The Effects of Maternal Employment on Childhood Obesity in the United States

Jackie Araneo
Department of Economics
Advisor: Christina Paxson
April 7, 2008

This paper represents my own work in accordance with the regulations of the University.

I. Introduction

Childhood obesity is a growing problem in the United States. The Center for Disease Control (CDC), based on data from the National Health and Nutrition Examination Survey (NHANES), reports that from 1971 to 2004, obesity rates have increased from 5% to 13.9% among two- to five-year-olds, from 4% to 18.8% among six- to eleven-year-olds, and from 6.1% to 17.4% among twelve- to nineteen-year-olds (CDC, 2007). Increases in childhood obesity have been especially pronounced among low-income children from racial and ethnic minority groups. This vast increase in the number of obese children is a major cause for alarm because of the many health problems associated with being overweight.

The reasons why child obesity has rapidly increased are not fully understood, but the increase in maternal employment is a potential factor. Just as there has been a great rise in child obesity since 1970, so too have there been more and more mothers joining the workforce since that time. In fact, according to the Bureau of Labor Statistics, less than half (47.4%) of mothers with children under the age of eighteen were part of the labor force in 1975. The percentage of mothers in the workforce has steadily increased since then, as 56.6% of mothers were in the labor force in 1980, 66.7% in 1990, and 72.9% in 2000. Since then the number of mothers in the workforce has leveled off, and as of March 2006, 70.6% of mothers with children under eighteen years old were in the workforce (U.S. Department of Labor, Bureau of Labor Statistics, 2007). Because the increasing trend in maternal employment closely matches the increasing rates of childhood obesity in the United States, it is worthwhile to explore whether or not there is a direct relationship between the two.

In this paper, I investigate the effects of maternal employment on childhood obesity by using data from The Fragile Families and Child Wellbeing Study. The data focuses primarily on low-income, minority children who were three years old at the time the information was

collected. The goal of my work is to determine if there is in fact such a link between maternal employment and childhood obesity. Additionally, I examine whether this link varies across mothers of different education levels and different races, in order to better understand determinants of differences in obesity rates across those from different socioeconomic groups. Exploring the effects of maternal employment on childhood obesity is important in that it will lead us a step closer to understanding the growing problem of childhood obesity in the United States.

II. Literature Review

A. *Overview of Obesity Health Risks*

Research shows that there are many health concerns associated with being overweight both as a child and as an adult. Overweight children are more likely to have high cholesterol levels, high blood pressure, and abnormal glucose tolerance, all of which put these children at a greater risk for cardiovascular disease in later life. Other health risks from being overweight as a child include asthma, hepatic steatosis, sleep apnea, and Type 2 diabetes (CDC, 2007). Overweight children are also more likely to be overweight as adults (Bouchard, 1997; Guo et al., 2002), and overweight adults have even more serious health risks such as coronary heart disease, diabetes, atherosclerosis, colorectal cancer, hypertension, gall bladder disease, breast cancer, endometrial cancer, colon cancer, and osteoarthritis (Power, et al. 1997; Wolf and Colditz, 1998).

In addition, research finds that overweight children are at risk of psychological problems due to social stigmatization. Overweight children may be made fun of and rejected by their peers, and even adults including parents and teachers may reject them as well. This may lead overweight children to have lower self-esteem and to fall into depression, which may even

extend into adulthood (Swartz and Puhl, 2002). These negative health consequences of obesity clearly indicate the importance of understanding its causes.

B. *Possible Causes of the Rise in Childhood Obesity*

The existing literature on childhood obesity looks at a wide range of issues, but the reasons why childhood obesity has greatly increased in the United States are still not fully understood. At the most basic level, it is clear that weight gain occurs when a person consumes more energy than he or she expends. Genetics could also impact weight, as children with parents that are obese are more likely to be obese themselves (Bouchard, 1997). While this much is understood, it still does not explain why so many more children are obese today than they were thirty to forty years ago.

Research has focused on several environmental factors that may have contributed to the rising rates of childhood obesity. Anderson and Butcher (2006), in *Childhood and Obesity: Trends and Potential Causes*, give an excellent review of the literature. First, there have been changes in the food market, including increased soft-drink consumption, increased portion sizes, declines in the relative prices of food, and increased consumption away from home such as at fast-food restaurants. A second factor that may have contributed to the rising rates of obesity is the changes in schools over the years. School snacks and lunches have become more caloric, more soft drinks are available, and even vending machines are extremely popular. Schools have also been giving less attention to physical education. In addition, many more parents drive their children to school today rather than allowing their children to walk and ride their bicycles, for reasons such as the school being farther away and fear that the neighborhood is unsafe. These factors can lead to less physical activity, which can result in more weight gain.

Anderson and Butcher also discuss maternal employment as a possible cause of increased child obesity rates. While maternal employment appears to be a plausible explanation, only a limited amount of research has looked into this issue. Therefore**,** I intend to further investigate the effect of maternal employment on childhood obesity using new and unique data from the Fragile Families Child Wellbeing Study.

