The Connection between Maternal Employment and Childhood Obesity:

Inspecting the Mechanism

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Abstract: We use time diaries and interview responses from the Child Development Supplement of the Panel Study of Income Dynamics to study the connection between maternal employment and childhood obesity. Our empirical strategy involves estimating the effect of children's activities and meal routines on children's body mass index (BMI), estimating the effect of maternal employment on these activities and routines and then combining these two estimates. We find that the effect of activities on BMI and the effect of maternal employment on activities vary greatly by the mother's educational status. In particular, among highly educated mother families, mother's employment significantly increases time spent watching TV, which in turn, significantly increases a child's BMI. However, for both groups higher levels of employment reduce the number of meals consumed per day by children, which increases their BMI. Overall, we find that the portion of the effect of maternal employment on children's BMI that can be explained by the most obvious channels – i.e. TV watching, child care, restaurant meals, and less supervision – is surprisingly small, which suggests that some of the effect may not be causal.

I. Introduction

Over the past several decades, obesity has swept across the US and other industrialized countries, affecting all age groups. The fraction of overweight children between the ages of six and eleven increased from 4 percent in the 1960s to 13 percent by 1999. The problem of childhood obesity has already triggered policy response – new law (Public Law 108 - 265) requires schools to have a local wellness program by the beginning of school year 2006-2007, that should address both nutritional and physical activity goals. The immediate cause of the increase in obesity is clear: calories taken in persistently exceed calories burned. The more fundamental reasons are less clear: why would so many people in these particular years choose to systematically take in more calories than they expend? According to Cutler and Glaeser (2003) and Philipson and Posner (1999), technological progress is responsible for cheaper fattening foods and a more sedentary lifestyle, while Chou, Grossman and Saffer (2002) claim that a decrease in smoking and an increase in the availability of restaurants, especially fast food restaurants, is responsible.

Any potential explanation for the phenomenal increase in *childhood* obesity must also involve changes in parental behavior, lifestyle, or attitudes (Patrick and Nicklas 2005, Golan and Crow 2004, and Ebbeling et al 2002). One important change over this period that has touched family life in many ways is the increase in employment among mothers. Recently a few papers have documented a positive relationship between maternal employment and bodyweight of the child (Anderson, Butcher and Levine 2003, Ruhm 2004, and Lamerz et al 2005). Interestingly, this connection seems to be especially pronounced for highly educated, rich, white families. These papers claim that the relationship between maternal employment and childhood obesity is causal; however, there are innumerable unobservable differences between mothers who choose

to work and mothers who do not. It may be the case that mothers who work a lot value luxurious (and high calorie) foods and do not value time spent exercising and thus their children would be heavier whether they worked or not. One way to demonstrate a causal relationship is to identify the mechanisms by which mother's labor supply affects a child's weight and why it might be the case that the effect of maternal employment is more pronounced for children from higher socioeconomic backgrounds. Thus, the goal of this paper is to shed some light on the mechanisms through which mother's employment translates into body weight of the child.

Mother's employment can affect childhood body weight through a variety of channels. First, a working mother has less time and energy available to cook and less time and energy to spend with her children. Working mothers may cook fewer meals at home, opting instead for more restaurant meals, or skipping meals like breakfast. Restaurant meals, especially from fast food restaurants, are more densely packed with calories than meals prepared at home. There is also evidence that skipping breakfast increases overall calories consumed . See Stauton and Keast (1989) and Morgan et. al. (1986); moreover a low meal frequency is associated with higher concentrations of 24 hour insulin, which can lead to increased fat deposition and higher body weight (see Ma, et. al. (2003).

Because working mothers may have less time and energy to spend with their children may mean that the children spend more time in the care of others – either at school or in child care, or alone. Since parents presumably care more about the future health of their children than do other caretakers, time spent in the care of others may be related to higher rates of obesity. Anderson and Butcher (2004) argue that schools "have given students greater access to 'junk' foods and soda pop," and find that access to junk food in schools increases students' weight. On the other hand, other caretakers may be able to offer a more structured routine involving physical activities

with other children and healthier snacks than parents might provide. Thus, it is not clear which effect a greater amount of time spent in school or in child care will have on a child's weight status.

In addition, when children are at home, working mothers may not be able to, due to time pressure or fatigue, supervise their children's outside activities. This might induce the child to spend more time inside in front of a TV or a computer resulting in fewer calories burned and a potential increase in weight.

Second, working mothers increase the income available in a household. There is a large empirical literature which finds a negative relationship between obesity and socioeconomic status (e.g. Gordon-Larsen et al 2003, Zhang and Wang 2004a, 2004b). The reasons for this linkage are debatable. Higher disposable income may allow households to provide better quality food or enroll children in organized activities which would reduce children's weight. However, the linkage might be entirely due to selection; people with low discount rates invest in education, which brings them higher earnings, and invest in their health, which keeps their weight in the normal range. While income in general is believed to have a negative effect on obesity, a mother's income, which might be seen as "extra" income to be spent on luxuries like restaurant meals and snacks, might have a positive effect on obesity. The extra income might also be used to provide children with an allowance which can also generate a higher weight since children tend to have high discount rates and generally prefer donuts to apples.

Third, and finally, we expect that currently working mothers returned to work sooner after birth and thus were less able to breastfeed or stopped breastfeeding at earlier ages. There is evidence that bottle fed infants are more likely to be overweight as children and adults than breastfed infants (Lucas et al 1980, 1981). Thus, it may be that a mother's average work hours

are correlated with her child's BMI because they are a good indicator of the probability that her child was bottle fed.

To quantify the importance of the various channels through which maternal employment may affect children's body weight, we use the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The CDS is well suited for this analysis because it includes the height and weight of the child, time diaries of the child's activities during one weekday and one weekend day, and a great deal of information about the child's household through the linkage with the main PSID survey.

