

**The Effect of Maternal Employment on
Adolescent Development**

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ABSTRACT

The sharp rise in maternal employment in the recent decade may have unintended consequences for child development. Previous research has shown the negative impacts of maternal employment during early childhood on child cognitive development. However, no studies have investigated the long term effects of maternal employment. This study fills this void and investigates the effect of maternal employment on adolescent youth (age 12-16). Following Christopher Ruhm's model, this paper analyzed 1444 youth using the 1997 National Longitudinal Survey of Youth. Results show no negative impact of maternal employment on child development. However, sex, race, child health, family income, parents' education, and family environment were significant factors in determining child outcome.

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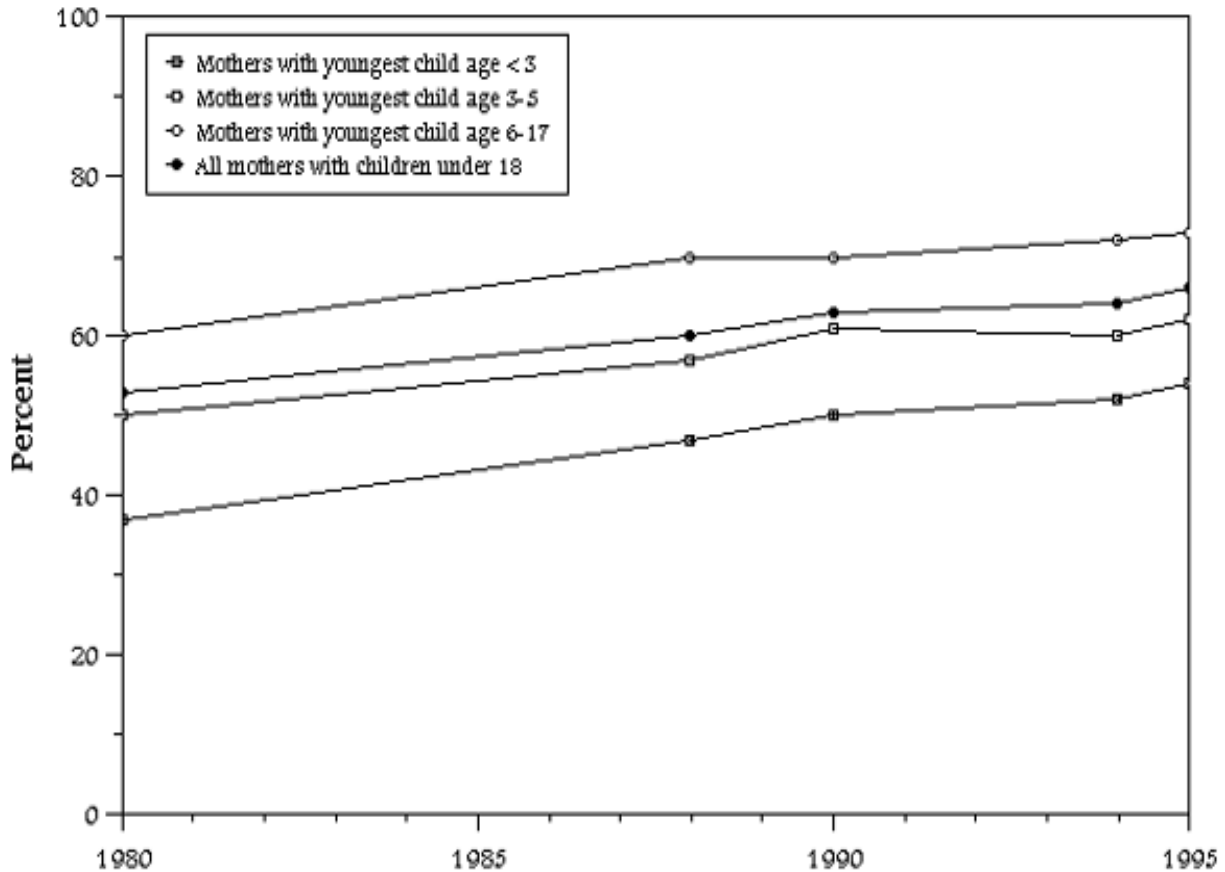
Abstract

The sharp rise in maternal employment in the recent decade may have unintended consequences for child development. Previous research has shown the negative impacts of maternal employment during early childhood on child cognitive development. However, no studies have investigated the long term effects of maternal employment. This study fills this void and investigates the effect of maternal employment on adolescent youth (age 12-16). Following Christopher Ruhm's model, this paper analyzed 1444 youth using the 1997 National Longitudinal Survey of Youth. Results show no negative impact of maternal employment on child development. However, sex, race, child health, family income, parents' education, and family environment were significant factors in determining child outcome.

I. Introduction

Maternal employment is now the norm in the United States. Fifty-six percent of married mothers with a child under age 1 are employed, 61% of those with a child aged 1, and 62% with a child aged 2. (U.S. Department of Labor, 2000). These numbers illustrate the sharp increase in early maternal employment during the recent decades: more mothers with young children participate in the labor force than ever before (figure 1). In 1960, less than 20% of mothers with preschool-aged children (under age 6) were working, but by the 1990s, this proportion had increased to about 60% (Leibowitz and Klerman, 1995). These percentages represent a major change in how children and infants are cared for in early childhood and may potentially have a detrimental effect on the development of these children.