C. Literature on Maternal Employment and Childhood Obesity

Economic theory suggests that maternal employment may affect childhood obesity. Anderson et al. (2002) discuss the trade offs between time-intensive and goods-intensive commodities that a mother and her family face when a mother decides to work or not. That is, if a mother spends more time working, she will have less time with her child and family but more income. Less time means that the mother may not be able to prepare healthy meals at home and might instead rely more on take out, fast food, and already prepared foods with high calories. Also, as mothers are away from home, their unsupervised children may choose to eat unhealthy snacks, or watch more television instead of engaging in more physical activity. At the same time, however, the more a mother works, the more income the family has, and this income could be used to purchase goods-intensive commodities, such as child care. Child care may or may not be beneficial for a child's health. It is possible that some caretakers are not concerned with the child's health, but others may indeed help children make healthier choices and encourage them to be more physically active (Fertig et al., 2006). More income could also allow the mother to pay for other extracurricular activities for her children, which would help keep them active. In addition, more income could be used to purchase higher quality food (Fertig et al. 2006), but at the same time, the additional income could just as well be spent on unhealthy foods, like fast

food and take out. For these reasons, it is unclear whether maternal employment is expected to lead to healthier or unhealthier outcomes for children in terms of obesity.

The existing literature has found that maternal employment leads to higher childhood obesity rates. Takahashi, et al. (1999) found such an effect for three year-old Japanese children. Anderson, et al. (2003) also explored the effects of maternal employment on child obesity but covered a much more extensive group of mothers and children by using data from the National Longitudinal Survey of Youth (NLSY), along with some 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). The study used a probit regression model of the form:

$$P\,(Weight_i > C) = \beta_0 + \beta_1 E_i^m + \beta_2 X_i^c + \beta_3 X_i^p + \varepsilon_i,$$

where $P\,(Weight_i > C)$ is the probability of the child being overweight, E_i^m is maternal employment, and X_i^c and X_i^p are characteristics of the child and his or her parents, including variables like mother's weight, educational attainment, demographics, and socioeconomic status. In addition to this model, Anderson, et al. (2003) use three "difference" models, including a sibling fixed-effect model, as well as an instrumental variable model, in order to reduce bias and provide evidence of a causal relationship rather than just correlation**.** The results indicate that it is the intensity of the mothers' work (measured in hours per week), not just whether or not mothers work, that increases the probability of their children being overweight. These findings were replicated by Fertig, et al. (2006) using a new data set (time diaries and interview responses from the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID)).

While maternal employment has been found to have an effect on childhood obesity, there is reason to believe that maternal employment may affect certain children differently than others.

One theory is that maternal employment may have more detrimental effects on children of highly educated mothers than on children of less well-educated mothers. Maternal education may be associated with greater knowledge in the areas of nutrition, health, and the benefits of physical activity. If so, the children of highly-educated mothers may have more to lose, on average, when their mothers work and they are cared for by alternative providers. The effects of the additional income that come with maternal employment could also differ according to maternal education. The marginal improvements in children's nutrition that stem from greater maternal earnings may be smaller for the children of more highly-educated mothers.

The idea that the effect of maternal employment on childhood obesity could vary among mothers with different education levels is well-illustrated in a figure from Fertig et al. (2006) (See Figure 1). The economic model used in Fertig et al.'s study of maternal employment and childhood obesity is the health production function, where the output is the child's health and the input is mother's time at home with the child. The figure illustrates two possible outcomes for child's health depending on maternal educational attainment. The first possibility is that the marginal returns to a mother's time spent with her children are equal for all children, regardless of their mother's education. In this case, a child with a less-educated mother is less healthy than a child with a highly educated mother, but maternal employment is not the source of this difference, i.e. H1 represents the production function of a higher educated mother and L represents the production function of a less well-educated mother. A second possibility is that the marginal returns to a mother's time spent with her children are greater for a highly educated mother than for a less well-educated mother, i.e. a highly educated mother's production function looks like H2 and a less well-educated mother's production function looks like L. This would suggest that increased working hours have a more harmful effect on children of highly educated

mothers than on children of less well-educated mothers, even though there are diminishing returns to mother's time spent with children in all circumstances (Fertig et al., 2006).

The findings of three studies suggest that maternal employment is more detrimental to children of highly educated mothers. Ruhm (2004) focuses on the effects of maternal employment not only on child obesity but also on their cognitive and socioemotional development. The results suggest the effect of maternal working hours is much more negative for advantaged children in terms of both overweight issues and cognitive development, while the negative consequences for average children are quite small. Anderson, et al. (2003) similarly finds the effects of maternal employment to be more harmful among children of highly educated mothers than of less well-education mothers. In addition, Anderson et al. (2006) finds the effect to appear mostly among white children and children of high-income families.

Fertig et al. (2006) takes this research a step further by exploring the actual mechanisms by which maternal employment impacts children of various backgrounds. This paper not only finds that the effect of maternal employment is greater for children of highly educated mothers, but also goes on to conclude that maternal employment affects a child's weight through the nutritional effect and supervision effect. The study finds that the nutritional effect of maternal employment on childhood obesity is the same among all children in their sample. That is, when mothers work longer hours, those children tend to eat fewer meals, more snacks, and bigger portions. However, the results of the study also indicate that the supervision effect actually varies depending on the mother's education. If the mother is highly educated, longer working hours has a negative effect on children's weight as those children watch more television and possibly consume more food while doing so. However, children of less well-educated mothers seem to benefit in terms of weight when their mothers work longer as they partake in activities such as staying in school longer hours rather than watching television.

