Maternal Employment and Direct Causes of Childhood Obesity

A THESIS
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY

Nadia Yayitra

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF APPLIED ECONOMICS

Advisor: Caroline Carlin

March 2012

Acknowledgements

I would like to acknowledge the excellent supervision of Caroline Carlin, and thank her for her encouragement and guidance. I would also like to thank my committee members, Patricia McGovern and Tim Beatty, and the faculty of Department of Applied Economics of University of Minnesota.

Dedication

This thesis is dedicated to my mother, a successful career woman, and a wonderful parent.

Abstract

This paper investigated the correlation between maternal employment and childhood obesity, and the probable mechanisms for that correlation. Previous papers have found that a child is more likely to be overweight if his/her mother worked more hours per week over the child's life, but few have looked into the mechanisms that caused the higher likelihood. Brown et al. (2010) and Chia et al. (2008) investigated the probable mechanisms, but their data have limited measures of children's lifestyle variables. The data used in this study have nine measurements of activities and seven measurements of diet; which is more inclusive than that of Chia (2008) and Brown et al. (2010)'s. Additionally, my methods included an adjustment explicitly modeling the endogeneity of mother's employment. The model in this paper followed the model in Anderson et al. (2003) in which energy expenditure and caloric intake enter linearly into the weight, and energy expenditure and caloric intake were determined by maternal employment, and mother, family and children's characteristics. Then, this research paralleled Chia (2008)'s models that extended the Anderson et al. (2003) model and looked into the relationship between maternal full-time employment and energy expenditure and caloric intake, captured by children's diet and activities. Using Early Childhood Longitudinal Study, Kindergarten data that has children's activities and diet information, and selection-corrected ordered probit to account for endogeneity issues that may influence both maternal full-time employment status and the variables of interest (overweight status, diet and energy expenditure), this paper found that the relationship between mother's fulltime status and the child's overweight status is positive (19 percentage point marginal effect). Maternal full-time employment status affects child's overweight status through affecting the child's habit in watching TV and in diet, such as the number of times the child drank juice and ate vegetables. If the endogeneity issue is ignored, the marginal effect of maternal full-time employment is biased toward zero.

Table of Contents

List of Tables

List of Figures

Background

Since 1980, the prevalence of school-age children with BMI at or above the 95th percentile has tripled, and it remains high at approximately 17%; while the prevalence of school-age children with BMI at or above the 85th percentile is 31.7% (Ogden et al., 2010). During the same period, the employment rate of mothers, especially those with young children has increased substantially. The increase is especially substantial among single Black and Hispanic mothers. According to the US Census Bureau (2011), from 1980 to 2009, the fraction of married women with school-age children that participate in the workforce has risen from 61.7 to 76.7%. The increase in employment of mothers could be a result of the welfare policies that emerged during the 1980s and 1990s, or the employment opportunities that arose due to the booming economy during the same period (Farley and Haaga, 2005).

One should wonder if a link exists between the increase in the prevalence of childhood obesity and the increase in maternal employment. Traditionally, it has been the women's job to raise children. The changes in this traditional role, due to maternal employment, have been hypothesized to be an important factor in the increase of overweight children (Anderson et al., 2003; Brown et al., 2010; Hawkins et al., 2008; Phipps et al., 2006).

Maternal Employment and Children's Obesity

Studies across several countries have found that there exists a link between maternal employment and childhood obesity. Anderson et al. (2003) found that the number of hours per week that the mother worked was correlated with the probability of the child being overweight. Hawkins et al. (2008) found that children were more likely to be overweight at age three if their mother held any employment since their birth. Phipps et al. (2006) found that the association between childhood obesity and parental paid work hours was larger for the multi-period averages of parental work time, compared to that of current period of parental work time. Brown et al. (2010) showed that children's weight gain could be explained by specific lifestyle behaviors, and maternal employment status

is indirectly associated with children's weight through its link with television viewing. Chia (2008) found that conditional on the mother returning to work in the period between the child's birth and the start of school for the child, a 10-hour increase in the number of hours worked per week when the mother first returned to work was associated with a 2.5 to 4 percentage point increase in the probability that the child later became overweight.

Maternal Employment and Energy Gap

In order to explore the pathways through which maternal employment affects childhood obesity, we need to examine the direct causes of weight gain. Given that the number of calories consumed equals the number of calories expended through physical activities and metabolic processes, body weight will remain stable. Children gain weight due to the energy gap: calories consumed are greater than calories expended (Katan and Ludwig, 2010).

Much of the literature attempts to identify the possible causes of the increase in the number of calories consumed, and whether maternal employment had an effect on this increase. The logic behind this theory is that mothers who work are constrained in time, and therefore have limited time for food preparation, and settle for less nutritious food that is faster to prepare. Horton and Campbell (1991) used data from the 1984 Family Food Expenditure Survey of Canada to find that maternal employment was associated with higher rates of restaurant-food consumption, and negatively associated with household nutrient availability. Additionally, the mothers could not supervise the food that their children ate when the mothers were at work. Parental influence is an important determinant of how children choose food. Klesges et al. (1991) found that both the threat of parental monitoring and the actual parental monitoring lowered the number of non-nutritious foods chosen by the children, and the caloric content of the foods.

Much of the literature also attempts to identify possible causes of the decrease in the number of calories expended. A popular theory is that the increase in time spent watching TV, instead of performing physical activities, is a cause of this decrease, ultimately causing the weight gain. Gortmaker et al. (1999) found that each hour of

reduction in TV viewing predicted reduced obesity prevalence among girls. Brown et al. (2010) also found a connection between TV viewing and obesity.

Cawley and Liu (2007) looked into both of the causes of increase in caloric intake and decrease in calories expended, and found that a higher number of typical hours worked per week is associated with a lower probability of spending any time grocery shopping, cooking, eating with children, playing with children, playing sports with children, child care, supervising children, and any time with children overall.

Determinants of Maternal Employment

Understanding why mothers choose to work is also important, since mothers that work are likely to be different compared to mothers that do not work, and these characteristics could affect the relationship between maternal employment and childhood obesity.

Leibowitz and Klerman (1995) found that married women's increasing opportunities in the labor force, and a decrease in their husbands' opportunities, account for much of the increase of maternal employment between 1971 and the 1990s. The research also found that there has been little change over time in the effect of the number of children, parental education, or the unemployment rate on maternal employment. However, Lichter and Costanzo (1987) found that changes in demographic composition accounted for 46% of the 23.11% increase in labor force participation of mothers age 25-49; the decrease in mothers' family size accounted for the largest share, along with marital status and education, while the age of mothers showed almost no effect.
Yoon et al. (1994) looked at differentiating factors among the different races, and found that white mothers often withdrew from paid employment when their children were young, and returned to work only when the children were older, while African American mothers more often worked without interruption. Additionally, the research also found that urban residence had an effect on African-American mothers' employment, but had no effect on White or Mexican American mothers.