The data and sample are described in section 2. There we also replicate the empirical finding that maternal employment has a positive and significant effect on children's BMI which is stronger for highly educated mothers using the PSID. In section 3, we detail our empirical strategy, which involves estimating two sets of equations; first, we estimate the effect of children's activities and meal routines on children's body max index (BMI); second, we estimate the effect of maternal employment on these activities and routines. Third, we combine these two estimates. We present our results in section 4. We find that the effect of activities on BMI and the effect of maternal employment on activities vary greatly by the mother's educational status. In particular, among highly educated mother families, mother's employment significantly increases time spent watching TV, which in turn, significantly increases a child's BMI. On the other hand, if the mother has no more than a high school diploma, mother's employment significantly increases the amount of time a child spends in school, which in turn, significantly *decreases* a child's BMI. However, for both education groups maternal employment decreases the number of meals consumed by children which in turn increases their weight. Finally, we offer a summary and conclusion in section 5.

II. The Data

The data used in this study comes from the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The PSID has followed approximately 5,000 families since 1968. This original sample includes an equal probability, nationally representative sample of about 3,000 households called the Survey Research Center (SRC) sample, and a sample of about 2,000 low-income families called the Survey of Economic Opportunity (SEO) sample. Over time, the study has added the 'split-off' households of children and other members of the original PSID households after they leave and start their own families, such that in 1996 there were over 8,700 families involved in the survey.

Currently, the CDS consists of two waves. The first wave involves a sample of approximately 3,500 children under the age of thirteen who are members of PSID families in 1997. Because the sample of children is drawn from both the SRC and the SEO samples, the children's sample has unequal selection probabilities. The second wave involves re-interviewing about 2,900 children in 2002, when they were between the ages of 5 and 17. In this analysis, we use 3,978 observations of 2,707 children from 1,200 PSID families. We have two observations on many children and there are some siblings as the CDS included at most two children from a family. Of the approximately 2,400 observations (3,500 + 2,900 – 3,978 = 2,422) that we omit, 700 are of children under the age of 3 at the first interview; the remainder are omitted because of missing information on height, weight, or mother's work hours, or there was no time diary for the child in a given wave.

Table 1 presents some descriptive statistics by mother's education. The primary variables of interest in this analysis are whether the child is overweight. The conventional basis

for determining whether a child is overweight is the child's body mass index. BMI is calculated as weight in kilograms divided by height in meters squared (kg/m^2). The Centers for Disease Control (CDC) has produced a chart of percentiles describing the BMI distribution by the age (in months) and sex of children based on early waves (from the 1960s, 70s, and 80s) of the nationally representative National Health and Nutrition Examination Survey (NHANES). Following the CDC and others (Anderson, Butcher, and Levine 2003), we define children to be overweight if the child's BMI is above the 95^{th} percentile for their age and sex. Because of the growing numbers of overweight children, more than 5 percent of children are classified as overweight in our sample measured in 1997 and 2002: the percentage of children overweight is 22.5 among less educated mothers and 19.5 among highly educated mothers. Correspondingly, the average BMI of the children is 0.65 higher (= 20.33 – 19.68) in households with less educated mothers compared to highly educated mothers.

The other key variables in this study are the hours per week worked by the mother. On average, less educated mothers worked 15 hours per week over the child's life while highly educated mothers worked over 19 hours per week on average. Consistent with this, the fraction of mothers who have never worked during this child's life is twice as high for less educated mothers (12.1% vs. 6.4%).

The remainder of Table 1 describes the sample with a list of our main demographic controls. On average, children were just under 10 years old. Because the CDS draws from both the SRC and the SEO samples, there are a large proportion of black families – over 44 percent of children with less educated mothers are black and over 30 percent of children with highly educated mothers are black. On the other hand, the Hispanic sample is disproportionately small because of the design of the PSID. The Latino sample added to the PSID in 1990 was dropped in

1995 and a new immigrant sample was added in 1997. The CDS includes about 250 immigrant children from this new sample, some of which are Hispanic.

Of particular importance to this analysis, we can calculate the mother's BMI from the main household interview which asks the height and weight of the head of the household and the wife. These questions are only available in the 1986, 1999, 2001, and 2003 interviews. We use the mother's BMI in 1999 for the 1997 CDS wave and her BMI in 2001 for the 2002 CDS wave. The definition for obesity among adults accepted by the CDC is a BMI above 30. In our sample, nearly 29 percent of less educated mothers are obese while almost 19 percent of highly educated mothers are obese.

A. Replication

Before describing the time diaries which allow us to investigate the mechanisms by which mother's employment can affect a child's BMI, we want to confirm that the empirical relationship between mother's employment and child's BMI exists in the PSID. The previous studies used the NLSY and German data. We do this in Table 2. For comparison, we construct control variables similar to those used by Anderson, Butcher, and Levine (2003). We find that, in the full sample, mother's work hours are positively correlated with the probability that the child is overweight. In addition, consistent with Anderson, Butcher, and Levine (2003), Ruhm (2004), and Lamerz et al (2005), the effect of maternal employment is greater for more advantaged children (those with a highly educated mother). Thus, this relationship appears to exist across several data sources.

B. Time Diaries

The time diaries are a unique feature of this data. A parent (most often the mother) was asked to write down what the child was doing at every point in time over two days – one

weekday and one weekend day. We have taken this information and categorized the child's time into six types of activities: sleeping, eating, attending school, being baby-sat, participating in passive activities (such as music lessons), and participating in active activities (e.g. sports). Passive activities are further sub-divided into eight categories: TV watching, reading (and watching movies, listening to music, etc.), playing indoor games, socializing, shopping, traveling, playing on the computer or with video games, and doing homework. Active activities are separated into four categories: playing sports, doing chores around the house, taking lessons (in dance, golf, etc.), and working at a part-time job.