III. Data

Like the previous literature, my study focuses on the impact of maternal employment on childhood obesity among different education groups. However, my study differs from these studies in that I use a new and unique data set. The data I use come from The Fragile Families and Child Wellbeing Study. This study collected data on approximately 5,000 children born between 1998 and 2000 in 20 cities throughout the United States. Surveys, in-home observation, and interview data were all used to collect information on the parents and the children at birth, age 1, age 3, and age 5. My research uses a sample of 2288 children from the age 3 interview. All of these children (and their mothers) participated in an in-home interview, during which the children were weighed and measured.

Some significant differences between The Fragile Families data set and the data used in previous research allows my study to build upon the existing literature in several ways. The NLSY data used by Anderson, et al. (2003) covers children of ages three to eleven, while the PSID data used in Fertig, et al. (2006) includes children under the age of thirteen (just under 10 years old on average). Unlike these data sets, The Fragile Families data is focused on younger children. I specifically look at three-year-old children in my study, although about 15% of the sample includes some 2 and 4 year olds. Focusing on one particular age group in depth is important because it is likely that the effects of maternal employment vary depending on the child's age. For instance, ten-year-old "latch key" children may be at home consuming junk food while their mothers are out working. However, this is unlikely to be the situation for three-year-olds. For this age group, the real question is whether the quality of care children receive with their mothers is better or worse than the quality of care they receive at day care centers or with baby sitters.

Another advantage of the Fragile Families data is that it contains an over-sample of children born to unmarried parents, yielding a sample that contains a disproportionate share of low-income, minority children. Unlike my data set, the NLSY data used in Anderson et al. (2003) included mostly white children. The PSID data used in Fertig et al. (2003) included a large portion of black children but just a very small portion of Hispanics. The large sample of low-income and minority children (both blacks and Hispanics) in the Fragile Families data is important, given that the rising rates of obesity have been greatest among these children (Kimbro et al., 2007; Anderson et al., 2006; Ogden et al., 2002; Kumanyika et al., 2006; Nelson et al., 2004; Mei et al., 1998).

Tables 1 and 2 display some specifics about overweight children in the Fragile Families data. As a measure of child obesity, I use body mass index (BMI). While some criticize the use of BMI, the Center for Disease Control (CDC), the American Academy of Pediatrics, and the American Obesity Association (AOA) have encouraged the use of BMI in detecting signs of weight issues in children. BMI has been found to correlate with direct measures of body fat. According to the AOA, a child with a BMI at or above the 85th percentile but below the 95th percentile is considered "overweight" while a child with a BMI equal to or above the 95th percentile is considered "obese." The BMI's that correspond to these percentiles were defined in a base year and have remained fixed over time. This means that, with increases in overweight and obesity, more than fifteen percent of children are now considered overweight. In this paper, I will use the term "overweight" to refer to those children who are either overweight or obese according to the AOA classifications. In other words, I will refer to a child as being "overweight" if his or her BMI is equal to or greater than the 85th percentile (as defined in the base year).

Table 1 shows the overall percentage of children overweight in the Fragile Families Study based on race. Note that there are 1203 observations of black children, 543 observations of Hispanics, and 453 observations of whites. About 35% of all children in the survey are overweight. Hispanic children are more likely to be overweight (46.96%) than either blacks (30.92%) or whites (32.23%). Table 1 also indicates the prevalence of overweight children is similar across maternal education groups: 35.98% of children with mothers who did not graduate high school, 34.32% of children with mothers who graduated high school, and 35.18% of children with mothers who had at least some college experience are considered overweight.

Table 2 further breaks down these overweight percentages based on maternal employment, race, and education. The Fragile Families data includes information about how many weeks and how many hours per week a mother worked in the past year (the year prior to the time of the survey). Because it is likely that the intensity of the mother's work influences child obesity rather than just whether the mother works or not (as Anderson et al. (2003) found), I used this data on maternal employment to create three categories of maternal employment- mother never worked/worked little in past year, mother worked part-time in past year, and mother worked full-time in past year. I considered mothers to have worked full time if they worked at least 40 hours per week for at least 39 weeks during the year. Mothers are considered to have worked part-time if they worked either a) at least 39 weeks in the year but less than 40 hours per week or b) worked at least 40 hours per week but only worked between 20 and 39 weeks during the year. Mothers in the group "Never Worked/Worked Little" are considered to be those mothers who never worked or worked less than 20 weeks in the past year. I also looked at other different definitions for mothers who worked part-time or full-time and mothers who never worked/worked little, but comparisons of the results show little difference between the

various classification systems. For this reason, I will use the definitions explained above throughout the rest of my paper.

