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The Effect of Maternal Employment on Family Well-Being

Bezawit Teshome Agiro
Western Michigan University, beziti_sal@yahoo.com

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by

Bezawit Teshome Agiro

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Doctoral Committee:

Wei-Chiao Huang, Ph.D., Chair
Donald Meyer, Ph.D.
Georgiana Onicescu, Ph.D.

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Bezawit Teshome Agiro, Ph.D.

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This dissertation is composed of three essays on the effect of maternal employment on family well-being using data from Early Childhood Longitudinal Study: Kindergarten Class of 2010-11 (ECLS-K: 2011). In general, the findings from this study suggest that the effect of maternal employment on children's weight status and cognitive development is not significant, but it is significant on mothers' overall health and psychological well-being.

The first essay re-examines the effect of maternal employment on child obesity by taking a sample of grade 2 children who had at least one younger sibling from the spring 2013 cohort. The study makes use of a bivariate probit model using exogenous variation in youngest sibling's eligibility for kindergarten as an instrument for maternal employment. The findings suggest that the effect of maternal employment on child obesity is not significant. The results show that rather than maternal employment, socio-economic status, schooling environment, and lifestyle behaviors including physical exercise and sedentary behavior are factors contributing to child obesity. More specifically, higher socio-economic status and more physical exercise are negatively related to child obesity, while sedentary behavior and free/reduced price school meals are positively related to child obesity.

The second essay is devoted to the analysis of the effect of maternal employment on child cognitive outcome. This study uses data from spring 2013 cohort of the Early Childhood

Longitudinal Study: Kindergarten Class of 2010-11 (ECLS-K: 2011). Using instrumental variable regression, the result shows that the effect of maternal employment on children's cognitive development is not significant. The quality of schooling as measured by teachers' years of experience and class size as well as socio-economic status are significant factors influencing children's cognitive outcome. Having more experienced teachers and coming from a higher socio-economic background contributes positively to children's cognitive outcome, while there is some evidence that smaller class size reduces children's scores.

The third essay investigates the effect of maternal employment on mothers' overall health and psychological distress. This study makes use of data from the Early Childhood Longitudinal Study: Kindergarten Class of 2010-11 (ECLS-K: 2011) and the U.S Bureau of Labor statistics. For analysis, IV probit regression is used, having state-level unemployment rate as an instrument for maternal employment. The findings of this paper suggest that the effect of mothers' weekly work hours on mothers' overall health is positive and significant for the spring third-grade cohort. In addition, there is evidence that the effect of maternal employment on mothers' overall health and psychological distress differs by type of occupation. Mothers in managerial, professional, and low supervisory jobs are more likely to be psychologically distressed, but also have higher probability of being in good overall health condition, compared to mothers in manual jobs.

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CHAPTER 1

INTRODUCTION

Maternal employment has become increasingly common in most industrialized countries including the United States since the 1970s. In the United States, by the year 1985, 61 percent of married mothers were in the labor force and by 1995, this figure rose to 70 percent (Cohany and Sok, 2007). In 2005, the labor force participation rate of married mothers with preschool children was 60 percent while for those mothers with school-age children, it was close to 75 percent (Cohany and Sok, 2007). Another important change that occurred during the same period was the rise in child obesity. Among children aged 2-5, the rate of obesity increased from 5 percent in the years 1976 to 1980 to 10.4 percent in the years between 2007 and 2008; and among children aged 6 to 11, obesity increased from 6.5 percent to 19.6 percent (Ogden and Carroll, 2010). Among adolescents aged 12 to 19, this rate rose from 5 percent to 18.1 percent during the same period (Ogden and Carroll, 2010).

The issue of child obesity has become a public concern because medical research has proven that obesity ultimately leads to various diseases including diabetes, hypertension, and the like. It is evident that excessive weight gain is the result of more energy intake than expenditure. The central point, however, is what brought about this change is life style over the past few decades. The increase in mothers' labor force participation has been commonly cited as the explanation behind poor child development outcome mainly because the rise in child obesity coincided with the rise in mothers' labor force participation.

There have been studies that investigated the association between maternal employment and child development outcomes including child obesity, cognitive development and behavioral outcomes. The effect of maternal employment on child development outcomes is not direct. There are some potential mechanisms through which maternal employment affects children's development. For instance, having a mother who works increases household income which can be used to purchase healthy food and provide more opportunity to engage in physical activities that reduce weight. In addition, the extra income generated from having a mother who works outside the home can be used to purchase resources that improve children's cognitive development. On the other hand, working outside the home puts more time constraint on the mothers which leads to poor parenting that negatively affects children's academic performance. In addition, this time constraint results in less supervision regarding children's diet and physical activity which negatively affects children's weight status. Therefore, the effect of maternal employment on child's development can be negative or positive depending on which of the two effects dominate. It is also possible that the two effects offset each other and we observe no significant effect.

Although the effect of maternal employment on child development outcomes is not straightforward, most of the studies in the United States document the adverse effect of maternal employment on children's well-being (Fertig et al., 2009; Anderson et al., 2003; Bernal, 2008; James-Burdumy, 2005). This result seems to suggest the notion that mothers should not work outside the home. However, this is not the ideal solution for many reasons. First, if mothers stay at home, there will be a reduction in household income; and there is evidence from previous studies that children from low income families are in fact more likely to be overweight and more likely to have poor academic performance compared to children from higher socio-economic

background (Akil and Ahmed, 2011; Gregg et al., 2003). Second, rather than the parents, it is the environment in which the family lives that influences children's physical and cognitive development. For instance, poor neighborhoods have more concentration of fast-food restaurants, less number of grocery stores, and less opportunity for physical activity which encourage sedentary behavior and unhealthy diet (Gwozdz, 2016). In addition, poor neighborhoods tend to have low quality public schools which negatively affects low-income children's cognitive development in addition to lack of resources at home. Thus, policies should be directed towards enriching healthy environment, active lifestyle as well as narrowing the gap in socio-economic status rather than discouraging maternal employment.

This dissertation consists of three essays on the effect of maternal employment on family well-being. Although there have been studies that investigated the effect of maternal employment on children's outcomes, mainly on children's cognitive development, behavioral outcomes and obesity, little attention has been given to the possible effect of maternal employment on the well-being of the mothers themselves in the economics literature. In line with this, this dissertation examines the effect of maternal employment on child obesity, children's cognitive development and mothers' overall health and psychological well-being.

The first essay re-examines the effect of maternal employment on child obesity by limiting the sample to school-age children. I use data from the spring 2013 cohort of the Early Childhood Longitudinal Study: Kindergarten Class of 2010-11 (ECLS-K: 2011). The sample includes 1,990 grade 2 children who have at least one younger sibling. The reason for limiting the sample only to those children who have at least one younger sibling is to avoid any bias coming from the focal child's own eligibility for kindergarten as youngest sibling's eligibility for kindergarten is used as an instrument for maternal employment. In order to minimize any

potential bias arising from the endogeneity of maternal employment, I use a recursive bivariate probit model using exogenous variation in youngest sibling's eligibility for kindergarten as an instrument for maternal employment. My findings indicate that the effect of maternal employment on child obesity is not significant. In addition, the results from this study suggest that the factors that significantly contribute to child obesity include, socio-economic status, schooling environment, and lifestyle behaviors including physical exercise and sedentary behavior. The findings indicate that children from higher socio-economic status and those that do regular physical exercise are less likely to be overweight, while those that spend more time watching TV and consume free/reduced price school meals are more likely to be overweight. The findings suggest that there is no evidence that maternal employment is the cause of child obesity, so policy should be directed towards narrowing the gap in socio-economic status and encouraging healthy diet and lifestyle.

The second essay examines the effect of maternal employment on child cognitive outcome using data from spring 2013 cohort of the Early Childhood Longitudinal Study: Kindergarten Class of 2010-11 (ECLS-K: 2011). In order to account for the endogeneity of maternal employment, I use youngest sibling's eligibility for kindergarten as an instrument. Children's normalized scores in math, reading and science were used as measures for cognitive development. Using 2SLS estimation technique, the findings indicate that the effect of maternal employment on children's cognitive development is not significant. The significant factors explaining children's cognitive development include, the quality of schooling as measured by teachers' years of experience and class size, socio-economic status, reading outside school, disability, and having English as the primary language at home. Specifically, having more experienced teachers, coming from a higher socio-economic background and having English as

the primary language at home are positively related to children's cognitive outcome; while having disability significantly reduces children's score. In addition, there is some evidence that smaller class size reduces children's math scores. Consistent with the findings from the first essay, the results from this study also show that maternal employment is not the explanation behind children's poor cognitive development. Policy makers should direct more effort towards improving quality of schooling and providing more support to children from lower socio-economic background and those with disability.

The third essay is intended to explore the effect of maternal employment on mothers' overall health and psychological well-being. This study uses data from the spring kindergarten and spring third grade cohorts of the Early Childhood Longitudinal Study: Kindergarten Class of 2010-11 (ECLS-K: 2011). Data on state level unemployment rate is obtained from the U.S Bureau of Labor statistics website. State level unemployment rate is used as an instrument in this analysis as opposed to youngest sibling's eligibility for kindergarten because the sample includes kindergarten children whose youngest siblings are all likely to be ineligible for kindergarten, which implies no variation in the instrumental variable. Using IV probit regression, the results indicate that there is a positive and significant association between mothers' weekly work hours and mothers' overall health for the spring third-grade cohort. In addition, mothers in managerial, professional, and low supervisory jobs are more likely to be psychologically distressed, but also more likely to be in good overall health condition, compared to mothers in manual jobs. This calls for more effort by public policy makers to ensure equitable distribution of favorable working environment across occupations.

