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Christopher J. Ruhm

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ABSTRACT

This study investigates how maternal employment is related to the outcomes of 10 and 11 year olds after controlling for a wide variety of child, mother and family background characteristics. The results suggest that the mother's labor supply has deleterious effects on cognitive development, obesity and possibly risky behaviors such as smoking or drinking, while reducing behavior problems. These negative consequences are quite small for the average child, however, and usually restricted to relatively long maternal work hours. Less intensive employment is often associated with favorable outcomes and labor supply after the first three years typically has little effect. By contrast, large adverse consequences are frequently obtained for "advantaged" adolescents, with negative impacts predicted even for limited amounts of maternal labor supply and for work during the child's fourth through ninth year.

Christopher J. Ruhm
Department of Economics
University of North Carolina at Greensboro
Greensboro, NC 27402-6165
and NBER
c_ruhm@uncg.edu

Maternal Employment and Adolescent Development

Between 1975 and 2001, the labor force participation rate of mothers with non-adult children increased 54 percent, from 47.4 to 73.1 percent (U.S. Department of Labor, Bureau of Labor Statistics, 1988; U.S. Bureau of the Census, 2002). Workforce involvement for women with children younger than six grew an even larger 66 percent over the same time span, from 39.0 to 64.9 percent, while participation among mothers of infants rose 78 percent, from 31.0 to 55.2 percent, between 1976 and 2000 (Downs, 2003). When combined with the growth in single-parent households, these changes suggest that adults have less time and energy to invest in their offspring, with potentially deleterious effects.[1] However, increased market work may also yield benefits, most obviously by providing extra income.

This paper analyzes how maternal employment affects the development of early adolescents, as measured by seven outcomes for 10 or 11 year olds using data from multiple years of the National Longitudinal Survey of Youth (NLSY). The dependent variables include three high quality assessments of cognitive skill, two indicators of socioemotional development and two measures of excess body weight.

The results suggest a modest deleterious effect of long work hours on cognitive development, particularly for employment during the infancy and young toddler periods. Conversely, modest amounts of labor supply do not appear to harm and may actually improve test scores for the average child. The findings are more ambiguous for other outcomes. There is some evidence that maternal employment occurring after the child's first three years is associated with lower rates of problem behaviors. Conversely, work hours are correlated with large (in percentage terms) but imprecisely estimated increases in early substance use. Finally, maternal employment is positively related to obesity and the risk of overweight but this may

[1] The proportion of children in two-parent households declined from 80.3 percent in 1975 to 69.1 percent in 2001 (U.S. Bureau of the Census, 1999). Increased female employment has not been offset by substantial reductions in male work hours but fertility rates and time spent in housework have declined since the 1960s (Juster and Stafford, 1991; Mayer, 1997). The time parents have available for children fell by 22 hours per week (14 percent) between 1969 and 1999 (Council of Economic Advisers, 1999) but Sandberg and Hofferth (2001) argue that behavioral changes by parents have prevented any decrease in the time actually devoted to children since the early 1980s.

result from a selection process not adequately accounted for in the econometric specifications rather than a causal effect.

The fairly modest average effects conceal disparities across groups of children. Most striking is the harmful effect of maternal labor supply on the most "advantaged" adolescents. For these children, the negative effects extend to include limited amounts of work and employment occurring after the third year of the child's life, suggesting that it may be a mistake to exclusively focus on work during the earliest years. The increases in excess body weight associated with having an employed mother are also more pronounced and less likely to result from remaining unobserved heterogeneity than for less advantaged adolescents.

Children whose mothers work long hours generally come from advantaged backgrounds, while child health or developmental problems often subsequently cause women to cut back on employment. Prior analyses, particularly those conducted more than a few years ago, typically inadequately control for these sources of heterogeneity and therefore often provide an overly favorable assessment of the consequences of early employment. This study does a better job of accounting for the disparities and so obtains more pessimistic results. However, to the extent that confounding factors are still not held constant, some sources of bias may remain, highlighting the need for further research.

A. Previous Research

The relationship between maternal employment and cognitive development or behavior problems in early childhood (typically 3 to 6 years of age) has been widely studied. A few investigations find positive effects (Vandell and Ramanan, 1992; Parcel and Menaghan, 1994; Moore and Driscoll, 1997), others negative impacts (Leibowitz, 1977; Stafford, 1987; Mott 1991; Belsky and Eggebeen, 1991) and many obtain results that differ depending on the timing of work or the specific group or outcome analyzed (e.g. Desai et al., 1989; Baydar and Brooks-Gunn, 1991; Blau and Grossberg, 1992; Parcel and Menaghan, 1994; Greenstein, 1995; Barglow, et al., 1998).[2] A common conclusion of the most recent (and generally carefully conducted)

[2] The limited research on paternal employment obtains inconclusive results (Parcel and Menaghan, 1994; Harvey, 1999; Ermisch and Francesconi, 2001; Waldfogel et al., 2002; Ruhm, 2004). A large body of research also investigates how early child care and education affects children. Many of the studies (e.g. Belsky and Rovine, 1988; Clarke-Stewart, 1989; Lamb and Sternberg, 1990; NICHD Early Child Care

analyses is that maternal employment during the child's first year has a deleterious impact (James-Burdumy, 1999; Neidell, 2000; Han et al., 2001; Hill et al., 2001; Brooks-Gunn et al., 2002; Waldfogel et al., 2002; Baum, 2003; Ruhm, 2004) but often with less consistent effects for work during the second and third year. However, it is not clear whether these effects last into adolescence or "fade out" over time. Harvey (1999) finds that the negative impact of first year employment is temporary, whereas Neidell (2000), Han et al. (2001) and Waldfogel et al. (2002) indicate greater persistence. The patterns may also vary with race, sex of the child, household structure and family income in ways that are poorly understood.

Studies of adolescents are also fairly voluminous. Many researchers (Hillman and Sawilowsky, 1991; Gottfried and Gottfried, 1994; Paulson, 1994; Vander Ven et al., 2001) conclude that maternal employment has no effect on outcomes such as academic achievement, delinquency, or substance abuse. However, both positive effects (Richards and Duckett, 1994; Muller, 1995) and negative impacts (Bogenschneider and Steinberg, 1994) have sometimes been obtained. There is also a tendency to find the greatest gains or lowest costs from part-time (rather than full-time) work, with larger benefits sometimes obtained for girls, blacks and children with less educated parents than for their counterparts (Richards and Duckett, 1991; Bogenschneider and Steinberg, 1994; Wolfer and Moen, 1996).

These inferences should be viewed as tentative because the samples are almost small and unrepresentative and the studies generally lack the methodological sophistication of the more recent investigations of younger children. For instance, researchers often interpret large but imprecisely estimated coefficients as accepting (rather than failing to reject due to a lack of statistical power) the null hypothesis of no effect.[3] Most importantly, mothers holding jobs or

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Research Network, 1997b) examine infant-mother attachments and suggest that maternal employment, by increasing the use of day care, could reduce attachment security in some situations. Recent investigations (NICHD Early Child Care Research Network, 2003; Watamura et al., 2003; Magnuson et al., 2004) indicate that child care is likely to increase behavioral problems and stress levels. However, high quality child care has also been linked to increased school readiness and improved cognitive development (NICHD Early Child Care Research Network, 2002; Magnuson et al., forthcoming). These results should be interpreted with caution because the studies do not generally use nationally representative samples or sufficient controls for parental inputs and child endowments.

[3] This is important given the small sample sizes. For example, the samples analyzed by Hillman and Sawilowsky (1991), Gottfried and Gottfried (1994), Paulson (1994), and Richards and Duckett (1994)

working long hours may differ from those who do not in ways that have typically been inadequately accounted for. For example, women with characteristics associated with high ability, such as education levels and AFQT scores, tend to have elevated employment rates (Vandell and Ramanan, 1992; Hill et al., 2001; Waldfogel et al., 2002; Ruhm, 2004). If these advantages extend to productivity in home activities, maternal employment will be positively associated with child outcomes, even absent a causal impact.[4] Reverse causation may also present problems if the mother's work hours are influenced by child outcomes in previous periods. Most prior studies control only for contemporaneous employment and so may suffer from this shortcoming.[5]

It is difficult to completely eliminate these potential sources of bias without an exogenous source of variation in labor supply. Two approaches are used below. First, an unusually comprehensive set of explanatory variables are included, with attention paid to changes in the parameter estimates when sequentially accounting for an increasing portion of the heterogeneity. The addition of more complete controls generally raises the predicted costs of maternal employment, suggesting that previous investigations may present an overly optimistic assessment. Second, employment in a period *after* the date of child assessment is controlled for in most models. Since labor supply is unlikely to have causal effects on outcomes in a prior

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contain 51, 106, 240 and 295 individuals. Results are often presented for subgroups of these already small samples.

[4] The bias could be in the opposite direction if women rapidly returning to work have less interest or ability in home production; however, there is no empirical support for this possibility. There are similar difficulties interpreting results of the related literature on day care (e.g. Clarke-Stewart, 1991; Field, 1991; Caughy et al., 1994). NICHD Early Child Research Network (1997a) shows that the age at which children are placed in non-parental care varies significantly with family characteristics. Those beginning care prior to 3 months of age come from families with relatively low non-maternal income whereas those placed in care at 3-5 months have the highest family income and maternal earnings. A few studies use quasi-experimental designs to control for omitted variables (e.g., Currie and Thomas, 1995). Karoly et al. (1998) provide an in-depth review of research examining early intervention programs.

[5] Anderson et al.'s (2003) investigation of child obesity overcomes many of these problems. They analyze a large and relatively representative sample with reasonably comprehensive controls and sometimes estimate fixed-effect or instrumental variable models to address the problem of non-random selection into maternal employment. However, they do not employ the tests for reverse causation discussed below. Menaghan et al. (2000) obtain evidence of a negative relationship between maternal employment and antisocial behaviors using a large sample and an apparently sound methodology. However, the control variables are not described in detail and they are unable to completely disentangle the effects of maternal employment from those of family circumstances.

period, large or statistically significant parameter estimates for this variable suggest model misspecification.

A. Conceptual Framework

Economic models portray households as productive entities where parents allocate resources to maximize an objective function that includes child outcomes as one argument. Holding marital status and household size constant, greater time, energy and income are likely to be devoted to children as more of each is available to the parents.[6] Maternal employment may therefore improve child outcomes by increasing incomes. However, market employment is also likely to decrease child-related investments in time or energy. Time-diary data confirm that working mothers spend less time with children than their nonemployed counterparts (Bryant and Zick, 1996; Zick and Bryant, 1996; Bianchi, 2000; Gershuny, 2000; Hofferth, 2001; Sandberg and Hofferth, 2001; Ichino and Sanz de Galdeano, 2002), although there is considerable uncertainty about the size of this effect.[7] Long hours might also cause parents to be tired or stressed, reducing the quality of the time with children.[8]

The psychological and sociological literatures emphasize complementary pathways through which market work by parents may negatively affect child development. Belsky (1988) argues that a mother's absence during the first year of life could disrupt mother-child attachments and deprive the child of the stimulation that promotes cognitive development. Hoffman (1980) states that the stress of maternal employment may yield fewer and lower quality interactions. Coleman (1988) expresses concern that the job-holding will weaken the "social

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[6] Early research by Leibowitz (1974a) highlights parental time investments in children. There is wide agreement that children benefit from being in households with higher incomes but debate over why. Duncan and Brooks-Gunn (1997) emphasize the causal effect of poverty, whereas Mayer (1997) suggests weaker income effects, possibly because a greater portion of family income is devoted to children in poor than wealthy families (Lazear and Michael, 1988). All else equal, more time will also be invested in children with fewer siblings and in two-parent (versus single-parent) households (Haveman and Wolfe, 1995; McLanahan, 1997). This section and the next draw heavily on material in Ruhm (2004).