Figure 1: Trends in the percentage of working mothers by child's age



The sociology and psychology literatures have pointed out the importance of the first years of a child's life to development because it is in this critical period that a child develops a sophisticated cognitive conception of objects and people (Shonkoff, 2000; Barnett, 1994; Campbell, 2001). Since the first few years are so critical to cognitive development, there are two pathways in which maternal employment could potentially be detrimental. First, participation in the labor force decreases the quantity of time a mother spends with her child. Second, employment may decrease the quality of time spent with the child (Bianchi, 2000), especially if the mothers work long hours and are subject to job stress, fatigue, and overload.

Conversely, maternal employment may also have indirect positive effects on children by increasing family income (Dahl, 2005). Increased family income would improve the social-economic status¹ (SES) of the family and enhance child development by enabling the family greater financial resources with which to purchase child development inputs such as books and educational trips (Blau, 1999). Furthermore, London (2004) found that women who are employed tend to have higher self-esteem. This may translate to better quality maternal care and could offset the negative impact of reduced hours spent at home.

Over 74 studies have been published between 1990 and 2000 addressing the relationship between a family's social-economic status and child achievement. In almost all these studies, it was found that maternal work hours were associated with negative child

¹ Overall home environment includes factors such as safety, access to books and computers, etc.

outcomes, while the extra income from maternal employment was associated with positive child outcomes (Sirin, 2005). Additionally, a recent study done by Christopher J. Ruhm (2004) investigated the interaction between these two competing factors. Using 1979-1998 data from National Longitudinal Survey of Youth 79 (NLSY79), Ruhm found that the effects of maternal employment differed greatly by SES: positive outcomes were found for low SES families, while negative outcomes were found for high SES families.

Studies conducted thus far have only focused on the effect of maternal employment on early child development (age 1-11). None of these studies have investigated the long term effects of maternal care, defined in this study as effects on children up to age 13-16. This study fills this void by using the new 2005 National Longitudinal Survey of Youth 97 data (NLSY97). The original contribution of this paper is to study of the effects of maternal employment, both present and past, on adolescent children.

The remainder of the paper is organized as follows. Section II presents a review of the literature and explains how this study expands upon existing studies. Section III describes the model and theoretical framework, and section IV describes the data used. I present and discuss the analysis and empirical results in sections V. Section VI concludes.

II. Literature Review

The effects of maternal employment on child achievement have been widely studied (Ruhm, 2004a; Ruhm, 2004b; Waldfogel, 2002; Baum, 2003) in the psychology, sociology, and economics literature. Many of these studies (Ruhm, 2004a; Ruhm, 2004b; Waldfogel, 2002; Baum, 2003) use the National Longitudinal Survey of Youth 79 and

employ the Peabody Picture Vocabulary Test (PPVT), the Peabody Individual Achievement Tests of Mathematics (PIAT-M) and the Peabody Individual Achievement Reading Recognition (PIAT-R) to assess child achievement². Similarly, there is a wide array of literature investigating the effects of income on child achievement (Duncan, 1997; Blau, 1999; Sirin, 2005; Dahl and Lochner, 2005).

These employment and income studies generally indicate a deleterious impact for maternal labor supply (Waldfogel et al., 2002; Baum, 2003; Ruhm, 2004a; Ruhm, 2004b) and a positive impact for income (Duncan, 1997; Blau, 1999; Sirin, 2005; Dahl and Lochner, 2005). Although all the above papers warrant attention, the most recent and relevant papers for this study are the empirical findings regarding income by Sirin (2005) and Dahl and Lochner (2005) and the results regarding maternal employment by Waldfogel et al. (2002), Baum (2003), and Ruhm (2004b). These are discussed in the next two subsections.

Previous Studies on the Effect of Income on Child Achievement

Sirin (2005) addressed the role of social-economic status on academic achievement through a meta analysis. This meta-analysis reviewed all relevant literature on SES and academic achievement in journal articles published between 1990 and 2000. The results showed a medium to strong positive SES-achievement relation. The strength of this relation, however, varied depending on the unit, the data, the range of SES variable,³ and

² The PPVT, PIAT-M, and PIAT-R were used by past researchers due to the availability of this data in the NLSY79. These three tests assessed the abilities of youths in vocabulary, math, and reading, and were standardized across age making them ideal indicators of cognitive ability.

³ This meta-analysis noted that the measurement for SES varied across the studies. Some studies used income and education as sole measures, while others included more comprehensive variables such as neighborhood crime rates and library densities.

the type of achievement measure. Although income was a factor in determining SES in most of the studies analyzed, Sirin never discussed the isolated effect of family income on academic achievement.