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CHAPTER 2

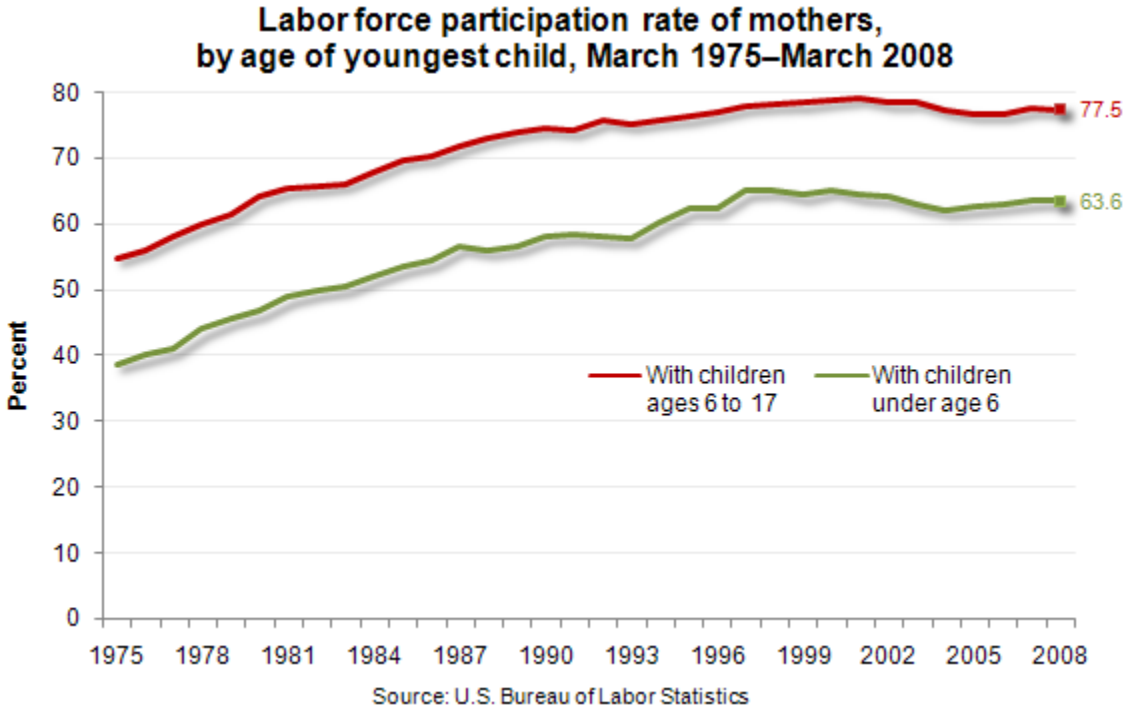
RE-EXAMINING THE EFFECT OF MATERNAL EMPLOYMENT ON CHILD OBESITY: THE CASE OF SCHOOL-AGE CHILDREN

2.1 Introduction

The problem of rising child obesity has posed a serious concern in many industrialized countries including the United States. Currently, it is estimated that one in seven children is overweight or obese in most European Union Countries (Gwozdz et al., 2013). Similarly, more than one third of children and adolescents in the United States are overweight or obese (Ogden et al., 2014). The problem of child obesity is not limited to looks only, it has serious health implications as well. Previous studies show that child obesity is associated with illnesses including cardiovascular disease, hypertension, type 2 diabetes, stroke, musculo-skeletal disorders and mental health problems (Gwozdz et al., 2013). In addition, childhood obesity has an impact on long-term psychological factors such as depression and low self-esteem as well as labor market outcomes including discrimination and lower wages (Daniels, 2006; Mocan and Tekin, 2009).

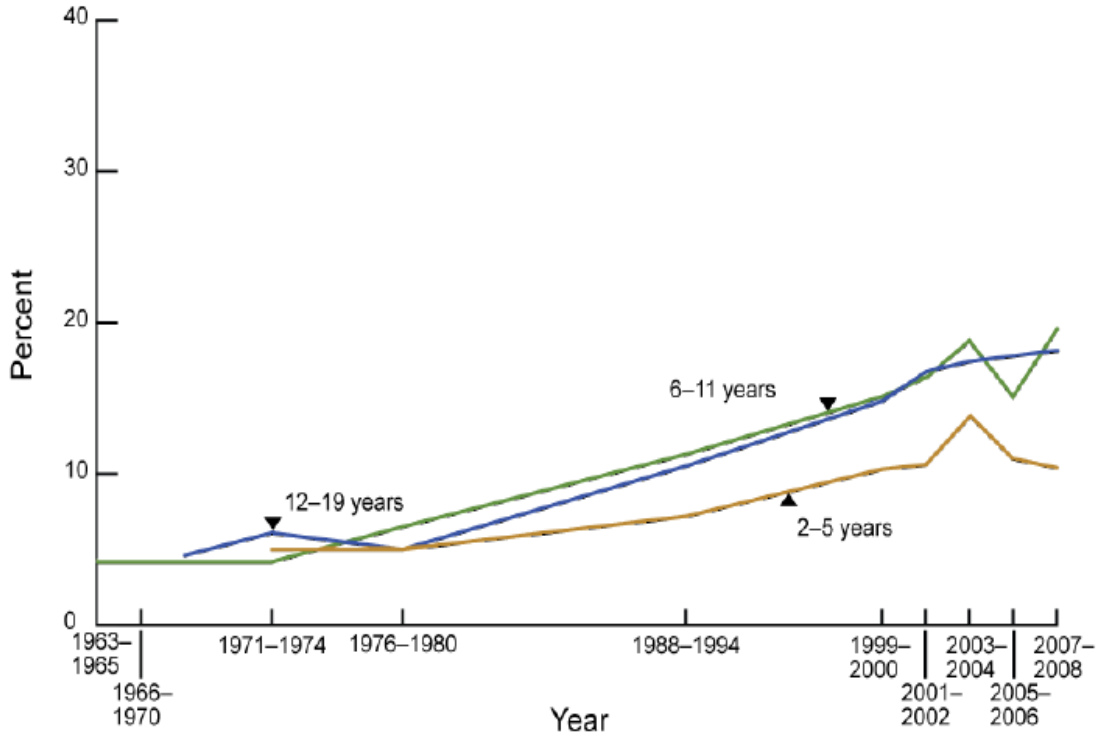
The reasons behind the rise in child obesity are manifold, but the main ones include sedentary lifestyle, technological advancement, and expansion of fast food restaurants (Cutler et al., 2003; Philipson and Posner, 2003; Chou et al., 2008). In an interesting twist, the rise in female labor force participation coincided with the rise in child obesity. According to a report from the U.S. Department of Labor, the labor force participation rate of mothers with children younger than 18 years old rose from 47% in 1975 to 71 % in 2006 (U.S. Department of Labor,

Bureau of Labor Statistics, 2007). By 2016, the labor force participation rate of mothers with youngest children between the ages of 6 to 17 was close to 75% (U.S. Department of Labor, Bureau of Labor Statistics, 2017). This has led some researchers to investigate the potential relationship between the two events to see if maternal employment is the explanation behind the increase in child obesity (see Figures 2.1 and 2.2).



(U.S. Department of Labor, Bureau of Labor Statistics, 2010)

Figure 2.1: Trend in Mothers' Labor Force Participation Rate 1975-2008



(Ogden & Carroll, 2010)

Figure 2.2: Trend in Obesity Prevalence Among Children and Adolescents in the United States (1963-2008)

The effect of maternal employment on child obesity is not straight forward. The first channel suggests that mothers who work have less time for cooking at home and are thereby more likely to buy ready to eat meals which are more condensed with fat (Fertig et al., 2009). Moreover, working mothers face a time constraint which makes it difficult for them to oversee their children's activities and these children have more autonomy on what to eat and what to do in the absence of their parents. In most cases, such children spend more time in sedentary activities like watching TV and eating junk food which contributes towards weight gain (Fertig et al., 2009). The second channel on the other hand suggests a negative relationship between maternal employment and child obesity. The reasoning behind this is that working mothers bring

in additional income which can be used to purchase better quality food. In addition, these mothers can afford to have their children placed in organized activities that help towards weight loss (Fertig et al., 2009). The findings of Gordon-Larsen et al. (2003), and Zhang and Wang (2004a, 2004b) for instance, indicate a negative relationship between socio-economic status and obesity which is in line with this conjecture.

The purpose of this paper is to re-examine the relationship between maternal employment and child obesity using data from the spring 2013 wave of Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011). The null hypothesis to be tested is that maternal employment has no effect on child weight outcome. This data contains a nationally representative sample of second grade students in the United States. An innovation of this re-examination of the effect of maternal employment on child obesity is that we use exogenous variations in the focal child's youngest sibling's eligibility for kindergarten as an instrument for maternal employment.

2.2 Previous Literature

There are various studies that analyzed the association between child obesity and maternal employment in the past. Using data from Child Development Supplement of the Panel Study of Income Dynamics, Fertig et al. (2009) explored the channels through which maternal employment affects child obesity. According to the authors, maternal employment affects the nature of her children's activities plus the number and composition of meals consumed, which in turn affects the child's BMI. Their findings indicated that more hours of working by mothers result in higher children's BMI through the mechanism of skipping meals, less time spent on reading/talking/listening to music and more time spent watching TV by children.

Araneo (2008), using data from The Fragile Families and Child Wellbeing Study, found that for children who belong to highly educated mothers who work full-time, there is higher probability of being overweight. However, this effect was not significant for children from less educated mothers and mothers who work part-time. Anderson et al. (2003) used matched mother-child data from the National Longitudinal Survey of Youth (NLSY) and the results suggest that a child is more likely to be overweight if his/her mother works more hours per week over the child's life, and this effect is more pronounced for children from higher socio-economic background.

Hawkins et al. (2008) studied 13,113 UK children born between 2000 and 2002 using data from Millennium Cohort Study. The result of this study suggests that the more hours the mother works per week, the higher the probability that the child is overweight, but this finding holds only for those children whose families are from higher income level. In addition, their findings also suggest that the effect of maternal employment on child obesity differs by type of child care. Children in formal day care are at a greater risk of being overweight for each additional hour their mothers work.

Recently, there have been other studies that show that the association between maternal employment and child obesity is mostly driven by child care choices. Greve (2011) used the Danish Longitudinal Survey of Children (DALSC) to examine the effect of maternal employment on child obesity. The results of subgroup analysis by type of care show that maternal employment has a reducing effect on children's overweight status for those children in formal daycare, while for those in informal daycare (family daycare), maternal employment has no significant effect.

McDonnell and Doyle (2014) examined the relationship between maternal employment, childcare during infancy and the overweight status of pre-school children using data from the Infant Cohort of the Growing-Up in Ireland Survey. The results suggest that only full-time maternal employment combined with informal childcare results in a higher children BMI while part-time employment combined with formal childcare reduces the likelihood of children being overweight. Formal child care coupled with full-time maternal employment results in higher child BMI, but only for those children from higher socio-economic backgrounds.

