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Maternal Employment and Overweight Children

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ABSTRACT

This paper investigates whether children are more or less likely to be overweight if their mothers work. The prevalence of both overweight children and working mothers has risen dramatically over the past few decades, although these parallel trends may be coincidental. The goal of this paper is to help determine whether a causal relationship exists between maternal employment and childhood overweight. To accomplish this, we mainly utilize data from the National Longitudinal Survey of Youth, which allow us to match the employment histories of a cohort of women passing through their main childbearing years with the weight status of their children as they age. We employ three main econometric techniques, probit models, sibling difference models, and instrumental variables models in this analysis. Our results indicate that a child is more likely to be overweight if his/her mother worked more intensively (in the form of greater hours per week) over the child's life. Applying our estimates to the trend towards greater maternal employment indicates that the increased hours worked per week among mothers between 1975 and 1999 led to about a 0.4 to 0.7 percentage point increase in overweight children, which represents a relatively small share of the overall increase

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The increase in maternal employment and the rise in overweight children represent two of the most notable trends in the American family over the past several decades. From 1970 to 1999, the fraction of married women with children under six who participate in the labor force doubled, rising from 30 percent to 62 percent. Married women with children ages 6 to 17 dramatically increased their labor force participation as well, rising from 49 percent to 77 percent over this period (U.S. Bureau of the Census, 2000). The prevalence of overweight children has also soared. Over the 1963-1970 period 4 percent of children between the ages of 6 and 11 were defined to be overweight; that level had more than tripled by 1999, reaching 13 percent (Centers for Disease Control, 2001). Childhood overweight may be one of the most significant health issues facing children today.[1] Thus, a better understanding of its determinants is of critical importance.

The existence of upward trends in both maternal employment and overweight among children could simply be a coincidence. In fact, the prevalence of overweight and obesity in adults has increased as well. However, the incidence of overweight in children relative to adults has increased. In the 1960's the ratio of overweight among children to adults was about 0.3, but had risen to almost 0.5 by 1999 (Centers for Disease Control, 2001). The purpose of this paper is to explore whether the relationship between maternal employment and childhood overweight is causal.[2]

Using the National Longitudinal Survey of Youth (NLSY), supplemented with additional information from the 1988-1994 National Health and Nutrition Examination Survey (NHANES III) and the 1994-1996, 1998 Continuing Survey of Food Intakes by Individuals (CSFII), we first document the extent to which a raw correlation exists between maternal employment and

[1]The Surgeon General has been quoted as saying, "This crisis is stealing youth, innocence, and health from our children, and yet as a nation we have been badly remiss in addressing it." (Mashberg, 1999).

[2]We focus on the role that maternal employment, rather than parental employment more generally, may play in children's overweight outcomes for three reasons. First, it is mothers' labor supply that has changed dramatically over recent decades. Second, despite the dramatic increase in women's paid market employment, they still bear the bulk of responsibility for child rearing. Third, data limitations in the analysis reported below only enable us to link the

overweight. The remainder of the paper attempts to identify whether these simple relationships are causal, or whether they reflect a spurious correlation in which children whose mothers work full-time would still be overweight even if their mothers did not work. Our results indicate that those mothers who worked more intensively, in the form of greater hours per week, since their child's birth are indeed significantly more likely to have an overweight child. A mother who worked an additional 10 hours per week is estimated to increase the likelihood of her child being overweight by roughly one-half to one full percentage point**.** This effect is too small to explain a large fraction of the time series trend in childhood obesity, however, indicating that other factors must have played a larger role.

The paper continues with some background information, followed by a discussion of our econometric approach in Section II. Section III describes the data, while Section IV presents the empirical results. We conclude with a discussion of the findings and of avenues for further research.

I. BACKGROUND

A. The Health Consequences of Childhood Overweight

Being overweight as a child has both immediate consequences and long-term implications for individuals, as well as for society as a whole. For example, the increase in childhood overweight has been accompanied by a marked increase in the number of children developing type II onset diabetes, which has serious health risks (Thompson, 1998). In addition, studies have shown that overweight children are much more likely to become overweight adults than normal weight children (Bouchard, 1997; and Dietz, 1997). Being overweight may have serious health consequences for adults including diabetes, coronary heart disease, atherosclerosis, and colorectal cancer (Power, et al., 1997). Furthermore, being overweight may have social and economic consequences. For example,

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employment histories of mothers and children.

studies have shown that obesity is negatively related to education and earnings (Averett and Korenman, 1996; Gortmaker, et al., 1993; and Cawley, 2000). Moreover, the health consequences for individuals place additional pressure on the scarce resources of the nation's health care system. Thus, the importance of a better understanding of the effect of maternal employment on this aspect of child health is clear.

B. Mechanical Causes of Childhood Overweight

At one level, the causes of overweight are well understood. Taking in more energy than one expends leads to weight gain, while burning more energy than one takes in leads to weight loss. At another level, however, the determinants of energy consumption and expenditures across individuals are not well understood. Genetics clearly play a role, but if overweight was only determined by genetics, it is difficult to imagine that such dramatic and rapid changes in overweight children could have taken place, as genetics are unlikely to have changed so significantly over the last 30 years. Thus, it is important to also consider other causes of overweight, including the environmental factors that may affect either the intake or expenditure of energy.

Looking first at the intake of calories, overweight individuals tend to have a much different relationship with food intake than do those with normal weight. Normal weight people eat in response to internal physical signals of hunger. The overweight tend to respond to external cues such as the sight of food, the time of day, or emotional stresses such as anxiety, anger, fear, and sadness (Schachter ,1968; and Zakus, 1982). Maternal employment may affect children's relationship with food if, for instance, children in institutionalized child-care settings, with fixed snack and lunch times, learn to eat according to the clock rather than the stomach.

Alternatively, many researchers and public health advocates point to the calorie rich foods that are readily available to children as causes of overweight (Bar-Or, et al., 1998). In this case,

overeating occurs not because of an inappropriate attitude toward food, but rather because in response to internal physical signals of hunger many "empty" calories are consumed. Maternal employment could affect this type of overeating either positively or negatively. On the one hand, the earnings from working could allow healthier foods to be chosen, and daycare may teach children about nutrition. On the other hand, monitoring child care providers is difficult. Child care providers may give children the sugary or fried foods they want in order to placate them in the short term, against both the long term best interests of the child and the wishes of parents. Further, working mothers with less time to prepare home-cooked meals may rely more heavily on higher calorie prepared or fast foods, and unsupervised children may make poor nutritional choices when preparing their own after-school snacks or meals.

Energy expenditure is the other side of the overweight puzzle. Thus, any increase or decrease in sedentariness attributable to maternal employment provides a mechanism for an effect on childhood obesity. Again, in theory the possible effect could be positive or negative. For example, one source of after-school activity is organized sports, which may increase activity. Alternatively, unsupervised children may spend a great deal of time indoors, perhaps due to safety concerns, watching television or playing video games rather than engaging in more active pursuits.

C. An Economic Model of Childhood Overweight

Childhood overweight can be placed within the context of a standard economic model of household production. This framework assumes that utility is generated through the consumption of time-intensive and goods-intensive commodities, with a tradeoff existing between the two. Time can be spent either in home production or in paid market work, leading to a family budget constraint. Families must then make rational decisions over time-intensive versus goods-intensive sources of utility. Assuming that investing in their children brings utility to the family, then one of the

decisions to be made is the amount of that investment in terms of parental time and purchased goods and services. The more time spent in market work, the less time is available for time-intensive household investments in children. However, the more time spent in market work, the more money is available for goods-intensive household investments in children. Paid child care, for example, is thus simply a goods-intensive method of producing the investment in one's child.