The statistics in Table 2 indicate that, overall, more children of mothers who worked full time are overweight than children of mothers who only worked part-time or not at all. Next, differences appear across maternal education groups. Among mothers who did not graduate from high school, there are only small differences in the prevalence of child overweight across maternal employment groups. For mothers with just a high school degree, more maternal employment seems to be related to higher overweight percentages. The association of full-time maternal employment with child obesity appears to be greatest among children with mothers who had at least some college experience: 31.49% of children with mothers who had at least some college experience but hadn't worked/worked little in the past year are overweight, but 40.31% of children with mothers who had some college experience and worked full-time are overweight.

The statistics in Table 2 also indicate that the association between child overweight and maternal employment varies across racial and ethnic groups. More specifically, the association of child overweight with the intensity of the mothers' work is evident for white children but not Hispanics, as one might expect given the findings of previous studies. However, one possibly unexpected observation is that maternal employment actually seems to have the most negative association with children in black households as compared with children in white and Hispanic households. These preliminary observations demonstrate maternal employment may indeed be related to child obesity under certain circumstances, but more definite conclusions are made in the results section based on actual regressions.

V. Methodology

The methodology I use to explore the effect of maternal employment on childhood obesity is probit regression, as in the Anderson et al. (2003) study. The specific equation I use, including the specific variables, is the following:

$$P(\text{Child Overweight}) = \alpha_0 + \alpha_1 \text{ Part-Time} + \alpha_2 \text{Full-Time} + \alpha_3 X + \varepsilon,$$

where P(Child Overweight)- the dependent variable- is the probability that the child is overweight, Part-Time is a binary variable (mother employed part-time or not), Full-Time is a binary variable (mother employed full-time or not), and ε is the error term. X includes control variables such as mother's weight status, the mother's race, the sex of the child, the age of the child (in months), and the family structure (living with man or living with no man).[1] The mother's weight status is an important variable to consider as children with overweight parents are more likely to be overweight as well (Bouchard, 1997). Race may also be a determining factor as obesity rates have been found to be higher among Hispanics and blacks than among whites (Kumanyika et al., 2006; Anderson et al., 2006; Mei et al., 1998; Ogden et al., 2002). In addition, obesity has also been found to be more common among girls (Mei et al., 1998). And it may also be important to control for family structure as some studies have found a relationship between family structure and obesity, even though the results of these studies have varied. Gerald et al. (1994) found that children of unmarried caretakers tend to be heavier, while Wolfe et al. (1994) found children in two-parent homes to be heavier than those of single-parent homes. Table 3 reports the mean and standard deviations of all these variables that I use in my regressions.

[1] It may seem that I should control for household income because obesity is more prevalent among low-income children (Kumanyika et al. 2006). However, since income is related to maternal employment, controlling for income makes it difficult to interpret the results. Therefore, I avoid using income as a control variable.

In order to explore the differences among children of different socioeconomic status (SES) backgrounds, I split the data sample into three groups depending on mother's educational attainment and run the regression for each group separately. The reason for using mother's education as the indicator for SES as opposed to income is because income is obviously too closely associated with maternal employment. The three groups are (a) mother did not graduate from high school, (b) mother graduated from high school but no college, (c) mother had at least some college experience.[2] The findings of Anderson et al. (2003), Fertig et al. (2006), and Ruhm (2004) all demonstrate the importance of looking at the effects separately for different subgroups.

Based on the literature review, I hypothesize that α_2 (the coefficient on the Full-Time binary variable) will be positive for mothers in group (c), where the mother had at least some college experience or more. On the other hand, I hypothesize that the coefficients for groups (a) and (b) (mother either did not graduate from high school or graduated from high school but did not go on to college) will be very small or insignificant. These predictions are based on the reasoning that mothers with more education have more to offer their children by being at home.

VI. Results

The results from the probit regressions are reported in Table 4. The results support my original hypothesis. When all mothers are included (reported in column 1), the coefficient on mother working full-time relative to not working at all is statistically significant at the ten percent significance level, but the coefficient on mother working part-time is not. More

[2] The reason for combining mothers who had only some college experience with mothers who actually graduated from college is because of sample size considerations. There is only BMI information on 221 children whose mothers graduated college. If I further break this down into mothers who never worked, worked part-time, and worked full-time, there would be very few observations for each and it would be hard to draw any conclusions from these statistics. By combining mothers who had some college experience with those who graduated from college causes the number of observations for each group (a,b, and c) to be approximately the same. In addition, it does not seem unreasonable to combine mothers who had only some college experience with those mothers who graduated college.

specifically, if a mother works full-time relative to not working at all, her child is 4.91 percentage points more likely to be overweight, while there is essentially no effect if a mother works part-time. In addition, the difference between mothers employed full-time and mothers employed part-time is statistically significant at the five percent significance level, as indicated by the t statistic of 5.54 reported at the bottom of Table 4.

Columns 2, 3, and 4 report the results of the probit regressions based on mother's education level, coded as "less than high school", "high school", and "at least some college education". Again, the results closely match my hypothesis. The effect of working part-time on child's weight is not statistically significant in any of the regressions, while the effect of working full-time relative to not working at all is statistically significant only among mothers with at least some college experience. In addition, among the well-educated mothers, the effect between full-time work and part-time work on a child's weight is also statistically significant at the five percent significance level, as the test statistic of 4.41 reported at the bottom of the table indicates.