Desai and Waite (1991) found that women who are committed to the work force over the long run would respond differently to characteristics of their occupations than women who preferred to not work on the long run (Desai and Waite, 1991).

Econometric Challenges

Selection into maternal employment is most likely endogenous in my model because the unobserved characteristics of the mother that influence employment decisions may also influence decisions about their children's exercise and nutrition. For example, mothers who worked more hours might be those who were less attentive to their children's health, regardless of their employment status, or they might have higher innate ability, and have been able to take care of their children more effectively. These omitted variables can bias the relationship between maternal employment and childhood obesity, either positively or negatively.

Anderson et al. (2003) used instrumental variables and differencing to manage this issue. The research used the variation between states and over time in the unemployment rate, child care regulations, wages of child care workers, welfare benefit levels, and the status of welfare reform in the state to instrument mother's work behavior. The research also used long differences, "point in time", and "at the same age" sibling differences to difference out any permanent unobservable characteristics of individual children over time or within families that might influence a mother's work intensity and the children's weight. Cawley and Liu (2007) used the same instrumental variables as Anderson et al.

In a paper that looked at the effect of maternal employment on children's cognitive and socio-emotional development, Ruhm (2008) controlled for maternal employment characteristics prior to birth, with the hope that these characteristics would absorb the effects of the remaining omitted variables without causally affecting the children's outcomes. Employment in the calendar year after assessment was also incorporated as an additional control for possible reverse causation.

Hawkins et al. (2008), Phipps et al. (2006) and Brown et al. (2010) did not account for endogeneity issues in their research. This might not have biased their results,

since Anderson et al. (2003) did not find a real indication of serious bias from unobserved heterogeneity in their probit specifications.

Contribution of This Work

Anderson et al. (2003) acknowledged that further work is required to understand the direct mechanism through which mothers' employment is connected to overweight children. Several previous studies, such as Chia (2008), Cawley et al. (2007), and Brown et al. (2010), attempted to investigate the direct link that connects maternal employment and childhood obesity.

Brown et al. (2010) found that the children whose mothers worked part-time watched less television and were less likely to be overweight than children of mothers who were not working, or who worked full time. However, Brown's data, the Longitudinal Study of Australian Children have limited measures of children's lifestyle variables. The research uses two measures of activities: TV watching and physical activity time that is the sum of three categories ('walk for travel or fun', 'ride bike, trike etc for travel or fun', 'other exercise e.g., swim, dance, and run about'). The research used three measures of snacking: 'sweet drinks', 'potato chips or savory snacks', and 'biscuits, donuts, cake, pie or chocolate'. As mentioned above, Brown's study also did not account for endogeneity of maternal employment.

Chia (2008) found that conditional on the mother's returning to work in the period after the child's birth and before the child started school, an increase in the weekly hours that the mother worked was associated with an increase in the probability that the child watches three or more hours of television or video programs per day, and a decrease in the probability that the child participated regularly in organized sporting activities in the year preceding the cycle when the child's overweight status was measured. Unfortunately, Chia's study did not have a measurement for the child's diet.

Cawley et al. (2007) used the American Time Use Survey (ATUS) to measure the effect of maternal employment on the mother's allocation of time, and found that employed women spent significantly less time cooking, eating with their children, and

playing with their children, and were more likely to purchase prepared foods; however, ATUS does not have data on the child's weight and height.

This study tried to be more comprehensive in the children lifestyle measurements compared to that of Chia (2008) and Brown et al. (2010). The data used in this study have nine measurements of activities and seven measurements of diet; which is more inclusive than that of Chia (2008) and Brown et al. (2010)'s. Additionally, the data used in this study contains the child's weight and height data. Finally, my methods included an adjustment explicitly modeling the endogeneity of mother's employment.

Conceptual Model

I began the analysis by replicating the Anderson et al. (2003) model with an alternative instrument and endogeneity correction. In the model, it is assumed that energy expenditure and caloric intake enter linearly into the weight. The primary model in Anderson's paper was:

$$Weight_{i,t} = \beta_0 + \beta_1\, Energy_{i,t} + \beta_2\, Calories_{i,t} + u_{i,t}$$

In the secondary model, energy expenditure and caloric intake were determined by maternal employment, and mother, family and children's characteristics:

$$Energy_{i,t} = \lambda_0 + \lambda_1\, Maternal\ Employment_{i,t} + \lambda_2\, Mother's\ Characteristics_{i,t} + \lambda_3\, Child's\ Characteristics_{i,t} + \lambda_4\, Family's\ Characteristics_{i,t} + v_{i,t}$$

$$Calories_{i,t} = \alpha_0 + \alpha_1\, Maternal\ Employment_{i,t} + \alpha_2\, Mother's\ Characteristics_{i,t} + \alpha_3\, Child's\ Characteristics_{i,t} + \alpha_4\, Family's\ Characteristics_{i,t} + e_{i,t}$$

Anderson et al. (2003) then used a reduced-form equation from the primary and secondary models to create the probability of the child being overweight:

$$Pr(Overweight_{i,t}) = \Phi_0 + \Phi_1\, Maternal\ Employment_{i,t} + \Phi_2\, Mother's\ Characteristics_{i,t} + \Phi_3\, Child's\ Characteristics_{i,t} + \Phi_4\, Family's\ Characteristics_{i,t} + \varepsilon_{i,t}$$

As mentioned above, Anderson et al. (2003) acknowledged that further work is required to understand the direct mechanism through which mothers' employment is

linked to overweight children. Therefore, this research extended their analysis by investigating the direct mechanism through which maternal employment has an effect on children being overweight.

Information regarding the children's diet and activities is available in the Early Childhood Longitudinal Study-Kindergarten data used in my analysis, and therefore allowed the extension of the analysis by investigating whether maternal employment affects children's diet and activities.

This research paralleled Chia (2008)'s models, which was also an extension of Anderson et al. (2003)'s model. Chia (2008)'s primary model:

$$Overweight_{i,t} =$$
$$\Pi_0 + \Pi_1 Activities_{i,t} + \Pi_2 Parental\ Characteristics_i +$$
$$\Pi_3 Child's\ Characteristics_i + \Pi_4 Family's\ Characteristics_i +$$
$$Province\ dummy + v_i$$

Chia (2008)'s secondary model then looked at the relationships between the activity measures and maternal employment:

$$Activities_{i,t} =$$
$$\theta_0 + \theta_1 Parental\ Characteristics_i + \theta_2 Child's\ Characteristics_i +$$
$$\theta_3 Family's\ Characteristics_i + Province\ dummy + v_i$$

My analysis extended Chia (2008)'s model to include the influence of the child's diet on weight status with an additional secondary equation for diet.