Within this framework, perfectly functioning markets would enable children's outcomes to be optimized regardless of whether investments in the children were provided directly by the parents or purchased. If a mother chose to work, the optimal level of investment in her children's nutrition would be made through the use of paid services rather than the mother's own care. It is important to note in this regard that the "optimal" nutritional outcome for a child is the one that maximizes family utility and does not preclude an overweight child.[3]

Market imperfections, however, may exist that lead to a positive relationship between maternal employment and child overweight. For instance, information problems may hinder a family in making an optimal decision. Families may be unaware of the potential long-term effects of overweight. Identifying the quality of available child care may be difficult. Parents may not be well-educated about the nutritional values of different food items. Overall, then, even if families are rational decision-makers, maternal employment may have an effect on children's overweight.

D. Past Evidence on Childhood Overweight

Although little research has directly examined the impact of maternal employment on childhood overweight, past work on other determinants may help inform this issue. Many studies have found a strong correlation between parent and child weight problems, (c.f. Vuille

[3]It is also possible that parents receive utility directly from feeding their children. See Jain et. al. (2001) for information

and Mellbin, 1979; Dietz, 1991), although such a correlation could be due to either genetic or behavioral factors. As indicated above, though, while a genetic explanation for overweight is compelling, other factors must play a role as well based on the dramatic trends in overweight in the United States over the last few decades.

Thus, researchers have turned to environmental factors, including socioeconomic status, family structure, television viewing, "psycho-social stress," and short sleep duration (c.f. Locard, et al., 1992; Woolston, 1987; Bar-Or, et al., 1998). Partially based on evidence of a positive correlation between television viewing and overweight among children, (c.f. Gortmaker, et al., 1996; and Dietz and Gortmaker, 1985), the American Academy of Pediatrics recently has recommended that children under two be prevented from watching television (Brody, 1999). Evidence on the relationship between family structure, socioeconomic status, and childhood overweight is more mixed. While Sobal and Stunkard (1989) find that low socioeconomic status is strongly correlated with obesity among adult women, they find the evidence is weaker for men and for children. Nevertheless, several more recent studies have found a relationship between socioeconomic status and childhood obesity (e.g. Dietz, 1991; Gerald, et al., 1994; Wolfe, et al., 1994). Similarly, studies have tended to find a relationship between family structure and obesity, although results across studies are not always consistent. For example, Dietz (1991) finds a negative effect of overall family size, but recently Wolfe, et al. (1994) found children from two parent families tended to be fatter, while Gerald, et al. (1994) concluded the opposite.

Researchers have also examined the influence of the types of foods children eat, but the role of parental involvement in this regard is also mixed. Some work finds that parental monitoring of food selection lowers the number of non-nutritious foods chosen by children

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on how mother's of overweight children feel about feeding their children.

(Klesges, et al., 1991) while other work suggests that a high degree of parental control over food appears to reduce the child's ability to self-regulate calorie intake (Birch and Fisher, 1998). Finally, recent work on breastfeeding suggests that infants who are breastfed may be less likely to be overweight later in life than those who are not (von Kries, et al. 1999, Gilman, et al. 2001).

In sum, although overweight is one of the most important health threats facing children today, and the increase in maternal employment represents a profound change in the dynamics of the family, there is a paucity of research examining links between the two. One exception is a study by Takahashi, et al. (1999) that finds a positive relationship between mothers' employment and children's probability of being overweight, but the data are only for 3-year-old Japanese children. Additionally, Johnson, et al. (1992) study US children age 2-5 in 1987-88 and find no significant effect of maternal employment on nutrient intake.

II. ECONOMETRIC APPROACH

A simple model of children's overweight in the present context may be formally specified as follows:

(1) $$Weight_i = \beta_0 + \beta_1 Energy_i + \beta_2 Calories_i + u_i$$

(2) $$Energy_i = \gamma_0 + \gamma_1 E_i^m + \gamma_2 X_i^p + \gamma_3 X_i^c + v_i.$$

(3) $$Calories_i = \delta_0 + \delta_1 E_i^m + \delta_2 X_i^p + \delta_3 X_i^c + e_i.$$

In this model, weight (and hence the probability of overweight) is related to energy expenditure and calorie intake. Each of these factors is affected by maternal employment, E^m, and other characteristics of the child and his/her parents (X^c and X^p, respectively), including things like socioeconomic status, demographics, educational attainment and, importantly, measures of the mother's weight. The specific measures used are described in more detail below. A reduced form version of this model, in terms of the probability of overweight, may be specified as:

(4) $$P(Weight_i > C) = \phi_0 + \phi_1 E_i^m + \phi_2 X_i^p + \phi_3 X_i^c + \varepsilon_i.$$

We report variants of equation (4), estimated as probit models on the probability of overweight, below. We use the notation from equation (4), substituting $Overweight_i$ for $P(Weight_i > C)$ in the rest of this discussion.

An important extension of this model is that it allows us to obtain some indication of the dynamics of changes within the family on our outcomes of interest. For example, if a very young child's mother works, it may affect his/her nutritional status as an older child. We can allow for this possibility by including maternal employment in, say, the child's first few years of life in our model. Such a model can be specified as:

(5) $$Overweight_i = \phi_0 + \phi_1 E_{it}^m + \phi_2 E_{i1}^m + \phi_3 X_i^p + \phi_4 X_i^c + \varepsilon_i.$$

where E_{it} indicates a child's exposure to maternal employment at time t and E_{i1} indicates maternal employment during the child's first few years of life. Exposure to maternal employment may represent a contemporaneous measure indicating whether a child's mother works now or may represent a lifetime measure that indicates the extent to which a child's mother worked over his/her entire life. Evidence that ϕ_2 was nonzero would support the notion that early childhood influences matter more.

The estimates obtained from these models may be subject to bias, however, because those mothers who are more likely to work may have other traits that also affect their children's health status. If these traits can be observed, they can be included as explanatory variables in the regression models. If they cannot be observed, however, they may introduce omitted variable bias. For example, if a mother suffers from depression, it may affect her ability to work and her ability to properly oversee her child's diet and level of exercise. As a result, we would find a spurious negative relationship between maternal employment and childhood overweight. Alternatively, consider a strongly achievement-oriented mother who strives to succeed in the world of work and

pays less attention to her child's nutrition. Here we would find a positive relationship between maternal employment and childhood overweight but, again, it would not be causal. If the mother was not working she would be engaged in some other activity, like community service, that would similarly distract her from her child's nutritional needs.

We address the important statistical problem of unobservable heterogeneity using two additional approaches. Both have weaknesses, but the advantage of using multiple approaches to estimate our basic model is that if we obtain consistent findings across approaches, that will considerably strengthen the reliability of our findings.

The first technique we use estimates differences in siblings' outcomes as a function of differences in maternal employment at a particular point in time or at the same age. Consider that equation (4) may be rewritten in the following form for siblings i and j, respectively, in family f:

$$\text{Overweight}_{if}^{c} = \phi_0 + \phi_f + \phi_1 E_{if}^{m} + \phi_2 X_{if}^{p} + \phi_3 X_{if}^{c} + \varepsilon_i^{c} \tag{6}$$

$$\text{Overweight}_{jf}^{c} = \phi_0 + \phi_f + \phi_1 E_{jf}^{m} + \phi_2 X_{jf}^{p} + \phi_3 X_{jf}^{c} + \varepsilon_j^{c} \tag{7}$$

These equations specify the unobserved determinants of a child's nutritional status as ϕ_f, which is fixed within each family. Observed parental characteristics are allowed to differ across siblings, so these equations are specified with sibling subscripts on parental characteristics.

Importantly, maternal employment is allowed to vary across siblings. While current employment status (and some other parental characteristics) cannot differ between siblings at a point in time, they may differ across siblings at the same age. For example, a mother may continue working after the birth of the one child, but decide to remain home after the birth of another. Therefore, differences would exist in maternal employment between siblings in, say, the first year of life that may lead to differences in subsequent outcomes like overweight as a young child. This is precisely the type of question that the model represented in equation (6) seeks to answer. Moreover,

differences in maternal employment since the child was born can differ between siblings, allowing for the identification of this model even when making comparisons at the same point in time.