Hong (2015) used data from Panel Study on Korean Children (PSKC) to investigate if the effect of maternal employment on child obesity varies by type of child care. The result shows that child care by kindergarten reduces the probability of child obesity for working mothers, while for those children under relative care, the probability of gaining weight goes up. Gwozdz et al. (2013) analyzed the association between maternal employment and childhood obesity using data from the IDEFICS study ("Identification and prevention of Dietary and lifestyle induced health Effects In Children and infants") using children aged 2–9 in 16 regions of eight European countries. The authors found no significant association between maternal employment and childhood obesity. Watanabe et al. (2011) used a self-administered questionnaire that interviewed parents of children aged 3 to 6 in Tohoku region of Japan. The findings of this study suggest that both maternal employment and the presence of grandparents who care for children are associated positively to child obesity.

The findings of most previous studies seem to suggest that maternal employment is detrimental to child health outcome as most of these studies document a positive relationship between maternal employment and childhood obesity. However, most of these studies focus on pre-school children or their sample consists of both pre-school and school-age children. There is

some evidence from previous studies that the effect of maternal employment on child obesity differs by the age of the child (Cawley and Liu, 2012). There are only a few studies that focus on the effect of maternal employment on the obesity of school-age children (Datar et al., 2014; Hubbard, 2008; Morrissey et al., 2011) and these studies did not control for schooling environment. In addition, most of the previous studies that employed instrumental variable technique to account for the endogeneity of maternal employment did so by using local labor market conditions such as state level unemployment rate (Gwozdz et al., 2013; Datar et al., 2014; Anderson et al., 2003), average hours of work among women by industry (Greve, 2011) and state welfare benefit level and welfare reform (Anderson et al., 2003). However, these instruments have been found to be weak predictors of maternal employment in the first stage.

This paper attempts to fill this gap in previous studies by investigating the effect of maternal employment on child obesity, focusing the analysis on school-age children that were less studied and controlling for schooling environment. In addition, this study uses exogenous variation in youngest sibling's eligibility for kindergarten as a better instrument for maternal employment. Previously, Morrill (2011) used exogenous variation in youngest sibling's eligibility for kindergarten as an instrument for maternal employment to examine the effect of maternal employment on the health of school-age children. The health measures used in that study are overnight hospitalizations, asthma episodes and injuries/poisonings for children between the ages of 7 to 17; and the proposed instrument was found to have good predictive power. By adopting Morrill's approach of instrumentation, this paper is, to the best of my knowledge, the first to use exogenous variation in youngest sibling's eligibility for kindergarten as an instrument for the analysis of the effect of maternal employment on child obesity.

2.3 Data

The data for this study come from Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011). This is an on-going survey tracking the same children from Kindergarten to 5th grade. The children in the ECLS-K: 2011 comprise a nationally representative sample from both public and private schools who were in kindergarten in the year 2010-11. The original data set consists of 18,174 children who participated or whose parents were interviewed in at least one of the two kindergarten data collections (i.e. fall 2010 or spring 2011). The survey period is on semester basis i.e. fall and spring of each academic year. The most recent data currently available is from spring 2013 academic year when children were in second grade. This study is a cross-sectional analysis using data from the spring 2013 wave. The reason for focusing on the sample from second grade cohort is to have enough sample of children that have younger siblings who could be eligible or not-eligible for kindergarten which gives sufficient variation in the instrument used. For instance, youngest sibling's eligibility for kindergarten cannot be used as an instrument if the sample of children is from the kindergarten cohort because if the focal child is in kindergarten, it is very likely that the youngest child will not be eligible for kindergarten which eliminates variation in the instrumental variable. The sample includes 1,990 grade 2 children aged 7 to 9 whose mothers were the primary respondents in the survey.

2.4 Empirical Model and Estimation Strategy

2.4.1 Model Specification

The estimation equation typically used in previous studies is given in Eq. *(1)* which shows the effect of maternal employment on child's weight status:

$$Child\ Overweight_i = \beta_0 + \beta_1 Empt + \beta_3 X_i + \mathcal{E}_i \quad (1)$$

The dependent variable is binary which takes a value of 1 if the child is overweight and 0 otherwise. The focus variable is mother's employment ('*Empt*') which is an indicator variable taking a value of 1 if the mother is employed and 0 otherwise. X is a vector of relevant child and parent specific characteristics and $\mathcal{E}_i$ is the error term.

The problem with the above model is that there are some unobserved child and mother specific characteristics that affect child's health outcome that are also correlated with mothers' employment decision, making the coefficient on maternal employment biased. For instance, it might be the case that high-ability mothers are more health conscious and are more likely to have healthy children and work more hours than low ability mothers (Greve, 2011). It might also be the case that mothers who have children with poor health might be constrained and less likely to work and not surprisingly the children also show to be more likely to have poor health (Hubbard, 2008). This means that maternal employment status is an endogenous variable in Eq. *(1)*, and failure to account for this unobserved heterogeneity would make the coefficient on maternal employment inconsistent.

In order to reduce any potential bias arising from the endogeneity of maternal employment, I use instrumental variables estimation. Specifically, a two stage least squares (2SLS) procedure is used where maternal employment is instrumented by youngest sibling's eligibility for kindergarten in the first stage and in the second stage, child health outcome is regressed on maternal employment using the predicted value of maternal employment from the first stage. The second stage estimation is shown in Eq. *(2)*:

$$Child\ Overweight_i = \beta_0 + \beta_1 \widehat{Empt} + \beta_3 X_i + \mathcal{E}_i \quad (2)$$

There is some concern with linear model estimation when both the dependent and the endogenous regressor are binary which make the coefficient estimates from 2SLS less efficient. One major flaw of linear models is that the fitted probabilities can fall below zero or above one which is theoretically impossible (Lewbel et al., 2012). However, Angrist (2001) argues that 2SLS with binary endogenous regressor often produce efficient estimates that differ very little from non-linear model estimates and there is no need to impose strict distributional assumptions. On the other hand, Wooldridge (2011) stated that in the case of binary dependent variable models with a dichotomous endogenous variable, non-linear models like bivariate probit model with Maximum Likelihood Estimation (MLE) would give consistent estimates. This model is shown in Eq. *(3)* and *(4)*. However, the bivariate probit model with maximum likelihood estimation requires that the error terms ($\mathcal{E}_{1,}\, u_2$) are independent of z and x_1 and distributed bivariate normal. If these assumptions do not hold, then the estimates from bivariate probit model would be inconsistent.

$$Y_1 = 1[\alpha_1 X_1 + \alpha_2 Y_2 + \mathcal{E}_1 > 0] \quad (3)$$

$$Y_2 = 1[\beta_1 X_{1+} \beta_2 Z + u_2 > 0] \quad (4)$$

Where $Y_1^* = \alpha_1 X_1 + \alpha_2 Y_2 + \mathcal{E}_1$ and $Y_2^* = \beta_1 X_{1+} \beta_2 Z + u_2$ are the underlying latent variables. Y_1 is the overweight equation and Y_2 is the equation for maternal employment. The instrument Z is included in the maternal employment equation but not in the child overweight status equation, which is the exclusion restriction.

In this paper I present the results from the bivariate probit model as the main result. As a robustness check, I also present the estimates from 2SLS using youngest sibling's eligibility for kindergarten as an instrument for maternal employment.

The success of instrumental variable estimation relies on the validity of the instrument. It is commonly known that in order for an instrument to be valid, two conditions must hold. First, the instrument must be highly correlated with the endogenous variable and second, the instrument is correlated with the outcome of interest only through the endogenous regressor. That is, the instrument must not be directly related to the dependent variable. Youngest sibling's eligibility for kindergarten is chosen as an instrument here for the reasoning that there is a substantial reduction in the opportunity cost of a woman's time (making them more likely to work) once the youngest child becomes eligible for kindergarten, and in the United States, kindergarten is provided free of charge by public schools for all children aged 5 and older (Morrill, 2011).

The exogenous variation in this instrument comes from variation in the exact timing of fertility (Morrill, 2011). I will use a similar example to describe the exogenous variation as the one given by Morrill (2011). For example, this study examines difference in overweight status between two 7-year-old boys, one whose mother works because his youngest sibling is 5.5 years old and therefore eligible for kindergarten, and another whose mother does not work because his youngest sibling is 4 years old and not eligible for kindergarten. The exogeneity requirement relies on the assumption that the exact timing of the two births (that is, 4 years ago and 5.5 years ago), was random conditional on family characteristics which seems to be a reasonable assumption. The analysis is restricted to those children who have at least one younger sibling so that the focal child's own eligibility for kindergarten will not bias the result.

2.4.2 Description of Variables

The outcome variable is the probability that the child is overweight which takes a value of 1 if the child is overweight and 0 otherwise. BMI is used to determine whether a child is

overweight or not. BMI is calculated as weight in kilograms divided by height in meters squared (kg/m^2). Unlike the case of adults, the BMI scale itself cannot be used in the determination of overweight status for children because it is highly dependent on the child's age and sex. Therefore, the 2000 BMI-for-age growth chart issued by the Centers for Disease Control and Prevention (CDC) is used to determine each child's overweight status based on age and sex. According to the American Obesity Association (AOA), a child is classified as "overweight" if his or her BMI is at or above the 85^{th} percentile and below the 95^{th} percentile. A child is classified as "obese" if his or her BMI is at or above the 95^{th} percentile. In this paper, I will use the term "overweight" to refer to those children who are either overweight or obese that is, those children at or above the 85^{th} percentile. The main focus variable in the analysis is maternal employment which takes on a value of 1 if the mother is currently employed and 0 otherwise.

Story et al. (2009) argues that school environment has a significant role in contributing to child obesity. More specifically, they claim that less than one third of U.S. schools offer meals that meet USDA standards for total fat and saturated fat. That study concluded that schools can help reduce child obesity by providing environment conducive to healthy eating and physical activity. Also, Cawley et al. (2012) found that an additional 50 minutes per week of physical education in schools reduces BMI z-score by 12 percent and lowers the probability of obesity by 4 percentage points for 5th grade students. In addition, the findings of Schanzenbach (2009) reveal that those children who receive school lunches are 2 percentile points more likely to be obese than those children who bring their own lunch. Moreover, students are more likely to eat school lunch and be obese if they are income eligible for reduced price school lunches. In light of these findings, I include two variables that measure school environment related to child obesity. The first variable is dichotomous variable taking a value of 1 if the school provides physical

education for greater than or equal to half an hour in any given day that this course is given, and 0 otherwise. Another variable related to the school environment is the percentage of children eligible for free or reduced-price meal which takes on a value of 1 if 75 percent or more of the students are eligible.

Patrick and Nicklas (2005) stated that the change in parental lifestyle including the meal composition and eating habits of rushed families is also an important determinant of child obesity. Busy families usually do not have enough time to eat together as a family and often opt for meals from fast food restaurants. In order to account for eating habits of families, I included a dummy variable taking a value of 1 if the child's family eat dinner together three or more days in a typical week.