Although the effect of full-time work is not statistically significant for less well-educated mothers, a clear pattern can be seen. The effect of a mother working full-time on her child's weight increases with the mother's education level. More specifically, if a mother with less than a high school diploma works full-time, the probability of her child being overweight increases by 0.30 percentage points; if a mother with a high school diploma works full-time, the probability of her child being overweight increases by 6.03 percentage points; and if a mother with at least some college experience works full-time, the probability of her child being overweight increases by 7.78 percentage points. No such pattern is seen among mothers employed part-time.

Table 5 displays results from regressions that use alternative definitions of children's weight status. First, I ran a regression using OLS, in which the child's BMI percentile is the dependent variable instead of the binary variable- child overweight or not. This seems important

because if a mother works, it may not be that her child suddenly goes from not being overweight to being overweight; however, this does not rule out the possibility that the more a mother works, the more likely her child is to be heavier than he or she would have been otherwise. The results show that full-time employment among mothers has a statistically significant effect in all circumstances except among mothers with a high school education. The largest effect, as expected, is among the highest educated mothers, in which full-time employment leads to a 7.86 percentage point increase in a child's BMI percentile.

Table 5 also displays the results of the regression in which the dependent variable is a binary variable, whether the child is obese (BMI percentile greater than or equal to 95) or not. Once again, among mothers employed full-time but not part-time, the effect on the probability of the child being obese is statistically significant at the ten percent significance level. More specifically, the child of a full-time employed mother is 3.96 percentage points more likely to be obese relative to the child of an unemployed mother. There are no statistically significant coefficients in the other three regressions, not even among the most educated mothers. However, this result is possibly due to the small sample size. There are only 410 obese children in the whole sample, and when broken down by mother's education level, this number obviously decreases even further.[3]

Table 4 also shows some interesting results that are not directly related to my main hypothesis but are nonetheless worth noting. First, the effect of being Hispanic (relative to being white) on the probability of being overweight as a child is statistically significant in three of the four regressions. In addition, the effect of being Hispanic relative to being black is statistically significant in all the regressions, as indicated by the test statistics reported at the bottom of the

[3] More specifically, among mothers with less than high school education, there are only 159 total obese children. Among mothers with a high school diploma, there are only 118 obese children. And among mothers with at least some college education, there are only 133 obese children.

table. This may have been expected, given that national studies have shown that obesity rates are particularly high among Hispanic children in the United States. The coefficient on black, on the other hand, is only significant among children with the least educated mothers. And interestingly, the coefficient is negative, which indicates that blacks are less likely than white children to be overweight at least in the Fragile Families data set. Another fact worth noting is the statistical significance of the coefficient on mother's weight status in all four regressions. This again might have been expected, given that overweight parents often have overweight children.

VII. Discussion

The findings of this paper are an important step in understanding the rise of childhood obesity in the United States. As I hypothesized, full-time maternal employment leads to a higher probability of a child being overweight, but such an effect is only significant among the most highly educated mothers. These findings seem to support Fertig's economic model of the household production function discussed in the Literature Review. That is, the marginal returns to a mother's time spent with her children do in fact appear to be greater for highly educated mothers than for less well-educated mothers.

There are several possible explanations why full-time employment is more harmful to children of highly educated mothers. Because higher education is associated with higher socioeconomic status, one may believe that well-educated mothers have a greater ability to purchase the best quality of child care for their children. This thinking would imply that the effect of work on a child's weight would be insignificant for the high educated mothers. However, as my results have shown, this is not the case. The time constraints for well-educated mothers employed full-time appears to weaken their ability to promote a healthy and nutritional environment for their children. Even if the children of well-educated mothers are receiving

quality care in their mother's absence, this care appears to not be as valuable as the children's time spent with their own mothers. Although well-educated mothers may be able to afford high quality care, it may still be very difficult to find such care. Such care may or may not be available, and even if it is available, lack of information may make child care decisions difficult.

There are also several possible reasons for why full-time employment among less well-educated mothers is not seen to have a significant effect on children's weight. First, the quality of care that these children receive in the absence of their mother may be better than, or at least equivalent to, the quality of care they would have received had their mothers not been working. Less well-educated mothers may not have much knowledge about nutrition, physical activity, and other weight-related issues. Thus, the time less well-educated mothers spend with their children may not benefit them much in terms of health. Another possible explanation is that mothers of lower economic status may be more time constrained whether or not they are employed. For example, as Anderson and Butcher (2003) explain, there may be fewer grocery stores in the neighborhood. If this is the case and the mother has transportation difficulties, she may not have the time to provide her children with healthy meals.

While the findings of this study are important, there is clearly still much more research needed to be done. In today's world, it is unrealistic to expect mothers to stop working so that their children are less likely to be overweight. Instead, further studies must be carried out in order to discover the mechanisms by which maternal employment leads to higher obesity among children. Once the mechanisms are understood, then the problem of childhood obesity could better be addressed. If, for instance, child care is found to play a role, then efforts could be made to improve child care in order to ensure a healthier population of children in the United States. Only additional studies will help us to better understand the underlying problem.