Table 3 provides the number of hours in an average day (averaged across one weekday and one weekend day) that a child spends on these activities by the child's age and the mother's education status. By far, sleeping takes the most amount of time. Time in school and time spent in passive activities are the next largest uses of time. In particular, children spend more time watching TV than participating in all of the active activities combined. Children spend little time in child care on average. The low and declining hours spent in child care may have to do with the definition of child care time. The time diary permits the parent to list two activities for any moment in time – a primary and a secondary activity. We have collapsed these two activities into one such that if the child was doing anything else while in child care, like watching TV, the other activity dominates. Thus, 'in child care' is really 'in child care and not doing anything else.' Older children in child care are more likely to be doing other activities while being watched. Finally, we dropped any time diary if more than 10 percent of the two days were missing. Thus, the average total number of hours account for in the time diaries, is quite close to, but not exactly equal to 24 per day.

We also know a few diet-related aspects of the household. These are shown in Table 4. We know from the time diary whether meals take place in a restaurant or at home. However, we cannot distinguish whether the meal eaten at home is from a restaurant (like take-out or delivery pizza). On average, fewer than 6 meals were eaten over the two days, and less than one was eaten in a restaurant. We are also interested in breastfeeding and allowances which can be affected by maternal employment and may impact a child's nutritional intake. These variables are available from the CDS parent interview. Highly educated mothers are almost twice as likely to have breastfed but are a little less likely to give an allowance to their child.

III. The Empirical Strategy

The goal of this paper is to investigate the channels through which maternal employment affects children's BMI. We assume that maternal employment affects the number and composition of meals and the nature of her children's activities, which influence calorie intake and expenditure, thereby affecting the child's BMI. Thus, our empirical strategy consists of estimating two equations. First, we estimate the direct effects of number and type of meals (calorie intake) and activities (calorie expenditure) on BMI. Then, we estimate the effects of maternal employment on these direct determinants of body weight.

Let the BMI of child i be a linear function of the direct determinants of body weight. For simplicity, we will use two examples of these direct determinants in this discussion: the number of meals in an average day (NM) and the number of hours watching TV in an average day (TV). Let X represent characteristics of the child and family related to both maternal employment and the child's body weight which confound the relationship of interest. For example, we control for the child's age because BMI changes with age and mothers of older children are more likely to

work. We control for race because black and Hispanic children are more likely to be overweight and black and Hispanic mothers may be less likely to work because they face a tougher job market than white mothers. We then estimate an equation of the following form:

$$ln\ BMI_i = \alpha_0 + \alpha_1 NM_i + \alpha_2 TV_i + \alpha_3 X_i + \varepsilon_i, \quad (1)$$

where ε_i is an idiosyncratic error with mean of zero.

Both the number of meals and the duration of TV watching depend on the number of hours the mother works (*MWH*) as follows:

$$NM_i = \beta_0 + \beta_1 ln\ MWH_i + \beta_2 X_i + u_i \quad (2)$$

$$TV_i = \delta_0 + \delta_1 ln\ MWH_i + \delta_2 X_i + v_i, \quad (3)$$

where u_i and v_i are idiosyncratic error terms with mean zero. Based on the model above the full effect of maternal employment on a child's BMI is equal to:

$$\frac{\partial \ln BMI}{\partial \ln MWH} = \frac{\partial \ln BMI}{\partial NM}\frac{\partial NM}{\partial \ln MWH} + \frac{\partial \ln BMI}{\partial TV}\frac{\partial TV}{\partial \ln MWH} = \alpha_1\beta_1 + \alpha_2\delta_1.$$

Of particular interest to this study, we can separate the effect of maternal employment on a child's BMI by channel to assess the relative importance of the various channels proposed. Thus $\alpha_1\ \beta_1$ is the part of the effect attributable to a change in the number of meals and $\alpha_2\delta_1$ is the part of the effect attributable to a change in the amount of TV watching that results when mothers work more.

We estimate equations (1) and (3) using ordinary least squares (OLS). Because NM_i is a non-negative count variable, we estimate equation (2) using a Poisson maximum likelihood regression. We use this technique instead of the more common ordered logit or probit because we need a marginal effect in order to combine coefficients to get the effect of maternal employment on a child's BMI. For dichotomous dependent variables, we compute marginal effects from a probit regression.

The goal is to estimate a set of elasticities of a child's BMI with respect to mother's work hours, one for each channel. These elasticities are computed by multiplying the appropriate coefficients from two regressions—equations (1) and (3), for example. Computing the standard error on this elasticity is not trivial because there is covariance between the estimators from equations (1) and (3). To deal with this issue, we "stack" our two equations and estimate them using seemingly unrelated estimation. That is, we stack the data needed for equation (1) on top of the data needed for equation (3) such that the dependent variable for the first half of the data is $ln\ BMI_i$ and is $ln\ TV_i$ in the second half of the data. Then, we can compute a standard error on a non-linear combination of coefficients from this one regression on stacked data, and it fully accounts for the correlation between the error terms across the two equations.

IV. Results

A. The effect of calorie intake and expenditure on a child's BMI

Table 5 presents the results of regressing the child's log BMI on variables that capture the child's calorie intake and expenditure, as expressed in equation (1) above. We also estimate the probability of being overweight, using the 95^{th} percentile on the CDC's distribution of children's BMI before the 1990s. The variables of interest in this regression are the number of meals, the fraction of meals in a restaurant, whether the child was breastfed, whether the child receives an allowance, and the time allocations of the child. We report our results for the full sample and when the sample is broken down by mother's education.

In the first two columns, which use the full sample, the variables that do *not* have a significant effect are as interesting as those that do. While the number of meals eaten over the two observed days and having been breastfed are significantly and negatively related to BMI, as

predicted, the fraction of meals in a restaurant and whether the child received an allowance are not. We expected that restaurant meals, which we assume to be more calorie-dense, would increase the probability of being overweight. However, we cannot distinguish between fast food and conventional restaurants in our data, thus it may be that families that go to restaurants often go to healthy restaurants. We also predicted that allowances, with which the child could buy junk food, would also increase a child's BMI.