Dahl and Lochner (2005) solved this shortcoming of the Sirin paper by directly focusing on the effect of family income on child achievement. In their study, Dahl and Lochner used changes in the Earned Income Tax Credit (EITC) over the last two decades to estimate the effect of income on math and reading achievement scores. By using the EITC as their exogenous variable, they hoped to eliminate the problem of endogeneity of income plaguing earlier studies. In particular, poor families are more likely to have negative home environments or suffer from problems which would continue to impair child development even if family income were to increase. Furthermore, Dahl and Lochner included a comprehensive list of control variables from the NLSY79 in order to address the problems of unobserved heterogeneity, endogenous transitory income shocks, as well as measurement errors in income. Their results showed that a \$1,000 increase in income raises PIAT-M scores by 2.1 percent and PIAT-R scores by 3.6 percent of a standard deviation. By using EITC as an instrument to estimate changes in family income, Dahl and Lochner's model isolated and empirically addressed the impact of income on child achievement. However, the problem with this model is that it raises a potential bias in the results: a boost in income for mothers who stay at home could potentially result in a bigger boost to child achievement compared to mothers who work. A possible causal pathway for this effect is in the utilization of home resources. Mothers who stay at home with children will utilize the extra income more efficiently compared to mothers who work. This theory was supported by the findings of Eissa and Hoynes

(2003). Their study focused on labor force participation as a result of EITC and found that for married couples, the increase in family income as a result of EITC caused a decline in the labor force participation by mothers and an increase in participation by fathers. These results appeared to indicate that at a given family income, the benefits of increased efficiency of mothers who stay at home could outweigh the benefits of extra income of mothers who work. Consequently, mothers may opt out of the labor force in order to maximize family utility.

Previous Studies on the Effect of Maternal Employment on Child Achievement

Waldfogel et. al (2002) investigated the effects of early maternal employment on children's cognitive outcomes from birth up to the age of 8. Using data on 1,872 children from the NLSY79, this study tracked the achievement of these children through the PPVT, PIAT-M, and the PIAT-R. Their results showed that for white children, maternal employment during the first year of life was associated with significantly poorer scores on all outcome measures, with effects ranging from -1.96 to -3.23 points.⁴ However, other maternal employment after the child's first year of life was not negative for any outcome variables and is surprisingly positive and statistically significant for three of them.⁵ The results for African American children were quite different, with no significant effects of first-year maternal employment and weak effects, both positive and negative, for subsequent employment. The results for Hispanic children follow a similar trend, showing little or no impact of maternal employment. This striking difference between

⁴ This difference is in the raw score of the tests, which ranged from 0-100.

⁵ Second and third year employment was associated with a 3.39 point increase in PIAT-R at age 3-4 and a 2.41 point increase in PIAT-R at age 7-8. Employment after the third year was associated with a 3.32 point increase in PIAT-M at age 7-8.

white and non-whites was noted by the authors but no explanation was offered. In addition to the striking differences between racial groups, there was also a distinct difference between income groups: the negative effects of first-year maternal employment were found to be the largest for the lowest income group. These outcome differences by income stratification suggest that children from low-income families suffer the most from the negative effects of maternal employment. This may be due to the lower-quality childcare afforded by the families or care by fathers who are unemployed.⁶ However, Waldfogel did not control for the endogeneity of maternal employment and income and therefore, his results demonstrate correlation and not causality.

Baum (2003) conducted a similar study using data from the NLSY79. Similar to Waldfogel et al., he assessed the cognitive ability through the use of the three tests: PPVT, PIAT-M, PIAT-R. However, unlike Waldfogel, Baum addressed the issue of endogeneity in three distinct ways. First, he included an extensive array of background variables to capture the potential differences between working and nonworking mothers. Second, he made his sample more homogenous by only analyzing the subsample of mothers who worked before giving birth. Lastly, he controlled for local labor market conditions that might affect mothers' labor supply. His results were similar to Waldfogel's and indicated negative effects of maternal employment in the child's first quarter (3 month) of life. The study also showed that maternal employment positively affects child development via increased family income. When family income was held constant, the effects of maternal labor supply almost always became more negative and increased in statistical significance. Furthermore, increasing family income by \$20,000

⁶ Only 68% of the fathers in the low-income group were working compared with 95% and 96% of the fathers in the two other income groups.

enhanced child development by about 6% of a standard deviation. Thus, their results indicate that the increase in income as a result of maternal work offsets, to a certain degree, the negative effects of maternal employment. The magnitude of this effect depends on the ratio of income to work hours that is associated with maternal employment.⁷

The most relevant study to this paper regarding maternal employment was done by Ruhm (2004b). Ruhm used NLSY79 data from 1986 to 2000 to study the effect of maternal employment on children 10-11 years old. Like the previous studies, Ruhm used PPVT, PIAT-M, PIAT-R as an assessment of child outcomes. However, unlike previous studies, Ruhm also included substance abuse and obesity as an outcome measure. In addition, his study controlled for the SES status of the family as well as the mothers abilities (assessed through instruments such as AFQT scores). Ruhm's model was based on the linear equation: $C_{it} = \alpha + \beta H_t + V_{it} + \varepsilon_{it}$ where C was child outcomes such as PPVT scores or substance abuse, β was the coefficient of interest, V are production shifters such as the families SES and mother's abilities and ε_{it} the error term. His findings were novel at the time and suggested that the effect of maternal employment differed depending on the family's SES. Between the top and lower half of the SES distribution, PPVT scores differed by .78 of a standard deviation, PIATM scores by .62 of a standard deviation, and PIAT-R by .59 of a standard deviation. Substance use and obesity rate followed a similar trend with the top half and lower half of SES differing by -5.1 percentage points in substance abuse and -5.8 percentage points in obesity rate. Based on these results, Ruhm

⁷ This is similar to Dahl and Lochner's conclusion in that increased income is associated with improved child development, but the effects here are smaller because Baum takes into account maternal employment.

concluded that for children from high SES families, maternal employment had a negative linear relationship with child achievement. However, for low SES families, the model was quadratic in nature and child achievement was maximized when mothers worked 18-20 hours a week. His findings were unexpected and suggest that the effect of maternal employment may be influenced by family background characteristics.

