpretation.

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Returning to Table 2, the inclusion of measures of human capital development, local labor market conditions, part-time work status, and current student status in Model 3 explained approximately half of the remaining effect of number of children on wages ($\gamma = -0.026$, s.e. = 0.013, $p < 0.05$). Like researchers before us (Anderson et al. 2003; Avellar and Smock 2003; Budig and England 2001; Gangl and Ziefle 2009; Waldfogel 1997), we find that the hourly wages of mothers are approximately 3% lower (per child) than the wages of nonmothers, even after controlling human capital variables and time-stable sources of unobserved heterogeneity. Educational attainment substantially increased wage attainments, especially when the respondent acquired a baccalaureate, master s, Ph.D., or other professional degree, compared to when they held a high school degree (the reference category). Women's wages also increased as they accumulated months of both full-time and part-time work experience in the absence of schooling, though the coefficient for "months full-time work experience squared" ($\gamma = -0.000027$, s.e. = 0.000007, $p < .001$) suggests that cumulative full-time work experience has diminishing returns to women's wages. With each additional month of cumulative part-time work experience in the absence of school, women's hourly wages increased by approximately .3% (i.e., $\gamma = .003$). In other analyses (not shown), we did not find non-linear effects of part-time work experience on wages. Women also earned lower wages when the local unemployment rate was high. Though women's wages increased when they accumulated both part-time and full-time work experience, part-time employment in a given year, compared to full-time employment, reduced wages by approximately 7.5%. In other analyses, we examined whether the effect of motherhood on wages varied by educational level, which would be the case if women with higher levels of education work in jobs that require more effort (Anderson et al. 2003). We also considered whether prior work experiences conditioned the effects of motherhood on wages. In the analyses (not shown), these interaction effects were statistically non-significant ($p > 0.10$).

Unlike previous research, in Model 4 we included measures of cumulative work experiences during periods of schooling and accumulated months of neither formal work nor school to account for school breaks and work interruptions. The inclusion of these measures reduced the effect of number of children on wages from $\gamma = -0.026$ to $\gamma = -0.007$, rendering the coefficient statistically non-significant. As shown in Model 4, women's wages not only increased when they accumulated full-time work experience, but also when they accumulated months of combined part-time work with school. The fact that educational attainment is controlled in these analyses suggests that combining *part-time work* and schooling has a net positive effect on wages independent of the certification or degrees that result from these spells of education and work. Educational attendance coupled with *full-time work*, however, confers no such advantage.

Women's wages decreased by approximately .5% when they accumulated breaks in their human capital investments (i.e., no schooling or employment). For instance, women's wages declined by 3.5% when they accumulated seven months of no work and school (i.e., the average over the study period). At 22 months of accumulated no work and school (one standard deviation above the mean), wages declined by 11%, holding all other variables constant.

In an alternative set of analyses, we considered whether some of the time-varying measures we included in Table 2 were more useful than others in explaining why the hourly wages of mothers are approximately 5.7% lower (per child) than the wages of nonmothers. Figure 1 indicates the percentage change in the coefficient from the regression of log wages on number of children when we added each of the covariates separately in a series of models. As this figure shows, the cumulative months of no work and no school alone explained

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approximately 60% of the motherhood wage penalty, and reduced the effect of number of children on log wages to statistical non-significance ($\gamma = -0.023$, s.e.= 0.012, $p = 0.061$).

In an additional set of analyses, we considered whether alternative measures of employment breaks and career interruptions used in previous research explained the motherhood wage penalty, as well as our measure of cumulative months of no work and school. For instance, when we included a measure of cumulative months of not working (irrespective of whether the respondent was attending school), the effect of number of children on log wages was reduced but remained statistically significant ($\gamma = -0.036$, s.e. = 0.013, $p = 0.007$). In additional analyses we added the following time-varying measures separately in a series of models: (1) cumulative months of unemployment (i.e., not currently working but looking for work); (2) cumulative number of times respondents were not working for one or more months in a given year (irrespective of their school attendance); (3) cumulative number of times respondents were not working for four or more months during a given year (also irrespective of school attendance);[5] and (4) cumulative number of times respondents were not working for one or more months after they had worked in a full-time job for more than one month. When we included each of these time-varying variables separately in a series of models, the effect of number of children on log wages ranged from $\gamma = -0.041$ to $\gamma = -0.053$ and remained statistically significant ($p < 0.01$). Thus, we still observed a statistically significant wage gap when we used the same measures as past research (e.g., counts of interruptions rather than months, employment breaks that occur after the respondent's first full-time job, etc.). The fact that the effects of these variables in the YDS panel are similar to those observed in other studies reduces the concern that our results are unique to this particular data set.