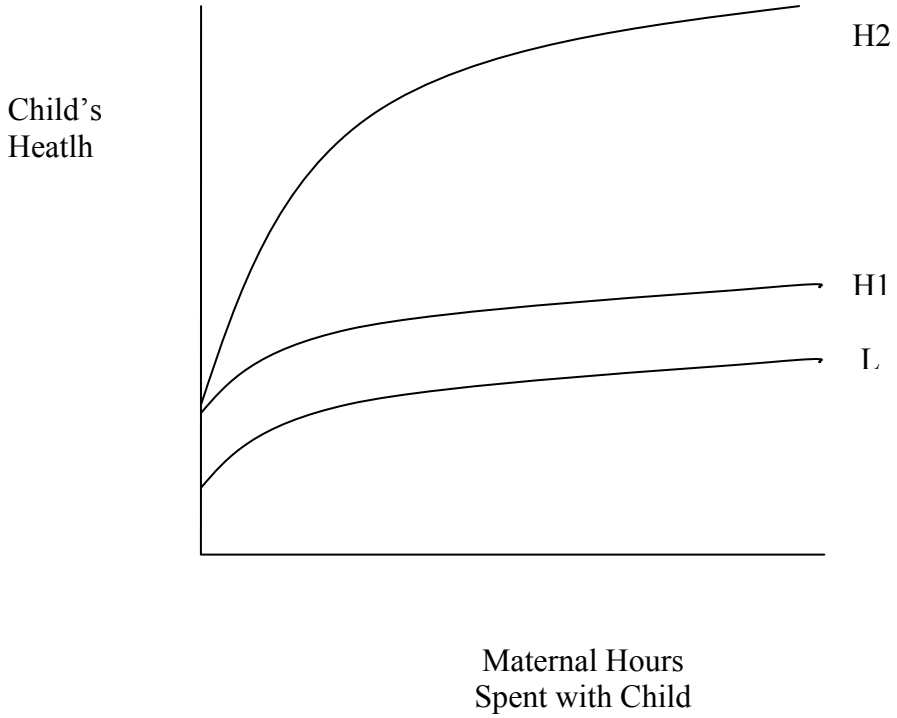
In addition, further studies should be carried out for children of various ages. This study looked only at three year olds in particular but these results do not necessarily generalize to children of all ages. It is very possible that the effects of maternal employment on child obesity vary depending on the age of the child. Further studies would put us in a better position to address the child obesity problem in the United States.

VIII. Conclusion

The results of this study suggest that full-time employment among highly educated mothers leads to a higher probability of the child being overweight. Such an effect is not seen, however, among highly educated mothers who only work part-time. And no significant effect is seen among the less well-educated mothers, whether employed part-time or full-time.

Because childhood obesity is associated with many health problems, it is important to reverse the upward trend seen in child obesity over the past forty years in the United States. While the rise in maternal employment appears to be a one factor explaining this upward trend, it is unrealistic to think the percentage of working mothers will decline anytime in the near future. Therefore, it is extremely important to look into the mechanisms by which maternal employment leads to an increase in children's weight. Once the mechanisms are understood, these issues could be addressed, and we will be another step closer to ensuring better health for our children.

Figure 1: Maternal Education and Child's Health Production



SOURCE: Fertig, et al., 2006

TABLE 1:
Percentage of children overweight* in The Fragile Families Study (ages 32 to 53 months) by race and mother's education

	Percentage Overweight	Total Observations
Overall	35.14 (0.998)**	2288
By Race		
White	32.23 (2.20)	453
Black	30.92 (1.33)	1203
Hispanic	46.96 (2.14)	543
Other	33.8 (5.65)	71
Missing	38.89 (11.82)	18
By Maternal Education		
Less than high school	35.98 (1.72)	781
High school graduate	34.32 (1.79)	708
At least some college	35.18 (1.69)	796

***** A child is considered overweight if his or her BMI is greater than or equal to the 85th percentile. There are the guidelines recommended by the American Obesity Association.
**Numbers reported in parentheses are standard errors.

TABLE 2:
Percentage of children overweight in The Fragile Families Study by maternal employment, maternal education, and race

	Mother Never Worked/ Worked Little In Past Year	Mother Worked Part-Time In Past Year	Mother Worked Full-Time In Past Year
All	33.78	33.18	38.68
	(1.83)	(1.59)	(1.79)
By Race			
White	32	29.94	35.29
	(3.82)	(3.55)	(4.11)
Black	27.74	27.97	36.58
	(2.54)	(2.07)	(2.35)
Hispanic	46.78	47.34	46.67
	(3.83)	(3.45)	(3.90)
Other	30	32	43.75
	(8.51)	(9.52)	(12.81)
By Maternal Education			
Less than high school	37.37	33.13	39.13
	(2.81)	(2.62)	(3.86)
High school graduate	30.56	34.8	36.47
	(3.44)	(2.89)	(3.02)
At least some college	31.5	31.67	40.31
	(3.38)	(2.78)	(2.73)
Observations	669	877	742

Note: Mothers are considered to have worked full time if they worked greater than 40 hours per week for at least 39 weeks in the past year (the past year refers to the year prior to the survey). Mothers are considered to have worked part time if they worked either a) at least 39 weeks in the past year but less than 40 hours per week or b) worked at least 40 hours per week but only worked between 20 and 39 weeks in the year. Mothers in the group "Never Worked/ Worked Little" are considered to be those mothers who never worked or worked less than 20 weeks in the past year. In order to measure the accuracy of these definitions of part-time and full-time, I created other definitions and compared the results. The results are strikingly similar so I will therefore use these definitions throughout my paper.