Although extensive work has been done on the costs and benefits of maternal employment, these studies have all focused on young children (1-11). Thus far, no studies that I am aware of have focused on the effects of maternal employment on older adolescents (13-16). This study fills this void by using the new 2005 NLSY97 data. Furthermore, by using econometric methods already established by Ruhm (2004b), this study controls for background variables (family income, childcare, mother's education, ect.) that might bias the results. The original contribution of this paper is the study of the effects of maternal employment, both present and past, on older adolescent children.

III. Theoretical Framework and Econometric Methods

This section follows Ruhm (2004a, 2004b). Ruhm states that households can be portrayed as productive entities where specific inputs are transformed into a good. Parents derive utility from the consumption of these goods and want to allocate resources to maximize their production. Included amongst the goods that a household produces is the health and development of children. As more resources (income, time, energy) become available to the households, more of each will be dedicated to the production of these "children" goods (Leibowitz, 1974). Parental employment may therefore have an impact on child development by modulating the availability of each resource. For instance, if parents

work, the availability of income will increase. However, as shown in Sandberg and Hofferth (2001), market employment also reduces the availability of time and energy and is likely to lead to a decrease in child-related investments in time or energy.

The reductions in parental time and energy investments may negatively affect child development through two different pathways. First, a reduction in maternal time investments during the first years of a child's life could interrupt mother-child attachments and deny the child the stimulation that is required for cognitive development (Belsky, 1988). Second, job-holding may lead to stress, reducing not only the quantity, but also the quality of time invested (Hoffman, 1980). However, the magnitude of these effects may vary depending on household and child characteristics. For example, maternal employment could be more detrimental to child development in high-SES households than low-SES households since the parents of high-SES households may have more education and thus, can provide higher quality time. Conversely, this negative effect may be offset because wealthier families can afford higher-quality daycare (substitute for maternal care) and educated women tend to spend a greater proportion of their leisure time in child-related activities (Leibowitz 1974).

The tradeoff between time and income investments can be represented in a model developed by Ruhm (2004a) where child outcome at age t (C_t) is a production function that is modulated by various determinants. These determinants include the child's status in the previous period (C_{t-1})⁸, the leisure time of parents (L), purchased goods such as

⁸ This measure is needed since not all children start at the same level and some may be better off already (previous period) than others.

food or books (F), and other exogenous production shifters (V). This production function can be written as:

$$1) C_t = C(C_{t-1}, L_t, F_t, V_t)$$

However, there are several important assumptions inherent in this model. First, parental leisure is beneficial for child outcome by either directly increasing child-related time investments or indirectly reducing stress and increasing the quality of time. Second, higher income is positive for child outcomes by enabling the purchase of more productive inputs, such as books and computers. Lastly, child outcomes are influenced not only by current factors, but also on the past endowments and choices of parents.

In Ruhm's model, parents also face a time constraint of $L_t + H_t = 1$, where H is the proportion of total time spent in employment and L the leisure time. The household also faces a budget constraint equal to the sum of earned and nonearned income. Solving for H and then substituting in for lags of C , Equation 1 can be rewritten as:

$$2) C_t = C(H, F, V)$$

Maximizing C_t subject to the budget and time constraints then produces the reduced-form demand function:

$$3) C_t = C(P, V)$$

where P is a vector of current and lagged prices and wages. However, information is unavailable on the full vector of prices and various individual-specific production shocks.⁹ This data restriction prevents estimations of the child production functions

⁹ Regional prices can not be used due to data restrictions that preclude identification of the region of each child.

specified by equations 1 and 3 and thus, Ruhm and this analysis focuses on the hybrid equation of:

$$4) C_t = C(H, V, e)$$

where H measures work hours, V a vector of individual or family background characteristics, and e a disturbance term capturing production shifters not otherwise controlled for by V . However, a limitation of this hybrid equation is that the coefficient estimates include both the technological aspects of the production function, as well as unobserved household preferences and production shifters. For example, the amount of time and income allocated to child care depends on family background characteristics, and these characteristics could potentially be correlated with parental attitudes about labor supply. Furthermore, the technologies in place when labor decisions are being made also modulate the effect of paternal employment. For instance, if the technology of day care is sufficient enough to provide equal quality non-parental care as parental care, the negative effects of parental employment will be diminished. Conversely, if the quality of day care decreases, the negative effects of labor supply will be magnified. Ideally, a model would address the issue of endogeneity between these technologies and parental labor decisions but the regression estimates I use do not.¹⁰ Instead, the employment coefficients below indicate the effects of working given average differences in other factors (income, parental education, ect.). As a result of this limitation, the results of this study cannot be generalized to foreign countries whose institutions (technologies) differ from that of the US. Moreover, a causal interpretation can only be implied between parental employment and child outcome if V adequately captures the effects of all other

¹⁰ Data restrictions prevent knowledge of the full vector of technologies.

determinants of child outcomes. However, this is especially challenging due to the difficulty in controlling for family or child characteristics that might be associated with parental job-holding. For example, previous studies (Ruhm, 2004a; Hill et al., 2005; Waldfogel et al., 2002) have found that women with characteristics associated with high ability tend to have elevated employment rates. If these advantages extend to home production, then maternal employment will be positively associated with child outcomes even if it has no causal effect.