Figure 1

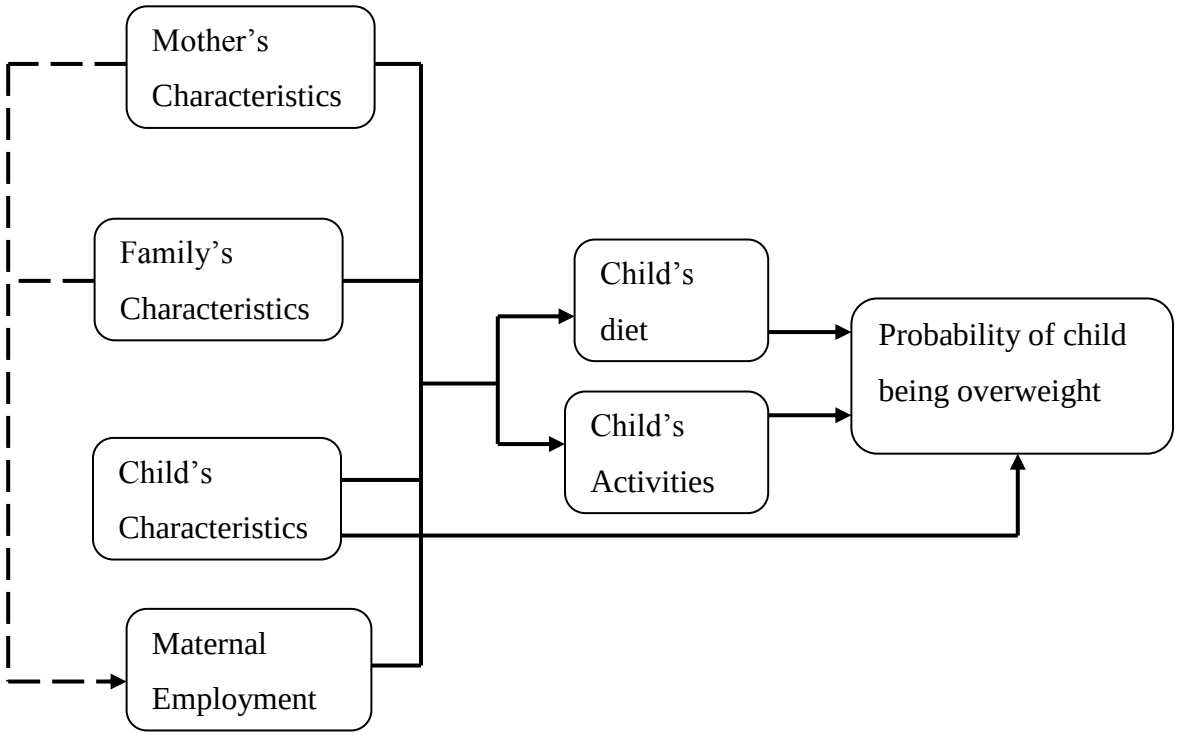
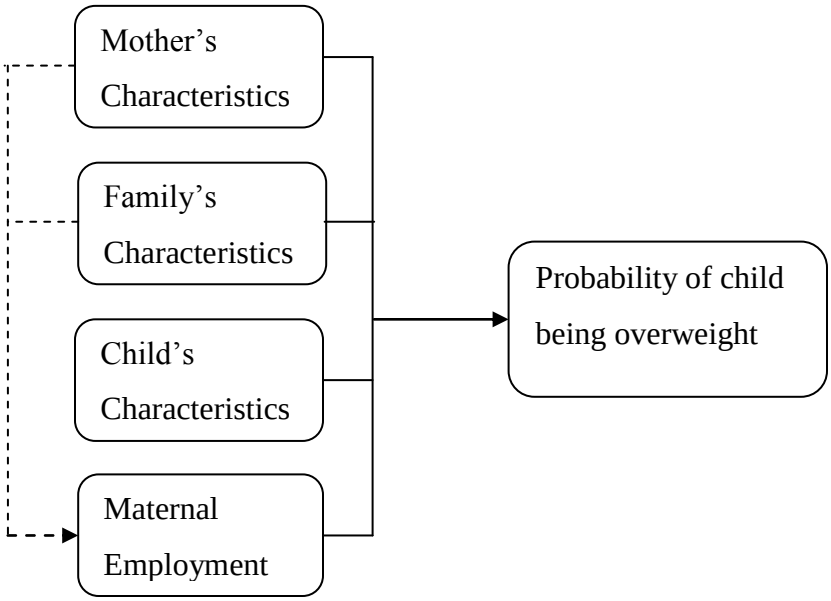


Figure 1 above summarizes the models in this paper. Mother's characteristics and family's characteristics affect mother's decision of employment. Mother's characteristics, family's characteristics, children's characteristics and maternal employment affect child's diet and activities. In turn, child's diet and activities, along with child's characteristics affect the probability of the child being overweight.

My initial analysis, paralleling Anderson et al. (2003), looked at the effect of maternal employment on the child's weight, without regard to the pathway, as represented in equation (1) and in Figure 2.

$$Pr(Overweight_i) =$$
$$\Phi_0 + \Phi_1 \, Maternal\ Employment_i + \Phi_2 \, Mother\ Characteristics_i +$$
$$\Phi_3 \, Child's\ Characteristics_i + \Phi_4 \, Family's\ Characteristics_i + \varepsilon_i \qquad (1)$$

Figure 2

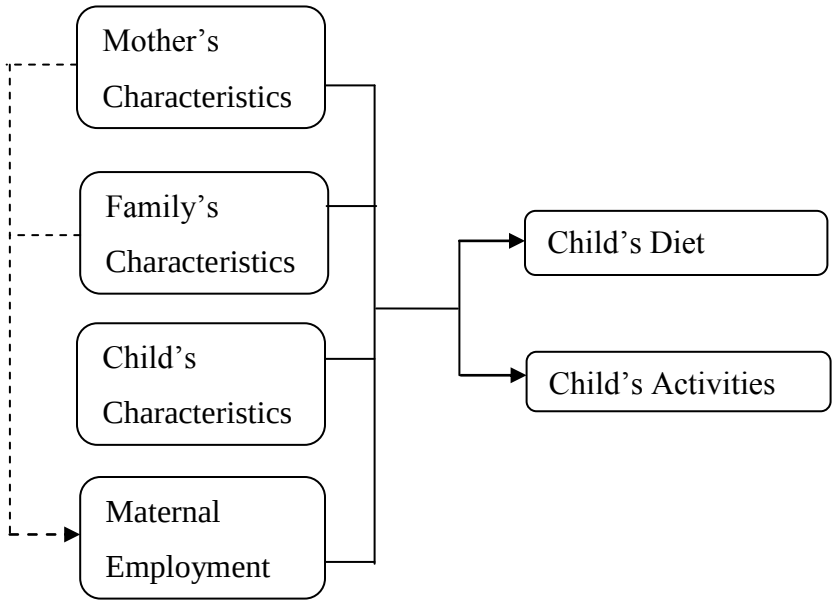


Since the data used in this research captures variables measuring children's activities and diet, this study then extended Chia (2008)'s secondary model to look at the relationship between maternal employment, and these measures of activities and diet (Figure 3):

$$Pr\,(Child's\ activities_i) = \Pi_1\, Maternal\ Employment_i + \Pi_2\, Family\ Characteristics_i + \Pi_3\, Child's\ Characteristics_i + \Pi_4\, Mother's\ Characteristics_i + \xi_i \quad (2)$$

$$Pr(Child's\ Diet_i) = \Psi_1\, Maternal\ Employment_i + \Psi_2\, Family\ Characteristics_i + \Psi_3\, Child's\ Characteristics_i + \Psi_4\, Mother's\ Characteristics_i + \upsilon_I \quad (3)$$