TABLE 3: MEAN AND STANDARD DEVIATIONS OF MAIN VARIABLES, 2288 OBSERVATIONS		
	MEAN	STANDARD DEVIATION
Child Overweight (Binary)	0.3514	0.4775
Mother Employed Part-Time	0.3833	0.4863
Mother Employed Full-Time	0.3243	0.4682
Mother Less Than High School Education	0.3413	0.4743
Mother with High School Degree	0.3094	0.4624
Mother with Some College Education	0.3479	0.4764
Child's Age (in months)	38.59	3.244
Female	0.4828	0.4998
Mother's Overweight(Binary)	0.7076	0.4550
Black	0.5258	0.4994
Hispanic	0.2373	0.4255
White	0.1980	0.3986
Mother and Child Living with Man	0.3046	0.4603
Mother and Child Not Living with Man	0.6954	0.4604

TABLE 4 : Probit Regression of Child Weight Status and Maternal Employment, reporting marginal effects				
Dependent binary variable: Child Weight Status (overweight or not overweight)				
Regressor	(1)	(2)	(3)	(4)
Mother Employed Part-Time (Binary)	-0.0083 (0.0248)	-0.0490 (0.0387)	0.0387 (0.0475)	-0.0053 (0.0458)
Mom Employed Full-Time (Binary)	0.0491* (0.0267)	0.0030 (0.0484)	0.0603 (0.0484)	0.0778* (0.0453)
Child's Age (in months)	0.0108*** (0.0031)	0.0158*** (0.0055)	0.0109** (0.0053)	0.0039 (0.0053)
Female	0.0111 (0.0202)	0.0263 (0.0349)	0.0161 (0.0365)	0.0010 (0.0344)
Mother Overweight (Binary)	0.0849*** (0.0218)	0.0655* (0.0389)	0.1222*** (0.0396)	0.0736** (0.0360)
Black	-0.0290 (0.0280)	-0.1515** (0.0590)	0.0140 (0.0525)	0.0110 (0.0406)
Hispanic	0.11778*** (0.0335)	0.0527 (0.0632)	0.1360** (0.0652)	0.0966* (0.0536)
Mother Living With Man (Binary)	-0.0058 (0.0222)	0.0107 (0.0362)	-0.0148 (0.0380)	-0.0237 (0.0430)
Mother High School Education (Binary)	-0.0034 (0.0254)			
Mother At Least Some College (Binary)	0.0080 (0.0260)			
Observations	2288	781	708	796
Test-statistics and p-value on Joint Hypotheses				
Part-Time minus Full-Time = 0	5.54** [0.0186]	1.21 [0.2714]	0.26 [0.6074]	4.41** [0.0357]
Black minus Hispanic = 0	33.22*** [0.000]	27.71*** [0.000]	6.55** [0.0105]	2.96* [0.0856]
Pseudo R^2	0.0260	0.0550	0.0289	0.0161

Note:
Standard Errors are reported in parentheses. Individual coefficients are statistically significant at the *10%significant level,**5% significant level, or ***1% significant level.

Regression (1): Includes mothers of all education levels
Regression (2): Includes only mothers who never graduated high school
Regression (3): Includes only mothers who graduated high school but did not go onto college
Regression (4): Includes only mothers who had some college experience

TABLE 5: Extensions				
Regression	(1)	(2)	(3)	(4)
Dependent variable: Child BMI percentile, OLS				
Mother Employed Part-Time (Binary)	0.8539	-0.6500	-1.2560	4.7908
	(1.552)	(2.370)	(2.820)	(3.015)
Mother-Employed Full-Time (Binary)	4.0250**	4.8798*	-0.9140	7.8574***
	(1.656)	(2.830)	(2.939)	(3.018)
Dependent Variable: Child BMI percentile greater than or equal to the 95th percentile (Binary), probit (reporting marginal effects)				
Mother Employed Part-Time (Binary)	-0.0122	-0.0110	0.0098	-0.0380
	(0.0196)	(0.0323)	(0.0370)	(0.0340)
Mother-Employed Full-Time (Binary)	0.0396*	0.0461	0.0570	0.0162
	(0.0216)	(0.0414)	(0.0388)	(0.0345)
Observations	2288	781	708	796

Note:
These are the same as the regressions in Table 1. The only difference is the dependent variables. Only coefficients on the main variables, not the control variables, are reported.