The model discussed above can be operationalized in the following manner:

$$5) C_{it} = \alpha + \beta H_{it} + V_{it} + \varepsilon_i$$

Where C_{it} represents child cognitive outcomes for child i at age t , H_{it} a vector of parental work hours, V_{it} are other production shifters (family and child background characteristics), and ε_i is an identical and independently distributed disturbance.

Nevertheless, there are two econometric issues when using this model. These can be clarified by using a simpler model where only current employment affects child cognitive outcomes. With no controls for heterogeneity in family or child characteristics, the following equation can be written:

$$6) C_{it} = \alpha + \beta H_{it} + \varepsilon_i$$

where $\varepsilon_i = V_{it} + e_{it}$. However, a problem arises when V is correlated with H (if employed women have higher home productivity or their children have favorable endowments).

This implies that the $\text{cov}(H_{it}, e_{it}) \neq 0$ and β will then be biased. Following Ruhm, I address this issue by using the detailed information in the NLSY97 to directly account for many potential confounding factors, thus I base my regression on

$$7) C_{it} = \alpha + \beta H_{it} + V_{it} + \mu_{it}$$

This regression estimates the effects of parental employment if a sufficient number of supplemental regressors (V_{it}) is included to produce an error term that is orthogonal to H_{it} . This implies that both the $\text{cov}(V_{it}, \mu_{it}) = 0$ and $\text{cov}(H_{it}, \mu_{it}) = 0$.

The second econometric issue occurs when the effects of maternal employment are additive but only work hours during the specific period of interest is controlled for. When this happens, the regression estimates embody not only the effects of maternal employment during the specific period, but also that of other periods. Ruhm illustrates this problem in the following manner. Take a model where $H_{it} = (H_{it}, H_{it-j})$, for t the specific period of interest and $t-j$ an earlier period. If H_{it} , work the specific period, is controlled for but H_{it-j} , work in a previous periods, is not, β_t will then be biased in the direction of β_{t-j} if employment is positively correlated over time (parents who work extensively during the current period are likely to have worked extensively during earlier periods). To address this potential problem, this analysis therefore controls for maternal employment during the youth's entire life, rather than just for the specific period of interest.

IV. Description of Data Set

This study utilizes the National Longitudinal Study of Youth 97 (NLSY97). This dataset is ideal for this analysis because of its large sample size as well as the extensive background information it contains for each respondent. The NLSY97 is a national survey conducted in 1996 that contains detailed information of approximately 9,000 youths who were 12 to 16 years old during the time of the first interview. Youths were then interviewed on an annual basis.

The goal of the NLSY97 is to document the transition from school to work of American youth and contains comprehensive information about each respondent's employment history, education, and family background. Educational data include both school records and standardized test scores. Furthermore, throughout 1997 and 1998, NLSY97 respondents were also given the computer-adaptive version of the Armed Services Vocational Aptitude Battery (CAT-ASVAB). This test is designed to be a standardized measure of knowledge and skill in a number of areas that include mathematics and language.

Aside from employment and educational histories, the NLSY97 also contains information about family background and history. Data include the parents' marital and employment histories, ethnic and religious background, health, household income, early child-care arrangements, and parent expectations about the youth.

V. Discussion of Analysis and Empirical Results

For this analysis, I use 1997 and 1999 data from the NLSY97 to assess the effect of maternal employment on child achievement. An explanation of the included outcomes measure, maternal employment, and family background is given below.

Outcome Measures

Child achievement is proxied by scores on computer-adaptive version of the Armed Services Vocational Aptitude Battery (CAT-ASVAB) and high school GPA. The CAT-ASVAB measures the respondent's knowledge and skills in the areas listed in figure 2.

Figure 2: ASVAB Topical Areas

Arithmetic reasoning	Electronics information	Numerical operations
Assembling objects	General science	Paragraph comprehension
Auto information	Mathematics knowledge	Shop information
Coding speed	Mechanical comprehension	Word knowledge

Source: Appendix 10 of the NLSY97

For this analysis, I use a summary percentile score variable (ASVAB_MATH_VERBAL_SCORE_PCT) created by the NLSY97¹¹.

Maternal Employment

Maternal employment is based on data from responding mothers and assesses maternal employment on an annual basis. The first year of the child's life (denoted as year 1)

¹¹ Refer to Appendix 10: CAT-ASVAB of the NLSY97 for detailed information how this variable was created.

covers the four quarters immediately following birth, year 2 includes the fifth through eight quarters and so on up until 1997. However, data restrictions preclude knowledge of exact weekly hours. Maternal employment is recorded as values between 0 and 4. 0 for No employment, 1 for Light Employment (less than 20 hours a week), 2 for moderate employment (20-35 hours a week), and 3 for Full employment (35+ hours a week). Furthermore, sociological and psychological literatures emphasize the first three years of a child's life as most critical to their cognitive development (Brooks, 2002; Neidell, 2000) with less noticeable effects in later years. Therefore, I group maternal employment history as follows: year 1, years 2-5, and years 6-13. The benefits to this approach is that it allows for a detailed analysis of the first year, when development is most critical, and a more general analysis for subsequent years, when the effects of each year may be too small to be noticeable individually.

Family Background

This analysis exploits the extensive information in the NLSY97 and includes a list of important background variables. These variables, along with maternal employment and outcome measures are listed in table 1. Their descriptive statistics are listed in table 2.