[7] Employed females may "protect" productive time by cutting back least on activities that directly engage children. Increased time investments by fathers could offset the reductions of working mothers (in two family households) but little empirical evidence supporting this possibility has been provided. The involvement of fathers in child care is rising over time (Bianchi, 2000) but paternal labor supply is unrelated or negatively related to the hours fathers spend with children (Gershuny, 2000; Hofferth, 2001).

[8] For instance, working mothers sleep 6 hours (10 percent) less per week than their nonemployed counterparts (Bianchi, 2000).

capital" that depends on the relationships in which children are embedded. These effects may vary with household characteristics and age of the child. For example, employment could be more harmful in rich than poor families if well-off parents provide higher *quality* time. Conversely, wealthier families can afford better day care and educated women spend a greater proportion of their nonmarket time in child-related activities (Leibowitz, 1974b).[9]

These approaches all stress the beneficial effects of household income and direct parental investments in children, suggesting a potential tradeoff between the two. To illustrate, consider a production function where child outcomes at age t (C_t) depend on status in the previous period (C_{t-1}), the non-market "leisure" time of parents (L), purchased inputs like food or medical care (F), and exogenous determinants or production shocks (V) according to:

(1) $$C_t = C(C_{t-1}, L_t, F_t, V_t).$$[10]

Using subscripts to indicate partial derivatives, C_L and C_F are positive. The production function has several important characteristics. First, parental leisure is good for children. This occurs either through direct time investments or indirectly through reductions in stress, increased energy levels and so forth. Second, higher incomes raise the ability of parents to purchase productive inputs and influence their time allocation decisions. Third, child outcomes depend partly on prior status and therefore on endowments and the past choices of parents.

Parents have a time constraint

(2) $$L_t + H_t = 1,$$

where H and L are the proportions of total time spent in employment and nonmarket activities.[11] The household also has a budget constraint that limits purchases of child inputs and other consumption to the amount of earned and nonearned income. Solving (2) for H and recursively substituting in for lags of C, equation (1) can be rewritten as:

(1') $$C_t = C(\mathbf{H}, \mathbf{F}, \mathbf{V}),$$

[9] The average quality of child care increases with income, although center-based care for low-income children appears to be of relatively high quality (NICHD Early Child Care Research Network, 1997a), probably due to early intervention programs (such as Head Start) that are available to poor families.

[10] This model follows Becker (1981) in emphasizing the role of non-market time in household production and Grossman (1972) in treating health as an outcome produced by investment activities.

[11] Total time is endogenous since it varies with the number of parents and children in the household. The econometric analysis deals with this by directly controlling for family structure.

where **H**, **F** and **V** are vectors of current and lagged values (e.g. $\mathbf{H}=\{H_t, H_{t-1}, \ldots H_{t-n}\}$, for t-n the first period where parental inputs affect child outcomes. Maximizing C subject to income and time constraints yields the reduced-form demand function:

$$C_t = C(\mathbf{P},\mathbf{V}), \tag{3}$$

where **P** is a vector of current and lagged prices and wages.[12]

The child production or reduced-form demand functions specified by (1') or (3) provide policy-relevant parameters of structural determinants of child development. However, data restrictions preclude estimation of either model, since information is lacking on the full vector of relevant prices and many individual-specific production shocks. Instead, this analysis focuses on what Rosenzweig and Schultz (1983) refer to as "hybrid" equations. These take the form:

$$C_t = C(\mathbf{H},\mathbf{X},\varepsilon), \tag{4}$$

where **H** measures work hours, **X** is a vector of individual or family background characteristics and ε is a disturbance term capturing production shifters or shocks not otherwise controlled for.

A limitation of the hybrid equations is that the coefficient estimates generally embody both the technological properties of the production function and the characteristics of unobserved household preferences or production shifters. For example, the proportion of total income devoted to children may vary with family background characteristics and parental attitudes about labor supply with other investments in children. Child outcomes similarly depend on the *quality* as well as the *quantity* of parental time and the "technologies" in place when decisions are made. For instance, since child care is one purchased input, the effects of employment partly depend on the difference in the quality of parental and nonparental care. One result is that any negative effects of labor supply are likely to rise as the price-adjusted quality of day care falls.[13] A fully specified model would account for the endogeneity between these technologies and parental decisions but the estimates below do not. Instead, the employment coefficients indicate the

[12] Formally, parents solve a dynamic programming problem where utility depends on child outcomes, parental consumption and non-market time, and is maximized subject to time and budget constraints. Blau et al. (1996) detail such a model.

[13] This could be modeled by specifying the child production function as $C_t = C(C_{t-1},q_tL_t,F_t,V_t)$, where q is an efficiency parameter reflecting differences in the quality of parental and nonparental care. Parental time could then have a negative effect ($q<0$), if its quality is sufficiently low relative to day care.

"effects" of working given the average differences in other factors (such as child care) that accompany the variation in labor supply. An implication is that limited information is provided on how maternal employment will affect child outcomes in different institutional environments, such as those in many European nations.[14]

Moreover, a causal interpretation can only be applied to the parameter estimates on parental employment if the variables in **X** capture the effects of all other structural determinants of child outcomes. A particular concern is the difficulty in adequately controlling for heterogeneity in family or child characteristics correlated with parental job-holding. This represents a major challenge for research in this area.

C. Econometric Issues

The model above is operationalized by assuming that outcomes for child i at age t (C_{it}) are an additive separable function of parental work hours at child ages t-1 through t-n ($\mathbf{H}_{it}=\{H_{it-1}, H_{it-2}, \ldots H_{it-n}\}$) and other production shifters (V_{it}), according to:

$$C_{it} = a + \mathbf{H}_{it}\mathbf{b_t} + V_{it} + e_{it}, \quad (5)$$

for e_{it} an i.i.d. disturbance.[15] Implicit in (5) is the assumption that parental job-holding prior to t-n or after t-1 has no impact on child outcomes at age t.

Several important econometric issues can be clarified using an even simpler (but unrealistic) model where only contemporaneous employment affects child outcomes (i.e. $\mathbf{H}_{it}=\{H_{it}\}$). In the absence of additional controls, this implies the regression equation:

$$C_{it} = \alpha + H_{it}\beta + \varepsilon_{it}, \quad (1)$$

where $\varepsilon_{it} = V_{it} + e_{it}$. $\hat{\beta}$ is then biased if $\text{cov}(H_{it},\varepsilon_{it}) \neq 0$, which occurs if V is correlated with H. For example, there is a spurious positive relationship if employed women have high home productivity or their children have endowments associated with favorable outcomes.

The primary econometric strategy is to use the detailed information in the NLSY to directly account for many potential confounding factors. Thus,

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[14] An alternative approach used by Ermisch and Francesconi (2001) is to estimate a conditional demand function (Pollack, 1969) that includes employment status (to proxy parental time) and other production shifters. Their key assumption is that sibling differences in parental employment during the early years are uncorrelated with child-specific endowments. This assumption is discussed below.

[15] The model could be modified to include lags of the production shifters.

(2) $$C_{it} = \alpha + H_{it}\beta + \mathbf{X}_{it}\gamma + \mu_{it},$$

consistently estimates the effects of parental employment if the supplementary regressors (**X**) control for determinants of child development, such that $cov(\mathbf{X}_{it},\mu_{it}) = cov(H_{it},\mu_{it}) = 0$. The goal therefore is to include a sufficiently rich set of covariates that the error term is orthogonal to $\mathbf{H}_{it}$. However, it is important to exclude variables that *result* from parental job-holding (such as the home environment), since these capture a portion of the labor supply effect.

A key feature of this analysis is that the inclusion of controls for maternal employment during the child's first nine years of life. By contrast, most previous research has focused on only a specific period of interest (e.g. the first three years) and has not accounted for labor supply at other times. One implication is that the prior estimates are likely to have combined the impact of working during the years of interest with those of jobs held in other periods. To illustrate, consider the situation where $\mathbf{H}_{it}=\{H_{it},H_{it-j}\}$, for t the assessment year and t-j an earlier period. Further assume that regressions of:

(3) $$C_{it} = \alpha + H_{it-j}\beta_{t-j} + H_{it}\beta_t + \mathbf{X}_{it}\gamma + \mu_{it}$$

yield unbiased estimates. If the model used is instead

(8') $$C_{it} = \alpha + H_{it-j}\beta_{t-j} + \mathbf{X}_{it}\gamma + \lambda_{it},$$

where $\lambda_{it} = H_{it}\beta_t + \mu_{it}$, $cov(H_{it-j},\lambda_{it}) = \beta_t\, cov(H_{it-j},H_{it})$ and $\hat{\beta}_{t-j}$ is biased in the direction of β_t if employment is positively correlated over time.[16]

Even an extensive set of explanatory variables may not fully account for all important sources of heterogeneity. One procedure below is to include controls for maternal employment characteristics prior to birth (occupation and average work hours before pregnancy and the number of weeks before giving birth that the mother exits employment), in the hope that these will absorb the effects of remaining omitted variables bias without causally affecting the child outcomes. Employment in the calendar year *after* assessment is also held constant. This may provide an additional control for heterogeneity and supply some indication of reverse causation. For example, a positive coefficient might occur if mothers work longer hours when their children are doing well than if they have health or developmental problems.

[16] For example, the correlation between average hours in years 1 through 3 and 4 through 9 is 0.654 for the representative NLSY subsample.

Conversely, bias due to unobserved child-specific factors may be particularly problematic in research that uses maternal fixed-effects to control for heterogeneity in family backgrounds (James-Burdumy, 1999; Neidell, 2000; Ermisch and Francesconi, 2001; Waldfogel et al., 2002). To see this, rewrite the model in (7) as:

(7') $$C_{ijt} = \alpha + H_{ijt}\beta + \mathbf{X}_{ijt}\gamma + \mu_{ijt},$$

where j subscripts the child's mother. The error term can then be decomposed as $\mu_{ijt} = M_j + K_i + \varphi_{ijt}$, where M are time-invariant maternal characteristics, K are child-specific endowments that are orthogonal to maternal factors (implying that $cov(M_j,K_i) = 0$), and φ is an i.i.d. error.[17] The fixed-effect (FE) models correspond to:

(8) $$C_{ijt} = \alpha + H_{ijt}\beta + X_{ijt}\gamma + M_j\delta + \phi_{ijt},$$

where M is a vector of mother-specific dummy variables and $\phi_{ijt} = K_i + \varphi_{ijt}$. Such specifications exploit intra-family variations, as can be seen by representing sibling disparities in the dependent variable, maternal employment (at given child ages) and personal characteristics using ΔC, ΔH and $\Delta\mathbf{X}$ and differencing (8) within families to obtain:

(9) $$\Delta C_{it} = \Delta H_{it}\beta + \Delta\mathbf{X}_{it}\gamma + \Delta\phi_{it}.$$

The maternal fixed-effect has been eliminated in (9) but the child-specific endowments have not and there is no reason to believe the FE models provide consistent estimates or even reduce the bias. Specifically, since the error term is $\Delta\phi_{it} = \Delta K_i + \Delta\varphi_{it}$, bias remains if $cov(\Delta H_i,\Delta K_i) \neq 0$ and may be *larger* than in corresponding OLS estimates if unobserved child-specific factors are a key determinant of sibling differences in maternal labor supply.[18] This is important given evidence that mothers work less when children have health or developmental problems,[19] suggesting that $cov(\Delta H_{it},\Delta K_i) > 0$ and that the FE models are likely to understate the costs or overestimate the benefits of maternal employment.[20]

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[17] The covariance restriction implies that M subsumes the effects of child-specific factors that are systematically correlated with those of the mother (e.g. the inherited portion of innate intelligence).