Figure 3



Data

This study uses Early Childhood Longitudinal Study-Kindergarten (ECLS-K) data (http://nces.ed.gov/ecls/kindergarten.asp) class of 1998-1999. ECLS-K is a large, nationally representative dataset of US kindergarteners who entered kindergarten in the fall. The study followed these kindergartners through elementary school. The children attended public and private schools, and were from diverse socioeconomic and racial background. Data for each child came from child assessment, along with parent, teacher, and school administrator interviews. Data are available in waves from fall of the kindergarten year thru spring of eighth grade. This research uses the data from the spring fifth grade wave. This wave was used because in fifth grade, children were asked about their diet and activities.

The key dependent variable is the child's overweight status based on body mass index (BMI). BMI was calculated by dividing weight in kilograms by height in meters squared. The Center for Disease Control (CDC) sex-specific BMI distribution for children aged 2-20 was used to determine whether the child is overweight (http://www.cdc.gov/growthcharts/percentile_data_files.htm). This research followed CDC's nomenclature and classified children with a BMI above the 85th percentile based

on their sex-age group in the BMI distribution as overweight. The classification is different from that of Anderson et al. (2003), which used an older CDC definition of overweight above the 95th percentile as overweight.

Child's activities include the following: TV watching before 8 a.m., TV watching between 3 p.m. and dinner, TV watching on Saturday, TV watching on Sunday, family eating breakfast and dinner together and at a regular time, and number of days per week of 20 minute exercise. Each of these activities measures is assigned a certain ordinal measurement if the child participates in a certain value of the activity. Please see Table 1 for the definition and distribution of these ordinal measurements.

Child's diet was measured by: number of glasses of juice drank last week, number of times soda pop/sport drinks/fruit drinks drank last week, number of times green salad, carrots, other vegetables, fruits, and fast food eaten last week. Each of these diet measures is assigned a certain ordinal measurement if the child consumes a certain value of the food or drink. Please see table 1 for the distribution of each of the measurements.

The predictor of interest was the mother's employment status. The employment status was calculated using number of hours that the mother worked per week. The mother was considered to work full time if she worked more than 20 hours per week. The maternal employment indicator took a value of 1 if the mother worked more than 20 hours per week, and 0 otherwise.

Child's characteristics were measured by gender, race, and age in months. Mother's characteristics were measured by age, race and mother's parent's education. Mother's parent's education was used because of possible endogeneity between mother's education and mother's employment status. Almost half of the sample mother's mother's education is missing. I assigned for a dummy variable indicating when mother's mother's education is missing to avoid losing observations. Family characteristics are measured by whether there are two adults living in the household, types of parents in the household, whether the family lived in an urban setting, number of children under five years old, and number of siblings.

As mentioned below in the Econometric Challenges section, selection into maternal employment was likely to be non-random; therefore, this study also estimated

the determinants of mother's employment. This paper used number of children below five years old in the household as an instrument to identify maternal fulltime status.

Table 1 summarizes the means and standard deviations of the variables used in the analysis. The prevalence of overweight among the ECLS-K sample was similar to the 35.5% reported by Ogden et al. (2010) data for the 6-11 year old age group. Forty percent of the sample is considered overweight. The sample was divided almost equally between male and female children. The average child's age was about 10 years old. The average mother's age is 39 years old. Seventy-six percent of the families lived in an urban setting. Sixty- three percent of the mothers worked full time, and 21% of the mothers were single parents.

Econometric Model

A standard regression model might deliver inconsistent estimators if unobserved characteristics that affect the response (overweight, diet, activity) were correlated with the switching variable (full-time maternal employment). As mentioned in the Econometric Challenges section, unobserved variables such as mother's innate ability can affect both her effectiveness in taking care of her child, and hence the child's diet and activities, and her probability of being employed full time.

Consistent estimators can be obtained by using maximum likelihood estimation of a joint model of the outcome and the switching variable (Miranda and Rabe-Hesketh, 2006).

In a joint model the variable of interest, y_i (overweight, activity, or diet), is assumed to follow a probit or ordered probit distribution with *n* response categories, the observed y_i is determined by the latent variable y_i^* such that:

$$y_i^* = x_i'\beta + \theta S_i + u_i$$

and

$$y_i = \begin{cases} = 1 \; if \;\; -\infty < y_i^* \leq cut\ 1 \\ = 2 \; if \; cut\ 1 < y_i^* \leq cut\ 2 \\ \qquad\qquad . \\ \qquad\qquad . \\ \qquad\qquad . \\ = n \; if \; cut\ n-1 < y_i^* \leq \infty \end{cases}$$

Here, θ and the K x 1 vector β are parameters to be estimated; x_i captures exogenous predictors; S_i is the switching variable; and u_i is a normally distributed error term. The ordered probit cut points (*cut* 1, … *cut n*-1) are also estimated in the model.

The switching variable, S_i, is assumed to follow a probit distribution determined by the latent variable S_i^*:

$$S_i^* = z_i'\varphi + v_i$$

where

$$S_i = \begin{cases} 1 \; if \; S_i^* > 0 \\ 0 \; otherwise \end{cases}$$

Here, φ is an L x 1vector of parameters, and v_i is the normally distributed error term. The vector z_i typically contains one or more instrumental variables, although the nonlinearity of the model provides weak identification without an instrument (Wilde, 2000, Heckman, 1978).

To capture the correlation between u_i and v_i, Miranda and Rabe-Hasketh (2006) expressed these variables as a function of three iid N(0,1) errors (ε_i, τ_i, ξ_i), and a factor loading λ.

$$u_i = \lambda\varepsilon_i + \tau_i$$

$$v_i = \varepsilon_i + \xi_i$$

From this, we can derive the covariance matrix of the residuals:

$$\text{Cov}\{(u_i, v_i)'\} \equiv \sum = \begin{pmatrix} \lambda^2+1 & \lambda \\ \lambda & 2 \end{pmatrix}$$

The correlation is:

$$\rho = \frac{\lambda}{\sqrt{2(\lambda^2+1)}}$$

S_i is exogenous if ρ=0.

In my study, in equation (1), y_i was the overweight status of the child, while for equation (2) and (3), y_i, were the child's activities and diet, respectively. The switching variable, S_i, was the mother's employment status.