We thus estimate models of sibling differences of the form:

$$(8) \qquad \Delta Overweight_f^c = \phi_1 * \Delta E_{if}^m + \phi_2 * \Delta X_{if}^p + \phi_3 * \Delta X_{if}^c + \Delta \varepsilon_i^c$$

where Δ signifies a difference between an older sibling and a younger sibling, i.e. equation (6) minus equation (7), and f indexes families. As indicated earlier, this sibling difference approach is useful because it eliminates the influence of any characteristic of the siblings' mother/family that is constant over time. This approach can provide stronger evidence of a causal relationship between maternal employment and children's outcomes than the previous models, because fixed characteristics of mothers have been controlled for even though they may not have been observed.

Models of sibling differences do have some limitations, however. Primarily, they are identified based on changes that occur within the family between siblings and over time, and one may question why those changes are taking place. A mother may quit her job because her child is experiencing weight-related health problems, for instance, suggesting that such changes may be endogenous and leading to biased estimates of the impact of maternal employment. Similarly, a mother may experience a stressful divorce and be forced to enter the labor market, but it may be the divorce and not her working per se, that leads to her kids overeating. In other words, this approach is only properly identified to the extent that differences in exposure to maternal employment across siblings are exogenous to the children's development.

An instrumental variables (IV) model is another approach to eliminating the bias due to the endogeneity of maternal employment. This approach requires the availability of variables that are related to maternal employment, but not to those characteristics that are not otherwise controlled for in the regression (i.e. the error term, ε_i). We use the variation between states and over time in child care regulations, wages of child care workers, welfare benefit levels, the status of welfare reform in

the state, and the mean wage and education level of married men under the age of 60.[4] We use a number of different measures, since collectively they are likely to better predict mother's decisions. Because the residuals in a model of children's overweight status are unlikely to be related to these geographic variables, our model should be appropriately identified.

III. DESCRIPTION OF THE DATA

To conduct our analysis, we mainly use data from the NLSY, but supplement that with additional data from the NHANES III, and the CSFII. The NLSY first surveyed 12,686 individuals, 6,283 of whom are women, between the ages of 14 and 22 in 1979 and has continued to survey them annually through 1994 and biannually since then. Beginning in 1986, and every other year since then, the children of those women have been surveyed as well. Through 1996, over 10,000 children have been born to these mothers, representing about 80 percent of the children who are likely to be born to them based on comparisons of this cohort to Vital Statistics birth data. At the time we began this project, data were available through the 1996 survey year for mothers and children; we restrict our analyses to these data.

Importantly, a large number of assessments have been conducted for those under age 15 to measure the children's development, including a child's height and weight that is necessary to calculate their Body Mass Index (BMI). BMI is defined as weight in kilograms divided by height in meters squared (kg/m^2) and is a commonly used measure to define obesity and overweight in adults. According to guidelines in National Institutes of Health (1998), adults are considered underweight if their BMI is less than 18.5, overweight if their BMI is 25 or more, and obese if their BMI is 30 or more. Use of the BMI to assess children has been more controversial, although its use is fairly

[4]We have also experimented with using the state level unemployment rate as an instrument, but have chosen not to use it in the models we estimate and report. The unemployment rate may not be a valid instrument if, say, a recession causes stress within the family (economic or otherwise) that alters eating patterns. Nevertheless, the estimates obtained when we included the unemployment rate as an instrument were quite similar to those reported below.

widespread.[5] The Centers for Disease Control (CDC) has just endorsed the use of BMI to assess overweight in children, and has produced sex-specific growth charts for children aged 2 to 20 for just this purpose.[6] We use these growth charts to define overweight for children in our samples. For children, the nomenclature is somewhat different than for adults. Children with a BMI above the 85th percentile of the BMI distribution for their sex-age group are defined as "at-risk of overweight;" those with a BMI above the 95th percentile for this distribution are termed "overweight." It is important to note that these percentile cutoffs are based mainly on data from years before our survey began, so that trends in overweight can be detected.[7]

The NLSY also provides ample data to measure the key explanatory variables required for our analysis as well as a wide variety of other control variables.[8] Regarding mother's employment, a virtually complete work history for each mother is available. In addition to contemporaneous measures of mother's employment, we can calculate total weeks worked and total hours worked starting from the date of the child's birth until the survey date in 1996.[9] In this way we can compute lifetime maternal employment measures, as well as measures for specific years of life, such as the first year.[10] In addition to these data, the NLSY also provides a wide array of information on other

[5]Recently, Dietz and Bellizi (1999) reporting on a conference convened by the International Obesity Task Force, noted that the BMI "offered a reasonable measure with which to assess fatness in children and adolescents." Additionally, they conclude that a BMI above the 85th percentile for a child's age and sex group is likely to accord with the adult definition of overweight, and above the 95th percentile with the adult definition of obese.

[6]See http://www.cdc.gov/growthcharts/ for general information, and see http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/bmiage.txt for specific BMI percentiles.

[7]While the new growth charts are based on data from 1963-1994, the 1988-1994 data from NHANES III is exluded in order to reflect increasing overweight. Prior to the release of these growth charts, percentiles based entirely on NHANES I from 1971-1974 had been available for older children. The newly released cutoffs are relatively similar.

[8]Sample means for all the variables used from the full NLSY sample are reported in Appendix Table.

[9] Only children born after the start of the survey are included in the sample.

[10]The child care choices of mothers who work is likely an important element in determining their children's outcomes and the NLSY does provide some limited information on child care use. This information mainly consists of the types of arrangements used in the child's first three years of life for almost all children. Data on the characteristics of current care in each year are not as complete. Basic information on the type of care used for the youngest child is collected in 1982, 1983, 1984, and 1985. In 1986 and 1988 detailed information, including quality measures, on the current arrangement is collected for all children. Information on enrollment in nursery or preschool was also available in 1988, 1990, 1992, 1994 and 1996 for children over 3, and not yet in regular school. In these years, for those between the ages of 10 and 14

characteristics of respondents. Plentiful information exists regarding demographics, family income, characteristics of respondents' parents (the grandparents of the children assessed), and the like.

While the NLSY is ideal for all of the planned reduced form models, and contains limited information on physical activity, such as measures of television viewing, it provides no information on food intake. Thus, we also use the NHANES and CSFII to supplement the NLSY. Both the NHANES and the CSFII include detailed 24-hour recall food intake information. Both are cross-sectional data sets, providing snapshots of children's nutrition at a particular point in time. However, both have only contemporaneous measures of maternal employment.[11] Both the NHANES and the CSFII also include measures of television viewing that we exploit in our analysis below. In laying out the basic facts about nutrition intake, energy expenditures and resulting probability of overweight, we provide the background necessary for interpreting the results from the more formal models that follow.

IV. EMPIRICAL ANALYSES

We begin our analysis by providing a descriptive examination of the relationship between nutritional measures and television viewing patterns among children that differ by their mothers' current employment status using all three of the datasets available to us. Then we shift our attention from contemporaneous measures of maternal employment to alternatives that incorporate the mother's work status since the child was born.

Descriptive Analysis

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we can identify who cared for them (including extended day programs) after regular school ended. In our analysis, we experimented with including measures of early life child care exposure as well maternal employment, but found the data were not sufficiently powerful to differentiate across modes of care among children whose mothers worked. Further analysis of the role of types of care, as well as its quality, should be pursued in future research.

[11] Unfortunately, because young children are oversampled in the NHANES, not all children have mothers in the sample. Additionally, the relationship between sample members is not always clear. We experimented with using only households with just 1 adult woman, or just 1 woman between the ages of 20 and 50. Of 10,649 adult women, 1,956 were deleted in this manner. Another 5,426 had no children. Of the 13,944 sampled children, only 6,339 had a matching woman in the household.