Our results on the correlation of the time allocations with BMI and the probability of being overweight reveal some interesting patterns. In the full sample, the time spent watching TV is positively and significantly associated with both log BMI and the probability of being overweight. Other sedentary activities like reading and going to the movies are also positively and significantly correlated with being overweight. Strangely, doing chores appears to significantly increase the probability of being overweight. In contrast, playing sports and being in child care has no significant effect on BMI or the probability of being overweight for the full sample. We expected that high levels of physical activity would significantly decrease the child's BMI. However, the finding is consistent with Cawley, Meyerhoefer, and Newhouse (2005) who find that an increase in physical activity time in school does not have a significant impact on children's BMI. We had also expected that time spent in child care, given that child care providers have lower discount rates than parents when it comes to their child's nutritional intake, might increase the child's BMI, contrary to what we find here.

The difference between the results by mother's education is striking. The effects of breastfeeding and doing chores are only significant for less educated mothers. The effects of watching TV, reading, going to the movies, etc. are only significant for highly educated mothers. This contrast is most striking for some of the effects which were not significant in the full sample

because they have opposite signs in the two sub-samples. The coefficients on school, indoor games and sports are all negative for mothers with little education and positive (but insignificant) for mothers with more education. On the other hand, the effect of working at a part-time job significantly increases the probability of being overweight for a child with a highly educated mother but has a negative (but insignificant) effect for a child with a less educated mother.

There are three sets of results we find surprising. We expected that more time spent playing indoors would increase BMI since this involves a rather sedentary list of activities—playing cards, board games, etc. On the other hand, we expected that working and doing chores would reduce BMI as these are more physical activities (mowing the lawn, walking the dog, etc). Thus, we investigated the characteristics and the trade-offs of those children who spent a lot of time at these activities to understand these results. In the first case, the negative effect of playing indoors is confined to less educated mother families and to children over the age 10. It is also the case that these older children who spend a lot of time playing indoors are more likely to live in urban areas where playing outdoors might be hazardous due to traffic or other safety concerns. Playing indoors comes at the expense of other passive activities but not sports. Thus, we interpret this finding to reflect parents finding a way for children to be active indoors.

In the case of working, we find that the positive effect of working is confined to older children of highly educated mothers. These older children who work a lot spend a lot less time playing sports and they eat out in restaurants to a much greater extent than other children their age. Thus, it must be that these children are spending their earnings on high calorie food, which has a detrimental effect on their weight.

Finally, the strong positive effect of doing chores on both log BMI and the probability of being overweight is significant among children with less educated mothers but large and positive

for children with more educated mothers as well. We find that children who do a lot of chores spend less time socializing, playing sports, and working. Thus, it may be the case that reverse causality plays a role in this case. That is, it could be the case that overweight children have less of a social life and spend more time at home helping adults. Alternatively, parents of overweight children may assign them more chores as a way of forcing them to perform more physical activities.

In summary, we find that having been breastfed and having a larger number of meals universally decreases a child's BMI. For children with less educated mothers, more time in school, playing indoor games, and playing sports decrease BMI; doing chores is associated with higher BMI, although we suspect reverse causality in this case. For children with highly educated mothers, watching TV, reading, going to the movies, etc., and working significantly increase a child's BMI.

B. Estimating the effect of maternal employment on calorie intake and expenditure

The second part of our empirical strategy is to estimate the effect of maternal employment on the variables we have chosen to capture calorie intake and expenditure. Table 6 presents the results of running regressions of the form expressed by equations (2) and (3) above. Each cell in the table contains the marginal effect from a separate regression of our independent variable of interest – the log of the average number of hours worked per week by the mother since the birth of the child – on the calorie intake or expenditure variable listed in the left-most column of the table. That is, the coefficient in the top left-hand cell, -0.030, indicates that, for the full sample of mothers, the marginal effect of mother's work on the number of meals for the full sample is negative and significant. We report our results for the full sample and for sub-samples by mother's education. Probit regression was used to estimate the effect of maternal

employment on breastfeeding and receiving allowance, and Poisson regression for the number of meals; the rest were estimated using OLS. In all the regressions we control for child's age, gender, race, number of children in the family, whether the child is first born, birth weight, mother's age, education, marital status, obesity, family income, geographic location and the year of the interview.

We find that mother's employment has a wide variety of effects in the first column. However, just as in the previous section, the effects vary substantially by the mother's education. In particular, of the eleven left-hand side variables that have a significant coefficient in any column, only two are significant for both less educated and highly educated mothers – the negative effect on the number of meals and the positive effect on the time spent in child care. Four others have the same sign in all three columns but are significant only in the first column, suggesting that the sample sizes of the second and third columns are too small to generate a significant effect. Those are the positive effects of maternal employment on the fraction of meals in restaurants and children's working and the negative effects on time spent reading, going to the movies, etc and playing sports.

The other effects differ by mother's education. Children with less educated mothers who work more hours are more likely to receive an allowance, spend time in school, and spend time traveling/commuting than if their mother worked less. On the other hand, children of highly educated mothers who work more hours spend more time watching TV and less time playing indoor games than if their mother worked fewer hours.

Given the time and energy constraints of all working mothers, most of these effects are expected and reasonable. The only effect that may need interpreting is the effect on children's

work. We suggest that mother's who work more value work and may want their children to acquire that value by earning their own money while young.

C. How does maternal employment affect childhood obesity?

Finally, we can put the coefficients from Tables 5 and 6 together to determine the relative importance of the various mechanisms we have considered in this analysis. We present these combined coefficients in Table 7. The first and second columns of each sample are taken from Tables 5 and 6. The third column of each sample is computed by multiplying the coefficients in the two previous columns and the standard error on this term is estimated by seemingly unrelated regression as described in a section above. We find that number of meals is the most persistent mechanism through which maternal employment affects child's BMI – although the elasticity is small, it is significant for both education groups (the p-value for the less educated mothers is 15%) as well as the full sample.