Table 1: Definition of Dependent and Explanatory Variables

Variable	Coding	Survey Year
Dependent		
ASVAB Score	=Percentile score on the CAT-ASVAB	1999
Avg. High School GPA	=0-5 depending on grade, 5 being best	1997
Independent		
Mothers work before birth	=0 no work and 1-3 depending on intensity	1997
Mothers work in year 1	=0 no work and 1-3 depending on intensity	1997
Mothers work in year 2-5	=0 no work and 1-12 depending on intensity	1997

Mothers work in year 6-13	=0 no work and 1-24 depending on intensity	1997
Youth Age	=Youth's age as of 12/31/96	1997
Gross Family Income	= Gross household income in thousands of dollars	1997
Mother's highest grade completed	=mother's highest grade completed, ranging from 0-20	1997
Father's highest grade completed	=father's highest grade completed, ranging from 0-20	1997
Black	=1 if black, =0 otherwise	1997
Sex	=1 if female, =0 if male	
Hispanic	=1 if Hispanic, =0 otherwise	1997
Non-black and Non-Hispanic	=1 if non-black and non-Hispanic, =0 otherwise	1997
Child Health	=0 if Excellent/Good =1 if Moderate/Poor	1997
20+ hrs/week of Childcare year 1	=1 if yes, =0 if no	1997
Fathers work	=0 no work and 1-3 depending on intensity	1997
Family Risk Index ¹²	=0-4, higher=worse	1997
Family Enrichment Index ¹³	=0-3 3 being best	1997
Live with Grandparents	=1 if yes, =0 if no	1997
Mother's Health	=1 if health problems, =0 if no health problems	1997

Table 2: Summary Statistics of Dependent and Explanatory Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
GPA	4408	2.833271	0.614826	0.1	4.17
Child Health (Excellent/Good)	7888	.7932302	0.405014	0	1
Child Health (Moderate/Poor)	7888	.2067698	0.405014	0	1
20hr/wk Childcare year 1	6426	0.292717	0.455045	0	1
Mother's Work Before birth	5330	1.334334	1.415819	0	3
Mother's Work yr 1	5500	1.276182	1.410704	0	3
Mother's Work yr 2-5 ¹⁴	8052	5.695183	5.394008	0	12
Mother's Work yr 6-13	7983	12.14067	10.73901	0	24
Dad's Work	6437	2.144167	1.318948	0	3
Dad's Education	5801	8.512843	6.692421	0	20
Mom's Education	6280	12.56369	2.893186	1	20
Age	6266	13.96329	1.403425	11	16
Sex	8984	.429764	.4950699	0	1
ASVAB score	5284	46.16403	29.32666	0	3.05
Family Enrichment Index	3896	1.731776	0.774879	0	3
Family Risk Index	3908	.5601949	.4650207	0	3.05

¹² Refer to Appendix 9 for detailed information on how the Family Risk Index of the NLSY97 was created.

¹³ Refer to Appendix 9 for detailed information on how the Family Enrichment Index of the NLSY97 was created.

¹⁴ For maternal employment in multiple years, I summed the values of each year.

Non-black/Hispanic	6466	0.531704	0.499032	0	1
Black	6466	0.2558	0.436343	0	1
Hispanic	6466	0.205227	0.403899	0	1
Mother's Health	6465	0.089095	0.284903	0	1
Live with Grandparents	6466	0.227343	0.419148	0	1
Gross Family Income	5302	45071.23	41000.21	0	246474

Data Restrictions:

I have restricted the NLSY97 data to a subset that only includes youths who have both taken the CAT_ASVAB and whose mothers have responded to the parent questioner. I made no further restrictions, but replaced non-responses, valid skips, refusals to answer, and responses of “don’t know” in the data to missing values. However, the number of observations used in the regressions will be substantially smaller as regressions are only possible where information is present for all the variables.

Regressing ASVAB Score on Parental Employment

The effects of maternal employment on ASVAB scores are reported in table 3. The data is first analyzed as a whole, then stratified by SES and then by race.¹⁵ Maternal and paternal work are each measured on a scale from 0-3.¹⁶ Furthermore, a host of background variables were included to control for heterogeneity in family or child characteristics correlated with maternal job-holding. The regression coefficients are reported in table 3, 4 and 5.

¹⁵ SES was divided into two groups: high and low. The cutoff point was the median value (38512) of gross household income. The top 50 percentile were considered high SES and the lower 50 percentile low SES.

¹⁶ 0-3 per year. Therefore, years 2-5 would have a max of 12 since it includes 4 years.

Table 3: Overall Regression of ASVAB score on Parental Employment

Observations	5143	4241	1444
ASVAB Scores	No Controls	Partial Controls ¹⁷	All Controls
Mother's Work Before Birth			0.17
Mother's Work Year 1	-1.59***	-0.80	-0.50
Mother's Work Year 2-5	-0.17	-0.17	-0.16
Mother's Work Year 6-13	0.48***	0.14	-0.03
Dad Work			0.81
Gross Family Income		0.09***	0.04**
Black			-14.26***
Hispanic			-5.13***
Childcare 20+ hrs in Year 1			1.83
Moderate to Poor Health			-5.16***
Father's Education		0.81***	0.39***
Mom's Education		2.90***	2.01***
Age			0.15
Sex			-3.48***
Live with Grandparents			2.00
Family Enrichment Index			7.06***
Family Risk Index			-8.17***
Mother's health			-2.88