In Table 1 we present a comparison of nutritional measures and television viewing measures by current maternal employment status for all three datasets. The first two rows indicate the percentage of children who are overweight or at-risk of being overweight. These data display no clear pattern by current maternal employment status. Overall, the NHANES III and NLSY data are roughly consistent in finding that 11 to 12 percent of children are overweight and about one-quarter are at-risk of overweight. Data from the CSFII indicate substantially higher levels of these outcomes, potentially due to measurement error created by parent-reports of children's height and weight in those data.[12] Nevertheless, patterns across current maternal employment status are similar in that no evidence exists that children of mothers who work more are more likely to be overweight.

Supporting this finding, these data show few differences in the food consumed or the amount of television viewed per day across these groups of children.[13] The CSFII provides the most evidence in this regard, highlighting that there is little obvious pattern in calories consumed, calories from fat, or levels of consumption of many food groups. Fruit and milk consumption is a bit higher for children of mothers who do not work and consumption of meat and fat/sugar is a bit lower. Interestingly, both the CSFII and the NHANES data indicate that fast food consumption is considerably higher among children whose mothers work, despite the fact that this does not translate into detectable differences in calorie consumption or levels of overweight.[14] Among working mothers, however, those with full-time schedules are more likely to have an overweight child.

[12]We pursued this discrepancy in measures of overweight with representatives of the federal agency that puts out the CSFII (U.S. Department of Agriculture, Food Services Research Group) and this was the only reason they could put forward to explain it. Since federal reports using these data concentrate on the food consumption measures rather than BMI, they had not investigated the problem.

[13]The television viewing estimates in the NLSY are considerably higher than that in the other surveys. We suspect that many of the respondents in the NLSY based their answers to these questions on a weekly rather than a daily frame of reference. This suspicion is based upon the relatively large number of individuals who said they watched TV for exactly 10, 15, 20, or even longer than 24 hours in a day.

[14]Regression-based estimates that control for a variety of characteristics of the mother and the child do not substantially alter the nature of the results presented in Table 1.

A potential reason why these findings are relatively weak is that overweight is a condition that develops over time, not instantaneously in response to changes in a child's environment. An alternative approach is to compare children's level of overweight with the extent to which their mothers worked since they were born.

Table 2 presents the evidence we are able to bring to bear on this question given the available data. Here we are unable to use the CSFII, which contains no information on anything other than the mother's current employment status. With the NHANES, we construct a proxy measure for lifetime employment, representing an indicator for whether a child was enrolled in a child care center for longer than 10 hours per week before the age of 4. Although such a measure obviously does not capture all of the variation in maternal employment across a child's life, we hypothesize that mothers of children who satisfy this condition are likely to work over more of their children's lives than other mothers. In the NLSY we have extensive data on maternal employment over the child's lifetime. For this analysis, we divide children into categories based on the average hours per week the child's mother worked since the child's birth. Here, we treat mothers who worked at least 35 hours per week since the child was born as those who have been full-time workers over the child's life. Therefore, these groups loosely distinguish between mothers who worked full or part-time from those who never worked since their child was born.

Separating the samples in these ways provides some indication that children of mothers who worked a lot since the child was born are more likely to be overweight or at-risk of this condition. For instance, in the NHANES III, those children who were enrolled in a child care center for 10 or more hours per week by age 4 were a full percentage point more likely to be overweight than those children who were not. As in Table 1, fast food consumption is also higher for those children whose mothers worked, although no difference in television viewing is detected.

With better measures of lifetime exposure to maternal employment in the NLSY, we find bigger differences in overweight. Children whose mothers while working averaged 35 or more hours per week since the child was born are 2 to 3 percentage points more likely to be overweight and 5 to 7 percentage points more likely to be at-risk of overweight compared to those children whose mothers did not work at all or who worked part-time. These absolute differences are large relative to the base level of overweight and at-risk of overweight among children whose mothers either do not work or who work part-time, representing increases on the order of 25 percent. The nonlinearity in these findings is important to note; based on these results we find no evidence suggesting that working part-time is associated with higher rates of overweight. While still only descriptive, this result is consistent with a model in which full-time work implies a higher level of substitution from time-intensive to goods-intensive inputs, such as potentially higher calorie fast food.

B. Multivariate Analysis

This section reports the results of our estimation of the econometric models described earlier using data from the NLSY. Throughout this analysis, we focus on a binary dependent variable indicating whether or not a child is overweight.[15] We also experiment with alternative measures of maternal employment, including current employment, employment over the child's lifetime, and employment while the child was very young.

Table 3 presents probit estimates where maternal employment is measured over the last calendar year. The first column is designed to approximate the results reported in Table 1. As we reported earlier, without controlling for other factors there is no clear pattern in children's overweight status as a function of mother's current employment. Children of mothers who worked

[15] We have also estimated comparable models using an indicator for at-risk of overweight as a dependent variable and obtained qualitatively similar results.

full-time last week are found to be more likely to be overweight, but children of mothers who work part-time are *less* likely to be overweight. Again, without controlling for other maternal characteristics, it is difficult to draw any conclusions. For instance, as shown in Appendix Table 1, the observed characteristics of mothers who don't work, who work part-time and who work full-time are considerably different.

In Column 2 of this table, we alter the specification of maternal employment to include measures of weeks worked and hours worked per week in the past calendar year.[16] We include both weeks worked and hours per week worked, rather than simply a total hours measure, as it helps us to distinguish between those mothers who work a lot, but intermittently, from those who consistently work at a lower intensity.[17] In this specification, we find that, holding constant the number of weeks worked in the past year, every additional 10 hours per week that a mother worked increases her child's likelihood of being overweight by 0.7 percent.

The remainder of the table includes additional explanatory variables. Among other variables, column 3 includes indicator variables for African American and Hispanic. Simple cross tabulations of overweight with race and ethnicity show that minority children are more likely to be overweight. To the extent that African American and Hispanic mothers have different employment patterns than white non-Hispanic mothers, this difference could load onto the employment measures. We also include controls for mother's education. Education levels are related to labor supply decisions, but may have their own direct impact on children's health. Finally, many women choose to continue working after the birth of their first child, but stay home after the birth of subsequent children. Our

[16] We have also estimated models analogous to those reported in Columns 2 through 5 of Tables 3 and 4, but continuing to use the same measures of part-time and full-time status in Column 1 of these tables. Throughout the analysis, we consistently find a positive and significant effect of working full-time, but an insignificant effect of working part-time.

[17] We have also experimented with estimating a model that includes quadratic measures of hours worked per week to determine whether or not the impact of working intensively is non-linear. The results indicated that the squared term was very small and statistically insignificant.

measures of work could be picking up the effect of small family size or the fact that the mother is inexperienced. Thus we include controls for whether this is the first-born child and the number of children in the family.

Results in column 3 show that including these control variables reduces the coefficient on average hours per week worked from 0.7 percentage points to 0.5, while the number of weeks worked remains insignificant. Among the other variables included in this specification, African American children are found to be significantly more likely to be overweight than other groups. Hispanic children (who may be of any race) do not differ significantly from other groups in this specification. Mother's education has a negative and significant effect on the probability that her child is overweight – an extra year of education reduces the probability that a child will be overweight by 0.6 percentage points. Although being the first-born child is not significantly related to the probability of being overweight, the number of children in the family is negatively and significantly related to overweight.

As with the work variables, there is a question of how to interpret these other coefficients. Is more maternal education causally related to childhood overweight, or is it just that more highly educated mothers have different attributes? Does having more children in a family reduce the probability that the children will be overweight because there are fewer resources per person within the family or does this simply indicate this is a family that has decided to devote more resources to childrearing? Our goal in this paper is to focus on causality as it relates to employment, and the subsequent models are designed to address that issue, but we will discuss the interpretation of these other measures as well.