The most pronounced effect of maternal employment on BMI for less educated mothers is through the increased time their children spend in school. For more educated mothers, the strongest effect is through the time their children spend watching TV – the more mothers work, the longer their children spend in front of TV, which, in turn, increases their BMI. However, the effect in either case is very small. If a less educated mother doubles her work hours from the average of 15 hours per week to 30 hours per week, her child's BMI would fall by less than 1 percent because of increased time in school. Likewise, if a highly educated mother doubles her work hours from the average of almost 20 to 40 hours per week, her child's BMI would increase by less than 1 percent because of increased time in front of the TV.

Our findings suggest that maternal employment affects a child's BMI in two ways: 1) there is a nutritional effect – children of mothers who work longer hours have fewer meals, and

either eat bigger portions or substitute snacks in between meals (this effect is similar for both education groups); and 2) there is a supervision effect – with less maternal supervision, children of highly educated mothers watch more TV which might be accompanied by the consumption of foods high in calories, while children of less educated mothers stay longer at school taking part in activities which reduce their BMI.

V. Conclusions

In this paper, we have replicated the empirical connection found in the NLSY between mother's employment and childhood BMI/obesity for the PSID. We then inspect the mechanisms which connect hours worked by the mother to BMI/obesity of the child. In the first stage of our analysis we find that the usual suspects, like being bottle fed, a small number of meals, and much time in front of the TV are positively correlated with bodyweight and that playing sports in negatively correlated with bodyweight (at least for less educated mothers). At the second stage the number of meals is negatively correlated with mother's work, while TV watching, for example, is positively correlated with mother's work.

Taking the results from these two steps/regressions separately is some evidence that mother's employment has influenced childhood body weight. Combining these results, as we do in table 7, reveals that this effect is not of great significance economically. Part of the reason why we do not get stronger results on restaurant meals, as opposed to meals at home, for example, is that we do not have information on take out meals. The pizza delivered from the hut to the home and eaten at home is as fattening as the pizza eaten in the hut. In our data set we can also not distinguish between a meal at a fast food restaurant and a salad in a conventional restaurant. We suspect that families who frequently eat greasy pizzas and fatty burgers in restaurants also use more fatty and calorie rich foods in meals that are cooked at home.

Answering the question of how mother's employment affects childhood obesity via the channel of the number and variety of meals cooked probably requires a much more detailed data set.

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Table 1: Descriptive Statistics by Mother's Education

	Mother's Ed ≤ 12 years		Mother's Ed > 12 years	
	Mean	N	Mean	N
Overweight (BMI>95th percentile for age & sex)	22.5%	1766	19.5%	1570
BMI of children	20.33	1766	19.68	1570
Hours per week worked by mother over child's life	15.09	1766	19.43	1570
Mother never worked during child's life	12.1%	1766	6.4%	1570
Age of child	9.78	1766	9.49	1570
Black	44.1%	1764	30.5%	1565
Hispanic	10.4%	1764	2.6%	1565
Female	50.4%	1766	47.7%	1570
First born child	43.8%	1766	58.5%	1570
Birth weight (pounds)	7.18	1747	7.49	1556
Number of children in household	2.39	1766	2.23	1570
Age of mother in 1997	31.02	1766	35.83	1570
Education of mother in 1997 (years)	10.57	1766	14.81	1570
Mother is obese (BMI>30)	28.7%	1625	18.5%	1458
Parents always married over child's life	47.0%	1766	70.0%	1570
Annual labor income over child's life	$33,723	958	$57,750	1116
Northeast	10.9%	1766	18.2%	1567
North Central	22.6%	1766	24.5%	1567
South	45.7%	1766	39.4%	1567
West	20.8%	1766	17.9%	1567
Urban	51.9%	1586	57.8%	1468

Table 2: Replication of result that mother's employment affects probability of being overweight
Dependent Variable: Overweight

Sample:	Full Sample	Mother's education ≤ 12	Mother's education > 12
Log hours/week worked by mother over child's life	0.014*	0.006	0.018+
	(0.006)	(0.008)	(0.009)
Child's Age	-0.017*	-0.015	-0.021+
	(0.008)	(0.013)	(0.012)
Child's Age Squared	0.000	0.001	0.000
	(0.000)	(0.001)	(0.001)
Black	0.059**	0.047+	0.076*
	(0.020)	(0.028)	(0.031)
Hispanic	0.142**	0.162**	0.143*
	(0.038)	(0.051)	(0.063)
Female	-0.043**	-0.034+	-0.045*
	(0.013)	(0.019)	(0.019)
First born child	0.016	0.014	0.019
	(0.015)	(0.021)	(0.022)
Birth weight (pounds)	0.017**	0.017*	0.019*
	(0.005)	(0.008)	(0.008)
Breastfed	-0.042**	-0.050*	-0.027
	(0.016)	(0.022)	(0.024)
Number of children in household	-0.012	-0.010	-0.007
	(0.007)	(0.009)	(0.012)
Age of mother in 1997	0.001	-0.000	0.003+
	(0.001)	(0.001)	(0.002)
Education of mother in 1997 (years)	-0.005+	-0.004	-0.020*
	(0.003)	(0.004)	(0.009)
Mother is obese (BMI>30)	0.141**	0.106**	0.171**
	(0.019)	(0.026)	(0.031)
Fraction of child's life parents married	-0.016	0.020	-0.084*
	(0.024)	(0.031)	(0.040)
Log labor income/1000 over child's life	-0.010	-0.006	-0.006
	(0.013)	(0.020)	(0.019)
Northeast	-0.021	-0.011	-0.009
	(0.027)	(0.042)	(0.037)
North Central	0.006	0.003	0.006
	(0.024)	(0.035)	(0.035)
West	-0.038+	-0.053+	-0.028
	(0.021)	(0.029)	(0.031)
Urban	-0.021	-0.045*	0.003
	(0.015)	(0.022)	(0.021)
2002 interview	0.069**	0.066**	0.081**
	(0.016)	(0.023)	(0.023)
Observations	4402	2254	1952

Probits. Marginal effects reported. Robust standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.