Do these findings mean that human capital investments for mothers substantially change after birth, or do women anticipate becoming mothers and adjust their human capital investments accordingly? Whereas most prior research assumes that a baby is born and mothers drop out of the labor force (or work intermittently thereafter), women who plan to become mothers (particularly in the context of traditional families) may invest less in both schooling and work, assuming that human capital acquisition is less important to them than it is for women who do not plan to become mothers. Our measures consider cumulative work and school investments, as well as "time out" since leaving high school. Thus, the cumulative patterns of human capital investments may be a consequence of striving (as well as various opportunities and constraints).

To partly address this issue, Figure 2 shows the percentage of months from 1991 to 2004 spent in each category of work and school experiences for: (1) mothers before the first birth; (2) mothers after the first birth; and (3) women who remained nonmothers throughout the observation period. The y axis in Figure 2 indicates percentage of months (of total months in each of the three states) to make the numbers comparable. As shown in Figure 2, the profile of mothers before the first birth looks very much like that of the nonmothers. It is especially noteworthy that before the first birth the mothers-to-be spent just 10% of their time in the no work and no school state; after the first birth, they spent 21% of their time in this state. In comparison, those who remained nonmothers to the age of 31 spent 6% of their time not working and not attending school. Though 6% versus 10% is a substantial difference, it is dwarfed by the difference between the mothers before (10%) and after (21%) the first birth. This pattern suggests that mothers-to-be are not lessening their investments in human capital

[5]In this measure of employment interruptions, we counted only breaks of four or more months to account for a possible three-month maternity leave among working mothers. Nonetheless, it is difficult to say with certainty whether working mothers had taken a paid or unpaid maternity leave.

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(in school, work, and the combinations of school and work) in anticipation of being out of the labor force.

To further illustrate this point, in a final set of analyses we considered whether accumulated months of no work and no school *after* first birth explained more of the motherhood wage penalty than cumulative months when childless. As shown in Table 3, the main effect of number of children on log wages (Model 1) increased when we included cumulative months of no work and no school when women were childless (Model 2). However, when we included cumulative months of no work and no school after first birth (Model 3), the effect of number of children on log wages was reduced substantially to statistical non-significance ($\gamma = -0.023$, s.e.= 0.013, $p = 0.074$).

DISCUSSION

To understand the motherhood penalty in a recent cohort of women, characterized by some scholars as experiencing a more disorderly sequencing of work, family, and school roles than earlier cohorts (Buchmann 1989; Rindfuss 1991; Rindfuss et al. 1987; Schoon and Silbereisen 2009; Shanahan 2000), this study measured cumulative investments in various combinations of work and school to adequately capture the diversity in human capital acquisition during the pivotal young adult years. We created measures of the cumulative number of months spent taking time out of the labor market and school, as well as part-time and full-time work experience that occurred during periods of schooling. We found that wages are not lower after women accumulated schooling while they were out of the labor force (Light 2001; Staff and Mortimer 2007); their wages declined only when employment breaks coincided with breaks in post-secondary schooling. In fact, the cumulative time spent in activities that do not involve human capital acquisition (no work and no school) was the most important single mediator of the motherhood wage penalty. When we considered jointly the time spent in employment and schooling, we explained the gap in pay between mothers and nonmothers.