Column 4 includes all the controls in column 3 and adds controls for whether the child was ever breastfed, and controls for the mother's weight status. As discussed earlier, recent evidence (von Kries, et al. 1999, Gilman, et al. 2001) suggests that children who were breastfed are less likely

to develop weight problems by the time they are school aged. Mothers with demanding work schedules may be less likely to find the time to breastfeed, and this is a possible pathway through which maternal work may affect childhood overweight. We estimate a large negative and significant impact of breastfeeding on childhood overweight. Children who are breastfed are about 2.3 percentage points less likely to be overweight. Again, the interpretation of this finding is unclear – there may be nutritional value in breastmilk that affects children's health later in life, or it may simply be that mothers who breastfeed are more attentive to their children's nutrition throughout the children's lives. Column 4 also includes two indicators for mothers weight status. Both of these variables are large, positive, and significant. Note that they are additive so that a child whose mother's BMI is above the 95th percentile is a full 8.1 percentage points more likely to be overweight. In a sense, including mother's weight may be "overcontrolling" for the home environment. If working mothers are time constrained and are more likely to rely on calorie-rich prepared and fast foods, then we would expect everyone in the family to be more likely to be overweight when the mother works. Although the additional variables included in column 4 are found to be related to childhood overweight they do not change the estimated impact of hours per week or weeks worked.

Column 5 includes controls for average family income since the child's birth and the percent of the child's life that the mother was married. Average family income since the child's birth is a proxy for permanent income, which should be a better measure of parents' long-term ability to meet their children's needs. Permanent income will not fluctuate with changes in mother's employment status. Similarly, the percent of the child's life for which the mother was married is a measure of the long-term resources available to the family. Although recent work by Case, et al. (2001) finds important impacts of permanent income on parents' assessment of children's health (particularly in the degree to which health is affected by chronic diseases), we find no effect of family income on

childhood overweight in these specifications.[18] Similarly, we find no impact of mother's average marital status on childhood overweight. Again, the inclusion of the additional variables in Column 5 does not affect the estimated impact of the maternal employment variables.

Since it takes time for children to become overweight, in Table 4, we consider the extent of exposure to maternal employment, and estimate multivariate models relating the probability of overweight among children to the amount their mothers worked since the child's birth. In Column 1, we again present estimates from a model that is analogous to the cross-tabulation presented in Table 2, and we similarly find that children of mothers who have worked, on average, 35 or more hours per week since they were born are 2 percentage points more likely to be overweight. Part-time work by the mother is not significantly related to childhood obesity.

Again, the remainder of the table incorporates alternative measures of maternal employment that can distinguish between the duration of maternal employment and its intensity while working. In these specifications we find that it is the intensity of work that has a statistically significant impact. Before controlling for other factors, we find that children of mothers who work an additional 10 hours per week while working experience a 1 percentage point increase in the likelihood of being overweight. Controlling for other factors lowers this estimate to 0.6 to 0.8 percentage points. Other results in the table are comparable to those reported in Table 3.

One difficulty in interpreting the results presented so far is that it is hard to understand the dynamics of the relationship between maternal employment and childhood overweight. Both lifetime exposure to more intense maternal employment and exposure over the last year have similar effects on a child's likelihood of being overweight. But recent employment and lifetime employment are highly correlated. To further understand timing issues, we estimate models

[18] This appears to be due to the fact that socioeconomic status is well controlled for by race, education, AFQT score and grandparents' education. If we include income without these other variables, we find the anticipated effect that overweight is negatively correlated with income.

comparable to those in Column 5 of Tables 3 and 4, but include multiple measures of maternal employment at different points in the child's life. One area upon which we focus is mother's employment in the child's first few years of life. Recent research emphasizes the importance of the early childhood environment on subsequent outcomes (see c.f. Nelson, 1999; and Shonkoff and Phillips, 2000). Therefore, we also integrate into the analysis models that include maternal employment during the child's first three years of life to determine if there are lasting effects on weight status attributable to maternal employment in those important developmental years.

The results of this analysis are reported in Table 5. The first three columns separately include our maternal employment measures in three different time frames, in the past calendar year, since the child's birth, and in the child's first three years of life. All specifications include the full vector of covariates as in Column 5 of Tables 3 and 4; the first two columns of Table 5 simply replicate those results for convenience. Column 3 of Table 5 includes maternal employment in the child's first three years of life only; we find no relationship between this and childhood overweight. In Column 4, we include measures of the mother's work patterns both since the child was born and in the past calendar year. Results indicate that lifetime exposure is probably the more meaningful measure. The point estimate on hours worked per week if working is largely unaffected, although the standard error is somewhat elevated due to multicollinearity. On the other hand, the point estimate on hours worked per week if working in the past calendar year is substantially diminished. In the next column, we keep lifetime exposure in the model and include maternal employment measures in the first 3 years of life. Based on the results in Column 3, it is perhaps not surprising that these early life experiences have no significant impact on the likelihood that the child is overweight. Given these findings, the remainder of this analysis focuses on the extent to which a child's mother worked since s/he was born.

Although the regression models estimated so far control for a large number of factors that could affect childhood overweight, unobservable differences across children and families could still bias our estimates. To further reduce the likelihood of such bias, we have also estimated models comparing outcomes between siblings as a function of differences in their own characteristics, and particularly their exposure to maternal employment. As described earlier, this approach is useful because it differences out any fixed characteristic of the siblings' family. We estimate these sibling difference models two different ways. First, we compare them in the same survey year, so that family characteristics are identical at that time, but the children who are being compared are at different developmental stages because they are different ages, and they may differ in the amount their mother has worked since they were born. Second, we utilize the longitudinal nature of the data to compare siblings at the same age, regardless of the survey year. In this approach, we are holding constant the children's developmental stage, but we are introducing some variation in family characteristics because they may have changed between survey years.[19] Consistent results across the two approaches will significantly strengthen our ability to draw conclusions.

The results of this analysis are reported in Table 6. All estimates based on sibling differences are obtained from ordinary least squares regressions. The estimates reported in this table strongly support the conclusion obtained earlier that the intensity of maternal employment over the child's life has a significant impact on childhood overweight. In both the comparisons at the same point in time as well as at the same age, we find that a 10-hour per week increase in work increases the likelihood that a child is overweight by 0.7 to 1.1 percentage points. These estimates are somewhat larger than those reported earlier and are precisely estimated. We continue to find weak results regarding the relationship between the number of weeks worked since birth and childhood

[19]Because we have restricted the NLSY child sample to include those between the ages of 2 and 15 and because the NLSY child assessments are only conducted every other year, only about half as many sibling pairs are available when we compare siblings at the same age.

overweight. It is the intensity of that work effort that seems to be most important. This result makes sense if it is the day-to-day time constraints and routines that matter for a mother's ability to supervise her child's nutritional intake and energy expenditure. Working fewer hours per week allows time for shopping, cooking, and energy expending play dates or organized sports.

Results for some of the other variables also bear examination. The coefficient on breastfeeding, for example, is unstable across the specifications in columns 2 and 4. In neither case is it significantly different from zero, although in column 4 the point estimate is similar to that in Table 4. As these results suggest that mothers who breastfeed their children may simply be different in many ways from mothers who do not, more research is likely needed into the impact of breastfeeding on the incidence of overweight before a causal effect can be established.