The analysis was done using Stata version 10 (Stata Corporation, College Station, TX). Specifically, the analysis was done using the Stata "wrapper" program, *ssm*, which calls GLLAMM (Generalized Linear Latent and Mixed Models) to fit the model. An

important feature of *ssm* is that the log likelihood can be evaluated using adaptive quadrature. Adaptive quadrature has proven to achieve good accuracy with fewer quadrature points than other algorithms such as Gauss-Hermite quadrature (Miranda and Rabe-Hesketh, 2006).

Results

Table 2 summarizes the results of the overweight regression. I show the coefficients of the primary equation of modeling overweight status, and the coefficients of the switching equation modeling full-time maternal employment.

The relationship between mother's fulltime status and child's overweight status is positive, and significant at 5%.

The child is less likely to be overweight for higher levels of education than for children whose maternal grandmother had less than a high school education. Female children were less likely to be overweight compared to their male counterparts. Black and Hispanic children were more likely to be overweight than the White children. The children of families that lived in an urban setting were less likely to be overweight compared to the children of families that did not live in an urban setting.

In the switching equation, mothers who are single parents were more likely to have full-time status than mothers who were not single parents. Mothers of Asian and Black children were more likely to work, and mothers of Hispanic children were less likely to work, than mothers of White children. Mothers that lived in an urban setting were less likely to work compared to mothers who did not live in an urban setting. For each additional child under 5 years old in the household, the mothers were less likely to work. Mothers whose mothers were high school graduates were most likely to work than mothers whose mothers did not have a high school degree.

Tables 3-5 summarize the coefficients of the diet and activity regressions. The coefficients of full-time maternal employment equations here were very similar to those of the overweight regression, and therefore are not shown to conserve space.

The estimated coefficient of mother's fulltime employment status is positive when the dependent variables are number of minutes child watched TV before 8 am, number of

minutes child watched TV on Sunday, and number of total minutes child watched TV in the week before the interview, all of which would reduce energy expended. The estimated coefficient of mother's fulltime employment status is negative when the dependent variables are number of times child drank juice, number of times child ate carrots, number of times child ate other vegetables, number of times child ate fruits, number of times child ate breakfast together, number of times child ate dinner together with family, and number of times child ate dinner regularly in the week before the interview, all of which are associated with better nutrition. All of these relationships associate maternal full-time employment with an increased energy gap and therefore increased probability of being overweight.

Besides exercising, female children were more likely to do activities that promote health than their male counterparts. Female children were less likely to drink soda, eat fast food, watch TV, and exercise that cause rapid heartbeat. Female children were more likely to drink juice, eat salad, eat carrots, eat vegetables, and eat fruits.

Black children tended to have less healthy habits than White children. Specifically, Black children were more likely to eat fast food, drink more juice, and watch TV, and less likely to eat salad, eat carrots, eat dinner together, eat breakfast together, and eat breakfast at a regular time. With the exception of a reduced probability of exercise that caused a rapid heartbeat, Asian children tended to have healthier habits than White children; they were less likely to drink soda, eat fast food, watch TV after dinner, watch TV on weekends, and more likely to eat vegetables, eat carrots, eat fruit, eat dinner together, and eat dinner at regular time.

Children whose families live in an urban setting were more likely to eat fast food and eat salad, and less likely to watch TV, eat dinner together, and eat dinner at regular time. Older children were more likely to drink soda, and less likely to eat dinner at regular time and eat breakfast together.

Children whose mothers were single parents tended to have less healthy habits. They were less likely to eat salad and eat breakfast together, and more likely to watch TV between 3 pm and dinner, watch TV after dinner, and watch TV on Saturday.

Children whose maternal grandmothers were more highly educated were more likely to do activities that promote health compared to the children whose maternal grandmother did not have a high school degree. They were more likely to eat salad, eat vegetables, eat carrots, eat fruits, and exercise that cause rapid heartbeat, and less likely to drink soda, eat fast food, and watch TV.

My primary interest was the impact of full-time employment on children's health. Table 6 summarizes the full-time status coefficients and correlations (ρ) from all of the selection corrected regressions. For comparison, I re-estimated the models using traditional probit methods without selection correction and have included the full-time parameters from those estimations in this table. Column one is the *ssm* estimate for maternal full-time status, column two is the ρ coefficient of equation (1), (2), and (3), and column three is the traditional ordered probit estimate for maternal full-time status. As mentioned above, maternal full-time status is exogenous if ρ is 0.

The ρ is positive when the key dependent variables are number of times child drank juice, number of times child ate other vegetables, number of times child ate fruits, number of times child ate breakfast and dinner together, and number of times child ate dinner at a regular time in the week before the interview, all associated with better nutrition and therefore reduced BMI. The ρ is negative when the key dependent variables are number of minutes child watched TV before 8 am, number of minutes child watched TV on Sunday, and total number of minutes TV watched in the week before the interview, all associated with reduced exercise and therefore increased BMI. These statistically significant correlations contradict Anderson et al. (2003), who did not find real indication of serious bias from unobserved heterogeneity.

Table 6 also summarizes the marginal effect of full-time employment, calculated using the delta method. Column four is the selection corrected marginal effect if the mother works fulltime, and column five is the traditional marginal effect if the mother works fulltime. When ρ is statistically significant, traditional methods result in a full-time status coefficient biased toward zero; we see this bias toward zero in the dampened marginal effects from the traditional models.

Looking at the selection corrected marginal effects results, maternal full time employment status increases the probability the child will drink more soda, eat more fast food, watch more TV including before 8 am, after dinner, and weekends. These lifestyle measures promote unhealthy weight. Maternal full time employment status also decrease the probability of some lifestyle measures that promote healthy weight, namely the probability that the child drink more juice, eat more salad, eat more green vegetables, eat more carrots, eat more fruits, and eat more breakfast together. In keeping with these results, maternal full-time employment status also increases the probability of the child being overweight.

Conclusions and Limitations

Unfortunately, the ECLS-K data does not have information regarding the mother's weight. Other research has shown positive relationship between mother's weight and the child's weight (Anderson et al., 2003, Brown et al., 2010). The data also does not have information regarding the child's neighborhood such as distance to a park or distance to a supermarket, to see if neighborhood characteristics influence lifestyle behavior. This study also did not investigate the effect of long term maternal employment.

From the results, we can see that maternal full-time employment increases the probability of the child being overweight, and the associated unhealthy behaviors. Looking at the traditional probit and ordered probit results, and comparing them to the selection corrected *ssm* model, I found that ignoring the endogeneity issue, reduces the marginal effect of maternal full-time employment, and this underestimation increases with the magnitude of ρ.