[18] The fixed-effect models also use a less representative sample that is restricted to siblings in the age groups where complete data are available.

[19] Low birth weight and slow developmental abilities delay the return of mothers to work (Neidell, 2000). Employment is reduced if children have limiting health conditions or disabilities (Ermisch and Francesconi (2001). Mothers of "high risk" children return to jobs relatively slowly and parental employment is decreased when children have low development scores or high levels of "fearfulness" Norberg (1998). Parents supply more (fewer) resources to siblings with lesser (greater) genetic

D. Data and Descriptive Results

Data are from the National Longitudinal Survey of Youth, a sample of U.S. residents born between January 1, 1957 and December 31, 1964 who have been surveyed since 1979.[21] In 1982 the NLSY began including questions on pregnancy, pre-natal and post-natal care. Children born to and living with female NLSY respondents have been interviewed at two year intervals beginning in 1986, with information used through 2000. The combined data set provides a unique source of longitudinal information on a large sample of children and their parents, including great detail on maternal, child and household characteristics.[22]

The NLSY (through 2000) includes children whose mothers were 35 to 42 years old at the end of 1999. This covers approximately 90 percent of childbearing for this cohort but does not represent all fertility, since the offspring of some older women (who tend to have high incomes and education levels) are excluded. The sample analyzed is somewhat more restrictive, since it is limited to children aged 10 or 11 years (120 to 143 months) old at one of the biennial assessment dates between 1986 and 1998. Thus, these children were born between 1979 and 1988 to 14 to 31 year old mothers.

D.1 Outcomes

Cognitive development is proxied by scores on the Peabody Picture Vocabulary Test (PPVT) and the Peabody Individual Achievement Test Mathematics (PIAT-M) and Reading Recognition (PIAT-R) subtests. These are among the most widely used assessments and are

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endowments than if they were indifferent to the distribution of outcomes across children (Behrman, et al., 1982). Child health problems or disabilities significantly reduce the probability that mothers will work and, conditional on employment, decrease their work hours (Corman et al., 2003, Powers, 2003).

[20] Some researchers (e.g. James-Burdumy, 1999; Baum, 2003; Anderson et al., 2003) have alternatively used IV strategies, most commonly using local labor market and economic conditions as instruments. A problem with IV methods for this study is that it is extremely difficult to devise instruments that have much power to predict differences in employment during the various periods (before pregnancy, during the first nine years and post-assessment) controlled for below.

[21] The NLSY originally included a representative sample of 6,111 youths, an oversample of 5,295 blacks, Hispanics and economically disadvantaged whites, and a supplemental sample of 1,280 persons in the military in September 1978. Interviews with the military subsample were suspended after 1984 and for economically disadvantaged non-Hispanic whites after 1990. This data set is now sometimes referred to as the NLSY79, to distinguish it from the new NLSY97 survey which covers a later cohort.

[22] See Center for Human Resource Research (2001) for additional information about the NLSY.

known to have high test-retest reliability and concurrent validity (Baker et al., 1993).[23] The PPVT measures receptive vocabulary for Standard American English and provides a quick estimate of verbal ability and scholastic aptitude. The PIAT-M assesses attainment in mathematics beginning with early skills, such as recognizing numerals and progressing to advanced concepts in geometry and trigonometry. The PIAT-R indicates word recognition and pronunciation ability by examining skills such as matching letters, naming names and reading single words aloud.

The analysis focuses on "standard" assessment scores which represent transformations, on an age-specific basis, of the raw scores originally (during the 1970s) designed to have a normal distribution with a mean of 100 and a standard deviation of 15. Standard scores have been commonly used by previous researchers (e.g. Baydar and Brooks-Gunn, 1991; Blau and Grossberg, 1992; Parcel and Menaghan, 1994; Ruhm, 2004). For ease of interpretation, the variables have been normalized to have a mean of zero and a standard deviation of one, for the nationally representative subsample of the NLSY, so that the regression coefficients show the standard deviation change in test scores predicted by a one unit change in the explanatory variable. These are sometimes referred to as "effect sizes" below.

Socioemotional problems are proxied by two outcomes. The Behavior Problems Index (BPI) measures the frequency, range and type of childhood problems. The overall BPI score, used here and in substantial previous research (e.g. Baydar and Brooks-Gunn, 1991; Moore and Driscoll, 1997; Harvey, 1999; Han et al., 2001), indicates problems in the domains of antisocial behavior, anxiousness/depression, headstrongness, hyperactivity, immaturity, dependency and peer conflict/social withdrawal. Age-specific "standard" scores are used, again transformed to a mean of zero and standard deviation of one. Higher scores imply increases in behavior problems and so more negative outcomes.[24] I also include a dichotomous measure of early substance use indicating whether the child has ever smoked a cigarette or drunk (more than a sip or two of) alcoholic beverages. Early drinking and drug use have been identified as among the most

[23] Further information on the outcomes and many explanatory variables is contained in Center for Human Resource Research (2002).

[24] The BPI is a 32-item parent reported scale with high internal consistency and test-retest reliability; it has been widely used and tested across diverse populations to predict future problems (Love, 1997).

significant and pervasive adolescent problem behaviors and are associated with increased mortality and morbidity (Kennedy and Prothrow-Stith, 1997). However, relatively few (13 percent) 10 or 11 year old NLSY children have engaged in these risky activities, limiting the statistical power of the analysis to detect moderate sized effects of maternal employment.

The final two dependent variables identify adolescents who are obese or at risk of overweight. Childhood obesity is rapidly increasing and results from poor diet or physical inactivity. Such excess weight has many negative effects including reduced physical functioning and impairment in psycho-social health (Schwimmer et al., 2003) and short-term risks of orthopedic, neurological, pulmonary and endocrine conditions (Must and Strauss, 1999). Similarly, type 2 diabetes, which was once virtually unrecognized in adolescence, is increasing rapidly, as is a prediabetic state consisting of glucose intolerance and insulin resistance among severely obese children (Ebbeling et al., 2002). Furthermore, being overweight during childhood significantly increases the chances of adult obesity (Whitaker et al., 1997; Guo et al., 2002), resulting in serious medical complications such as hypertension, type-2 diabetes, coronary heart disease, stroke, gallbladder disease, respiratory problems and several types of cancer (National Heart, Lung and Blood Institute, 1998), higher rates of future mortality (Engeland et al., 2004) and elevated lifetime medical costs (Johnson et al., 2003).

Adults are conventionally classified as obese if their body mass index (BMI), defined as weight in kilograms divided by height in meters squared, exceeds a single threshold. Since child BMI varies systematically with age, a more complicated criterion is used for children. Specifically, they are classified as "obese" if their BMI is at or above the 95th percentile for gender and age-specific growth charts compiled by the CDC's National Center for Health Statistics using reference populations from the 1960s through 1980s and "at risk of overweight" if their BMI reaches or exceeds the corresponding 85th percentile (Kuczmarski et al., 2000).[25] Since the BMI thresholds were benchmarked from earlier cohorts, secular increases in body

[25] See www.cdc.gov/nccdphp/dnpa/bmi/bmi-for-age.htm for further information. The CDC terms children above the 95th percentile as "overweight". Following Johnson et al. (2003), I call these children "obese" to avoid confusion with the distinct categories of "overweight" and "obese" used for adults. Also, children at or above the 85th percentile are placed in the at risk of overweight category, including those above the 95th percentile who are often excluded from this category in government statistics.

weight imply that far more than 5 (15 percent) of adolescents in the sample analyzed are obese (at risk of overweight).

D.2 Maternal Employment

Maternal employment is measured on an annual basis. The first year of the child's life (denoted as year 1) covers the four quarters immediately following birth, the second year (called year 2) includes the fifth through eight quarters and so on, through the ninth year.[26] The models control for average weekly work hours in all jobs divided by 20, implying that a one unit change corresponds to 20 additional hours of labor supply per week.[27] NLSY mothers with a job but on maternity leave are generally categorized as employed, implying that employment rates immediately after birth are overstated. However, few women take more than a few weeks of leave, so any resulting bias is likely to be small.[28]

Most models control for average weekly work hours (divided by 20) during the first nine years of the child's life. However, some estimates allow nonlinear impacts while others separately estimate the effects of employment in the first year or first three years and in the fourth through ninth years. As with most prior research, the role of paternal employment is ignored, a significant limitation due to severe constraints on the data available for fathers.[29]

D.3 Other Explanatory Variables

This analysis exploits the extensive child, maternal, household and geographic information in the NLSY. A vector of "basic" background variables, so labeled because they have frequently used in prior research, contains continuous measures of birth order, mother's age (in years) and a quadratic for child age in months. Also included are dummy variables for

[26] The NLSY Child/Young Adult File indicates work hours for the first 16 quarters after birth. These were used to construct the hours variables in the child's first through forth years of life. Average hours in other years were calculated using data from the NLSY Work History File that contains weekly employment information from January 1, 1978 through the end of 1999. In these cases where work hours were missing for specific weeks, the average was calculated over the weeks for which data were reported.

[27] Hours are calculated only for the main job in the few cases where information on secondary jobs is missing.

[28] For instance, Klerman and Leibowitz (1994) find that, during the late 1980s, just 2.2 percent of mothers were on paid leave and 6.0 percent on unpaid leave three months after giving birth.

[29] In particular, information is only available for fathers residing with interviewed mothers. Moreover, most weeks away from jobs do *not* occur because fathers are choosing to spend time with young children but rather for other reasons (Ruhm, 2004), making it especially difficult to avoid omitted variables biases when considering the labor supply of fathers.

race/ethnicity (2 variables), sex of the child, the mother's Armed Forces Qualifications Test (AFQT) score in 1980, her education at child birth (4 variables) and if a spouse/partner was in the household during the child's birth year. Unless noted, all regressors are measured at the child assessment date. Table A.1 provides further describes these and other variables used in the analysis.

Most models include supplemental characteristics that have usually not previously been controlled for but which provide information on the time or financial resources available to children, their health endowments at birth and on the quality of maternal inputs.[30] Early child health or developmental problems are incorporated through dichotomous indicators of low or very low birth weight (2 variables), long hospital stay by the infant at birth, hospitalization during infancy and physician visits for illness during the first three months of life (3 variables). Total family income in the year prior to birth (in 2000 year dollars) is included, as are relative ages of the child's siblings (4 variables) and a dummy variable for whether the mother attended a private secondary school.

A third set of regressors, labeled "maternal employment characteristics", control for the occupation of the mother in the quarter prior to pregnancy (5 variables), the number of weeks before giving birth that the mother stopped working (4 variables) and her average weekly work hours (divided by 20) in the year prior to pregnancy.[31] These supply information on tastes for employment and opportunity costs of not working that may be correlated with unobserved influences on child development. Average work hours (divided by 20) in the calendar year after the assessment survey date (e.g. 1999 for children who were 10 and 11 in 1998) is also held constant to further control for confounding factors and to indicate possible reverse causation – from child outcomes to maternal labor supply.