Another approach to avoiding bias due to correlation between mother's employment history and unobserved variables is to apply an instrumental variables technique. The instruments we use to predict maternal employment are state child care regulations, wages of child care workers, welfare benefit levels, the status of welfare reform in the state, and the mean wage and education level of married men under the age of 60.[20]

Table 7 presents the results of this analysis. For computational simplicity, we apply linear probability models to estimate the factors affecting childhood overweight despite the discrete nature of this outcome. Column 4 in this table reports the results of a linear probability model in which we do not instrument for maternal employment and shows that the parameter estimates in this model are virtually identical to the derivatives from the analogous probit model reported in Column 5 of Table 4 – thus, the use of probits versus linear probability models does not change the results. The first

[20]First stage regression results are presented in Appendix Table 2. Because each of our instruments only differs across states and time, the fact that we use so many of them makes it difficult to interpret any one particular coefficient. Multicollinearity will lead to imprecise parameter estimates because so little variation in the data is available to identify any specific coefficient. On the other hand, it is beneficial to include so many instruments to provide the best possible prediction of maternal employment to be used in the second stage.

thing to notice about the instrumental variables results in Columns 1-3 is that the point estimates on average hours per week when working since child's birth are quite similar to those reported in the probit and sibling differences models. The second thing to notice is the degree of imprecision with which our parameters are estimated. The fact that the point estimates are virtually identical to those reported earlier gives us some confidence that the earlier results were not driven by endogeneity. However, our instruments do not allow enough power to reject that the true coefficient is zero.

V. DISCUSSION

In this paper, we have explored the relationship between maternal employment and overweight among children, with a specific focus on determining whether any observed relationship is causal. To that end, we estimated probit models using a number of alternative specifications controlling for a multitude of explanatory variables. We also estimated models that compare outcomes across siblings, attempting to control for differences within the family that may or may not be observed. In addition, we estimated instrumental variable models predicting maternal employment as a function of a number of geographic factors, including state child care regulations, welfare policy measures, and proxy measures of the characteristics of husbands in a state.

Overall, the results of this analysis indicate that a relationship exists between maternal employment and childhood overweight. In particular, we have found that a measure of the intensity of mother's work over the child's lifetime is consistently shown to be positively related to the child's likelihood of being overweight. A 10-hour increase in the average hours worked per week while working over the child's entire life is estimated to increase the likelihood that the child is overweight by about one half to one full percentage point. On the other hand, we found no evidence that the number of weeks a mother works over her child's life has any impact on the likelihood that her child will be overweight. These findings suggest that the link between maternal employment and a child's weight status may be the time constraints faced by mothers who work intensively.

To put the magnitude of our findings in context, we consider the extent to which this effect can explain the increased prevalence of overweight among children over the past few decades. To do this, we used data from the March 1976 and March 2000 CPS to estimate the increase in hours worked per week over the past calendar year for women, 16 years or older, who had children under 18 living at home. Average hours worked per week increased from 17.8 in 1975 to 25.3 in 1999, or an increase of about 7.5 hours per week. The results of our analysis above predict that this change in average hours per week alone would lead to an increase in childhood overweight of between 0.38 to 0.75 percentage points. Levels of overweight among children age 6 and over rose from roughly 5 percent to over 13 percent over this period. Although there are problems associated with a direct comparison of these results (like the age range of those included), to put some perspective on our findings, the magnitude indicates that increased maternal employment could "explain" 6 to 11 percent of the growth in childhood overweight. Obviously, other factors also played a significant role in driving this trend.

One of the other potentially important factors is the growth of adult overweight and obesity. Estimates reported from the NHANES III (which is the data set used to calculate official statistics on overweight) indicates that obesity (BMI greater than 30) among women between the ages of 30 and 39 rose from 15 to 26 percent between 1976-80 and 1988-94 and overweight (BMI greater than 25) rose from 35 to 47 over this period. To the extent that adult behavior changes nutritional patterns in households in a way that affects children, or to the extent that adults and children are affected by common environmental factors that affect the weight of both, increased overweight among adults should correlate with increased overweight among children. Based on the estimates reported in Tables 3 and 4 (and with all appropriate precautions against a causal interpretation of those findings), these increases in adult BMI would be predicted to increase childhood overweight by 0.9 percentage points. Therefore the increase in adult weight problems can "explain" about 11 percent

in the trend in overweight among children. This effect is only slightly bigger than the effect of increases in the intensity of mothers' work habits. Nevertheless, even combining these two potential contributors leaves most of the trend in childhood overweight unexplained.

This project lays the groundwork for future research into the causes of childhood overweight. The contribution of this work is several fold. First, much of the research on childhood overweight reports simple correlations between overweight and various characteristics of the child or the family. This project is among the first to grapple with issues of causality. It presents robust evidence of a positive and significant impact of maternal work on the probability that a child is overweight. Further, it presents prima facie evidence that the mechanism through which this takes place is constraints on mother's time: it is hours per week, not the number of weeks worked, that affects children's probability of overweight.

There is much more to learn about causal factors related to the epidemic of overweight among children in the United States. These include understanding direct contributors to childhood overweight and the mechanisms through which mothers' working translates into overweight children. For example, how does child care quality affect children's nutrition and energy expenditure? Additionally, we need to know more about children's opportunities for vigorous exercise, including physical education in school, after-school programs, and access to parks or other recreational facilities. This deeper understanding is important if society is going to develop appropriate policy responses to this important public health issue.

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Table 1: Nutritional Measures and Television Viewing by Current Maternal Employment Status

	CSFII, 1994-1996 and 1998			NHANES III		NLSY		
	Mother Does Not Work	Mother Works Part-Time	Mother Works Full-Time	Mother Does Not Works	Mother Works	Mother Does Not Work	Mother Works Part-Time	Mother Works Full-Time
% Overweight	24.2	17.7	21.3	11.3	11.1	12.3	9.5	13.7
% At-Risk of Overweight	37.4	29.7	37.6	26.3	26.8	25.1	21.5	25.5
% Any Fast Food	19.2	27.9	28.9	11.7	17.1	—	—	—
% of Calories from Fast Food	5.7	9.4	8.9	—	—	—	—	—
Hours Watched TV	2.7	2.5	2.8	2.1	2.1	5.0	4.3	4.7
Calories, % of Recommended	97.3	98.4	97.9	—	—	—	—	—
% Calories from Fat	32.3	32.3	32.5	—	—	—	—	—
Grain Consumption (grams)	294	299	296	—	—	—	—	—
Vegetable Consumption (grams)	121	112	118	—	—	—	—	—
Fruit Consumption (grams)	210	201	200	—	—	—	—	—
Milk Consumption (grams)	425	415	392	—	—	—	—	—
Meat Consumption (grams)	140	151	153	—	—	—	—	—
Fat/Sugar Consumption (grams)	46	49	42	—	—	—	—	—
Sample Size	3,044	1,512	2,832	1,946	2,127	1,874	1,269	3,751

Notes: The estimates are based on one observation for each individual, which is the last observation per child in the NLSY. Nutritional data is for one 24-hour period, TV data is for a typical weekday. Sampling weights are used to provide nationally representative estimates. A full-time job in the CSFII is defined to be one where the respondent worked 35 or more hours in the week preceding the survey. In the NLSY it is 35 or more hours per week while working over the previous calendar year. Some cells have fewer than the listed sample size due to missing observations.

Table 2: Overweight and and Television Viewing by "Lifetime" Maternal Employment Status

	NHANES III		NLSY		
	No Center-Based Care > 10 Hours/Week by Age 4	Center-Based Care > 10 Hours/Week by Age 4	Mother Never Worked	Mother Worked < 35 Hours/Week Since Birth	Mother Worked $ 35 Hours/Week Since Birth
% Overweight	10.2	11.2	11.7	10.3	13.7
% At-Risk of Overweight	24.5	25.1	20.1	21.8	27.1
% Any Fast Food	12.8	14.8	—	—	—
Hours Watched TV	2.0	2.1	4.9	4.6	4.8
Sample Size	4,967	2,739	778	2,843	4,375

Notes: Sampling weights are used to provide nationally representative estimates. The NLSY estimates are based on the last observation per child. Some cells have fewer than the listed sample size due to missing observations.