This study shows the relationship between maternal full-time employment status and children's diets and activities. Possible policies might be increasing child's access to healthy food and beverage, not only at school, but also at home, and promote active lifestyle. For example, since full-time maternal employment status increases the probability of the child consuming fast food, the addition of healthy menu items in fast food restaurants, might help reduce the impact of maternal employment. Additionally,

since the full-time maternal employment status increases the probability of the child watching TV in the weekends, a nationwide campaign, such as Michelle Obama's Let's Move campaign, teaching parents the importance of spending time with their children doing other activities instead of watching TV during the weekends should be initiated. Policies to fight childhood obesity should not only be directed to the children, but also the parents.

Table 1 Descriptive Statistics

	Mean (s.d.) or % as indicated
Dependent Variables	
Overweight	40.0%
Number of time child drank juice last week	
0	23.8%
1-3	34.7%
4-7	25.3%
More than 7	16.3%
Number of time child drank soda last week	
0	15.7%
1-3	37.6%
4-7	28.4%
More than 7	18.4%
Number of time child ate green salad last week	
0	48.8%
1-3	32.5%
4-7	14.7%
More than 7	4.1%
Number of time child ate carrot last week	
0	45.7%
1-3	31.9%
4-7	15.5%
More than 7	6.9%
Number of time child ate other vegetables last week	
0	18.2%
1-3	35.6%
4-7	32.5%
More than 7	13.6%
Number of time child ate fruits last week	
0	9.0%
1-3	29.7%
4-7	35.5%
More than 7	25.7%
Number of time child ate fast food last week	
0	28.5%
1-3	50.5%
4-7	10.0%
More than 7	5.2%
Number of minutes TV watched before 8 am last week	
0	69.9%
1-15	6.6%

	Mean (s.d.) or % as indicated
16-30	16.1%
More than 30	7.5%
Number of minutes TV watched between 3 pm and dinner last week	
0	32.6%
1-30	16.0%
31-60	32.3%
More than 60	19.1%
Number of minutes TV watched between after dinner last week	
0	16.1%
1-30	12.0%
31-60	50.4%
61-120	21.5%
More than 120	
Number of minutes TV watched on Saturday last week	
0	5.6%
1-60	11.2%
61-120	29.2%
121-180	22.9%
181-240	16.8%
More than 240	14.3%
Number of minutes TV watched on Sunday last week	
0	9.7%
1-60	15.4%
61-120	29.2%
121-180	20.2%
181-240	14.3%
More than 240	11.1%
Number of total minutes TV watched last week	
0	0.3%
1-240	19.3%
241-480	44.6%
481-962	32.7%
More than 962	3.1%
Number of times the family ate breakfast together last week	
0	9.9%
1-3	45.6%
4-5	15.9%
More than 5	28.7%
Number of times the child ate breakfast at a regular time last week	
0	3.2%
1-3	9.9%
4-5	53.2%

	Mean (s.d.) or % as indicated
More than 5	33.8%
Number of times the family ate dinner together last week	
0	1.1%
1-3	15.0%
4-5	30.2%
More than 5	53.7%
Number of times the child ate dinner at a regular time last week	
0	6.5%
1-3	14.5%
4-5	38.3%
More than 5	40.7%
Number of times the child exercise that cause rapid heartbeat last week	
0	5.7%
1-3	44.0%
4-5	34.7%
More than 5	15.6%
Predictor Variables	
Fulltime status	0.633 (0.482)
Child is female	0.488 (0.500)
Family lives in large and mid-size city	0.761 (0.427)
Child's race or ethnicity	
White	55.2%
Black	15.1%
Hispanic	17.9%
Asian	6.4%
Other race	5.4%
Mother's mother's education level	
Less than high school	5.3%
High school	12.5%
Less than four year college	17.6%
Four year college	9.1%
More than four year college	5.6%
Missing	49.9%
Child's age	10.279 (0.470)
Mother's age	39.507 (6.120)
Number of kids less than 5 year old	0.183 (0.468)

Table 2 Estimated Coefficients from Selection Corrected Overweight Regression

	Overweight	
Primary equation of interest: Child is overweight		
Mother works full time	0.559	**
Mother is a single parent	0.042	
Mother's mother's education (less than high school omitted)		
High school	-0.149	***
Some college	-0.286	***
4-year degree	-0.230	***
More than 4-year degree	-0.252	***
Education missing	-0.027	
Child is female	-0.071	***
Child's age	-0.022	
Child race (White omitted)		
Black	0.184	***
Hispanic	0.327	***
Asian	-0.090	
Other	0.201	***
Family lives in urban setting	-0.079	**
Constant	-0.280	
Switching equation: mother works fulltime		
Mother's age	-0.010	***
Mother is a single parent	0.359	***
Mother's mother's education (less than high school omitted)		
High school	0.144	***
Some college	0.087	*
4-year degree	-0.016	
More than 4-year degree	0.058	
Education missing	-0.041	
Child's race (White omitted)		
Black	0.193	***
Hispanic	-0.102	**
Asian	0.263	***
Other	0.004	
Family lives in urban setting	-0.147	***
Number of children under 5	-0.299	***
Constant	0.762	***

*Significant at $p \leq 10\%$
** Significant at $p \leq 5\%$
*** Significant at $p \leq 1\%$

Table 3 Estimated Coefficients from Selection Corrected Diets Regressions

	# of Time Drank Soda Last Week		# of Time Ate Fast Food Last Week		# of Time Ate Carrots Last Week		# of Time Drank Juice Last Week		# of Time Ate Salad Last Week		# of Time Ate Vegetables Last Week		# of Time Ate Fruits Last Week	
Fulltime status	0.252		0.287		-0.503	*	-0.596	***	-0.273		-0.687	***	-0.882	***
Child is female	-0.144	***	-0.061	**	0.068	***	0.077	***	0.271	***	0.125	***	0.080	***
Child's race (white omitted)														
Child is Black	-0.055		0.344	***	-0.268	***	0.265	***	-0.116	**	-0.001		0.061	
Child is Hispanic	-0.027		0.203	***	0.124	***	0.243	***	0.027		-0.087	**	0.199	***
Child is Asian	-0.374	***	-0.118	*	0.183	***	0.248	***	0.059		0.328	***	0.417	***
Child is other race	-0.003		0.168	***	0.133	**	0.196	***	0.080		0.085		0.225	***
Family lives in an urban setting	0.013		0.092	***	0.007		0.020		0.090	***	-0.024		-0.012	
Child's age	0.060	**	0.032		-0.022		0.012		0.021		0.000		0.011	
Mother is a single parent	0.045		0.066		-0.081		0.058		-0.097	**	0.031		0.060	
Mother's mother's highest education (less than high school omitted)														
High school diploma	-0.014		-0.043		0.061		0.019		-0.002		0.019		0.051	
Less than a 4 year degree	-0.104	**	-0.089	*	0.170	***	0.030		0.114	**	0.057		0.082	*
4 year degree	-0.149	***	-0.200	***	0.124	**	0.023		0.124	**	0.094	*	0.084	
More than a 4 year degree	-0.235	***	-0.251	***	0.212	***	0.108		0.194	***	0.117	*	0.156	**
Education information missing	0.033		0.021		-0.006		0.006		-0.001		-0.066	*	0.012	