There is also evidence from previous literature that sedentary behaviors and less time on physical activity contribute to child obesity (Fertig et al., 2009). In order to capture the activities of children, I include three variables; time spent watching TV, time spent playing video games, and doing exercise. The first two variables are dummy variables taking a value of 1 if the child watches TV/play video games for an hour or more in a typical week day. The third variable measures the number of days in a typical week the child does exercise that causes rapid breathing for twenty minutes or more.

There is also some evidence from previous studies that child obesity also differs by socio-economic factors like race, mother's education and income (Stamatakis et al., 2010; Araneo, 2008; Akil and Ahmed, 2011). The findings from Huffman et al. (2010) indicated that single parents often face role strain while trying to balance their role as a wage earner and as a parent which has a negative implication on the weight of their children. Accordingly, this study used four racial categories; White, Black, Hispanic and other racial groups. I constructed a dummy for

each of these racial categories having 'white' as a reference group in the regression analysis. Information on parents' education level was not asked in the spring 2013 survey. However, a socio-economic status score which is imputed using parental education, income level and occupation prestige score is available in the spring 2012 survey. Since current parental education is not available in the spring 2013 wave and using current income is not recommended due to its strong correlation with current maternal employment, I use the spring 2012 socio-economic status score as a measure for child's socio-economic status. Three dummies are constructed for the lowest, middle and top tertiles[1] in the socio-economic status distribution. A dummy for marital status taking a value of 1 if the mother is married or living with a partner and 0 if single (lone parent) is also included in the analysis.

A significant portion of previous studies that examined the relationship between maternal employment and child obesity included child care usage as one of the factors associated with child obesity (Greve, 2011; McDonnell and Doyle, 2014; Hawkins et al., 2008). In line with this, this paper includes three categories of pre-kindergarten child care; parental care, informal care[2] and center-based care. In addition, the present before- or after-school care arrangements are also included in this analysis. Other child and mother-specific control variables including child age, child sex, biological mother's age at first birth, number of siblings, and whether the child had high birth weight[3] are also considered.

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[1] Tertile refers to dividing the sample into three parts.

[2] Informal care includes both relative and non-relative care.

[3] High birth weight is a dummy variable taking a value of 1 if the child had a birth weight of more than 8.8 pounds and 0 otherwise by the standard cutoff.

2.5 Results and Discussion

2.5.1 Descriptive Statistics

Table 2.1 shows that about 55 percent of the mothers in the sample are employed. About 28 percent of the children in the sample are overweight which is not far from the nation-wide figure given by Ogden et al. (2014) that indicates about more than one third of children and adolescents in the United States are overweight. In the sample, 41.4 percent of the children are white, close to 35 percent are Hispanic, about 14 percent are Black and the remaining 9.8 percent belong to other racial minorities including Asians, native Alaskan, native Hawaiian and children who have one or more races.

There are substantial differences in child care use in the year before kindergarten and current child care. In the year before children entered kindergarten, about 44% of the children were in center-based care, compared to only 13% once they enter second grade. Intuitively, this seems a reasonable decline in the usage of center-based care as children spend most of their time in school once they enter kindergarten. About 35 percent of the mothers in the sample are single[4]. About 74 percent of the children watch TV for an hour or more in a typical weekday and close to 39 percent play video game for an hour or more in a typical week day. On average, children in the sample do physical exercise that causes fast breathing for at least 20 minutes, about 4 days a week. On the days physical education class is given in their school, about 66 percent of the children have that class time for half an hour or more. About 38 percent of the children attend school where 75 percent of the children or more are eligible for free/reduce price meal.

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[4] The category ‘single’ also includes those who are divorced, separated, widowed, and never married. The category ‘married’ includes those who are married or in civil union/domestic partnership.

Table 2.1: Summary Statistics

Variable	Percent of sample or mean value (SD)
Mother employed	55.33%
Overweight	28.19%
Days eat dinner together	5.90 (1.64)
Mom's age at first birth	22.31 (4.18)
Days child exercises	4.50 (2.28)
Child age	7.64 (0.53)
Number of siblings	2.69 (1.37)
Male	51.56%
Race	
White	41.41%
Black	14.12%
Hispanic	34.67%
Other	9.80%
Primary type of pre-kindergarten care	
Parental	24.32%
Informal	17.29%
Center-based	44.27%
Primary type of before-or after-school care	
None	60.06%
Informal	26.98%
Center-based	12.96%
Single	35.23%
Child had high birth weight	5.68%
Played video game for an hour or more	38.74%
Watched TV for an hour or more	74.12%
Physical Education in school for half an hour or more	66.03%
75% or more students eligible for free/reduced price meal	38.04%

Note: Standard deviation is in parenthesis. N=1,990.

Table 2.2 shows the proportion of overweight children in the sample by mothers' employment status, race/ethnicity and socio-economic status. It can be seen from Table 2.2 that there is little difference in the proportion of overweight children by maternal employment status. About 27.6 percent of children from working mothers are overweight, and among children whose mothers are not employed, 28.9 percent are overweight. If we consider the proportion of children by socio-economic status, the lowest tertile has the largest proportion of overweight children (35.65 percent) whereas only 18.94 percent of the top tertile children are overweight. This result is consistent with the findings of Stamatakis et al. (2010) that obesity is more prevalent among children from lower socio-economic status, compared to children from higher socio-economic status. The two racial groups that have the largest proportion of overweight children are Hispanics and blacks. About 36.5 percent of Hispanic children are overweight and 27.8 percent of black children are overweight.

2.5.2 Regression Results

The bivariate probit model results in Table 2.3 show that the effect of maternal employment on child's overweight status is insignificant. The difference between column (1) and column (2) estimates is that column (1) includes only current child care usage, while column (2) includes both current and pre-kindergarten child care usage. In both specifications, it can be seen that the effect of maternal employment on child overweight status is not significant. This might be due to the fact that the possible positive and negative effects of maternal employment on child weight outcome as outlined by economic theory, offset each other. From this result, it can be inferred that the detrimental effects of maternal employment on child weight outcome for pre-school children that were documented in most previous studies, do not persist to school-age years.

Table 2.2: Percentage of Overweight Children by Maternal Employment, Socio-economic Status and Race

Sub-group	Percentage overweight
All	28.19
By maternal employment	
Mother employed	27.61
Mother not employed	28.91
By socio-economic status	
Lowest tertile	35.65
Middle tertile	28.46
Top tertile	18.94
By race/ethnicity	
White	22.57
Black	27.76
Hispanic	36.52
Other	23.08

The variables that have significant effect on child weight outcome are race/ethnicity, birth weight, socio-economic status, school environment and physical activity by the child including TV watching and exercise. Specifically, if a child had high birth weight, the probability that he/she is overweight goes up by 13 percentage points approximately. On average, those children in the upper tertile of the socio-economic status distribution are 6 to 7 percentage points less likely to be overweight than those children in the middle tertile of the socio-economic status distribution. One possible reason might be that children from higher socio-economic background have better access to healthier foods which are usually more expensive, and more opportunity to do regular physical exercise.

Table 2.3: Bivariate Probit Model Estimates for the Impact of Maternal Employment on Child Weight Outcome

Variables	Overweight (1)	Overweight (2)
Mother employed	0.219 (0.181)	0.116 (0.261)
Female	-0.033 (0.023)	-0.035 (0.024)
Child age	-0.002 (0.003)	-0.001 (0.003)
Days eat dinner together	0.007 (0.008)	0.005 (0.009)
Black	0.008 (0.041)	0.008 (0.045)
Hispanic	0.074** (0.031)	0.053 (0.036)
Other	0.010 (0.043)	0.051 (0.045)
Informal (current)	-0.052 (0.087)	-0.014 (0.107)
Center-based (current)	-0.098 (0.056)	-0.042 (0.071)
Single	0.049 (0.030)	0.061 (0.033)
Mom's age at first birth	0.002 (0.003)	0.004 (0.003)
Child had high birth weight	0.130** (0.052)	0.143*** (0.055)
Days child exercises	-0.010** (0.005)	-0.012** (0.005)
Lowest tertile	0.051 (0.035)	0.045 (0.041)
Highest tertile	-0.067** (0.033)	-0.074** (0.035)
Played video game for an hour or more	-0.002 (0.026)	0.004 (0.029)
Watched TV for an hour or more	0.073*** (0.028)	0.082*** (0.031)
Physical Education in school	-0.020 (0.026)	-0.020 (0.031)
Free/reduced price meal	0.055** (0.028)	0.056 (0.030)
Center-based care pre-kindergarten		-0.039 (0.031)
Informal care pre-kindergarten		-0.056 (0.055)
Number of siblings	-0.009 (0.014)	-0.012 (0.014)

Note: The estimates represent marginal effects. Robust Standard errors are in parentheses. N=1595 for model (1) and N=1388 for model (2) ** and *** represent 5% and 1% significance level respectively. (1) includes only current before-and- after school child care arrangements, while (2) includes both current and pre-kindergarten child care arrangements.

Table 2.3 shows that the activities of children also have a significant effect on their weight status. For one additional day per week a child does exercise that causes rapid breathing for 20 minutes or more, the probability that he/she becomes overweight goes down by approximately 1 percentage point. On the contrary, if a child watches TV for an hour or more on a typical weekday, the probability that he/she becomes overweight increases by 7 to 8 percentage points depending on the specification. This result supports the findings of Fertig et al. (2009) that more hours of TV watching by children is positively related to their weight status. This is also in line with the conclusions of Akil and Ahmed (2011) that obesity is strongly related to lifestyle behaviors like low levels of physical activity or greater consumption of foods with high concentration of calories. TV watching is a sedentary activity which is usually accompanied by the consumption of unhealthy foods which can contribute to weight gain.

The results from Table 2.3 suggest that schooling environment also has a significant effect on children's weight status. If a child attends a school where 75 percent or more of the students are eligible for free/reduced price meal, the likelihood of him/her becoming overweight increases by 5.5 percentage points. This is in line with the findings of Schanzenbach (2009) that those children who are eligible for free/reduced price school lunch are more likely to be overweight. One possible reason for this might be the one given by Story et al. (2009) that, less than one third of U.S. schools offer meals that meet USDA standards for total fat and saturated fat. Another possible explanation for this might be the fact that if a child attends a school where 75% or more of the students are eligible for free/reduced price meal, it implies that the child is living in a poor neighborhood which also indicates that socio-economic status is also an important factor explaining child obesity. Physical education class where children exercise for at least half an hour is not significantly associated with children's overweight status. It can be

inferred from Table 2.3 that Hispanic children are about 7 percentage points more likely to become overweight than white children.