Table 3: Probit Estimates of the Impact of Current Maternal Employment on Childhood Overweight
(Estimates Represent Derivatives, Robust Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
Mother Worked $ 35 Hours/Week Over Last Calendar Year	0.014 (0.007)				
Mother Worked < 35 Hours/Week Over Last Calendar Year	-0.016 (0.008)				
Average Hours per Week if Working, Last Calendar Year (in units of 10)		0.007 (0.002)	0.005 (0.002)	0.005 (0.002)	0.005 (0.002)
Number of Weeks Worked Last Calendar Year (in units of 52)		-0.017 (0.009)	-0.0005 (0.010)	-0.005 (0.010)	-0.002 (0.010)
African American			0.054 (0.011)	0.031 (0.011)	0.022 (0.011)
Hispanic			0.015 (0.013)	0.011 (0.012)	0.010 (0.012)
Mother's Highest Grade Completed			-0.006 (0.002)	-0.005 (0.002)	-0.005 (0.002)
Child Was First Born			-0.007 (0.007)	-0.005 (0.008)	-0.004 (0.008)
Number of Children			-0.012 (0.004)	-0.012 (0.004)	-0.011 (0.004)
Child Was Breast Fed				-0.023 (0.008)	-0.023 (0.008)
Mother's BMI > 85th percentile				0.035 (0.008)	0.036 (0.008)
Mother's BMI > 95th percentile				0.046 (0.011)	0.045 (0.011)
Average Family Income Since Birth (in units of $10,000)					-0.001 (0.002)
Percent of Child's Life Mother was Married					-0.016 (0.011)
Psuedo R-Squared	0.002	0.002	0.028	0.044	0.046
Number of Observations	23,013	23,013	20,135	18,818	18,707

Notes: Dependent variable is a binary variable equal to 1 if child's BMI is above the 95th percentile for his/her age. The standard errors are robust, clustered on the mother's identification code, as there are multiple children per mother. Columns 3-5 also include mother's afqt score, both the child's and mother's age in years, dummy variables for the year of the survey, controls for education levels of the mother's parents, dummy variables indicating whether mother's parents were present when she was 14, and a dummy variable indicating whether the child is female. All estimates are weighted using the child's sampling weight.

Table 4: Probit Estimates of the Impact of Maternal Employment Since Child was Born on Childhood Overweight
(Estimates Represent Derivatives, Robust Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
Mother Worked $ 35 Hours/Week Since Child's Birth	0.024				
	(0.011)				
Mother Worked < 35 Hours/Week Since Child's Birth	0.0004				
	(0.011)				
Average Hours per Week if Working Since Child's Birth (in units of 10)		0.010	0.008	0.007	0.006
		(0.002)	(0.002)	(0.002)	(0.002)
Number of Weeks Worked Since Child's Birth (in units of 52)		-0.003	-0.001	-0.001	-0.0005
		(0.001)	(0.002)	(0.002)	(0.002)
African American			0.053	0.030	0.022
			(0.011)	(0.011)	(0.011)
Hispanic			0.014	0.009	0.009
			(0.012)	(0.012)	(0.012)
Mother's Highest Grade Completed			-0.005	-0.005	-0.005
			(0.002)	(0.002)	(0.002)
Child Was First Born			-0.008	-0.007	-0.006
			(0.008)	(0.008)	(0.008)
Number of Children			-0.012	-0.012	-0.011
			(0.004)	(0.004)	(0.004)
Child Was Breast Fed				-0.022	-0.022
				(0.008)	(0.008)
Mother's BMI > 85th percentile				0.035	0.036
				(0.008)	(0.008)
Mother's BMI > 95th percentile				0.046	0.045
				(0.011)	(0.011)
Average Family Income Since Birth (in units of $10,000)					-0.001
					(0.002)
Percent of Child's Life Mother was Married					-0.016
					(0.011)
Psuedo R-Squared	0.003	0.004	0.028	0.044	0.045
Number of Observations	23,338	23,338	20,413	19,086	18,973

Notes: The dependent variable is a binary variable equal to 1 if child's BMI is above the 95th percentile for his/her age. The standard errors are robust, clustered on the mother's identification code, as there are multiple children per mother. Columns 3-5 also include mother's afqt score, both the child's and mother's age in years, dummy variables for the year of the survey, controls for education levels of the mother's parents, dummy variables indicating whether mother's parents were present when she was 14, and a dummy variable indicating whether the child is female. All estimates are weighted using the child's sampling weight.

Table 5: Probit Estimates of the Impact of Maternal Employment
at Different Points in Child's Life on Childhood Overweight
(Estimates Represent Derivatives, Robust Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
Average Hours per Week if Working,	0.005			0.002	
Last Calendar Year (in units of 10)	(0.002)			(0.002)	
Number of Weeks Worked	-0.002			0.006	
Last Calendar Year (in units of 52)	(0.010)			(0.011)	
Average Hours per Week if Working		0.006		0.005	0.008
Since Child's Birth (in units of 10)		(0.002)		(0.0027)	(0.003)
Number of Weeks Worked		-0.0005		-0.002	-0.001
Since Child's Birth (in units of 52)		(0.002)		(0.002)	(0.003)
Average Hours per Week if Working			0.001		-0.002
in Child's First 3 Years of Life (in units of 10)			(0.002)		(0.003)
Number of Weeks Worked			0.002		0.003
in Child's First 3 Years of Life (in units of 52)			(0.004)		(0.005)
Psuedo R-Squared	0.046	0.045	0.045	0.046	0.046
Number of Observations	18,707	18,973	18,761	18,707	18,761

Notes: See notes to Tables 3 and 4. All specifications include the same covariates as Column 5 of Tables 3 and 4. See notes to those tables.

Table 6: Sibling-Differenced Estimates the Impact of Maternal Employment Since Child was Born on Childhood Overweight
(Robust Standard Errors in Parentheses)

	Differences at Same Point in Time		Differences at Same Age	
	(1)	(2)	(3)	(4)
Average Hours per Week	0.011	0.011		0.008
Since Child's Birth (in units of 10)	(0.002)	(0.002)	0.007	(0.002)
			(0.003)	
Number of Weeks Worked	-0.007	-0.003		0.004
Since Child's Birth (in units of 52)	(0.003)	(0.005)	0.009	(0.006)
			(0.006)	
Mother's Highest Grade Completed		—		0.024
				(0.013)
Child Was First Born		-0.003		0.012
		(0.013)		(0.017)
Number of Children		—		0.016
				(0.012)
Child Was Breast Fed		0.003		-0.029
		(0.016)		(0.022)
Mother's BMI > 85th percentile		—		-0.013
				(0.019)
Mother's BMI > 95th percentile		—		0.008
				(0.024)
Average Family Income		0.005		-0.017
Since Birth (in units of $10,000)		(0.007)		(0.006)
Percent of Child's Life		0.017		0.031
Mother was Married		(0.049)		(0.037)
R-Squared	0.005	0.009	0.002	0.014
Number of Observations	11,936	10,782	5,744	4,908

Notes: The dependent variable is the difference between the two siblings in a binary variable equal to 1 if child's BMI is above the 95th percentile for his/her age. Estimates are computed using ordinary least squares. The standard errors are robust, clustered on a sibling pair identification code, as there are multiple observations for each sibling pair. Column 2 also includes differences in the child's sex and age and column 4 also includes differences in the child's sex, the years between the two surveys, and the number of children in the family. All estimates are weighted using the child's sampling weight.