I tested whether the results were sensitive to including a still more detailed "auxiliary" set of family and location characteristics such as: presence of the father in the household at the

[30] An exception is that many of these same explanatory variables have been included by Ruhm (2004).
[31] The pre-pregnancy period includes the 40th through 91st weeks prior to birth. Since the NLSY employment history begins on January 1, 1978, information for the entire year was not available for mothers giving birth during the first three quarters of 1979. In these cases, work hours were averaged for all available weeks (prior to pregnancy) during 1978.

survey date, the mother's number of siblings (3 variables), her geographic location at age 14 (3 variables), whether magazines, newspapers, or library cards were in her home at 14 (3 variables), place of birth and education of her parents (4 variables), whether her mother worked when she was 14, her family structure at age 14 (2 variables), if she had smoke a cigarette before age 14 or tried marijuana or hashish before 21 (2 variables). This vector also contained location-specific factors possibly correlated with child outcomes such as: residence in a central city or SMSA/MSA (2 variables), crime, birth, marriage and divorce rates, and number of physicians per 100,000 population (5 variables).[32] These variables potentially account for attitudes, experiences, capabilities and geographic factors correlated with investments in children. They were excluded from the "preferred" econometric models because their impact is likely to be indirect or of limited importance and may be accounted for by the "basic" or "supplemental" regressors. Also some of them (e.g. presence of the father) could be endogenous.

Data on one or more background characteristics was lacking for some respondents. To avoid excluding these persons, the relevant regressors were sometimes set to zero and dummy variables created denoting the presence of missing values. For example, mothers not reporting an AFQT score were given a value of zero and the "missing AFQT" variable was set to one.[33] Alternatively, some dummy variables were valued at one when the specified condition was met and zero when it was not *or* when the relevant data were absent.[34]

D.4 Patterns of Maternal Employment

Figure 1 provides kernel density estimates for weekly maternal employment hours during the first, third and ninth year of the child's life, and averaged over the nine years.[35] For each individual year, there are spikes at 0 and 40 hours per week, combined with fairly constant probabilities for intermediate hours and low rates of labor supply beyond 40 hours. However,

[32] Most of these variables were obtained from the restricted-use NLSY Geocode File and refer to the county of residence.
[33] This was also done for family income before pregnancy, father's presence in the household and the local area characteristics.
[34] This strategy was used for hospitalizations and doctor visits in the first year, race/ethnicity and the two low birth weight regressors.
[35] Results in this section and the next refer to the nationally representative subsample of the NLSY. Similar findings are obtained using weighted data for the full sample.

the fraction of mothers with no annual work experience declines substantially and the spike at 40 hours per week becomes much more pronounced as the child ages. Because multiple years are averaged together, the distribution for the entire nine years is considerably more uniform. Over 91 percent of mothers work at some point during the period, the sample average is 18.2 hours per week and the 10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th} percentiles are 0.3, 5.4, 16.8, 29.7 and 37.7 hours.

The top panel of Table 1 provides additional detail for each of the nine years, as well as for the year prior to pregnancy and after the 10 or 11 year old assessment date. The lower panel provides corresponding information for the entire nine years, the first three years and the fourth through ninth years. In addition to average work hours, the table indicates probabilities of positive work hours and averaging at least 20 and 35 hours per week. The last column indicates average hours for mothers with some employment during the specified period, hereafter referred to as conditional averages.[36]

Mothers with infants work much less than in the year prior to pregnancy (11.8 vs. 19.1 hours) but labor supply rises substantially by the second year (to 15.2 hours) and then increases steadily in subsequent years due to growth at both the intensive and extensive margins. For instance, just 57 percent engage in market employment during their child's first year, compared to 64 percent in year 2 and 75 percent in year 9. Work hours, conditional on employment, average 20.7, 23.8 and 30.5 per week in the first, second and ninth years.

D.5 Descriptive Relationships

Maternal employment is generally associated with favorable child outcomes. The top panel of Table 2 shows that children whose mothers averaged at least 35 hours per week during the nine years had mean scores that were .19 to .22 (.10 to .13) standard deviations higher on the three cognitive assessments than those with mothers working fewer than 19 (20 to 34) hours weekly. They also had substantially fewer behavioral problems and lower rates of substance use but higher probabilities of obesity or risk of overweight. The patterns differ somewhat when focusing on employment during the first three years of the child's life. Here, the highest cognitive scores were obtained by children whose mothers averaged 20-34 hours per week,

[36] Conditional means in the lower panel are averaged over years when mothers have positive work hours.

although the penalties associated with intensive maternal employment were generally not statistically significant and the latter group of children was least likely to have behavioral problems or to have used tobacco or alcohol.

These disparities need *not* reflect a causal effect of the labor supply. Instead, the remainder of the table demonstrates that children whose mothers worked relatively long hours come from advantaged families and possess characteristics that are likely to promote favorable development. For instance, women averaging 35 or more hours per week during the nine years were older at child birth (24.0 vs. 22.6 years) and more likely to have attended college (47.1 vs. 27.0 percent) than those working 19 or fewer hours. They also more often lived with a spouse or partner when their child was born (81.8 vs. 71.0 percent), had higher AFQT scores (46.7 vs. 37.0), greater income in the calendar year preceding the assessment date ($62,757 vs. $48,024), and their children much less frequently had low or very low birth weight (3.8 and 0.3 vs. 7.1 and 1.1 percent). The characteristics for mothers working 20-34 hours per week were generally intermediate between the upper and lower categories, with similar patterns obtained when averaging work hours during only the child's first three years of life.

These findings indicate the need for a careful multivariate investigation. Otherwise, disadvantaged family backgrounds or child problems that retard development and are associated with reduced labor supply could lead to an upwards biased estimate of the return to maternal employment.

E. Econometric Estimates

Table 3 summarizes the results of four econometric specifications for the three cognitive outcomes (PPVT, PIAT-M and PIAT-R scores). Table 4 provides corresponding results for BPI scores, substance use, and excess body weight. Maternal employment refers to average weekly work hours (divided by 20) during the child's first nine years. Estimation is by ordinary least squares for the cognitive test scores and Behavior Problems Index, with the effect sizes of a 20 hour per week increase in the mother's labor supply displayed. Binary probit models are used for the dichotomous outcomes (substance use, obesity and overweight risk) and the tables indicate the predicted effect of an extra 20 hours per week of maternal employment with other

explanatory variables evaluated at the sample means. All models include assessment year dummy variables. Additional regressors are detailed at the bottom of the table: B, S and E refer to the vectors of basic, supplemental and maternal employment characteristics discussed previously and described in appendix Table A.1. One empirical strategy is to examine how the addition of more extensive controls alters the parameter estimates on maternal labor supply. This hopefully provides an indication on the direction of the omitted variables bias remaining after incorporating the comprehensive sets of regressors. Additional specifications, summarized in Table A.2, include vectors of auxiliary characteristics or state dummy variables.[37]

E.1 Cognitive Development

Column (a) of Table 3, which controls only for work hours and the assessment year, provides further evidence that 10 and 11 year olds with employed mothers have relatively high verbal, mathematics and reading scores – 20 hours of labor supply per week during the child's first nine years is associated with a .19 to .25 standard deviation rise in test performance. However, this positive relationship largely results from omitted variables bias rather than any causal effect. Inclusion of the basic set of covariates (specification b) cuts the parameter estimate by over 75 percent; adding the supplemental regressors (column c) further reduces the predicted gains and accounting for maternal employment characteristics (model d) yields negative point estimates. For instance, in specification (d), the increased employment is correlated with .03, .04 and .05 standard deviation reductions in verbal, mathematics and reading recognition scores, implying changes from the median to the 49th, 48th and 48th percentiles. The inclusion of auxiliary characteristics or state fixed-effects do not substantially alter these estimates (see Table A.2) but, if anything, suggest more negative impacts than in model (d), the "preferred" specification focused upon below.

The coefficients on post-assessment employment imply a fairly strong positive relationship between test scores and the mother's *future* labor supply. Since employment is unlikely to substantially affect outcomes in prior periods, these results suggest reverse causation, whereby good cognitive performance is positively correlated with subsequent maternal job-

[37] The state dummy variables account for location-specific factors that affect child outcomes and remain fixed within-states over time. State identifiers are included in the NLSY Geocode File.

holding. Assuming a similar pattern occurs at younger child ages, the estimates in Table 3 probably understate the negative effects of work by failing to completely control for the negative effect of poor cognitive performance on the mother's labor supply.

E.2 Socioemotional Development and Excess Body Weight

Absent regressors other than the survey year, there is a negative association between maternal work hours and BPI scores or early substance use but a positive correlation with child obesity or risk of overweight (see column a of Table 4). The inclusion of additional controls (specifications b through d) attenuates but does not eliminate the reduction in BPI scores – the effect size declines from -.11 to -.05 – implying that maternal employment continues to predict fewer problem behaviors and the positive coefficient on future work hours suggests that the favorable BPI effect may remain understated in specification (d). Conversely, labor supply is positively related to smoking or tobacco use and the predicted effect is large in percentage terms, although imprecisely estimated.[38]

The addition of covariates only minimal affects the measured effect of maternal employment on excess adolescent body weight – 20 additional hours of work per week are anticipated to raise probabilities of obesity and overweight risk by 1.7 and 3.1 percentage points in column (a), compared to 1.4 and 2.5 points in specification (d). Such magnitudes are substantial in percentage terms, although the confidence intervals are fairly large.[39] While these results are consistent with evidence by Anderson et al. (2003) that maternal labor supply increases child obesity, the large coefficients on future employment raise doubts that these represent causal effects rather than a spurious positive relationship.[40]

[38] Evaluating other explanatory variables at their sample means, the predicted probability of substance use is .1110, so that an increase of .0115 corresponds to a rise of 10 percent. The small coefficient on future employment (.001 with a standard error of .007) provides no indication of reverse causation.

[39] At the sample means, 13.5 (30.7) percent of children are predicted to be obese (at risk of overweight); therefore the estimates in model (d) imply that 20 extra work hours weekly raises the probabilities by 10 (8) percent.

[40] The parameter estimates on labor supply, for all of these outcomes, are only minimally affected by controlling for auxiliary characteristics or state fixed effects (see Table A.2).

E.3 Nonlinearities

The impact of maternal employment might vary with its intensity. For example, several studies suggest benefits of limited employment but with decreasing returns or costs for longer work hours (Parcel and Menaghan, 1994; Richards and Duckett, 1994; Muller, 1995; Ruhm, 2004). Table 5 allows for such nonlinearities by including a quadratic in labor supply. Here and below, all specifications control for the survey year and the basic, supplemental and maternal employment characteristics (equivalent to model d of Tables 3 and 4). The first two rows display the coefficients for hours and hours squared; the third shows p-values for the null hypothesis that the employment coefficients are jointly equal to zero; the fourth indicates the number of hours where the predicted effects reach a maximum or minimum (where the first derivative with respect to hours is zero). The bottom panel shows the predicted change associated with working 20, 30 or 40 hours per week, compared to no employment.

Predicted scores on the three cognitive tests are maximized when the mother averages 15 to 19 hours per week, with negative effects at long work hours. For instance, compared to not working, 20 hours per week of employment predicts test score gains of .12, .05 and .05 standard deviations for the PPVT, PIAT-M and PIAT-R assessments versus decreases of .04, .07 and .08 standard deviations for 40 hours per week of labor. It is noteworthy that the quadratic specifications yield much more highly significant results for these outcomes than the corresponding linear models in Table 3.