It is evident from this study that neither current nor pre-kindergarten child care usage significantly affects children's current weight outcome. This result implies that the effect of pre-kindergarten childcare usage does not persist to school age years. It is not surprising that current child care usage turns out to be insignificant in explaining child weight outcome given that children spend most of their time in school. The results of column (1) and column (2) from Table 2.3 are very similar except that the effect of free/reduced price meals eligibility becomes insignificant with the addition of pre-kindergarten child care arrangements in column (2).

2.5.3 Robustness Check

Table 2.4 presents the results from the linear model using 2SLS estimation technique. The results from the 2SLS regression are by and large consistent with the results from the bivariate probit model. The effect of maternal employment on child overweight status is not significant in both column (1) and column (2) which is in line with the findings from the bivariate probit model in Table 2.3. Similar to the results from the bivariate probit model, the factors that significantly affect child weight outcome are birth weight, socio-economic status, school environment and physical activity by the child including TV watching and exercise. The only difference is that marital status is now significant and race is insignificant in this model. If the mother is single, the probability that the child is overweight goes up by 7 percentage points. This result seems to be in agreement with Huffman et al. (2010) findings that single parents face role strain in balancing market work with child rearing which has a negative implication on their children's weight outcome.

Table 2.4: 2SLS Estimates for the Impact of Maternal Employment on Child Weight Outcome

Variables	Overweight (1)	Overweight (2)
Mother employed	-0.046 (0.377)	0.010 (0.376)
Female	-0.034 (0.023)	-0.034 (0.025)
Child age	-0.002 (0.003)	-0.001 (0.003)
Days eat dinner together	0.001 (0.011)	0.003 (0.011)
Black	0.004 (0.044)	0.002 (0.048)
Hispanic	0.063 (0.038)	0.044 (0.043)
Other	0.002 (0.041)	0.043 (0.047)
Informal (current)	0.059 (0.149)	0.027 (0.141)
Center-based (current)	-0.034 (0.100)	-0.020 (0.095)
Single	0.068** (0.033)	0.070** (0.035)
Mom's age at first birth	0.003 (0.003)	0.005 (0.003)
Child had high birth weight	0.166*** (0.058)	0.161*** (0.060)
Days child exercises	-0.010** (0.005)	-0.013** (0.006)
Lowest tertile	0.024 (0.057)	0.040 (0.052)
Highest tertile	-0.062** (0.030)	-0.067** (0.032)
Played video game for an hour or more	-0.015 (0.031)	0.000 (0.032)
Watched TV for an hour or more	0.062** (0.031)	0.074** (0.033)
Physical Education in school	-0.008 (0.031)	-0.015 (0.036)
Free/reduced price meal	0.065** (0.030)	0.061 (0.033)
Center-based care pre-kindergarten		-0.035 (0.035)
Informal care pre-kindergarten		-0.041 (0.072)
Number of siblings	-0.022 (0.019)	-0.016 (0.016)

Note: Robust Standard errors are in parentheses. N=1595 for model (1) and N=1388 for model (2) ** and *** represent 5% and 1% significance level respectively. (1) includes only current before-and- after school child care arrangements, while (2) includes both current and pre-kindergarten child care arrangements.

The first stage results from Table 2.5 provide evidence for the validity of the instrument used in the 2SLS regression. The first row for column (1) and (2) shows that if the child's youngest sibling is eligible for kindergarten, the probability that the mother is employed increases by 6 to 7 percentage points depending on the specification. This is in line with the initial argument that as the youngest child becomes eligible for kindergarten, the opportunity cost of the mother's time decreases substantially and she is more likely to be employed. The coefficient estimates in both columns (1) and (2) are statistically significant at 1 percent level which indicate that the instrument is a good predictor of the endogenous variable. The F-statistic in both specifications is greater than the rule of thumb critical value of 10 which is an added evidence for the validity of the instrument.

As stated earlier, some studies (Fertig et al., 2009; Datar et al., 2014) claim that the mechanisms through which maternal employment affects child obesity are through children's activities and eating habits. The reasoning is that mothers who work have less time available to supervise the activities of their children, and unsupervised children are more likely to spend more time in sedentary activities like watching TV which is usually accompanied with eating junk food. This in turn has a negative implication on their weight. If this is the case, including these potential channels in the regression of child weight outcome on maternal employment might yield incorrect regression estimates. Therefore, I regressed each of these activities on maternal employment to check the association between the two. These results are shown in Appendix B. The first row in Columns (1), (2) and (3) shows the effect of maternal employment on the probability of TV watching by child for an hour or more in a typical weekday, the probability that the child plays video game for an hour or more in a typical weekday and the changes in log count in the number of days the child does exercise that causes rapid breathing for

Table 2.5: First Stage Results for the IV Estimates Reported in Table 2.3

Outcome variable: Mother employed	First Stage (1)	First Stage (2)
Youngest sibling eligible	0.061*** (0.022)	0.065*** (0.024)
Female	0.006 (0.022)	0.020 (0.024)
Child age	-0.002 (0.002)	-0.003 (0.003)
Days eat dinner together	-0.023 (0.007)	-0.023 (0.007)
Black	0.007 (0.041)	0.008 (0.046)
Hispanic	-0.047 (0.031)	-0.063 (0.034)
Other	-0.011 (0.040)	-0.027 (0.042)
Informal (current)	0.386 (0.023)	0.363 (0.027)
Center-based Care (current)	0.249 (0.031)	0.232 (0.035)
Single	0.037 (0.026)	0.029 (0.029)
Mom's age at first birth	0.001 (0.003)	0.001 (0.003)
Child had high birth weight	0.077 (0.049)	0.085 (0.048)
Days child exercises	0.002 (0.005)	0.004 (0.005)
Lowest tertile	-0.123 (0.029)	-0.105 (0.032)
Highest tertile	0.005 (0.030)	-0.003 (0.033)
Played video game for an hour or more	-0.051 (0.024)	-0.051 (0.026)
Watched TV for an hour or more	-0.041 (0.027)	-0.040 (0.030)
Physical Education in school	0.056 (0.025)	0.071 (0.027)
Free/reduced price meal	0.000 (0.028)	-0.019 (0.031)
Center-based care pre-kindergarten		0.051 (0.030)
Informal care pre-kindergarten		0.161 (0.037)
Number of siblings	-0.046 (0.009)	0.038 (0.009)
F(20, 1574)	35.57	
F(22, 1365)		31.12

Note: Standard errors are in parentheses. (1) Corresponds to the first stage results for model (1) in Table 2.3 and (2) corresponds to first stage results for model (2) in Table 2.3. N=1595 for model (1) and N=1388 for model (2) *** represents 1% significance level indicating that youngest sibling's eligibility for kindergarten is highly significant in explaining maternal employment in both specifications.

at least 20 minutes. The results show that maternal employment is not significantly associated with any of the child activities considered in this study. Therefore, these activities can be included in the regression of child weight outcome on maternal employment as independent regressors as specified in columns (1) and (2) in Table 2.3 and Table 2.4.

2.6 Conclusions and Policy Implications

The purpose of this paper is to re-examine the effect of maternal employment on child obesity. To this end, this study used bivariate probit model and instrumental variable regression using 2SLS to estimate the effect of maternal employment on child's overweight status. The instrumental variable for maternal employment used here is exogenous variation in youngest sibling's eligibility for kindergarten. The results from the non-linear and linear models are consistent with each other. In particular, the effect of maternal employment on child overweight status is not significant in both specifications. Therefore, I fail to reject the null hypothesis which states that maternal employment has no effect on child weight outcome. One explanation for this result is that the positive and negative effects of maternal employment on child obesity outlined by economic theory might offset each other and we observe no significant effect. In addition, this finding suggests that the detrimental effects of maternal employment on child weight outcomes that were documented in earlier studies are not applicable to school-age children, or at least these effects do not persist to school-age years. This finding supports the argument made by Gwozdz (2016) that child development is more influenced by the environment in which the family lives than by the parents. There tends to be more concentration of fast-food restaurants, less number of grocery stores, and limited prospect for physical activity in poor neighborhoods resulting in sedentary behavior and unhealthy diet which all contribute to weight gain.

This result has an interesting policy implication calling for policies regarding maternity leave to be more generous during the child's early years. In addition, this study finds that socio-economic status, marital status, birth weight, TV watching and physical exercise by children, and school environment are the factors that significantly contribute to child obesity. In particular, children from higher socio-economic background are less likely to be overweight. Children with single mothers are more likely to be overweight compared to children from dual-parent households. In addition, those children who watch TV for an hour or more on a typical weekday are more likely to be overweight compared to those who do not. By contrast, with an increase in the number of days children do exercise that causes rapid breathing for 20 minutes or more during a typical week, the probability that they become overweight goes down. Those children who had high birth weight are more likely to be overweight compared to those children who had normal birth weight. This might be due to genetic factors or other maternal characteristics during pregnancy. In any case, this result suggests that weight problem in infancy persists to school-age years which implies that early intervention is needed to tackle childhood weight problems at a later stage in life.

This paper finds some evidence for health disparities across different racial/ethnic groups. Also, this study finds that if a child attends a school where 75 percent or more of the children are eligible for free/reduced price meal, the likelihood that the child is overweight increases. This calls for more actions by the government to ensure that school meals meet USDA's quality standards for healthy diet. In addition, since the presence of more children eligible for free/reduced price meal also indicates that the child is living in a poor neighborhood, policies directed towards meeting the needs of children from low socio-economic status can be helpful in this aspect. Based on the findings that children from higher socio-economic status are less likely

to be overweight, and the high prevalence of overweight children in the lowest socio-economic status distribution, public policies directed towards narrowing the socio-economic status gap might help reduce the prevalence of overweight children in the United States. In general, the findings of this paper suggest that rather than maternal employment, it is lifestyle behaviors, socio-economic background and schooling environment that significantly contribute to child obesity.

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CHAPTER 3

IS MATERNAL EMPLOYMENT A SIGNIFICANT FACTOR EXPLAINING CHILDREN'S COGNITIVE OUTCOME? EVIDENCE FROM EARLY CHILDHOOD LONGITUDINAL STUDY, KINDERGARTEN CLASS OF 2010-11

3.1 Introduction

The purpose of this paper is to investigate the effect of maternal employment on child cognitive development[5]. This topic is important because children's early achievement are strong predictors of later outcomes in life. The most successful individuals are more likely to have higher educational attainment and higher earnings, and are less likely to be on welfare or participate in crime (Bernal, 2008). Therefore, investigating the factors that influence the ability of individuals at early stages of life is crucial in designing public policy measures intended for improving labor market outcomes and societal wellbeing.