*=10% significance, **=5% significance, ***=1% significance

At first glance, the results from column 1 of table 3 seems to indicate that maternal employment has a significant negative impact during the first year of a child's life and a significant, though smaller, positive impact during years 6-13. Based on these results, the unscrupulous researcher may conclude that early maternal employment is deleterious while later employment is positive, but those conclusions are misleading. In column 2, family income and parental education are included as covariates to control for the heterogeneity of families. The results change dramatically. Maternal employment is no longer significant in any year while family income and parental education are significant

¹⁷ Includes family income and parental education.

at the 1% level.¹⁸ The regression coefficients in column 3 includes all covariates. These results are similar to the ones found in column 2 and indicate no deleterious effect on ASVAB scores due to early or late maternal employment and like previous studies (Sirin, 2005; Dahl and Lochner, 2005), family income was significant and positive. Furthermore, child health, Family Risk Index, and the race dummies are negatively significant while mother's education, father's education, being female, and Family Enrichment Index are positively significant.

SES Stratification Results

Table 4 contains the overall and SES-stratified results. The stratification is done based solely on gross family income. The median income is \$37,750 with the lower quartile at \$18,000 and the upper quartile at \$61,400. These were used as the cutoff points for comparing high and low SES families.

Table 4: Regression of ASVAB score on Parental Employment by SES

Observations	1444	274	460
ASVAB Scores	All	Lower Quartile SES	Upper Quartile SES
Mother's Work Before Birth	0.17	-4.22	-0.63
Mother's Work Year 1	-0.50	--	-0.31
Mother's Work Year 2-5	-0.16	0.62	0.21
Mother's Work Year 6-13	-0.03	0.30	-0.14
Dad Work	0.81	0.54	-0.01
Gross Family Income	0.04**	0.21	0.02
Black	-14.26***	-24.28***	-7.26*
Hispanic	-5.13***	-12.16***	-6.50*

¹⁸ These results demonstrate the importance of including a sufficient number of covariates as to make the error term orthogonal to maternal employment.

Childcare 20+ hrs in Year 1	1.83	6.36*	3.04
Moderate to Poor Health	-5.16***	-4.53	-6.32
Father's Education	0.39***	-0.08	0.68***
Mom's Education	2.01***	0.96*	2.26***
Age	0.15	1.02	0.16
Sex	-3.48***	-4.71*	-1.16
Live with Grandparents	2.00	-0.33	4.22
Family Enrichment Index	7.06***	4.26*	9.18***
Family Risk Index	-8.17***	-5.70*	-13.17***
Mother's health	-2.88	-1.33	-10.35***

*=10% significance, **=5% significance, ***=1% significance

The SES-stratified results seem to indicate that paternal education, Family Enrichment Index, Family Risk Index, and parental health is of more importance to those of the higher SES brackets while race is of more importance to those in the lower SES bracket. Comparing columns 2 and 3 of table 4, we see that the race variables diminishes in significance from the 1% level in the lower SES bracket to the 10% level in the high SES bracket. Conversely, parental education, Family Risk Index, Family Enrichment Index, and parental health increase in significance to the 1% level as we move from low SES to high SES. One possible explanation for this trend are the differences in the parental allocation of leisure time. Past studies have shown that educated women tend to spend a greater proportion of their leisure time on childcare activities (Leibowitz 1974). Combined with the fact that educated women also tend to earn more income--placing them in the high SES bracket--this could explain why parental education and mother's health increases in significance in the high SES bracket.¹⁹ This same argument can also be applied to paternal education, which only becomes significant in the high SES bracket.

¹⁹ For example, if two mother's have equal levels of education but one spends time with her child while the other does not, education will only be significant in the former case since parental education only affects child development indirectly through mother-child interactions.

Nevertheless, even though paternal education is significant, its coefficient is much smaller than that of maternal employment, supporting the notion that maternal education is of greater importance to the development of the child since it is mother's who spend the most time with childcare related activities.

In addition to the trend in parental education, there are also significant differences across SES in the home environmental measures: Family Risk Index and Family Enrichment Index. These differences may be due to the increasing marginal effects of each as SES increases. In low SES families, the mean Family Enrichment score is 1.34 while high SES families has a mean of 1.91. Similarly, the mean Family Risk scores are 0.79 for low SES and 0.45 for high SES families. Taken together--a lower mean enrichment score and almost double the mean risk score--this appears to indicate that environmental factors are more important past a certain threshold. In the low SES families this threshold has not been exceeded and therefore, the marginal effects are not highly significant. Conversely, high SES families have surpassed this threshold and the effects of these two environmental factors become highly significant. Lastly, the changing significance of the race dummies suggest that the majority of the racial gap happens in the lower SES bracket and once past a certain SES threshold, the racial gap may diminish and become insignificant.

Race Stratification Results

Table 5 contains the overall and race-stratified results. One important note is the reduced sample size of the black and Hispanic stratifications compared to the white stratification.