Table 3: Average Time Use per day by mother's education and child's age (in hours)

	Mother's Ed ≤ 12 years		Mother's Ed > 12 years	
	Child's Age<10	Child's Age≥10	Child's Age<10	Child's Age≥10
Sleeping	11.0	10.2	10.9	9.9
Eating	1.5	1.4	1.5	1.4
Attending school	5.9	6.2	5.6	6.5
In child care	0.4	0.0	0.5	0.0
Passive activities	4.3	5.7	4.3	5.9
TV watching	*2.3*	*2.4*	*1.9*	*2.3*
Reading, movies, etc.	*1.1*	*1.7*	*1.3*	*1.7*
Playing indoor games	*0.9*	*0.3*	*1.0*	*0.3*
Socializing	*0.7*	*0.8*	*0.8*	*0.9*
Shopping	*0.5*	*0.5*	*0.5*	*0.5*
Traveling	*0.4*	*0.4*	*0.4*	*0.5*
Computer/Video games	*0.4*	*0.7*	*0.4*	*0.8*
Homework	*0.2*	*0.4*	*0.2*	*0.6*
Active activites	1.7	1.8	1.6	1.7
Sports	*1.3*	*1.0*	*1.2*	*0.9*
Chores	*0.3*	*0.5*	*0.4*	*0.5*
Lessons	*0.0*	*0.0*	*0.0*	*0.0*
Work	*0.0*	*0.3*	*0.0*	*0.3*
Total	23.9	23.9	23.9	23.9
Observations	849	917	801	769

Table 4: Determinants of Diet by Mother's Education

	Mother's Ed ≤ 12 years		Mother's Ed > 12 years	
	Mean	N	Mean	N
Total number of meals	5.3	1766	5.7	1570
Percent of meals at home	88.8%	1766	86.3%	1570
Percent of meals in a restaurant	10.9%	1766	13.2%	1570
Child breastfed as infant	36.0%	1760	59.7%	1569
Percent of children age 6+ with an allowance	59.7%	1533	53.1%	1316

Table 5: What affects BMI and the probability of being overweight?

Sample:	Full Sample		Mother's Ed ≤ 12		Mother's Ed > 12	
Dependent Variable:	Log BMI	Overweight	Log BMI	Overweight	Log BMI	Overweight
Number of meals	-0.008**	-0.007	-0.006+	-0.001	-0.006+	-0.005
	(0.002)	(0.005)	(0.003)	(0.006)	(0.003)	(0.006)
Fraction of meals in restaurant	0.033	0.027	0.032	0.015	0.023	0.026
	(0.025)	(0.043)	(0.040)	(0.062)	(0.032)	(0.066)
Breastfed	-0.022*	-0.046*	-0.032*	-0.062*	-0.019	-0.037
	(0.010)	(0.018)	(0.015)	(0.025)	(0.015)	(0.027)
Receives allowance	-0.000	0.011	0.005	0.024	-0.008	-0.007
	(0.009)	(0.016)	(0.015)	(0.025)	(0.013)	(0.023)
Fraction of time spent (omitted=sleeping)						
eating	0.060	0.079	0.041	-0.146	-0.093	-0.182
	(0.146)	(0.284)	(0.204)	(0.380)	(0.230)	(0.450)
in school	-0.071	0.046	-0.304*	-0.189	0.180	0.346
	(0.087)	(0.160)	(0.123)	(0.221)	(0.133)	(0.250)
in child care	0.130	0.004	0.453	0.331	-0.131	-0.327
	(0.256)	(0.293)	(0.465)	(0.455)	(0.203)	(0.375)
Passive activities						
watching TV	0.182+	0.328*	0.014	0.122	0.341*	0.607*
	(0.099)	(0.165)	(0.131)	(0.226)	(0.169)	(0.268)
reading, going to the movies, etc.	0.191+	0.076	0.137	-0.148	0.405*	0.698*
	(0.109)	(0.203)	(0.147)	(0.275)	(0.165)	(0.317)
playing indoor games	-0.127	-0.039	-0.343*	-0.247	0.086	0.245
	(0.131)	(0.250)	(0.174)	(0.353)	(0.212)	(0.375)
socializing	-0.093	0.050	-0.193	0.107	0.071	0.131
	(0.105)	(0.194)	(0.153)	(0.278)	(0.163)	(0.309)
shopping	0.200	0.322	0.149	0.383	0.176	0.180
	(0.150)	(0.257)	(0.219)	(0.348)	(0.213)	(0.405)
traveling	0.064	-0.331	-0.016	-0.307	0.066	-0.230
	(0.194)	(0.376)	(0.327)	(0.607)	(0.250)	(0.492)
computer/video games	-0.002	-0.051	0.044	-0.225	0.069	0.371
	(0.114)	(0.220)	(0.148)	(0.263)	(0.191)	(0.347)
homework	-0.135	-0.056	-0.085	0.009	-0.141	0.057
	(0.162)	(0.315)	(0.304)	(0.548)	(0.213)	(0.440)
Active activities						
playing sports	-0.084	0.094	-0.252+	-0.126	0.122	0.399
	(0.104)	(0.199)	(0.143)	(0.274)	(0.160)	(0.323)
doing chores	0.390*	0.645*	0.408	0.882*	0.361	0.415
	(0.190)	(0.329)	(0.276)	(0.417)	(0.274)	(0.542)
taking lessons	0.084	-0.745	-0.505	-1.548	0.822	0.054
	(0.467)	(1.232)	(0.648)	(1.860)	(0.762)	(1.812)
working	0.055	0.240	-0.084	-0.078	0.266	0.732*
	(0.160)	(0.251)	(0.238)	(0.384)	(0.236)	(0.368)
Child's Age	0.014*	-0.023*	0.027**	-0.013	0.002	-0.034*
	(0.006)	(0.011)	(0.009)	(0.017)	(0.008)	(0.015)
Child's Age Squared	0.001*	0.001	0.000	0.000	0.001**	0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)