*Significant at $p \leq 10\%$
** Significant at $p \leq 5\%$
*** Significant at $p \leq 1\%$

Table 4 Estimated Coefficients from Selection Corrected Activities (TV and Exercise) Regressions

	Minutes of TV before 8 am		Minutes of TV between 3 pm and dinner		Minutes of TV after dinner		Minutes of TV on Saturday		Minutes of TV on Sunday		Minutes of Total TV watched		Exercise that Cause Rapid Heartbeat	
Fulltime status	0.861	***	-0.120		0.111		0.086		0.994	***	0.600	**	0.238	
Child is female	-0.203	***	-0.061	**	-0.032		-0.071	***	-0.095	***	-0.094	***	-0.313	***
Child's race (white omitted)														
Child is Black	0.072		0.433	***	0.165	***	0.614	***	0.354	***	0.540	***	-0.150	***
Child is Hispanic	-0.156	***	0.261	***	-0.187	***	0.092	**	0.021		0.057		-0.084	**
Child in Asian	-0.044		0.118	*	-0.496	***	0.031		-0.112	**	-0.116	**	-0.240	***
Child is other race	0.109	*	0.011		0.087		0.173	***	0.114	**	0.189	***	0.133	**
Family lives in an urban setting	0.029		-0.160	***	-0.145	***	-0.061	*	0.019		-0.078	**	-0.049	
Child's age	0.027		0.030		0.030		-0.009		-0.030		0.005		0.000	
Mother is a single parent	-0.053		0.111	**	0.168	***	0.101	**	-0.046		0.064		-0.063	
Mother's mother's highest education (less than high school omitted)														
High school diploma	-0.073	*	-0.024		-0.002		0.000		0.016		-0.019		0.018	
Less than a 4 year degree	-0.138	***	-0.119	***	-0.136	***	-0.068		-0.066		-0.159	***	0.087	**
4 year degree	-0.149	**	-0.205	***	-0.404	***	-0.223	***	-0.188	***	-0.338	***	0.090	*
More than a 4 year degree	-0.190	**	-0.255	***	-0.354	***	-0.260	***	-0.186	***	-0.364	***	0.250	***
Education information missing	-0.012		0.020		-0.031		-0.025		-0.026		-0.056		-0.065	*

*Significant at $p \leq 10\%$
** Significant at $p \leq 5\%$
*** Significant at $p \leq 1\%$

Table 5 Estimated Coefficients from Selection Corrected Activities (Breakfast and Dinner habits) Regressions

	Eat Dinner Together		Eat Dinner at Regular Time		Eat Breakfast Together		Eat Breakfast at Regular Time	
Fulltime status	-0.864	***	-0.655	***	-0.582	***	-0.059	
Child is female	0.003		-0.011		-0.014		-0.010	
Child's race (white omitted)								
Child is Black	-0.117	**	-0.033		-0.304	***	-0.377	***
Child is Hispanic	-0.037		0.070	*	-0.239	***	-0.164	***
Child in Asian	0.218	***	0.400	***	-0.040		-0.064	
Child is other race	0.113	*	0.383	***	-0.105	*	-0.025	
Family lives in an urban setting	-0.212	***	-0.153	***	0.028		0.027	
Child's age	-0.042		-0.068	***	-0.074	***	-0.032	
Mother is a single parent	0.088	**	-0.017		-0.216	***	-0.182	***
Mother's mother's highest education (less than high school omitted)								
High school diploma	-0.025		-0.030		0.092	***	-0.006	
Less than a 4 year degree	-0.021		-0.044		0.152	***	0.039	
4 year degree	-0.032		-0.069		0.273	***	0.123	**
More than a 4 year degree	-0.035		-0.051		0.236	***	0.085	
Education information missing	-0.007		0.012		-0.044		-0.052	

*Significant at $p \leq 10\%$
** Significant at $p \leq 5\%$
*** Significant at $p \leq 1\%$

Table 6 Fulltime Parameter Summary with and without Selection Correction and Marginal Effect Summary

	Parameter Estimates						Marginal Effects	
Ordered probit result	Fulltime coefficient with selection correction		ρ coefficient		Fulltime coefficient without selection correction		Selection Corrected	Traditional
Overweight	0.559	**	-0.282		0.108	***	19.0%	4.1%
Number of times child drank juice	-0.596	***	0.333	**	-0.061	**		
0							16.5%	1.9%
1-3							4.0%	0.5%
4-7							-5.3%	-0.9%
More than 7							-15.2%	-1.5%
Number of times child drank soda	0.252		-0.119		0.061	**		
0							-6.1%	-1.4%
1-3							-3.6%	-1.0%
4-7							3.4%	0.8%
More than 7							6.4%	1.6%
Number of times child ate green salad	-0.273		0.118		-0.082	***		
0							10.5%	3.2%
1-3							-3.1%	-1.0%
4-7							-4.8%	-1.5%
More than 7							-2.5%	-0.7%
Number of times child ate carrot	-0.503	*	0.393		-0.075	***		
0							18.0%	2.9%
1-3							-2.9%	-0.7%
4-7							-7.0%	-1.2%
More than 7							-8.1%	-1.0%
Number of times child ate other vegetables	-0.687	***	0.393	***	-0.056	**		
0							16.2%	1.4%
1-3							6.1%	0.8%
4-7							-5.9%	-1.0%
More than 7							-16.4%	-1.2%

	Parameter Estimates						Marginal Effects	
Ordered probit result	Fulltime coefficient with selection correction		ρ coefficient		Fulltime coefficient without selection correction		Selection Corrected	Traditional
Number of times child ate fruits	-0.882	***	0.513	***	-0.065	***		
0							15.5%	1.0%
1-3							7.4%	1.4%
4-7							-0.5%	-0.4%
More than 7							-22.5%	-2.1%
Number of times child ate fast food	0.287		-0.120		0.095	***		
0							-10.0%	-3.3%
1-3							3.5%	1.1%
4-7							3.6%	1.2%
More than 7							2.9%	0.9%
Number of minutes TV watched before 8 am	0.861	***	-0.481	***	0.107	***		
0							-22.4%	-3.7%
1-15							1.5%	0.4%
16-30							7.0%	1.8%
More than 30							13.9%	1.4%
Number of minutes TV watched between 3 pm and dinner	-0.120		0.087		0.021			
0							4.2%	-0.8%
1-30							0.5%	-0.1%
31-60							-1.5%	0.3%
More than 60							-3.1%	0.6%
Number of minutes TV watched after dinner	0.111		-0.009		0.096	***		
0							-2.6%	-2.2%
1-30							-1.0%	-0.9%
31-60							0.2%	0.2%
61-120							2.3%	2.0%
More than 120							1.1%	1.0%