Standard Errors are reported in parentheses. Individual coefficients are statistically significant at the *10%significant level,**5% significant level, or ***1% significant level.

Bibliography

American Obesity Association. 2005. *Childhood Obesity.* http://obesity1.tempdomainname.com/subs/childhood/prevalence.shtml (accessed November 17, 2007).

Anderson, Patricia M. and Kristin F. Butcher. 2006. "Childhood Obesity: Trends and Potential Causes." *The Future of Children,* 16 (1): 19- 45.

Anderson, Patricia M., Kristin F. Butcher, and Phillip B. Levine. 2003. "Economic Perspectives on Childhood Obesity." *Economic Perspectives,* (27): 30- 47.

Anderson, Patricia M., Kristin F. Butcher, and Phillip B. Levine. 2003. "Maternal Employment and Overweight Children." *Journal of Health Economics*, 22 (3): 477-504.

Anderson, Patricia M., Kristin F. Butcher, and Phillip B. Levine. 2002. "Maternal Employment and Overweight Children." National Bureau of Economic Research Working Paper 8770.

Bouchard, Claude. 1997. "Obesity in Adulthood- the Importance of Childhood and Parental Obesity." *New England Journal of Medicine*, 337(13): 926-927.

Centers for Disease Control and Prevention, National Center for Health Statistics. Division of Health Examination Statistics. Data available at: http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overwght99.htm

Centers for Disease Control and Prevention. 2007. *Overweight and Obesity.* http://www.cdc.gov/nccdphp/dnpa/obesity/index.htm (accessed November 17, 2007).

Fertig, Angela, Gerhard Glomm, and Rusty Tchernis. 2006. "The Connection Between Maternal Employment and Childhood Obesity: Inspecting the Mechanisms." Center For Applied Economics and Policy Research Working Paper 2006-020.

Gerald, L.B., A. Anderson, G.D. Johnson, C. Hoff, and R.F. Trimm. 1994. "Social Class, Social Support, and Obesity Risk in Children." *Child Care, Health, and Development,* 20 (3): 145-63.

Guo, Shumei Sun, Wei Wu, William Cameron Chumlea, and Alex F. Roche. 2002. "Predicting Overweight and Obesity in Adulthood by Body Mass Index Values in Childhood and Adolescence." *American Journal of Clinical Nutrition*, 76(3), 653-58.

Kimbro, Rachel Tolbert, Jeanne Brooks-Gunn, and Sara McLanahan. 2007. "Racial and Ethnic Differentials in Overweight and Obesity Among 3-Year-Old Children." *American Journal of Public Health,* 97 (2): 298-305.

Kumanyika, Shiriki, and Sonya Grier. 2006. "Targeting Interventions for Ethnic Minority and Low-Income Populations." *The Future of Children,* 16(1): 187-207.

Mei, Zuguo, Kelley S. Scanlon**,** Laurence M. Grummer-Strawn**,** David S. Freedman**,** Ray Yip, and Frederick L. Trowbridge. 1998. "Increasing Prevalence of Overweight mong US low-income preschool children: the Centers for Disease Control and Prevention Pediatric Nutrition Surveillance, 1983 to 1995." *Pediatrics,* 101: 103-105.

Nelson, Jennifer A., Mary Ann Chiasson, and Viola Ford. 2004. "Childhood Overweight in a New York City WIC Population." *American Journal of Public Health,* 94: 458-462.

Ogden, CL, K.M. Flegal, M.D. Carroll, C.L. Johnson. 2002. "Prevalence and Trends in Overweight Among US Children and Adolescents, 1999-2000." *JAMA*, 288: 1728-1732.

Power, C., J.K. Lake, and T.J. Cole. 1997. "Measurement and Long-term Health Risks of Child and Adolescent Fatness." *International Journal of Obesity,* 21: 507-526.

Ruhm, Christopher J. 2004. "Maternal Employment and Adolescent Development." National Bureau of Economic Research Working Paper 10691.

Story, Mary, Karen M. Kaphingst, and Simone French. 2006. "The Role of Child Care Settings in Obesity Prevention." *The Future of Children,* 16 (1): 143-168.

Swartz, M.B. and R. Puhl. 2003. "Childhood obesity: a societal problem to solve." *Obesity Reviews,* 4(1): 57–71.

Takahashi, E., K. Yoshida, H. Sugimori, M. Miyakawa, T. Izuno, T. Yamagami, and S. Kagamimori. 1999. "Influence Factors on the Development of Obesity in 3-year-old Children Based on the Toyama Study." *Preventive Medicine,* 28(3): 293-6.

U.S. Department of Labor, Bureau of Labor Statistics. *Women in the Labor Force: A Databook (2007 Edition),* Report 1002.

Wolf, A.M., and G.A. Colditz. 1998. "Current Estimates of the Economic Cost of Obesity in the United States." *Obesity Research* 6: 2S-7S.

Wolfe, Wendy S., Cathy C. Campbell, Edward A. Frongillo J. Jere D. Haas, and Thomas A. Melnik. 1994. "Overweight Schoolchildren in New York State: Prevalence and Characteristics." *American Journal of Public Health,* 84 (5):807-13.