The results for BPI scores suggest that even fairly long maternal work hours reduce behavior problems. Conversely, the estimates indicate increases in the risk of early substance use that are sizeable in percentage terms, particularly for full-time employment, while lengthy hours are correlated with a substantial rise in adolescent obesity or risk of overweight. However, the labor supply estimates are imprecise in all of these cases.

E.4 Timing of Employment

The first years of life are believed to be particularly important for children (Carnegie Task Force on Meeting the Needs of Young Children, 1994; Council of Economic Advisers, 1997). Recent research emphasizes the effects of early influences on brain development (Shore,

1997) and investments by parents during this period are likely to be significant for the development of learning skills, self-esteem and emotional security (Heckman, 2000).[41] As mentioned, some prior research finds that work by mothers during the child's first years has detrimental impacts. With this in mind, Table 6 examines whether the effects of maternal employment differ with child age. The top panel repeats results where the key explanatory variable is average hours during the first nine years. The middle panel allows hours during the first three and next six years to have different effects. Finally, the bottom panel breaks out labor supply in year 1 from that in years 2 and 3.

The results generally support the hypothesis of a special role for maternal investments during very early childhood. An extra 20 hours of work per week during the first three years is predicted to reduce PPVT, PIAT-M and PIAT-R scores by .05, .05 and .03 standard deviations, compared to effect sizes of -.00, -.00 and -.02 for corresponding labor supply in the fourth through ninth year. The negative effects on cognitive development are particularly large for employment during infancy, where an additional 20 hours per week is predicted to reduce the three cognitive scores by .05, .03 and .06 standard deviations. Labor supply during the early years also appears relatively important when considering adolescent substance use, whereas that occurring during the fourth through ninth years may matter more for excess body weight.[42]

The pattern for behavioral problems is noteworthy. Work by the mother in the first three years (and particularly in infancy) is positively correlated with BPI scores, whereas that during years 4 through 9 has a negative predicted effect. This might occur because maternal employment has different impacts in early and later years. Alternatively, mothers might be less likely to work when children exhibit behavioral problems, so that the negative relationship for work hours in the later years reflects reverse causation. The positive coefficient obtained for post-assessment employment (.028 with a standard error of .020) raises doubts about this second possibility, since it suggests that higher BPI scores predict increases rather than decreases in future labor supply.

[41] However, the mechanisms are poorly understood and the relationship between early brain development and future outcomes remains controversial (Bruer, 1999).

[42] Once again, however, large coefficients on future employment (.015 and .029 with standard errors of .007 and .009 for obesity and risk of overweight) raise the possibility of reverse causation.

E.5 Subgroups

Some previous researchers (e.g. Desai, et al., 1989; Richards and Duckett, 1991; Brooks-Gunn, et al., 2002) obtain stronger negative maternal employment effects for boys than girls.[43] Others (Han, et al., 2000; Waldfogel, et al., 2002) suggest that the deleterious impact is largely restricted to white children.[44] Highly educated mothers provide relatively high quantities and quality of time investments, raising the possibility of especially harmful consequences when these are reduced by market employment.[45] Household composition could also be important since female-headed families have less total time (than those with two parents) available to invest in children but may also particularly benefit from the additional income provided by market work. These possibilities are investigated in Table 7, which summarizes the results for subgroups of children.

Stronger negative effects on cognitive development and excess body weight are generally obtained for boys than girls. A 20 hour per week increase in maternal labor supply is predicted to reduce male PPVT, PIAT-M and PIAT-R scores by .04, .08 and .08 standard deviations, compared to effect sizes of -.03, .01 and .00 for females. Obesity and overweight risk are expected to rise by 2.6 and 3.2 percentage points (17 and 10 percent) for boys versus -0.2 and 1.5 points (-1 and 5 percent) for girls. Labor supply is also associated with smaller reductions in behavioral problems for males.

The deleterious impacts on cognitive development are much larger for children who are neither black nor Hispanic (hereafter referred to as whites) than for minorities. Effect sizes for the PPVT, PIAT-M and PIAT-R are -.11, -.09 and -.09 among whites versus .01, -.01 and -.02 for minorities. Increased work hours similarly predict sharp reductions in behavioral problems for blacks or Hispanics – the effect size is -.12 – compared to small increases for whites. Findings are mixed for the two body weight outcomes.

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[43] Conversely, Han et al. (2001) and Hill et al. (2001) fail to uncover gender differences in the impact of first year employment; Waldfogel et al. (2002) find larger negative effects of full-time work for girls than boys and the relative magnitudes obtained by Ruhm (2004) vary across outcomes.

[44] However, the disparities across race/ethnicity groups are ambiguous in Ruhm (2004); Hill et al. (2001) show that race differences are eliminated by carefully controlling for the selection into employment.

[45] Bianchi et al. (2004) provide evidence that these education differentials have risen over time, despite faster increases in the employment of highly educated mothers.

More detrimental consequences are obtained for children in households with two adults present in the birth year than for those with only the mother at home. Effect sizes are .03, -.02 and .03 for the three cognitive outcomes and -.07 for BPI scores in mother-only families versus -.06, -.05, -.09 and -.04 when a husband was present. The extra 20 hours of weekly work are correlated with 0.8, -0.5 and 1.4 percentage point increases in substance use, obesity and overweight risk in female-headed families, compared to 1.0, 2.3 and 3.5 point changes in two-adult households.[46]

Finally, the negative predicted impacts of maternal employment are particularly pronounced for adolescents with college educated mothers: effect sizes are -.21, -.16 and -.13 for the three cognitive scores, compared to .06, .02, and -.01 among those whose mothers had not attended college. Obesity and risk of overweight are predicted to rise by 1.4 and 3.9 percentage points for the former group versus 0.9 and 1.4 points for the latter. However, maternal labor supply is also correlated with a larger reduction in BMI scores for adolescents with highly educated mothers.

E.6 Socioeconomic Status

The previous section presented evidence of relatively strong negative effects of maternal employment for "advantaged" children. This is further examined through a systematic investigation of the role of socioeconomic status. Researchers considering how outcomes differ with SES typically use univariate measures such as education, income or occupational attainment (e.g. Anderson et al., 2003; Zhang and Wang, 2004) or composites (like the Hollingsworth index) that represent relatively simple combinations of two or more factors (e.g. Gordon-Larsen et al., 2003). By contrast, I construct an index of SES by regressing total family income in the calendar year prior to the 10 or 11 year old child's assessment date on the mother's age (at child birth), her AFQT score and education, the child's race/ethnicity, and whether a spouse/partner was in the household during the birth year; children are then ordered by predicted incomes and placed into quartiles based on this ranking (i.e. $<25^{th}$, 25^{th}-50^{th}, 50^{th}-75^{th}, $>75^{th}$ percentiles).[47]

[46] Hill et al. (2001) and Brooks-Gunn et al. (2002) similarly find more negative effects of work for children of married than unmarried mothers.

[47] Rosenbaum and Ruhm (2003) use a similar procedure. The econometric estimates are generally as expected. Income is positively related to the mother's AFQT score, education and age at child birth.

This method has the advantage of simultaneously accounting for a large number of determinants, rather than relying on multiple stratifications with indicators that are often highly correlated. It also removes some (but not all) sources of endogeneity. For example, incomes vary with employment status which, in turn, may be partially determined by child health or development at younger ages. This is less of an issue for predicted incomes, which rely on group rather than individual characteristics.[48]

Table 8 displays selected sample characteristics for the four SES quartiles. There are sharp gradients for all outcomes, with the most advantaged children having the highest cognitive scores and lowest rates of behavior problems, substance use or excess weight. Mean differences between the top and bottom SES quartiles are 1.23, 1.01, .95, and -.34 standard deviations for PPVT, PIAT-M, PIAT-R and BPI scores and -8.2, -9.2, and -6.8 percentage points for substance use, obesity, and risk of overweight. These disparities once again mainly reflect factors other than maternal employment. For instance, as shown in the lower two panels of the table, high SES children rarely had low or very low birthweight, were predominantly born into two-parent households and often have college-educated mothers.

Mothers in the highest SES groups supply relatively large amounts of labor. The top quartile averaged 22 hours per week during the child's first nine years versus 13 hours for the bottom quartile (see Table 9). They are almost twice as likely to have been employed 20 or more hours per week (55 vs. 30 percent) and 3 times as frequently averaged 35 or more hours (24 vs. 8 percent). These differences are even more pronounced during the child's first three years, where the top quartile worked nearly twice as much (18 vs. 10 hours per week), averaged 20 or more hours 2.3 times as often (46 vs. 20 percent) and were 2.9 times as likely to have worked at least 35 hours weekly (20 vs. 7 percent).

Incomes are relatively low for black children and those born into single-parent households. The one possibly surprising result is that being Hispanic has statistically insignificant positive effect on predicted income. Sample weights were accounted for when calculating the income percentiles. Since the NLSY oversamples minorities (who tend to have low incomes), this implies that the lower quartiles have more observations than the higher ones.

[48] However, some endogeneity may remain. For example, nonwhites have relatively low average incomes and high obesity prevalence but both could result from third factors.

The econometric estimates, summarized in Table 10, suggest substantial negative impacts of maternal employment for the most advantaged children, compared to neutral or favorable effects among lower SES groups. The labor supply variable refers to average weekly work hours (divided by 20) during the first nine years, except for the last two rows where employment in the first three and next six years is separately examined for the top quartile. An extra 20 hours of weekly work by mothers is predicted to *decrease* the PPVT, PIAT-M and PIAT-R scores of children in the highest quartile by .24, .17 and .13 standard deviations, compared to *increases* of .06, .07 and .06 standard deviations for the bottom quartile. Obesity is anticipated to rise by 2.1 and 3.2 percentage points (22 and 27 percent) and risk of overweight by 5.2 and 5.5 percentage points (20 and 19 percent) for the top two quartiles, compared to changes of -0.8 and 1.9 percentage point (-4 and 6 percent) for the lowest quartile. Moreover, there is no evidence that the positive relationship between the maternal work hours and excess weight among the highest SES group reflects reverse causation.[49] Another difference is that, for this group, the negative effects often extend to include employment after the child's first three years of life – 20 extra hours of weekly work during the fourth through ninth years is predicted to reduce cognitive scores by .05 to .17 standard deviations and increase obesity (risk of overweight) by 2.0 (3.8) percentage points or 21 (14) percent.

For the typical child, harmful effects were only seen when mothers worked long hours. By contrast, deleterious impacts are predicted at all levels of maternal labor supply for high SES children and they accumulate in an approximately linear fashion. This can be seen in Table 11, which summarizes econometric results among the highest quartile for cognitive scores and the top two quartiles for excess body weight.[50] Specification (b) differs from column (a) by adding a quadratic in work hours. The coefficient on hours squared is never statistically significant and the p-value on maternal labor supply is always reduced by including the quadratic term, suggesting that the linear model (in column a) is preferable. However, the predicted employment

[49] The coefficient (standard error) on future employment is .009 (.011) for obesity and .012 (.021) for risk of overweight.

[50] BPI scores and substance use are not shown since mixed results were obtained above for these outcomes. The sample includes the top two SES quartiles for excess body weight since Table 10 indicates strong effects for both groups.

effects are generally similar (and large) in either specification. For example, compared to not working, 40 hours per week of maternal work is estimated to reduce PPVT, PIAT-M and PIAT-R scores by .48, .35 and .27 standard deviations in model (a) and .49, .35 and .26 standard deviations in column (b). Obesity and risk of overweight are predicted to rise by 5.8 and 10.8 percentage points in the first case, versus 4.7 and 10.0 points in the second, although with larger disparities at shorter hours.