	Parameter Estimates						Marginal Effects	
Ordered probit result	Fulltime coefficient with selection correction		ρ coefficient		Fulltime coefficient without selection correction		Selection Corrected	Traditional
Number of minutes TV watched on Saturday	0.086		0.014		0.108	***		
0							-1.0%	-1.2%
1-60							-1.2%	-1.5%
61-120							-1.2%	-1.5%
121-180							0.4%	0.5%
181-240							1.1%	1.4%
More than 240							1.8%	2.3%
Number of minutes TV watched on Sunday	0.994	***	-0.534	***	0.148	***		
0							-20.1%	-2.6%
1-60							-4.2%	-2.2%
61-120							-0.9%	-1.0%
121-180							2.5%	1.2%
181-240							4.6%	2.0%
More than 240							18.1%	2.6%
Number of total minutes TV watched	0.600	**	-0.281	*	0.150	***		
0							-1.4%	-0.2%
1-240							-15.6%	-4.0%
241-480							-2.5%	-1.2%
481-962							15.3%	4.5%
More than 962							4.2%	0.9%
Number of times the family ate breakfast together	-0.582	***	0.217	*	-0.236	***		
0							9.3%	3.8%
1-3							12.1%	5.4%
4-5							-1.9%	-1.1%
More than 5							-19.5%	-8.1%
Number of times the child ate breakfast at a regular time	-0.059		-0.019		-0.089	***		

	Parameter Estimates			Marginal Effects	
Ordered probit result	Fulltime coefficient with selection correction	ρ coefficient	Fulltime coefficient without selection correction	Selection Corrected	Traditional
0				0.4%	0.6%
1-3				0.8%	1.2%
4-5				1.0%	1.5%
More than 5				-2.1%	-3.2%
Number of times the family ate dinner together	-0.864 ***	0.437 ***	-0.179 ***		
0				5.4%	0.4%
1-3				13.4%	3.7%
4-5				7.3%	2.9%
More than 5				-26.2%	-7.0%
Number of times the child ate dinner at a regular time	-0.655 ***	0.288 **	-0.198 ***		
0				8.4%	2.3%
1-3				8.5%	3.1%
4-5				6.1%	2.1%
More than 5				-23.1%	-7.6%
Number of times the child exercise that cause rapid heartbeat	0.238	-0.112	0.057 **		
0				-2.7%	-0.6%
1-3				-6.5%	-1.6%
4-5				3.8%	0.9%
More than 5				5.4%	1.3%

*Significant at $p \leq 10\%$
** Significant at $p \leq 5\%$
*** Significant at $p \leq 1\%$

Bibliography

Aaker, D., & Carman, J. (1982). Are You Overadvertising? *Journal of Advertising Reserach* , 57-70.

Anderson, P., Butcher, K., & Levine, P. (2003). Maternal employment and overweight children. *Journal of Health Economics* , 477-504.

Blasko, V., & Patti, C. (1981). Budgeting Practices of Big Advertisers. *Journal of Advertising Reserach* , 23-29.

Blasko, V., & Patti, C. (1984). The Advertising Budgeting Practices of Industrial. *Journal of Marketing* , 104-110.

Brown, J., Broom, D., Nicholson, J., & Bittman, M. (2010). Do working mothers raise couch potato kids? Maternal employment and children's lifestyle behaviours and weight in early childhood. *Social Sciend and Medicine* , 1816-1824.

Cawley, J., & Liu, F. (2007). Maternal Emmployment and Childhood Obesity: a Search for Mechanism in Time Use Data. *NBER Working Paper* .

Chia, Y. F. (2008). Maternal labour supply and childhood obesity in Canada: evidence from the NLSCY. *Canadian Journal of Economics* , 217-242.

Desai, S., & Waite, L. J. (1991). Women's Employment During Pregnancy and After the First Birth: Occupational Characteristics and Work Commitment. *American Sociological Review* , 551-566.

Dixit, A. (1979). A model of duopoly suggesting a theory of entry barriers. *Bell Journal of Economics* , 20-32.

Gortmaker, S. L., Peterson, K., Wiecha, J., Sobol, A. M., Dixit, S., Fox, M. K., et al. (1999). Reducing Obesity via a School-Based Interdisciplinary Intervention Among Youth. *Archieves of Pediatric and Adolescent Medicine* , 409-418.

Hawkins, S., Cole, T., & Law, C. (2008). Maternal employment and early childhood overweight: findings from the UK Millennium Cohort Study. *International Journal of Obesity* , 30-38.

Heckman, J. (1978). Dummy endogenous variables in a simultaneous equation system. *Econometrica* , 931-959.

Horton, S., & Campbell, C. (1991). Wife's Employment, Food Expenditures, and apparent Nutrient Intake: evidence from Canada. *American Journal of Agricultural Economics* , 784-794.

Katan, M. B., & Ludwig, D. S. (2010). Extra Calories Cause Weight Gain—But How Much? *Journal of the American Medical Association* , 65-66.

Klesges, R., Stein, R., Eck, L., Isbell, T., & Klesges, L. (1991). Parenta Influence on Food Selection in Young Children and Its Relationships to Childhood Obesity. *The American Journal of Clinical Nutrition* , 859-864.

Leibowitz, A., & Klerman, J. A. (1995). Explaining Changes in Married Mothers' Employment over Time. *Demography* , 365-378.

Lichter, D., & Costanzo, J. (1987). How Do Demographic Changes Affect Labor Force Participation of Women? *Monthly Labor Review* , 23-25.

Miranda, A., & Rabe-Hesketh, S. (2006). Maximum likelihood estimation of endogenous switching and sample selection models for binary, ordinal, and count variables. *The Stata Journal* , 285-308.

Ogden, C. C. (2010). Prevalence of High Body Mass Index in US Children and Adolescents, 2007-2008. *JAMA: Journal of the American Medical Association* , 242-249.

Phipps, S., Lethbridge, L., & Burton, P. (2006). Long-run consequences of parental paid work hours for child overweight status in Canada. *Social Science and Medicine* , 977-986.

Ruhm, C. J. (2008). Maternal Employment and Adolescent Development. *Labour Economics* , 958-983.

United States Census Bureau. (2011). *Statistical Abstract of the United States 2011.* Washington DC: Government Printing Office.

Wang, Y. C., Gortmaker, S. L., Sobol, A. M., & Kuntz, K. M. (2006). Estimating the Energy Gap Among US Children: A Counterfactual Approach. *Pediatrics* , 1721-1733.

Wilde, J. (2000). Identification of Multiple Equation Probit Models with Endogenous Dummy Regressors. *Economics Letters* , 309-312.

Yoon, Y.-H., & Waite, L. J. (1994). Converging Employment Patterns of Black, White, and Hispanic Women: Return to Work After First Birth. *Journal of Marriage and Family* , 209-217.