Black	0.027*	0.048*	0.018	0.045	0.051**	0.074*
	(0.013)	(0.023)	(0.018)	(0.031)	(0.019)	(0.036)
Hispanic	0.053**	0.125**	0.051+	0.138*	0.095**	0.162*
	(0.020)	(0.042)	(0.028)	(0.057)	(0.026)	(0.064)
Female	-0.011	-0.039*	-0.003	-0.035	-0.015	-0.036+
	(0.009)	(0.016)	(0.013)	(0.023)	(0.012)	(0.022)
First born child	0.001	0.010	0.012	0.019	-0.009	0.003
	(0.009)	(0.017)	(0.014)	(0.024)	(0.013)	(0.024)
Birth weight (pounds)	0.017**	0.023**	0.014**	0.023**	0.021**	0.025**
	(0.003)	(0.006)	(0.004)	(0.008)	(0.005)	(0.009)
Number of children in household	-0.016**	-0.020*	-0.018**	-0.019+	-0.009	-0.015
	(0.004)	(0.008)	(0.006)	(0.010)	(0.007)	(0.013)
Age of mother in 1997	0.001*	0.002+	0.001	0.001	0.002	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Education of mother in 1997 (years)	-0.003	-0.004	-0.005+	-0.003	-0.006	-0.015
	(0.002)	(0.003)	(0.003)	(0.005)	(0.005)	(0.010)
Mother is obese (BMI>30)	0.098**	0.151**	0.086**	0.114**	0.112**	0.182**
	(0.012)	(0.021)	(0.017)	(0.029)	(0.020)	(0.034)
Fraction of child's life parents married	0.001	-0.022	0.020	0.043	-0.019	-0.110*
	(0.016)	(0.028)	(0.021)	(0.036)	(0.026)	(0.044)
Log labor income/1000 over child's life	-0.009	-0.010	-0.020	-0.016	0.013	0.005
	(0.008)	(0.014)	(0.013)	(0.024)	(0.012)	(0.020)
Northeast	-0.003	-0.018	0.002	0.031	-0.007	-0.038
	(0.017)	(0.032)	(0.028)	(0.053)	(0.022)	(0.039)
North Central	-0.008	0.010	-0.016	0.007	0.004	0.009
	(0.015)	(0.027)	(0.022)	(0.040)	(0.022)	(0.039)
West	-0.019	-0.047*	-0.030	-0.058+	-0.008	-0.033
	(0.014)	(0.022)	(0.022)	(0.033)	(0.019)	(0.032)
Urban	-0.017+	-0.022	-0.023	-0.039	-0.014	-0.007
	(0.010)	(0.017)	(0.015)	(0.024)	(0.013)	(0.022)
Diary recorded in winter	0.035*	0.059*	0.044*	0.085*	0.021	0.027
	(0.015)	(0.026)	(0.019)	(0.035)	(0.022)	(0.039)
Winter*Northeast	-0.014	-0.024	-0.019	-0.076	-0.013	0.005
	(0.021)	(0.039)	(0.036)	(0.048)	(0.024)	(0.057)
Winter*North Central	-0.014	-0.052+	-0.032	-0.093*	0.003	-0.004
	(0.017)	(0.028)	(0.026)	(0.038)	(0.024)	(0.044)
Weekend day = Saturday	-0.001	0.004	-0.004	0.005	-0.000	0.004
	(0.008)	(0.015)	(0.012)	(0.021)	(0.011)	(0.021)
2002 interview	0.028+	0.023	0.014	0.015	0.038+	0.031
	(0.016)	(0.029)	(0.021)	(0.039)	(0.023)	(0.043)
Constant	2.683**		2.767**		2.588**	
	(0.062)		(0.092)		(0.111)	
Observations	3486		1759		1566	

Omitted time use category is sleeping. OLS when dependent variable is ln BMI; Probits when Overweight. Robust standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%. Missing indicators for controls included.

Table 6: What does mother's employment affect?
Coefficient: Marginal effect of mother's work hours on dependent variable.

Dependent Variable:	Sample: Full Sample	Mother's Ed ≤ 12	Mother's Ed > 12
Number of meals	-0.030**	-0.019*	-0.035**
	(0.005)	(0.008)	(0.007)
Fraction of meals in restaurant	0.006*	0.004	0.007
	(0.003)	(0.004)	(0.004)
Breastfed	-0.018	-0.008	-0.023
	(0.011)	(0.014)	(0.018)
Receives allowance	0.015	0.027+	0.016
	(0.010)	(0.014)	(0.016)
Fraction of time spent:			
eating	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)
in school	0.002	0.003*	0.000
	(0.001)	(0.001)	(0.002)
in child care	0.002**	0.002**	0.002**
	(0.000)	(0.001)	(0.001)
Passive activities			
watching TV	0.002*	0.000	0.005**
	(0.001)	(0.001)	(0.001)
reading, going to the movies, etc.	-0.001*	-0.002	-0.001
	(0.001)	(0.001)	(0.001)
playing indoor games	-0.002**	-0.001	-0.003**
	(0.001)	(0.001)	(0.001)
socializing	-0.000	0.001	-0.001
	(0.001)	(0.001)	(0.001)
shopping	0.001	0.000	0.000
	(0.000)	(0.001)	(0.001)
traveling	0.001*	0.001*	0.001
	(0.000)	(0.000)	(0.001)
computer/video games	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)
homework	-0.001	0.000	-0.001
	(0.000)	(0.000)	(0.001)
Active activities			
playing sports	-0.001+	-0.002	-0.000
	(0.001)	(0.001)	(0.001)
doing chores	0.000	0.001	-0.000
	(0.000)	(0.001)	(0.001)
taking lessons	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
working	0.001**	0.001	0.001
	(0.000)	(0.001)	(0.001)

Probit when dependent variable is Breastfed and Receives Allowance; Poisson when Number of Meals; OLS for all others. Marginal effects reported. Robust standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%. Missing indicators for controls included.