Previous studies that examined the effect of maternal employment on children's cognitive development suggest mixed results. Blau and Grossberg (1992) using data from National Longitudinal Survey of Youth (NLSY), found a negative effect of maternal employment during the child's first year of life, on child's cognitive development using both OLS and IV regression. The children in their sample include 3 and 4 year olds. The authors used the Peabody Picture Vocabulary Test (PPVT) test scores as a measure of cognitive development. Greenstein (1995) used children aged 4 to 6 years old from NLSY data and found no significant relationship

[5] Cognitive development refers to how a person perceives, thinks, and gains understanding of his or her world.

between maternal employment and child cognitive development using OLS regression. The author used the revised version of PPVT as a measure of child cognitive outcome. On the other hand, the findings of Parcel and Menaghan (1994) using the NLSY suggest a positive effect of maternal employment on child cognitive development. The sample in this study includes 3 to 6 year old children. The authors used a multivariate model for estimation purposes and a revised version of PPVT scores as a measure of cognitive outcome.

Most studies focus on the effect of maternal employment during the child's first three years of life because the first three years of life are considered to be the critical periods for children's development (Ruhm, 2004). In addition, most of the previous studies in the U.S. used data from NLSY. My study re-examines the relationship between maternal employment and child cognitive outcomes using data from Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011) which is a relatively new dataset. This paper extends the work of previous research by investigating the effect of maternal employment on child cognitive outcomes focusing the analysis on school-age children and using a unique instrument for maternal employment, which is youngest sibling's eligibility for kindergarten. In addition, this paper intends to examine if children's cognitive outcome depends on the quality of school using broader measures for school quality.

There are two conjectures with respect to the effect of maternal employment on child cognitive outcome. The first conjecture states that the attempt to combine motherhood with market work leads to increased maternal stress and tiredness, the consequence of which is poorer quality parenting which in turn has a negative implication on children's cognitive development. Another hypothesis is that working mothers provide extra income that can be used to purchase

inputs that improve children's academic performance. Accordingly, the null hypothesis to be tested is that maternal employment has no effect on children's cognitive outcome.

3.2 Previous Literature

Bernal (2008) used data from the National Longitudinal Survey of Youth to estimate a dynamic model of employment and child care decisions of women after childbirth to analyze the effects of these choices on children's cognitive development. The results indicate that there is a negative and sizable effect of maternal employment and child care on children's cognitive development. More specifically, full-time employment by the mother during the first year results in a reduction in ability test scores by 1.8%.

Gregg et al. (2003) used data from The Avon Longitudinal Study of Parents and Children (ALSPAC) to investigate the effects of early maternal employment on child cognitive and behavioral outcomes. The findings suggest that full time maternal employment 18 months after childbirth has a negative but small impact on child development at a later stage. On the other hand, part-time maternal employment and employment that began 18 months after child birth do not have any significant effect. The negative effect of maternal employment is more pronounced in those families where mothers work full-time and rely on unpaid care by relatives and friends. According to this paper, there is some evidence that the use of paid child care and center-based care leads to better cognitive outcomes compared to having the child at home with a non-working mother.

Waldfogel et al. (2002) examined the effect of maternal employment on children's cognitive outcomes using data from National Longitudinal Survey of Youth. The results show that there is a negative effect of first year maternal employment and some positive effects of

second and third year maternal employment on children's cognitive development. However, these results hold only for non-Hispanic white children but not for African American or Hispanic children.

Using data from a Danish data set that follows 135,000 Danish children from birth to 9th grade, Dunifon et al. (2013) investigated the effect of maternal employment during the child's first three and fifteen years on the child's grade point average (GPA) in the 9th grade. This is one of the few studies that examined the effect of maternal employment on school-age children. The authors found that maternal employment has a positive effect on children's academic performance, particularly for those women who work part-time.

James-Burdumy (2005) used data from National Longitudinal Survey of Youth to study the effect of maternal employment on child development using a fixed effect model. The author used three types of scores as measures of cognitive outcome that is, Peabody Individual Achievement Test (PIAT) reading, PIAT Math and Peabody Picture Vocabulary Test (PPVT) scores. The author also used the hours worked during the child's first, second and third year as well as the number of weeks worked during those years as measures for maternal employment. The results show that it is only the PIAT Math score that was negatively affected by maternal employment during the first year of the child's life. The PIAT reading score was negatively affected by weeks worked during the first year but not by the hours worked by the mother. Maternal employment during the second year seems to have no impact on any of the scores while the number of weeks worked during the third year positively affects the PIAT math scores.

This study contributes to existing literature by focusing the analysis on school-age children and using a unique instrument for maternal employment, which is exogenous variation in youngest sibling's eligibility for kindergarten. Most previous studies that used instrumental

variable regression used local labor market conditions like state level unemployment rate (Dunifon et al., 2013), percentage of county labor force employed in services (James-Burdumy, 2005) and state level welfare reform (Bernal, 2008) as an instrument for maternal employment. But very often, these instruments turned out to be weak predictors of maternal employment in the first stage. To the best of my knowledge, this is the first paper to use youngest sibling's eligibility for kindergarten as an instrument in the analysis of the effect of maternal employment on child cognitive outcomes.

In addition, most previous studies that examined the effect of maternal employment on child cognitive development did not take into account the effect of schooling quality on child cognitive outcome. There are some previous studies that examined the direct effect of schooling on child cognitive outcome. These studies did not take into account the effect of maternal employment on child cognitive outcome but rather the direct effect of schooling on child's cognitive outcome. For instance, Sylva (1994) found that schooling is directly related to children's educational achievement. The basic skills children acquire in school lay the foundation to entry into higher education and employment in subsequent stages. In addition, Dronkers and Robert (2003) pointed out that the quality of school (as proxied by private schools vs. public schools) is a significant factor in explaining children's academic achievement. More specifically, private schools are more effective than public schools due to better school climate in private schools. In line with this, this study investigates if the quality of schooling has any significant effect on children's cognitive outcome. In addition to the broad measure of quality of schooling as proxied by private vs. public schools, this study uses more specific indicators of quality of schooling as outlined by the U.S. Department of Education (U.S. Department of

Education, 2000). These indicators of school quality include class size, technology (proxied by number of computers with internet access in class) and teachers' experience.

3.3 Data

For the purpose of analysis, I used data from Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011). This is a longitudinal data set following the same children from Kindergarten to 5th grade. The ECLS-K: 2011 is a nationally representative data set collected by the U.S. Department of Education. Data is collected from both public and private schools. The first wave was conducted in the year 2010-11 when children were in kindergarten. Data is collected in fall and spring of each academic year the most recent of which is in spring 2013. This study makes use of data from spring 2013 survey period where most children were in second grade. The sample for this study contains 1990 children who have at least one younger sibling and whose mothers were the primary respondents.

3.4 Empirical Model and Estimation Technique

3.4.1 Model Specification

The baseline regression equation is shown in Eq. *(1)* which captures the effect of maternal employment on child's cognitive outcome:

$$Child\ Score_i = \beta_0 + \beta_1 Empt + \beta_3 X_i + \mathcal{E}_i \qquad (1)$$

The dependent variable indicates the child's cognitive outcome which is measured by each child's standardized score in math, science and reading. Eq. *(1)* is estimated separately for each of these three measures. The main predictor is mother's employment ('*Empt'*) which is a binary variable taking a value of 1 if the mother is employed and 0 otherwise. X represents a set of other child and parent specific characteristics and $\mathcal{E}_i$ is the error term.

The issue with using Eq. *(1)* in regression analysis is that maternal employment is not truly exogenous because there are some unobserved factors that affect both child's cognitive outcome and maternal employment decision. This implies that maternal employment is endogenous in the model and β_1 is inconsistent. A simple example for this is that mothers who have children with poor academic performance might be less likely to work to make up for the poor performance of their children or it might also be that high-ability mothers are more likely to work than low-ability mothers, and more likely to invest in their children's cognitive development resulting in high performance by their children.

In order to account for the endogeneity of maternal employment, instrumental variables regression using a two stage least squares (2SLS) estimation technique is used. In this procedure, maternal employment is predicted using youngest sibling's eligibility for kindergarten as an instrument in the first stage regression. In the second stage, child cognitive outcome is regressed on predicted maternal employment. This second stage estimation is given in Eq. *(2)*:

$$Child\ Score_i = \beta_0 + \beta_1 \widehat{Empt} + \beta_3 X_i + \mathcal{E}_i \qquad (2)$$

There are two conditions that need to be fulfilled in order for an instrument to be valid. First, the instrument should be strongly correlated with the endogenous variable and second, the instrument must not be directly correlated with the outcome variable. It can be argued that youngest sibling's eligibility for kindergarten satisfies these two conditions because of the observation that the opportunity cost of a mother's time decreases substantially once the youngest sibling becomes eligible for kindergarten and thereby making the mother more likely to work (Morrill, 2011). In addition, it can also be argued that youngest sibling's eligibility for kindergarten does not have a direct effect on the focal child's cognitive development. Variation in the exact timing of fertility is the source of exogenous variation in the instrument (Morrill,

2011). In order to avoid any bias that might arise due to focal child's own eligibility for kindergarten, the analysis is limited to those children who have at least one younger sibling.

3.4.2 Description of Variables

The IRT Math Scale Score, IRT Reading Scale Score, and IRT Science Scale Score are used as measures of child cognitive development[6]. For the purpose of making the measurements comparable, the dependent variables have been normalized to have mean zero and standard deviation of one. Therefore, the regression coefficients show the standard deviation change in the test scores as a result of a one unit change in the explanatory variable. The main variable of interest is maternal employment which takes on a value of 1 if the mother is employed and 0 otherwise.

There is evidence from previous literature that poor health condition at an early stage will have a negative impact on child cognitive development at a later stage (Figlio et al., 2014). In line with this, this paper uses whether the child had low birth weight and whether the child has disability as measures of the child's health status.

Mother's level of education[7] (high school, some college, college degree) and a dummy variable for low income[8] taking a value of 1 if a child is from low income family and 0 otherwise are used as measures of socio-economic status. We use the following variables to represent child

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[6] IRT stands for Item Response Theory. It is a method for modeling assessment data that makes it possible to calculate an overall score for each domain measured for each child that can be compared to scores of other children. The children were given a set of questions testing their math, reading and science ability and their response was converted to a score ranging from 0 to 120 for reading, 0 to 113 for math and 0 to 64 for science.