Table 5: Regression of ASVAB score on Parental Employment by Race

Observations	1444	284	241	906
ASVAB Scores	All	Black	Hispanic	White
Mother's Work Before Birth	0.17	6.66	-15.44***	0.39
Mother's Work Year 1	-0.50	-3.69	12.90***	-0.36
Mother's Work Year 2-5	-0.16	-2.35***	0.06	-0.02
Mother's Work Year 6-13	-0.03	0.80***	0.14	-0.21
Dad Work	0.81	0.15	-0.65	1.22
Gross Family Income	0.04**	0.18***	0.15***	0.01
Black	-14.26***	--	--	--
Hispanic	-5.13***	--	--	--
Childcare 20+ hrs in Year 1	1.83	-0.51	1.35	2.26
Moderate to Poor Health	-5.16***	-8.77***	-2.72	-2.96
Father's Education	0.39***	0.04	0.54	0.46***
Mom's Education	2.01***	3.05***	0.65	2.43***
Age	0.15	1.38	-0.60	0.13
Sex	-3.48***	-6.58***	-3.15	-2.08
Live with Grandparents	2.00	-2.17	7.34*	2.32
Family Enrichment Index	7.06***	4.27***	7.74***	7.64***
Family Risk Index	-8.17***	-2.30	-8.09***	-9.61***
Parents' health	-2.88	2.56	15.01***	-6.02***

*=10% significance, **=5% significance, ***=1% significance

The results from the race stratification show two interesting findings. First, family income seems to be significant only in black and Hispanic stratification. Second, parental education is only significant in white stratifications. Although I offer no explanation for the trend in income, one possible cause of the phenomenon in parental education is again allocation of parental leisure time. If one culture values parental care more than another, then parental qualities (i.e. Education) will be more significant in the one that stresses parent-child interactions.

Regressing High School GPA on Parental Employment

Regressing average high school GPA on parental employment gave similar results regarding parental education but different results with family income. As seen in table 6 in the appendix, family income is not statistically significant in any of the regressions. One plausible explanation of this phenomenon may be unequally weighted GPA's and school district self-segregation. For example, as shown by Mike Harris (2008), there are uneven racial/income distributions across school districts (Low income families may self-segregate from high income families and vice versa). Thus, receiving a 4.0 at a low-income/quality school is not equivalent to receiving a 4.0 at a high-income/quality school. The dataset does not delineate between high and low quality schools and applies equal weighting to all GPA's. This could be the reason family income is significant in ASVAB scores, which are standardized across the nation, and insignificant in high school GPAs, which are not standardized.

VI. Conclusion

The results of this study indicate no deleterious effect of maternal employment on adolescent outcome. However, several other factors seem to play an important role in child development. Most significant of these are family income, the education of the parents, the health of the child, the race of the child, and the family environment.

According to past studies and child development theory, the education of the parents are important in two manners. First, higher educated parents tend to spend more of their

leisure time with childcare related activities. Second, the quality of time spent with the child also increases with parent education. With both of these effects being positive, it is no a surprise that maternal education is so important. In addition to parental education, race at first appears to a significant indicator of child performance. However, when stratified by SES, race loses its significance in the top-quartile SES bracket while increasing in significance in the lower-quartile bracket. Furthermore, when stratified by race, the average income of whites is double that of blacks and Hispanics and income becomes significant in black and Hispanic stratifications but not in white. All this evidence point to the theory that past a certain threshold, the importance of income diminishes. Finally, the home environment measures were significant and positive. Given the importance of environmental stimulation in development, a more enriching home environment should lead to better cognitive results and the results of the regressions support this theory.

The results of this study are intended to offer a better assessment of the impact of maternal employment on child development. However, there are some shortcomings in this study. First, the sample size, especially in the stratifications, is small compared to some past studies. Second, data for maternal work is not a true continuous variable but rather a categorical variable. Lastly, there is no control for the allocation of parental leisure time. Future studies should aim to overcome these shortcomings by acquiring more complete data on maternal employment and also including a measure of parental time allocation. This will improve the accuracy of the results and provide a clearer picture on the true effect of maternal employment.

Appendix

Table 6: Regression of GPA by Maternal Employment

Observations	1129	207	381	212	241	706
Average GPA	All	Lower Quartile SES	Upper Quartile SES	Black	Hispanic	White
Mother's Work Before Birth	0.00	-0.01	-0.02	-0.13	0.10	0.03
Mother's Work Year 1	0.00	--	0.02	0.02	-0.22	0.01
Mother's Work Yearr 2-5	-0.01	-0.02	-0.02	0.01	0.03	-0.02
Mother's Work Year 6-13	0.00	0.00	0.01*	0.01	0.00	0.00
Dad Work	0.01	-0.02	0.04	-0.02	0.00	0.02
Gross Family Income	-0.33	4.06	0.83	1.02	-1.34	-0.37
Black	-0.12***	-0.20	-0.14	--	--	--
Hispanic	-0.02	-0.13	0.01	--	--	--
Child Care 20+ hrs in Year 1	0.07*	-0.05	0.10	0.05	0.05	0.04
Moderate to Poor Health	-0.03	0.10	-0.13	-0.09	-0.01	0.01
Father's Education	0.01***	0.01	0.02***	0.01	0.02***	0.01***
Mom's Education	0.03***	0.02	0.03***	0.07***	0.01	0.04***
Age	0.01	0.02	0.02	-0.01	0.03	0.02
Sex	-0.23***	-0.19**	-0.26***	-0.42***	-0.12	-0.21***
Live with Grandparents	0.02	-0.05	0.03	0.11	0.12	-0.05
Family Enrichment Index	0.08***	-0.02	0.13***	0.05	0.05	0.10***
Family Risk Index	-0.23***	-0.14*	-0.27***	-0.03	-0.21***	-0.31***
Parents' health	-0.17***	-0.27	-0.12	-0.05	-0.32	-0.16***

*=10% significance, **=5% significance, ***=1% significance

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