Table 7: Two-Stage Least Squares Estimates
of the Impact of Maternal Employment Since Child was Born on Childhood Overweight
(Robust Standard Errors in Parentheses)

	2SLS (1)	2SLS (2)	2SLS (3)	OLS (4)*
Average Hours per Week if Working Since Child's Birth (in units of 10)	0.006	0.008	0.010	0.006
	(0.019)	(0.019)	(0.019)	(0.003)
Number of Weeks Worked Since Child's Birth (in units of 52)	-0.008	-0.009	-0.011	-0.001
	(0.011)	(0.011)	(0.011)	(0.002)
African American	0.058	0.038	0.032	0.026
	(0.012)	(0.013)	(0.013)	(0.012)
Hispanic	0.012	0.012	0.011	0.011
	(0.013)	(0.013)	(0.013)	(0.013)
Mother's Highest Grade Completed	-0.004	-0.004	-0.004	-0.005
	(0.003)	(0.003)	(0.002)	(0.002)
Child Was First Born	-0.010	-0.009	-0.009	-0.006
	(0.009)	(0.009)	(0.009)	(0.008)
Number of Children	-0.018	-0.020	-0.020	-0.012
	(0.008)	(0.007)	(0.007)	(0.004)
Child Was Breast Fed		-0.024	-0.024	-0.022
		(0.009)	(0.009)	(0.009)
Mother's BMI > 85th percentile		0.033	0.033	0.033
		(0.009)	(0.009)	(0.008)
Mother's BMI > 95th percentile		0.052	0.052	0.055
		(0.013)	(0.013)	(0.013)
Average Family Income Since Birth (in units of $10,000)			0.0006	-0.0003
			(0.002)	(0.002)
Percent of Child's Life Mother was Married			-0.012	-0.018
			(0.015)	(0.013)
R-Squared	0.017	0.027	0.026	0.031
Number of Observations	18,301	17,162	17,057	18,973

Notes: The dependent variable is a binary variable equal to 1 if child's BMI is above the 95th percentile for his/her age. The standard errors are robust, clustered on the mother's identification code, as there are multiple children per mother. *Column 4 is a linear probability model, for comparison. All models also include mother's afqt score, both the child's and mother's age in years, dummy variables for the year of the survey, controls for education levels of the mother's parents, dummy variables indicating whether mother's parents were present when she was 14, and a dummy variable indicating whether the child is female. All estimates are weighted using the child's sampling weight. First stage results are presented in Appendix Table 2.

Appendix Table 1: Sample Averages from NLSY Data

	Full Sample	Mother Worked ≥ 35 Hours/Week Last Year	Mother Worked < 35 Hours/Week Last Year	Mother Did Not Work Last Year
% Overweight	0.111	0.123	0.093	0.108
Mother Worked ≥ 35 Hours/Week Last Year	0.458	--	--	--
Mother Worked < 35 Hours/Week Last Year	0.267	--	--	--
Mother Worked ≥ 35 Hours/Week Since Birth	0.485	--	--	--
Mother Worked < 35 Hours/Week Since Birth	0.404	--	--	--
Average Hours per Week if Working Since Child's Birth (in units of 10)	2.992	3.992	2.551	1.825
Number of Weeks Worked Since Child's Birth (in units of 52)	4.066	5.597	4.496	1.269
Average Hours per Week if Working Last Calendar Year (in units of 10)	2.554	4.306	2.183	0.000
Number of Weeks Worked Last Calendar Year (in units of 52)	0.591	0.848	0.746	0.045
Average Hours per Week if Working in Child's First Year of Life (in units of 10)	2.059	2.710	2.054	1.046
Number of Weeks Worked in Child's First Year of Life (in units of 52)	0.371	0.498	0.382	0.161
African American	0.162	0.196	0.090	0.174
Hispanic	0.073	0.077	0.048	0.090
Child's Age	7.207	7.458	7.181	6.838
Child is Femal	0.486	0.494	0.475	0.482
Mother's Highest Grade Completed	12.558	12.624	12.903	12.137
Mother's AFQT Score	42.004	41.417	49.084	36.523
Mother's Age	31.981	31.967	32.399	31.620
Mother's BMI>85th percentile	0.425	0.440	0.380	0.444
Mother's BMI>95th percentile	0.179	0.182	0.148	0.205
Mother's Mother's Highest Grade Completed	10.250	10.168	10.862	9.809
Mother's Father's Highest Grade Completed	8.098	7.878	9.013	7.601
Mother's Mother Present at Age 14	0.929	0.930	0.943	0.914
Mother's Father Present at Age 14	0.735	0.730	0.779	0.703
Child Was Breast Fed	0.509	0.465	0.584	0.508
Child Was First Born	0.475	0.496	0.474	0.442
Number of Children	2.553	2.346	2.538	2.894
Average Family Income Since Birth (in units of $10,000)	39.586	40.097	42.675	35.957
Percent of Child's Life Mother was Married	0.707	0.677	0.795	0.674
Maximum Observations	24,003	11,304	5,301	7,398

Notes: Some cells have fewer observations due to missing observations. Percent overweight does not match the figures in Table 1 since there are multiple observations per child here, representing the sample used for estimation.

Appendix Table 2: First Stage Regressions for Maternal Employment Measures
(Robust Standard Errors in Parentheses)

	Average Hours per Week	Number of Weeks Worked
Maximum AFDC/TANF Benefit for a Family of 3	-0.0007	-0.0001
	(0.0005)	(0.0008)
Pre-TANF Welfare Reform Implemented (Waiver State)	-0.121	-0.753
	(0.281)	(0.437)
Years of Education Required for Director of Day Care Center	-0.012	0.022
	(0.012)	(0.022)
Years of Education Required for Family Day Care Provider	0.026	-0.064
	(0.022)	(0.043)
Max caregiver/child ratio, kids 0-11 months, Center based	0.087	0.321
	(0.075)	(0.139)
Max caregiver/child ratio, kids 0-11 months, Family based	0.088	0.051
	(0.055)	(0.107)
Max caregiver/child ratio, kids 11-23 months, Center based	-0.073	-0.073
	(0.047)	(0.080)
Max caregiver/child ratio, kids 11-23 months, Family based	-0.021	0.080
	(0.048)	(0.088)
Max caregiver/child ratio, kids 24-35 months, Center based	0.041	0.004
	(0.026)	(0.046)
Max caregiver/child ratio, kids 24-35 months, Family based	0.032	0.016
	(0.061)	(0.104)
Max caregiver/child ratio, kids 36-47 months, Center based	0.020	0.085
	(0.040)	(0.078)
Max caregiver/child ratio, kids 36-47 months, Family based	-0.224	-0.503
	(0.629)	(1.345)
Max caregiver/child ratio, kids 48-59 months, Center based	-0.043	-0.051
	(0.034)	(0.064)
Max caregiver/child ratio, kids 48-59 months, Family based	0.324	0.491
	(0.611)	(1.340)
Max caregiver/child ratio, kids 60+ months, Center based	0.011	-0.033
	(0.020)	(0.035)
Max caregiver/child ratio, kids 60+ months, Family based	-0.196	-0.059
	(0.062)	(0.106)

Is Center Required to Carry Liability Insurance?	0.050 (0.128)	-0.084 (0.243)
Is Family Care Required to Carry Liability Insurance?	0.155 (0.209)	0.424 (0.375)
Number of Annual Inspections Conducted by Licensing Agency, Center based	-0.077 (0.130)	-0.687 (0.228)
Number of Annual Inspections Conducted by Licensing Agency, Family based	0.037 (0.106)	0.263 (0.177)
More than One Inspection per Year, Center based	0.531 (0.305)	1.663 (0.551)
More than One Inspection per Year, Family based	0.211 (0.190)	-0.226 (0.335)
Training Beyond H.S. Required for Director, Center based	-0.036 (0.123)	-0.146 (0.229)
Training Beyond H.S. Required for Director, Family based	8.876 (2.499)	-5.820 (6.468)
Hourly Wage of Workers in Child Care Sector	-0.181 (0.106)	-0.182 (0.186)
% of Husbands < Age 60 with H.S. Degree	0.613 (0.749)	2.398 (1.380)
% of Husbands < Age 60 with College Degree	3.777 (1.510)	10.212 (2.755)
Average Hourly Wage of Husbands < Age 60	-0.033 (0.072)	-0.348 (0.129)
R-Squared	0.1127	0.4226
Number of Observations	17508	17508

Notes: Both models also include all the other explanatory variables listed in Column 5 of Tables 3 and 4. Each variable reflects the characteristic in the child's state/year of interview. All estimates are weighted using the child's sampling weight.