[7] Maternal education is measured as a categorical variable where mothers with a high school diploma or less are categorized under 'high school', those with some sort of college education but no degree, vocational training and associate's degree are grouped under 'some college' and those with a bachelor's degree or higher are categorized under 'college degree'.

[8] Low income refers to a family earning below 200 percent of the federal poverty threshold given its household size.

and parent specific characteristics, which could affect the child's cognitive development as supported by previous studies; mother's age, child age, number of siblings, sex of the child (dummy variable where 1=female and 0=male), race of the child (White, Black, Hispanic, and other), mother's marital status taking a value of 1 if the mother is single[9] and 0 otherwise and home language of the child (a dummy variable taking a value of 1 if English is the primary language used at home and 0 otherwise). Previous research also shows that early reading facilitates cognitive development (Echols et al., 1996). To account for this, the number of minutes in a typical weekday the child reads to himself/herself and to others outside school is added as a control variable. In addition, if any member of the family visited the library with the child during the month preceding the survey is also included due to its possible correlation with the child's cognitive outcome.

In order to examine if the effect of maternal employment on child cognitive outcome differs by quality of school, a dummy variable is used which takes a value of 1 if the child attends public school and 0 if private school. In addition, more specific indicators of the quality of school including class size, teachers' years of experience, and technology are used in the analysis. According to the cutoff set by the U.S. Department of Education, a class size of less than 20 students is classified as 'small class size'. Following this, a dummy variable indicating class size taking a value of 1 if the number of students in class is less than 20 is used to ascertain the fact that small class size implies higher quality of school (U.S. Department of Education, 2000). Previous research has shown that there is greater gain in student achievement in classes with fewer students (13 to 20 students) than in larger classes (Krueger, 1999). According to the

[9] 'single' refers to those mothers who are divorced, separated, widowed, or never married; while 'married' refers to those who are married or have partners living with them.

U.S. Department of Education, educational technology in classrooms measured by the availability of computers with internet access, can increase teaching effectiveness (U.S. Department of Education, 2000). In line with this, the number of computers with internet access in classrooms is used as a measure of educational technology. Darling-Hammond (2000) pointed out that experienced teachers are more effective than new ones. Accordingly, a teacher's years of experience is another measure used as an indicator of quality of school in this paper. In addition, there is evidence from previous literature that the effect of maternal employment on child cognitive outcome differs by type of child care (Bernal, 2008; Loeb et al., 2007; Gregg et al., 2003). In line with this, three measures for both current and pre-kindergarten child care are used in this study. These are center-based care, informal care[10] and parental care.

I intend to test the null hypothesis that maternal employment has no effect on child cognitive outcome. In addition, based on the quality of schooling argument favoring private schools (Dronkers and Robert, 2003), I expect to find those children placed in private schools to have higher child cognitive outcome than those who attend public schools. In addition, I expect children in small classes, classes with more computers with internet access and with more experienced teachers to have better cognitive outcome.

3.5 Results and Discussion

3.5.1 Descriptive Statistics

Table 3.1 provides basic summary statistics of the variables included in the analysis. About 55 percent of the women in the sample are employed. Mothers in the sample are on

[10] Informal care refers to relative and non-relative care.

average 33 years old. On average, children spend about 24 minutes reading to themselves and to others outside of school.

About 43 percent of the mothers in the sample had a high school diploma or less, about 23 percent had some college experience and close to 24 percent have a bachelor's degree and above. Most of the children in the sample attend public school (close to 88%). In the year before kindergarten, most of the children in the sample attended center-based care (about 44%) and about 17% were under informal care and around 24% were under parental care. When we look at current child care use, only 13% are in center-based care and about 27% are in informal child care before and after school. About 69% of the children in the sample are from low income families. Families are categorized as low income if their household income falls below 200% of the federal poverty threshold. About 60% of the families reported visiting the library with their children during the month preceding the survey period and about 78% of the children use English as their primary home language. About 51 percent of the children attend a small class. On average there are 4 computers with internet access in class, and on average teachers have close to 15 years of teaching experience.

Taking the children's scale score on each of the three cognitive development measures, the average score for reading is about 94 in a scale ranging from 0 to 120. The average score on math is around 79 in a range from 0 to 113 and the mean score for science is around 42 in a range from 0 to 64. For the purpose of analysis, these scores are normalized to have mean 0 and standard deviation 1.

Table 3.1: Summary Statistics

Variable	Percent of sample or mean value (SD)
Mother employed	55.33%
Mom's age	33.41 (5.67)
Mom's education level	
Some college	23.37%
High school	43.27%
Degree	23.63%
Child age	7.64 (0.53)
Number of siblings	2.69 (1.37)
Male	51.56%
Race	
White	41.41%
Black	14.12%
Hispanic	34.67%
Other	9.80%
Primary type of pre-kindergarten care	
Parental	24.32%
Informal	17.29%
Center-based	44.27%
Primary type of before-or after-school care	
None	60.06%
Informal	26.98%
Center-based	12.96%
Single	35.23%
Child had low birth weight	9.55%
English as primary language	77.89%
Child attends public school	87.94%
Child is from low income	69.55%
Child has disability	16.58%
Child visited library	60.50%
Child reads outside school	23.65 (14.75)
Small class	51.36%
Computers with internet	3.94 (2.94)
Teacher's years of experience	14.84 (9.11)
Reading Score	94.09 (13.25)
Math Score	78.77 (14.97)
Science Score	41.72 (9.26)

Note: Standard deviation is in parenthesis, N=1,990

3.5.2 Regression Results

Table 3.2 shows the regression estimates where the dependent variable is the normalized reading score. It can be inferred from this table that the effect of maternal employment on child's reading score is not significant. The only difference between column (1) and column (2) is that column (2) includes both current and pre-kindergarten child care while column (1) includes the type of current child care only. Children from mothers with low level of education generally score lower than those from mothers with high level of education. Having a mother with a high school diploma or less compared to having a mother with a college degree (the reference group) is associated with a 0.5 standard deviation reduction in children's reading score, and having a mother with some college experience compared to having a mother with a college degree is associated with a 0.26 standard deviation reduction in reading score. This might be interpreted as children from lower socio-economic background generally perform worse than those from higher socio-economic background. Black children, Hispanic children and children from other racial minorities generally perform lower in reading than white children.

Children whose primary language at home is English score 0.2 standard deviation higher in reading that those children from non-English speaking background. This result is consistent with previous studies that document that children from non-English speaking background score lower on achievement tests (Cohen and Parmelee, 1983). Children from low income families score lower than those from higher income families. Coming from a low-income family is associated with a 0.27 standard deviation reduction in reading score. This shows that children from lower socio-economic background perform worse academically. This is in line with the finding of Quagliata (2008) that there is a positive correlation between socio-economic status and academic achievement.

Table 3.2: Regression Estimates for Reading Score

Dependent Variable: Reading Score	**(1)**	**(2)**
Mother Employed	-0.896(0.769)	-0.580 (0.804)
Computers with internet	-0.002(0.009)	0.006(0.008)
Small Class	-0.072(0.049)	-0.082(0.052)
Child from low income	-0.267***(0.065)	-0.250***(0.062)
Mom age	0.006(0.006)	0.005(0.006)
Child age	0.005(0.006)	0.004(0.006)
Female	0.113**(0.048)	0.125**(0.052)
Black	-0.249***(0.083)	-0.217**(0.086)
Hispanic	-0.365***(0.072)	-0.322***(0.077)
Other	-0.169**(0.081)	-0.163**(0.081)
English as primary language	0.196**(0.093)	0.176(0.115)
Mother's education: some college	-0.264***(0.088)	-0.236**(0.093)
Mother's education: high school	-0.520***(0.105)	-0.540***(0.094)
Child attends public school	-0.065(0.109)	-0.014 (0.104)
Number of siblings	-0.113***(0.043)	-0.099**(0.041)
Child has disability	-0.578***(0.071)	-0.602***(0.071)
Child had low birth	-0.097(0.096)	-0.130(0.095)
Single	-0.172**(0.071)	-0.225***(0.072)
Informal child care (current)	0.340(0.305)	0.182(0.304)
Center-based care (current)	0.369(0.198)	0.294(0.193)
Child reads outside school	0.008***(0.002)	0.009***(0.002)
Child visited library	0.057(0.050)	0.022(0.049)
Teacher's years of experience	0.005**(0.002)	0.006**(0.003)
Center-based care pre-kindergarten		0.001(0.064)
Informal care pre-kindergarten		0.105(0.132)
N	1550	1350

Note: Robust Standard errors are in parentheses. ** and *** represent 5% and 1% significance level respectively.

Female children score higher on reading compared to male children. There is evidence from Table 3.2 that children's health status also has an implication on their academic performance. Specifically, having disability is associated with a 0.58 standard deviation reduction in reading score. In addition, children from single mothers score 0.17 standard deviation lower than children from dual parent households. Children who read by themselves more often outside of school score higher than those children who read less. It can be seen from Table 3.2 that neither current nor pre-kindergarten child care usage has any significant effect on children's reading score.

The results from Table 3.2 suggest that there is some evidence that the quality of school matters in children's academic performance. More specifically, having more experienced teachers raises children's reading score. Each additional year of teaching experience increases children's reading score by 0.01 standard deviation. There is no significant difference in reading score between those children who attend public school and those who go to private school.

Table 3.3 shows the regression estimates when children's math score is used as a dependent variable. The results are similar to the ones found in Table 3.2. The effect of maternal employment on the child's math score is not significant in this specification as well. Being female is associated with a 0.12 standard deviation lower math score. This is different from the results in Table 3.2 where being female is associated with a higher reading score. Another interesting difference from the results found in Table 3.2 is that coming from a family where English is the primary language used at home is not a significant factor in explaining children's math score.