Why does cumulative time out of school and the labor force, in particular, lead to a motherhood wage penalty? One plausible reason is that women who are planning to leave the labor force will invest less in on-the-job training or schooling than other women (Mincer and Polachek 1974; Polachek 1981). Moreover, women who plan to take years out of work for motherhood may initially select occupations in which their human capital may have lower depreciation over those jobless periods. Occupations that rely on human capital with low depreciation, such as office and clerical positions, tend to pay lower wages than those with high depreciation. However, our analyses indicate that women do not necessarily forego human capital investment in anticipation of becoming mothers; instead, their more disadvantageous pattern of time use, with respect to wage growth, occurs primarily after they become mothers. Mothers may also work in jobs that have lower wages but are otherwise “mother-friendly” (i.e., part-time hours, flexible schedules). If mothers are indeed more likely to want these job conditions than nonmothers, primarily because they are the primary caregivers during childrearing (Sayer et al. 2004), employers may simply lead them to jobs that entail fewer hours and also lower pay.

An alternative explanation is that employers are discriminating against mothers. Correll and colleagues (2007) found that students who evaluated fictitious applicants for a marketing position were less likely to hire mothers. They also offered mothers starting salaries that were lower than those they offered nonmothers partly because mothers were perceived as less committed to paid work and less competent relative to other employees in similar positions in the company (Browne and Kennelly 1999; Correll et al. 2007). Because the present study focuses on the wages of working mothers and nonmothers, it may have even

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underestimated the effect of employer discrimination on mothers economic attainments. Employers may not only pay mothers less than nonmothers, they also may be less willing to hire them for new positions. The present study does not allow us to directly measure whether the employers are actually discriminating against mothers by offering them jobs with lower wages. As a result, understanding the proximal dynamics that produce the maternal wage penalty awaits further research.

Why does our model explain more variance than models used in previous research? We argue that past research could not fully account for the motherhood wage penalty because it lacked finely-grained measures that were sensitive enough to capture time out of school and the labor force. Our inclusion of variables in this study reflecting more nuanced patterns of human capital acquisition fully explained the gap in pay between mothers and nonmothers. Previous studies that have included measures of work interruptions (Budig and England 2001; Gangl and Ziefle 2009) do not capture interruptions prior to the first childbirth or the first full-time job, nor do they account for time out of *both* school and work. Prior to their first birth mothers spent 10% of months not in school or work, compared to 6% among women who did not have children. In addition, 22% of work interruptions in our study occurred prior to the respondent's first full time job. However, counts of interruptions fail to capture the duration of time that is not spent in the labor force or in school.

Our study does have some notable limitations. First, women in our study are followed up to the age of 31. Since only 35% of the person/wave observations in our sample are of mothers, the data are skewed towards a young, largely childless sample. Nonetheless, as more waves of data are collected in the YDS, we can observe whether the wage penalty increases at older ages when the disadvantages of taking time out of the labor force may accumulate. Second, because our study is based on a panel originating in St. Paul, MN, future studies should examine whether more nuanced measures of human capital acquisition explain the motherhood penalty in nationally representative samples of young adults. Third, our analyses do not control for *time-varying* unobserved differences between mothers and other women, and future research with analyses using instrumental variables may gain greater leverage on the possibility that motherhood and wage attainments are related to preferences for work and for family that change over time.

In summary, though prior research shows that differences between mothers and other women in work experience and job characteristics do not entirely explain the wage penalty for motherhood, this article supports the contention that work interruptions and breaks in schooling, as well as work experiences during schooling, explain the remaining wage gap. As the context of childrearing no longer necessarily includes a partner who contributes economically, and wives income becomes increasingly important to the family's economic welfare (White and Rogers 2000), research must continue to address alternative explanations of the wage penalty for motherhood.

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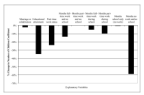

Figure 1.
Percentage Change in the Regression Coefficient Predicting Log Wages from Number of Children when each Covariate is included Separately

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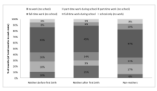

Figure 2.
Percentage of Months Spent in Work and School Experiences through the Observation Period for Mothers before the First Birth, Mothers after the First Birth, and Nonmothers

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Table 1

Descriptive Statistics of Pooled Sample (1991–2004)