Table 7: The Implied Elasticities of Mother's Employment on BMI, by Channel

Sample:	Full Sample			Mother's Ed ≤ 12			Mother's Ed > 12		
Variable (V):	∂lnBMI / ∂V	∂V / ∂lnMWH	∂lnBMI / ∂lnMWH	∂lnBMI / ∂V	∂V / ∂lnMWH	∂lnBMI / ∂lnMWH	∂lnBMI / ∂V	∂V / ∂lnMWH	∂lnBMI / ∂lnMWH
Number of meals	-0.008**	-0.030**	0.0002**	-0.006+	-0.019*	0.0001	-0.006+	-0.035**	0.0002+
	(0.002)	(0.005)	(0.0001)	(0.003)	(0.008)	(0.0001)	(0.003)	(0.007)	(0.0001)
% of meals in restaurant	0.033	0.006*	0.0002	0.032	0.004	0.0001	0.023	0.007	0.0002
	(0.025)	(0.003)	(0.0002)	(0.040)	(0.004)	(0.0002)	(0.032)	(0.004)	(0.0002)
Breastfed	-0.022*	-0.018	0.0010	-0.032*	-0.008	0.0007	-0.019	-0.023	0.0011
	(0.010)	(0.011)	(0.0008)	(0.015)	(0.014)	(0.0013)	(0.015)	(0.018)	(0.0014)
Receives allowance	-0.000	0.015	-0.0000	0.005	0.027+	0.0004	-0.008	0.016	-0.0003
	(0.009)	(0.010)	(0.0003)	(0.015)	(0.014)	(0.0010)	(0.013)	(0.016)	(0.0006)
Fraction of time spent:									
eating	0.060	-0.001	-0.0000	0.041	-0.001	-0.0000	-0.093	-0.000	0.0000
	(0.146)	(0.001)	(0.0001)	(0.204)	(0.001)	(0.0002)	(0.230)	(0.001)	(0.0001)
in school	-0.071	0.002	-0.0001	-0.304*	0.003*	-0.0009+	0.180	0.000	0.0000
	(0.087)	(0.001)	(0.0002)	(0.123)	(0.001)	(0.0005)	(0.133)	(0.002)	(0.0003)
in child care	0.130	0.002**	0.0002	0.453	0.002**	0.0007	-0.131	0.002**	-0.0003
	(0.256)	(0.000)	(0.0004)	(0.465)	(0.001)	(0.0008)	(0.203)	(0.001)	(0.0004)
Passive activities									
watching TV	0.182+	0.002*	0.0004	0.014	0.000	0.0000	0.341*	0.005**	0.0018+
	(0.099)	(0.001)	(0.0003)	(0.131)	(0.001)	(0.0000)	(0.169)	(0.001)	(0.0010)
reading, movies, etc.	0.191+	-0.001*	-0.0003	0.137	-0.002	-0.0002	0.405*	-0.001	-0.0005
	(0.109)	(0.001)	(0.0002)	(0.147)	(0.001)	(0.0003)	(0.165)	(0.001)	(0.0004)
playing indoor games	-0.127	-0.002**	0.0002	-0.343*	-0.001	0.0005	0.086	-0.003**	-0.0002
	(0.131)	(0.001)	(0.0003)	(0.174)	(0.001)	(0.0004)	(0.212)	(0.001)	(0.0005)
socializing	-0.093	-0.000	0.0000	-0.193	0.001	-0.0001	0.071	-0.001	-0.0001
	(0.105)	(0.001)	(0.0001)	(0.153)	(0.001)	(0.0002)	(0.163)	(0.001)	(0.0001)
shopping	0.200	0.001	0.0001	0.149	0.000	0.0001	0.176	0.000	0.0001
	(0.150)	(0.000)	(0.0001)	(0.219)	(0.001)	(0.0001)	(0.213)	(0.001)	(0.0001)
traveling	0.064	0.001*	0.0001	-0.016	0.001*	-0.0000	0.066	0.001	0.0000
	(0.194)	(0.000)	(0.0002)	(0.327)	(0.000)	(0.0003)	(0.250)	(0.001)	(0.0001)
computer/video games	-0.002	-0.000	0.0000	0.044	-0.000	-0.0000	0.069	-0.001	-0.0000
	(0.114)	(0.001)	(0.0000)	(0.148)	(0.001)	(0.0000)	(0.191)	(0.001)	(0.0001)
homework	-0.135	-0.001	0.0001	-0.085	0.000	-0.0000	-0.141	-0.001	0.0001
	(0.162)	(0.000)	(0.0001)	(0.304)	(0.000)	(0.0001)	(0.213)	(0.001)	(0.0002)
Active activities									
playing sports	-0.084	-0.001+	0.0001	-0.252+	-0.002	0.0004	0.122	-0.000	-0.0000
	(0.104)	(0.001)	(0.0002)	(0.143)	(0.001)	(0.0004)	(0.160)	(0.001)	(0.0002)
doing chores	0.390*	0.000	0.0002	0.408	0.001	0.0002	0.361	-0.000	-0.0000
	(0.190)	(0.000)	(0.0002)	(0.276)	(0.001)	(0.0003)	(0.274)	(0.001)	(0.0002)
taking lessons	0.084	-0.000	-0.0000	-0.505	-0.000	0.0000	0.822	-0.000	-0.0001
	(0.467)	(0.000)	(0.0000)	(0.648)	(0.000)	(0.0001)	(0.762)	(0.000)	(0.0002)
working	0.055	0.001**	0.0001	-0.084	0.001	-0.0001	0.266	0.001	0.0002
	(0.160)	(0.000)	(0.0002)	(0.238)	(0.001)	(0.0002)	(0.236)	(0.001)	(0.0002)

The first and second columns of each sample are taken from Tables 5 and 6. The third column of each sample is computed by multiplying the coefficients in the first and second columns. The standard error on this combined term is estimated by seemingly unrelated regression on "stacked" data. Robust standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.