A. Discussion

A number of carefully conducted studies have recently indicated that maternal employment during the child's first years has negative effects on cognitive development measured around the time of school entry. This analysis suggests that although a portion of these deleterious consequences persist through early adolescence, the harmful impacts are typically quite modest. An additional 20 hours per week of work during the child's first nine years is predicted to reduce the average verbal, mathematics and reading recognition scores of 10 or 11 year olds by .03, .04 and .05 standard deviations, corresponding to decreases from the median to the 49th, 48th and 48th percentiles.[51] Results for the other outcomes examined are more ambiguous. Work during the child's first three years is predicted to increase the frequency of behavior problems, while that during the next six years is anticipated to reduce them. Maternal labor supply is correlated with relatively large (in percentage terms) but imprecisely estimated increases in the probability that 10 or 11 year olds will have tried tobacco or alcohol and is linked to higher rates of excess body weight. This last finding would seem to confirm evidence provided by Anderson et al. (2003) on the role of maternal employment in contributing to the epidemic of child obesity. However, the full-sample estimates also indicate a strong positive relationship between body weight and the mother's labor supply in *future* years, raising the possibility of omitted variables bias or reverse causation.

The deleterious consequences summarized above are generally concentrated among children whose mothers work long hours, while lower amounts of labor supply are often correlated with positive effects. This is important because although over 90 percent of mothers

[51] By comparison, Ruhm (2004) estimates that 20 hours of extra work during the first three years reduces the PPVT, PIAT-M and PIAT-R scores of 3 to 6 year olds by .04, .11 and .08 standard deviations.

engage in market employment during their child's first nine years, most do not work intensively – just 15 percent average 35 or more hours per week – implying that many families may be making decisions consistent with favorable child outcomes.

Children whose mothers are employed intensively typically come from advantaged backgrounds and women tend to work less if their offspring had low test scores in *previous* years, suggesting that cognitive development influences employment decisions. (Behavior problems and early substance use do not have the same depressing effect.) One consequence is that the predicted labor supply effects generally become less favorable with the addition of more complete controls for heterogeneity. Much prior research only crudely controls for these disparities and therefore probably presents an overly optimistic assessment.

In contrast to the small average impacts, large negative effects of maternal employment are often obtained for advantaged children (e.g. whites and those with highly educated mothers or born into two-parent households). To examine this issue systematically, I constructed a multidimensional measure of socioeconomic status and found far much more injurious impacts for the highest SES groups. Among the top quartile, 20 extra hours of employment per week during the child's first nine years reduced predicted PPVT, PIAT-M and PIAT-R scores by .24, .17, and .13 standard deviations. Losses of this size are substantial, corresponding to decreases from the 66th to the 57th, 59th and 61st percentiles respectively.[52] Currie and Thomas (1999) indicate that early test performance is strongly related to future educational and labor market outcomes, suggesting that such effects may cause lasting economic costs. The additional work by mothers translated into a 3.2 and 2.1 percentage point (27 and 22 percent) rise in obesity among the top two SES quartiles and a 5.5 and 5.2 point (19 and 20 percent) increase in the risk of overweight.[53] Evidence that high SES children are particularly disadvantaged by maternal employment has been obtained in a number of recent studies (e.g. Hill et al., 2001; Brooks-Gunn

[52] Average scores of the top SES quartile were at the 66th percentile of the full NLSY sample distribution for all three cognitive assessments.

[53] The small and statistically insignificant coefficients on future employment for the top SES quartile suggest that the weight gain associated with maternal employment is likely to represent a causal effect.

et al., 2002; Ruhm, 2004) as well as some earlier research but, with the exception of Anderson et al. (2003), this issue has received only peripheral attention.[54]

There are several reasons why maternal labor supply might be particularly deleterious for advantaged children. First, they may have rich home environments, implying relatively high costs of being placed in nonparental care. Second, the benefits of the income obtained from the mother's employment could be muted at high SES levels. Third, while work may impose time constraints on high income mothers, their low income counterparts may be constrained whether or not they supply market labor (Anderson et al., 2003). Fourth, high SES mothers much more frequently work the long hours that are associated with adverse outcomes for the typical child.

The preceding analysis provides some information on these possibilities. There was no evidence of improved model fit among the highest SES quartile by moving from a linear to a quadratic work hours specification (see Table 11). Negative consequences for this group therefore appear to occur even for limited employment, rather than being restricted to children whose mothers work intensively. Such a result might be expected if this group has particularly favorable home environments and is also consistent with the evidence of negative effects of maternal employment after the first three years of the life for children in this group.[55] That said, the sources of SES disparities remain poorly understood and merit further attention.

Several limitations of this analysis should be recognized. First, the NLSY is not entirely representative, since it excludes some offspring of older mothers and is restricted to children born between 1979 and 1988. Different results might be obtained for more recent cohorts if workplaces have become more "family-friendly" or there have been changes in the quality of nonparental child care and education. Second, the included explanatory variables are relied upon to account for the selection into market work, rather than exploiting exogenous sources of variation. Identifying natural experiments or instrumental variable approaches represents an

[54] A potential concern with Anderson et al.'s approach is that they classify SES based on actual (rather than predicted) family income, which is partly determined by maternal employment. Their analysis is also limited to an examination of child obesity. Greenstein (1995) reviews early research pertaining to this issue; these studies generally control poorly for the selection into maternal employment.

[55] For example, time investments by highly educated mothers during the child's early school years might be particularly valuable for the development of good study habits and the mastery of difficult material.

important goal for future research. Third, our confidence in the conclusions will be strengthened if subsequent investigations confirm and identify mechanisms for the findings. Fourth, the role of paternal employment needs to be examined, which is difficult given limitations in existing data sources.

Finally, child development is just one argument in the household utility function, raising the prospect of tradeoffs between this and other desirable components. For example, the benefits of early parental time investments might be partially or fully offset by reductions in future incomes, if the periods out of market work adversely affect advancement in the labor market. The consequences of maternal employment are also likely to depend on the technologies and institutional arrangements in place and thus could differ markedly across countries or locations within the United States. A better understanding of the mechanisms by which parental investments promote child health and development might also facilitate designing less costly methods of achieving the same benefits. These represent important topics for future research.

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Table 1: Maternal Employment at Specified Child Ages

Time Period	Average Weekly Work Hours	Prob (Hours>0)	Prob (Hours ≥20)	Prob (Hours≥35)	Conditional Average Hours
Before Pregnancy	19.1	.747	.477	.257	25.5
Year 1	11.8	.570	.273	.119	20.7
Year 2	15.2	.636	.362	.202	23.8
Year 3	16.3	.638	.396	.224	25.4
Year 4	17.3	.652	.420	.242	26.6
Year 5	18.3	.679	.448	.271	27.0
Year 6	19.4	.692	.470	.295	28.0
Year 7	20.5	.714	.496	.309	28.7
Year 8	21.9	.737	.526	.342	29.7
Year 9	23.0	.753	.556	.365	30.5
Post-Assessment	25.2	.771	.596	.415	32.6
Years 1 - 9	18.2	.919	.435	.152	24.3
Years 1 – 3	14.4	.764	.339	.134	21.2
Years 4 - 9	20.1	.884	.489	.226	26.1

Note: Table displays results for the nationally representative subsample of the NLSY. The sample size is 2,241, although missing values reduce the number of observations in some years. Year 1 refers to the first four quarters of the child's life, year 2 to the fifth through eighth quarter, and so forth. The period before pregnancy refers to the 40th through 91st week prior to pregnancy; that after assessment refers to the calendar year following the survey date at which the child is 10 or 11 years old. Conditional average hours refer to mothers with some employment in the specified year in the top panel and averaged over years of work in the bottom panel.

Table 2:
Sample Means of Selected Variables By Average Weekly Work Hours of Mother

Variable	Full Sample	Weekly Work Hours In First Nine Years			Weekly Work Hours In First Three Years		
		0-19	20-34	≥35	0-19	20-34	≥35
Outcome							
PPVT	0.00	-0.06	0.05	0.15	-0.06	0.14	0.08
	(0.02)	(0.03)	(0.04)	(0.05)	(0.03)	(0.05)	(0.05)
PIAT-Mathematics	0.00	-0.05	0.03	0.14	-0.04	0.12	0.02
	(0.02)	(0.03)	(0.04)	(0.06)	(0.03)	(0.04)	(0.06)
PIAT-Reading Recognition	0.00	-0.06	0.03	0.16	-0.06	0.14	0.06
	(0.02)	(0.03)	(0.04)	(0.05)	(0.03)	(0.04)	(0.05)
Behavior Problems Index	0.00	0.03	0.02	-0.14	0.02	-0.01	-0.08
	(0.02)	(0.03)	(0.04)	(0.05)	(0.03)	(0.04)	(0.06)
Substance Use (%)	13.1	13.9	13.1	10.2	14.0	11.9	10.5
	(0.8)	(1.1)	(1.5)	(1.8)	(1.0)	(1.6)	(2.0)
Obese (%)	12.8	11.7	13.9	14.8	12.5	12.2	15.3
	(0.7)	(0.9)	(1.4)	(2.0)	(0.8)	(1.6)	(2.1)
Overweight Risk (%)	29.2	28.0	30.0	32.4	28.1	31.1	31.9
	(1.0)	(1.3)	(1.9)	(2.6)	(1.2)	(2.2)	(2.8)
Family Background							
Mother's Age (years)	22.9	22.6	22.8	24.0	22.6	23.3	24.0
	(0.1)	(0.1)	(0.1)	(0.2)	(0.1)	(0.1)	(0.2)
Mother Has Attended College (%)	32.5	27.0	35.7	47.1	27.4	42.4	42.7
	(1.0)	(1.2)	(1.9)	(2.7)	(1.2)	(2.3)	(2.9)
Mother's AFQT Score	40.3	37.0	43.0	46.7	37.2	46.2	45.8
	(0.6)	(0.8)	(1.0)	(1.4)	(0.7)	(1.2)	(1.5)
Spouse/Partner Present (%)	74.7	71.0	78.3	81.8	71.8	80.7	80.0
	(0.9)	(1.3)	(1.6)	(2.1)	(1.2)	(1.8)	(2.3)
Total Family Income in Previous Year ($)	52,793	48,024	56,313	62,757	47,737	61,764	62,586
	(1,949)	(2,562)	(4,042)	(4,030)	(2,192)	(5,533)	(4,436)
Child Characteristics							
Low Birth Weight (%)	6.4	7.1	6.4	3.8	7.0	6.1	4.2
	(0.5)	(0.7)	(1.0)	(1.1)	(0.7)	(1.1)	(1.2)
Very Low Birth Weight (%)	0.8	1.1	0.5	0.3	0.9	0.7	0.4
	(0.2)	(0.3)	(0.3)	(0.3)	(0.3)	(0.4)	(0.4)

Note: See note on Table 1. Table displays averages for the nationally representative subsample of the NLSY. Standard errors of sample means are in parentheses. The PPVT, PIAT and BPI scores are normalized to have a mean of zero and a standard deviation of one (for the nationally representative NLSY subsample). Mother's age or education and presence of a spouse/partner refer to the year in which the child was born. Total family income is for the calendar year before the survey date at which the child was 10 or 11 years old. Low (very low) birth weight indicates that the child weighed less than 2500 (1500) grams at birth.