	Mothers (before and after first birth)		Non-Mothers	
	Mean or %	**SD**	**Mean or %**	**SD**
Wages (log)	2.01	.44	2.05	.47
Motherhood				
Number of children	.97	1.03	.00	.00
No children	43%		100%	
One child	28%		0%	
Two children	18%		0%	
Three or more children	11%		0%	
Married or cohabitation	32%		60%	
Accumulated Months of Work and School				
Cumulative months full-time work and no school	37.21	33.65	37.14	34.86
Cumulative months part-time work and no school	12.36	15.58	9.34	10.19
Cumulative months full-time work during school	5.81	10.44	7.11	10.97
Cumulative months part-time work during school	12.42	14.57	19.50	16.99
Cumulative months school only (no work)	4.34	7.71	6.29	10.07
Cumulative months no work and no school	9.44	16.66	2.65	5.30
Current Job Characteristics				
Part-time work status (vs. full-time)	33%		33%	
Educational Attainment				
Less than high school	1%		2%	
High School or GED	27%		15%	
Some college	14%		6%	
Vocational degree	8%		5%	
Associate’s degree	37%		38%	
Baccalaureate degree	11%		29%	
Master’s degree	2%		4%	
Ph.D. or professional degree	<1%		1%	
Currently in school	37%		50%	
Unemployment Rate	3.43	1.17	3.67	1.52
Year	5.27	3.14	5.09	3.08
Number of respondents	323		163	
Number of respondent-years	2,078		1,185	

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Table 2

Unstandardized Coefficients from Within Individual Regressions of Hourly Wages (log) on Number of Children and Explanatory Variables

Time-varying covariates	Model 1	Model 2	Model 3	Model 4
Number of children	−.057 *** (.013)	−.056 *** (.013)	−.026 * (.013)	−.007 (.013)
Married or cohabiting (vs. not married or cohabiting)		.042 ** (.016)	.021 (.015)	.021 (.015)
Less than high school (vs. high school)			.001 (.063)	−.036 (.061)
Vocational degree			.077 * (.032)	.078 * (.032)
Some college			.047 * (.021)	.046 * (.021)
Associate's degree			.111 ** (.038)	.085 * (.038)
Baccalaureate degree			.228 *** (.038)	.186 *** (.040)
Master's degree			.458 *** (.087)	.381 *** (.091)
Ph.D. or professional degree			.452 *** (.095)	.364 *** (.096)
Cumulative months full-time work and no school			.005 *** (.001)	.005 *** (.001)
Cumulative months full-time work and no school^2			.000 *** (.000)	.000 *** (.000)
Cumulative months part-time work and no school			.003 * (.001)	.002 (.001)
Local unemployment rate			−.012 * (.005)	−.011 * (.005)
Working part-time (vs. full-time)			−.075 *** (.017)	−.075 *** (.017)
Attending school (vs. not attending school)			−.015 (.015)	−.024 (.015)
Other work and school experiences				
Cumulative months school only (no work)				.002 (.002)
Cumulative months full-time work during school				.002 (.001)
Cumulative months part-time work during school				.003 * (.001)
Cumulative months no work and no school				−.005 *** (.002)
Age	.097 *** (.003)	.095 *** (.003)	.039 *** (.007)	.039 *** (.010)
Age* Age	−.002 * (.001)	−.002 * (.001)	.000 (.001)	.001 (.001)

Note. Numbers in parentheses are standard errors;

*** $p < .001$,

** $p < .01$,

* $p < .05$; sample size = 486 respondents (3,263 occasions)

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Table 3

Unstandardized Coefficients from Within Individual Regressions of Hourly Wages (log) on Number of Children and Cumulative Months No Work and No School

Time-varying covariates	Model 1	Model 2	Model 3
Number of children	−.057 *** (.013)	−.068 *** (.014)	−.023 (.013)
Cumulative months no work and no school when childless		−.007 (.004)	
Cumulative months no work and no school during motherhood			−.008 *** (.001)
Age	.097 *** (.003)	.100 *** (.003)	.101 *** (.003)
Age* Age	−.002 * (.001)	−.002 ** (.001)	−.002 ** (.001)

Note. Numbers in parentheses are standard errors;

*** $p < .001$,

** $p < .01$,

* $p < .05$; sample size = 486 respondents (3,263 occasions)