Table 3:
Regression Estimates of the Effect of Maternal Employment on Cognitive Outcomes

Time Period	(a)	(b)	(c)	(d)
		PPVT Score		
Years 1-9	.254 (.026)	.045 (.023)	-.019 (.023)	-.033 (.030)
Post-Assessment				.031 (.018)
		PIAT-Mathematics Score		
Years 1-9	.185 (.024)	.046 (.024)	.034 (.024)	-.042 (.031)
Post-Assessment				.039 (.018)
		PIAT-Reading Recognition Score		
Years 1-9	.190 (.025)	.020 (.024)	-.003 (.024)	-.047 (.031)
Post-Assessment				.037 (.018)
Other Regressors	None	B	B,S	B,S,E

Note: Table shows predicted effect of a 20 hour increase in average weekly maternal work hours during the specified time period. Outcomes are for children 120-143 months of age. The cognitive assessments are normalized to have a standard deviation of 1 and estimation is by ordinary least squares. All models control for the assessment year. The categories of additional regressors are "Basic" child, maternal and household characteristics (B); Supplementary child health, family background and location specific characteristics (S), and pre-pregnancy maternal employment characteristics (E). See Table A.1 for full descriptions. Sample sizes are 3,556, 3,593 and 3,584 for PPVT, PIAT-M and PIAT-R scores.

Table 4:
Regression Estimates of the Effect of Maternal Employment on Non-Cognitive Outcomes

Time Period	(a)	(b)	(c)	(d)
		Behavior Problems Index		
Years 1-9	-.112 (.024)	-.050 (.025)	-.041 (.026)	-.045 (.033)
Post-Assessment				.023 (.020)
		Substance Use		
Years 1-9	-.009 (.009)	.002 (.009)	.003 (.009)	.012 (.011)
Post-Assessment				.001 (.007)
		Obesity		
Years 1-9	.017 (.008)	.030 (.009)	.022 (.009)	.014 (.011)
Post-Assessment				.016 (.007)
		Overweight Risk		
Years 1-9	.031 (.011)	.042 (.012)	.034 (.012)	.025 (.015)
Post-Assessment				.028 (.006)
Other Regressors	None	B	B,S	B,S,E

Note: See note on Table 3. BPI scores are normalized to have a standard deviation of 1. Estimation is by OLS for BPI and as binary probit models for substance use and excess body weight. For the binary probit estimates, the table shows predicted effects with the other explanatory variables evaluated at the sample means. Sample sizes are 3,689, 3,275, 3,819 and 3,819 for BPI, Substance Use, Obesity and Overweight Risk.

Table 5:
Non-Linear Effects of Maternal Employment During the Child's First Nine Years

	PPVT	PIAT-M	PIAT-R	BPI	Substance Use	Obesity	Overweight Risk
Coefficient/Standard Error							
Hours	.258 (.077)	.143 (.080)	.145 (.080)	-.108 (.085)	.226 (.152)	-.021 (.134)	-.023 (.113)
Hours Squared	-.140 (.034)	-.090 (.036)	-.093 (.036)	.030 (.038)	-.080 (.068)	.040 (.058)	.045 (.050)
P-Value	<.001	.017	.010	.280	.297	.356	.176
Max/Min Effect (hours)	18.4	16.0	15.6	35.7	28.1	5.2	5.1
Predicted Change From Working:							
20 Hours	.118	.054	.052	-.078	.027	.004	.007
30 Hours	.072	.013	.009	-.094	.030	.013	.023
40 Hours	-.044	-.072	-.081	-.095	.024	.027	.046

Note: See notes on Tables 3 and 4. The specification estimated is the same as model (d) of those tables, except for the additional control for a quadratic in average weekly work hours (divided by 20) during the first nine years after birth. The P-Value refers to the hypothesis that the linear and quadratic terms on work hours are jointly equal to zero. The maximum/minimum effect refers to the point at which the first derivative with respect to hours is zero. Predicted changes refer to estimated differentials relative to no employment during the first nine years of the child's life. For the binary probit estimates, these are calculated as differences in predicted values averaged across all sample members.

Table 6:
Effects of Maternal Employment at Different Child Ages

Time Period	PPVT	PIAT-M	PIAT-R	BPI	Substance Use	Obesity	Overweight Risk
Years 1 - 9	-.033	-.042	-.047	-.045	.012	.014	.025
	(.030)	(.031)	(.031)	(.033)	(.011)	(.011)	(.015)
Years 1 – 3	-.045	-.051	-.034	.045	.016	-.004	.016
	(.032)	(.033)	(.033)	(.035)	(.012)	(.012)	(.017)
Years 4 - 9	.002	-.003	-.019	-.071	-.000	.015	.012
	(.029)	(.030)	(.030)	(.032)	(.011)	(.011)	(.015)
Year 1	-.046	-.033	-.063	.037	.009	.004	.018
	(.033)	(.035)	(.035)	(.037)	(.013)	(.001)	(.017)
Years 2 – 3	-.008	-.022	.013	.013	.007	-.006	.002
	(.030)	(.032)	(.032)	(.034)	(.011)	(.011)	(.016)
Years 4 - 9	.000	-.002	-.023	-.068	-.000	.016	.012
	(.029)	(.030)	(.030)	(.032)	(.011)	(.011)	(.015)

Note: See notes on Tables 3 and 4. The specification estimated above is the same as model (d) of those tables except for the additional controls for average weekly work hours (divided by 20) during the specified years. Each panel displays the results of a separate model.

Table 7:
Effect of Maternal Employment During Child's First Nine Years For Population Subgroups

Group	PPVT	PIAT-M	PIAT-R	BPI	Substance Use	Obesity	Overweight Risk
Boys	-.037	-.084	-.083	-.026	.017	.026	.032
	(.043)	(.044)	(.045)	(.047)	(.017)	(.016)	(.021)
Girls	-.032	.010	.001	-.061	.009	-.002	.015
	(.042)	(.043)	(.042)	(.046)	(.014)	(.015)	(.022)
Hispanic or Black	.006	-.012	-.015	-.119	.000	.006	.022
	(.043)	(.043)	(.043)	(.045)	(.015)	(.016)	(.021)
Not Hispanic or Black	-.111	-.089	-.085	.029	.020	.012	.017
	(.040)	(.045)	(.045)	(.048)	(.017)	(.014)	(.022)
Mother Has Not Attended College	.059	.024	-.012	-.012	.018	.009	.014
	(.037)	(.038)	(.038)	(.041)	(.015)	(.014)	(.019)
Mother Has Attended College	-.205	-.162	-.127	-.117	.001	.014	.039
	(.050)	(.053)	(.052)	(.055)	(.016)	(.017)	(.026)
No Spouse/Partner Present in Birth Year	.025	-.019	.030	-.071	.008	-.005	.014
	(.050)	(.054)	(.053)	(.058)	(.021)	(.022)	(.027)
Spouse/Partner Present in Birth Year	-.063	-.047	-.086	-.039	.010	.023	.035
	(.038)	(.038)	(.038)	(.040)	(.013)	(.013)	(.019)

Note: See note on Tables 3 and 4. The specification estimated is the same as model (d) of those tables, with the sample limited to the specified group. Maternal education refers to status in the year the child was born. Samples sizes range between 1,631 and 1,942 for boys, 1,633-1,877 for girls, 1,420-1,631 for non-Hispanic non-Blacks, 1,855-2,178 for Hispanics or blacks, 2,240-2,596 for no college, 1,030-1,223 for attended college, 2,086-2,456 for spouse/partner present in birth year and 1,176-1,363 for no spouse/partner present in birth year.

Table 8:
Sample Means of Demographic Characteristics and Outcomes By SES Quartile

Variable	SES Quartile			
	Lowest	**Second**	**Third**	**Highest**
Outcomes				
PPVT	-0.81 (0.03)	-0.35 (0.03)	0.09 (0.04)	0.42 (0.04)
PIAT-Mathematics	-0.60 (0.03)	-0.24 (0.03)	0.04 (0.04)	0.41 (0.04)
PIAT-Reading Recognition	-0.54 (0.03)	-0.20 (0.03)	0.12 (0.04)	0.41 (0.03)
Behavior Problems Index	0.17 (0.03)	0.05 (0.03)	-0.07 (0.04)	-0.17 (0.04)
Substance Use (%)	14.8 (1.0)	13.8 (1.2)	12.9 (1.3)	6.6 (1.0)
Obesity (%)	18.5 (1.0)	15.0 (1.2)	12.0 (1.2)	9.3 (1.1)
Overweight Risk (%)	33.2 (1.3)	32.3 (1.5)	29.2 (1.6)	26.4 (1.7)
Family Background				
Mother's Age (years)	20.8 (0.1)	22.6 (0.1)	23.8 (0.1)	25.1 (0.1)
Mother Has Attended College (%)	13.1 (0.9)	19.6 (1.2)	37.3 (1.7)	81.5 (1.5)
Mother's AFQT Score	12.6 (0.3)	23.4 (0.5)	40.0 (0.7)	67.7 (0.8)
Spouse/Partner Present (%)	22.0 (1.1)	82.4 (1.2)	97.4 (0.6)	88.1 (1.2)
Total Family Income in Previous Year ($)	24,855 (1,260)	36,369 (2,717)	45,592 (2,310)	69,035 (4,915)
Child Characteristics				
Low Birth Weight (%)	10.7 (0.8)	6.2 (0.8)	6.9 (0.9)	3.9 (0.7)
Very Low Birth Weight (%)	1.6 (0.3)	0.9 (0.3)	0.5 (0.3)	0.1 (0.1)

Note: SES is determined by ranking children according to predicted total family income in the year prior to assessment. Predicted income is estimated by regressing total family income on maternal age, education and AFQT scores, race/ethnicity and presence of a spouse/partner in the household in the birth year. All other variables are defined as described in Table 2. Standard errors are in parentheses.

Table 9:
Weekly Work Hours By SES Quartile

Variable	SES Quartile			
	Lowest	**Second**	**Third**	**Highest**
		Years 1-9		
Average Hours	13.4 (0.4)	19.3 (0.4)	20.7 (0.5)	21.9 (0.5)
Prob (Hours >0)	.864 (.009)	.932 (.008)	.945 (.008)	.933 (.010)
Prob (Hours ≥20)	.295 (.012)	.468 (.016)	.508 (.018)	.548 (.019)
Prob (Hours ≥35)	.079 (.007)	.159 (.012)	.193 (.014)	.244 (.016)
		Years 1-3		
Average Hours	9.5 (0.3)	15.8 (0.5)	16.4 (0.5)	18.3 (0.6)
Prob (Hours >0)	.641 (.013)	.773 (.013)	.822 (.014)	.822 (.014)
Prob (Hours ≥20)	.198 (.010)	.374 (.015)	.402 (.017)	.461 (.019)
Prob (Hours ≥35)	.067 (.007)	.158 (.011)	.160 (.013)	.197 (.015)
		Years 4-9		
Average Hours	15.4 (0.4)	21.0 (0.5)	22.9 (0.5)	23.8 (0.6)
Prob (Hours >0)	.813 (.010)	.901 (.009)	.912 (.010)	.901 (.011)
Prob (Hours ≥20)	.360 (.013)	.517 (.016)	.561 (.018)	.581 (.019)
Prob (Hours ≥35)	.150 (.009)	.241 (.013)	.284 (.016)	.303 (.017)

Note: See notes on Tables 1 and 8.

Table 10:
Effects of Maternal Employment By Socioeconomic Status

SES Quartile/ Period of Employment		PPVT	PIAT-M	PIAT-R	BPI	Substance Use	Obesity	Overweight Risk
Lowest:	**Years 1-9**	.058	.072	.059	-.052	-.006	-.008	.019
		(.051)	(.054)	(.054)	(.060)	(.021)	(.022)	(.027)
Second:	**Years 1-9**	-.037	-.032	-.094	.009	.037	.007	-.015
		(.063)	(.064)	(.066)	(.068)	(.025)	(.024)	(.033)
Third:	**Years 1-9**	-.017	-.068	-.093	-.157	.020	.032	.055
		(.067)	(.069)	(.067)	(.070)	(.023)	(.020)	(.033)
Highest:	**Years 1-9**	-.238	-.174	-.134	.002	-.002	.021	.052
		(.066)	(.070)	(.066)	(.070)	(.015)	(.018)	(.033)
	Years 1-3	-.069	-.140	-.009	.001	.017	-.001	.014
		(.074)	(.078)	(.073)	(.078)	(.017)	(.020)	(.037)
	Years 4-9	-.166	-.052	-.116	-.001	-.016	.020	.038
		(.070)	(.074)	(.069)	(.075)	(.016)	(.019)	(.035)

Note: See notes on Tables 3, 4 and 8. The specification estimated is the same as model (d) of those tables, with the sample limited to the specified SES quartile. The last two rows show separate estimates for the first three and next six years of the child's life for the highest quartile.

Table 11:
Predicted Effect of Maternal Employment on the Cognitive Development and Body Weight of High SES Children

	PPVT		PIAT-M		PIAT-R		Obesity		Overweight Risk	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Coefficient/Standard Error										
Hours	-.238	-.307	-.174	-.174	-.134	-.101	.173	-.161	.169	.047
	(.066)	(.187)	(.070)	(.198)	(.066)	(.185)	(.087)	(.247)	(.069)	(.195)
Hours Squared		.030		-6.2E-5		-.014		.144		.054
		(.078)		(.082)		(.077)		(.100)		(.080)
P-Value	<.001	.002	.013	.047	.042	.125	.045	.046	.015	.040
Predicted Change From Working:										
20 Hours	-.238	-.276	-.174	-.174	-.134	-.116	.026	-.003	.051	.031
30 Hours	-.358	-.392	-.261	-.261	-.201	-.184	.042	.014	.079	.060
40 Hours	-.477	-.492	-.349	-.349	-.268	-.260	.058	.047	.108	.100

Note: See notes on Tables 5, 8 and 10. Results for the cognitive test scores are estimated for children in the top SES quartile; those for obesity and overweight risk in the highest two quartiles. Specification (b) includes a quadratic term for maternal work hours whereas model (a) does not. The P-Value refers to the hypothesis that the linear and quadratic term (if any) on work hours are jointly equal to zero. Predicted changes refer to estimated differentials relative to no maternal employment during the child's first nine years.

Appendix

Table A.1: Variables Used in Analysis

Variable	Description
	Outcomes
PPVT	Peabody Picture Vocabulary Test-Revised Total Standard Score
PIAT-M	Peabody Individual Achievement Test, Mathematics Total Standard Score
PIAT-R	Peabody Individual Achievement Test, Reading Recognition Total Std. Score
BPI	Behavior Problems Index Total Standard Score
Substance Use	Has Smoked Cigarettes or Used (more than a sip or two of) Alcohol
Obesity	Body Mass Index (BMI) at or above sex- and age-specific 95th percentile cut point
Overweight Risk	BMI at or above sex- and age-specific 85th percentile cut point
	Maternal Employment
Hours	Average Weekly Work Hours (divided by 20) during specified period
Future Hours	Average Weekly Work hours (divided by 20) in calendar year after assessment
	"Basic" Child, Maternal and Household Characteristics (B)
Age	Age of child (in months) at assessment date
Age Squared	Age Squared of child at assessment date
Race/Ethnicity	Child is Hispanic or a non-Hispanic Black (2 d.v.'s)
Female	Child is Female (d.v.)
Parity	Birth order of child
AFQT Score	Mother's score on the Armed Forces Qualification Test in 1980
Mother's Age	Age (in years) of mother at the time of child's birth
Education	Mother completed high school, had attended college, college graduate in birth year (3 d.v.'s)
Spouse	Spouse/Partner present in birth year (d.v.)
	Supplemental Maternal, Family and Child Characteristics (S)
Birth weight	Low ($\leq$2500 grams) or Very Low ($\leq$1500 grams) Birth weight (2 d.v.'s)
Long Hospital Stay	Child stayed in hospital longer than mother following birth (d.v.)
M.D. Visit	M.D. visit in first, second/third month of life (2 d.v.'s)
Hospitalization	Child hospitalized during first year (d.v.)
Income	Family Income in Year Before Birth (2000 year dollars)
Siblings	Sibling born $\leq$18, 19-36 months before/after child's birth (4 d.v.'s)
Private	Mother's current or last secondary school attended in 1979 was private (d.v.)
	Pre-Pregnancy Employment Characteristics (E)
Weeks Before	Mother Stopped Working 0, 1-13,14-39, 40-155 weeks before birth (4 d.v.'s)
Hours Before	Average Weekly Work Hours (divided by 20) in Year Prior to Pregnancy
Occupation	Occupation of main job in 4th quarter prior to birth was: professional/managerial, sales, clerical, crafts/operative, service/household (5 d.v.'s)
	Auxiliary Family and Location Characteristics (A)
Father Present	Father living in household at assessment date (d.v.)
Location	Mother lived outside U.S., in Southern U.S., or in rural area at age 14 (3 d.v.'s)
Grandmother Work	Mother's mother worked when mother was 14 (d.v.)
Learning Resources	Mother had magazines, newspaper, library card in home in age 14 (3 d.v.'s)
Foreign Born	Mother's mother/father foreign born (2 d.v.'s)
Grandparents Educ.	Mother's mother/father completed high school, attended college (4 d.v.'s)
Both Parents	Mother lived with both mother and father at age 14 (d.v.)

Table A.1 (Continued)

Mother Only	Mother lived with mother and no adult male in household at age 14 (d.v.)
First Smoked	Mother smoked first cigarette before age 14 (d.v.)
Marijuana	Mother tried marijuana/hashish, before age 21 (d.v.)
Mother's Siblings	Mother had 0, 3-5, ≥ 6 siblings (3 d.v.'s)
Residence	Lives in central city, SMSA/MSA at assessment date (2 d.v.'s)
Crime	Local crime rate (in 1985)
Birth	Local birth rate (in 1984)
Marriage	Local marriage rate (in 1984)
Divorce	Local divorce rate (in 1985)
Physician	Local physicians per 100,000 people (in 1985)

Note: All variables are obtained from the NLSY. See text for additional details.

Table A.2:
Additional Estimates of Effect of Maternal Employment During Child's First Nine Years

Outcome	(a)	(b)	(c)
PPVT	-.060	-.064	-.065
	(.055)	(.055)	(.056)
PIAT-Mathematics	-.083	-.093	-.083
	(.060)	(.061)	(.061)
PIAT-Reading Recognition	-.093	-.100	-.100
	(.060)	(.061)	(.061)
Behavior Problems Index	-.090	-.124	-.086
	(.065)	(.066)	(.067)
Substance Use	.023	.025	.033
	(.023)	(.023)	(.023)
Obesity	.028	.028	.029
	(.022)	(.022)	(.022)
Overweight Risk	.050	.049	.050
	(.030)	(.031)	(.031)
Additional Regressors	B,S,E	B,S,E,A	B,S,E,F

Note: See notes on Tables 3 and 4. Specification (a) is the same as model (d) of those tables. Columns (b) and (c), respectively, add controls for auxiliary characteristics (A) and state dummy variables (F).

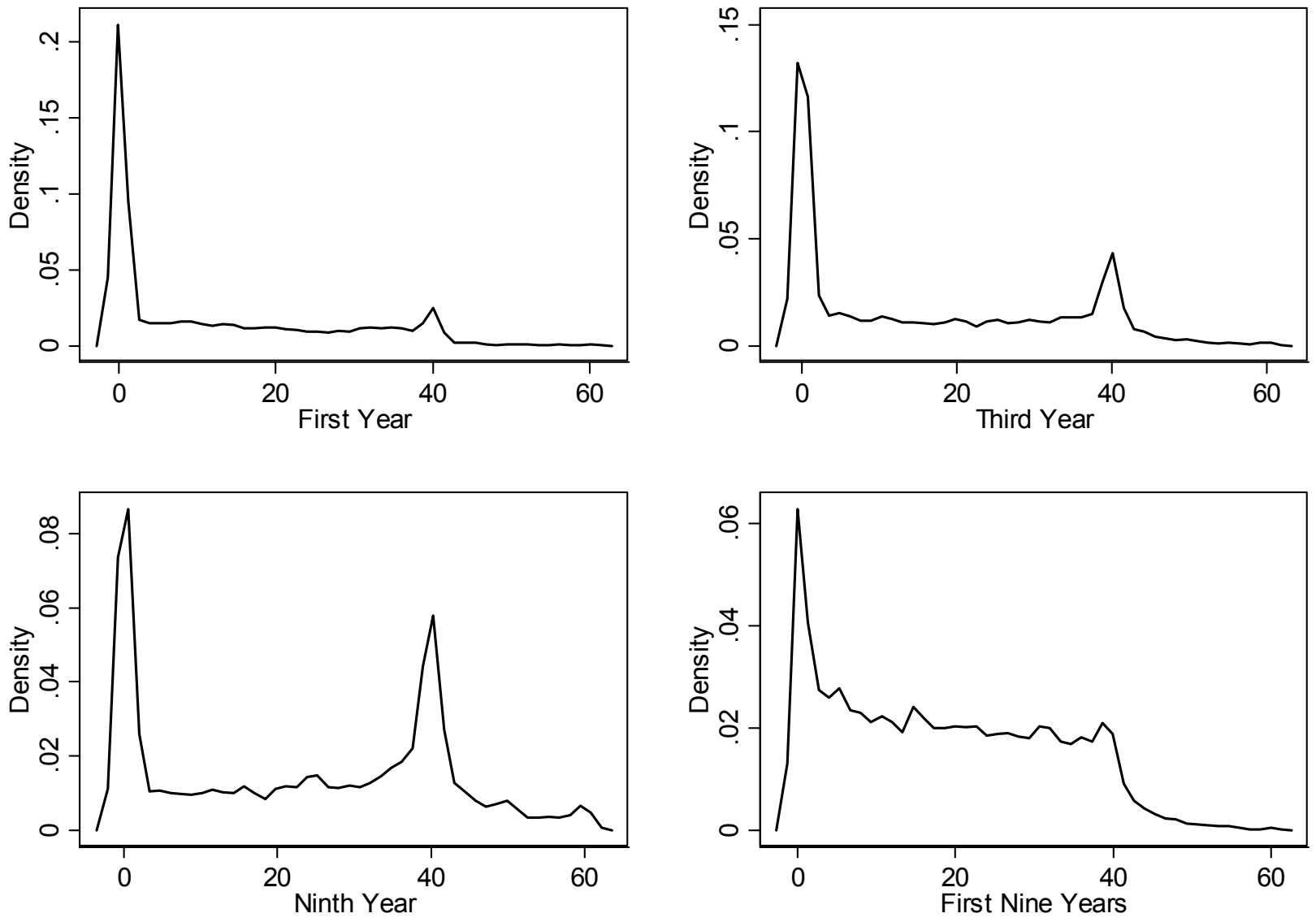

Fig 1: Average Weekly Work Hours of Mother at Specified Child Ages