Table 3.3: Regression Estimates for Math Score

Dependent Variable: Math Score	**(1)**	**(2)**
Mother Employed	0.017 (0.721)	0.047 (0.808)
Computers with internet	-0.006 (0.008)	-0.001(0.008)
Small Class	-0.107** (0.046)	-0.141***(0.053)
Child from low income	-0.236*** (0.059)	-0.214***(0.059)
Mom age	0.003 (0.006	0.002(0.007)
Child age	0.009 (0.006)	0.006(0.006)
Female	-0.125*** (0.044)	-0.118**(0.050)
Black	-0.557*** (0.077)	-0.487***(0.083)
Hispanic	-0.337*** (0.067)	-0.307***(0.077)
Other	-0.078 (0.076)	-0.076(0.082)
English as primary language	0.131 (0.084)	0.142(0.113)
Mother's education: some college	-0.202** (0.086)	-0.161(0.096)
Mother's education: high school	-0.344*** (0.102)	-0.373***(0.099)
Child attends public school	0.146 (0.099)	0.121(0.104)
Number of siblings	-0.032 (0.040)	-0.022(0.040)
Child has disability	-0.584*** (0.072)	-0.569***(0.076)
Child had low birth	-0.264*** (0.094)	-0.271***(0.099)
Single	-0.263*** (0.066)	-0.302***(0.071)
Informal child care (current)	-0.014 (0.285)	-0.064(0.304)
Center-based care (current)	0.262 (0.185)	0.275(0.196)
Child reads outside school	0.007*** (0.002)	0.006***(0.002)
Child visited library	0.105** (0.046)	0.086(0.048)
Teacher's years of experience	0.005** (0.002)	0.005**(0.003)
Center-based care pre-kindergarten		0.034(0.064)
Informal care pre-kindergarten		0.092(0.131)
N	1549	1349

Note: Robust Standard errors are in parentheses. ** and *** represent 5% and 1% significance level respectively.

Table 3.3 shows that children's early health has an implication on their cognitive development at a later stage as discussed by (Figlio et al., 2014). Having low birth weight is associated with a 0.26 standard deviation reduction in math score. In addition, children who visited the library in the month preceding the survey period score 0.10 standard deviation higher than those who did not. In addition to teacher's years of experience, class size is also another indicator of quality of school that turned out to be significant. However, contrary to initial expectation, children in small class score lower in math than those in larger class. If we consider reading and science score, class size is still negatively associated with children's performance in these scores although not significant. One possible explanation is that large-scale efforts to reduce class size may in fact lead to negative outcome if greater number of unqualified teachers are hired due to lack of enough qualified teachers to accommodate smaller classes (Bohrnstedt and Stecher, 1999). According to Hanushek (1997), it is possible that some of the best teachers are assigned to larger classes so that more students can reap the benefits. Another possibility outlined by Hanushek (1997) is that there are some specific classes, some group of students and some teachers for whom smaller classes work best but this is balanced by others where there is no advantage for smaller classes. Based on this, my own interpretation for the significant negative relationship between math score and class size is that math is a subject that needs more analytical thinking and larger class size might provide a better opportunity for students to be more engaged and interact with one another which might lead to a better outcome.

Table 3.4 shows the regression results when science score is used as a dependent variable. The results from this table are by and large consistent with the results from Table 3.2 and Table 3.3. The effect of maternal employment on child's science score is not significant either. Older children score higher than younger children. Female children's science score is

Table 3.4: Regression Estimates for Science Score

Dependent Variable: Science Score	**(1)**	**(2)**
Mother Employed	-0.926 (0.741)	-0.742 (0.796)
Computers with internet	0.007 (0.008)	0.008 (0.008)
Small Class	-0.006 (0.048)	-0.016 (0.053)
Child from low income	-0.239*** (0.064)	-0.224** (0.063)
Mom age	0.008 (0.006)	0.007 (0.007)
Child age	0.012** (0.006)	0.011 (0.006)
Female	-0.104** (0.047)	-0.122** (0.052)
Black	-0.497*** (0.077)	-0.505*** (0.083)
Hispanic	-0.413*** (0.070)	-0.403*** (0.077)
Other	-0.073 (0.081)	-0.101 (0.083)
English as primary language	0.521*** (0.092)	0.530*** (0.116)
Mother’s education: some college	-0.252*** (0.090)	-0.210** (0.097)
Mother’s education: high school	-0.407*** (0.108)	-0.381*** (0.102)
Child attends public school	-0.016 (0.102)	-0.016 (0.102)
Number of siblings	-0.104** (0.042)	-0.083** (0.041)
Child has disability	-0.440*** (0.067)	-0.423*** (0.071)
Child had low birth	-0.098 (0.096)	-0.122 (0.097)
Single	-0.215*** (0.067)	-0.237*** (0.070)
Informal child care (current)	0.407 (0.298)	0.277 (0.306)
Center-based care (current)	0.358 (0.189)	0.320 (0.190)
Child reads outside school	0.006*** (0.002)	0.006*** (0.002)
Child visited library	0.082 (0.050)	0.079 (0.052)
Teacher's years of experience	0.004 (0.002)	0.005 (0.003)
Center-based care pre-kindergarten		0.060 (0.066)
Informal care pre-kindergarten		0.156 (0.134)
N	1549	1349

Note: Robust Standard errors are in parentheses. ** and *** represent 5% and 1% significance level respectively.

0.10 standard deviation lower than their male counterparts. Similar to the findings in Table 3.2, children from English speaking background score 0.5 standard deviation higher than those children whose primary language at home is not English. When science score is used as a measure of cognitive outcome, none of the quality of schooling indicators turned out to be significant.

Regarding the validity of our proposed instrument, Appendix D shows the first stage results from the 2SLS regression for all the three measures of cognitive outcome. The first columns of Tables 3.2, 3.3 and 3.4 show that if the child's youngest sibling is eligible for kindergarten, the probability that the mother is employed increases by approximately 6 percentage points and these results are statistically significant at 1 percent level. This suggests that the instrument is a good predictor of maternal employment. The F-statistics in all specifications are greater than 10, which is the cutoff point for the validity of instrument.

The main objective of this study is to investigate the effect of maternal employment on child's cognitive outcomes. The findings of this paper show that this effect is not significant for any of the cognitive outcome measures considered in this study. Based on these findings, I fail to reject the null hypothesis that maternal employment has no effect on children's cognitive development. One explanation for this result might be that the positive and negative effects of maternal employment on child cognitive outcomes offset each other resulting in no significant effect. As an alternative interpretation of the results, we might argue that the unfavorable effects of maternal employment on child cognitive outcomes found in most previous studies are not pertinent to school-age children, or do not persist to school-age years.

The results of this paper show that quality of schooling has a significant effect on children's cognitive outcome. More specifically, teacher's years of experience is the most

important factor affecting children's cognitive outcome. Class size is found to be a significant factor explaining children's math score but insignificant in reading and science scores. Contrary to the quality of schooling argument favoring private schools (Dronkers and Robert, 2003), this study found that there is no significant difference in cognitive outcome between those children who attend public school and those in private school. Children of mothers with low level of education and from low income family generally score lower than those children from highly educated mothers and higher income family. This result confirms the finding of previous studies that children from low socio-economic status have lower cognitive development than those children from higher socio-economic background (James-Burdumy, 2005; Bernal, 2008).

According to the findings of this paper, neither current nor pre-kindergarten child care usage is a significant factor explaining child cognitive outcome. However, this result is not surprising given the fact that children spend most of their time in school as opposed to child care center or in informal care. The result also implies that the effect of early child care use does not continue to school-age years.

3.6 Conclusion

This paper investigates the effect of maternal employment on child cognitive development using three measures of cognitive development: IRT reading, IRT math, and IRT science scores. The findings of this paper suggest that the effect of maternal employment on child cognitive development is not significant. One possible explanation is that the positive and negative effects of maternal employment on child cognitive outcomes described in the introduction section of this paper might offset each other resulting in no significant effect. It can also be because the environment in which children are raised including schooling factors, play

greater role in children's cognitive development rather than maternal employment. Children from low-income families are more likely to attend poor-quality public schools which negatively affects their cognitive development in addition to lack of resources at home. Thus, policies should be directed towards narrowing the gap in socio-economic status and improving quality of schooling rather than discouraging maternal employment.

Similar to the findings of most previous research, children with less educated mothers and those from low income group exhibit lower cognitive development compared to those children with highly educated mothers and those from a higher income group. Thus, socio-economic status is indeed one of the major factors affecting children's cognitive development. There is evidence from this study that race also plays a role in children's cognitive development. Hispanic and black children score lower than white children in all the three measures of cognitive outcome considered in this study. I interacted maternal employment with race, income group and maternal education level to see if the effect of maternal employment on child's cognitive outcome differs by socio-economic status but I did not find any significant effect for these interactions, which might be due to small sample size.

This paper adds to the existing literature by showing that the quality of schooling is an important determinant of children's cognitive outcome. In particular, the result shows that children benefit academically from more experienced teachers. The result on class size shows that having small class size by itself does not guarantee higher achievement by students. One reason why the coefficient on small class size has an unexpected sign might be that unqualified teachers might be assigned to teach these classes due to lack of enough qualified teachers. Contrary to the quality of schooling argument favoring private schools, the finding of this paper suggests that there is no significant difference in cognitive outcome between children who attend

public school and those who go to private school. This finding is consistent throughout all cognitive development measures. This calls for continued effort by government and public policy makers to ensure that schools provide enough support to improve the skills and experiences of their teachers and make an effort to combine efficient class size with qualified teachers. Based on the findings that suggest that children with disabilities and those from lower socio-economic background perform poorly, programs designed to address the needs of these children can help narrow this gap in academic performance.

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CHAPTER 4

THE EFFECT OF MATERNAL EMPLOYMENT ON MOTHERS' HEALTH AND PSYCHOLOGICAL WELL-BEING

4.1 Introduction

It is evident that there has been a tremendous increase in female labor force participation rate in the United States since the 1970s. Currently, it is estimated that close to 75% of mothers with youngest children between the ages of 6 to 17 are employed (U.S. Department of Labor, Bureau of Labor Statistics, 2017). Since both child rearing and market work are time-intensive activities, there has been studies that investigate the potential harmful effect of maternal employment on children's outcome through the mechanism of less time available to invest in children's development (Cawley and Liu, 2012; Ruhm, 2004). However, the role strain employed mothers face in attempting to combine motherhood with market work and its possible effect on the mothers' well-being has largely been neglected.

Most previous economic research focused solely on the effect of maternal employment on children's outcome; mainly on children's health, cognitive development and behavioral outcomes. So far, only one study in the economics literature (Chatterji et al., 2012) did a thorough analysis on the effect of maternal employment on maternal mental health, maternal overall health, parenting stress, and the quality of parenting. In order to design public policies that address the needs of a society where most mothers are employed, it is crucial to understand the effect of maternal employment on family well-being, including the well-being of children as well as mothers (Chatterji et al., 2012).

According to a report by Pew Research Center, 60 percent of working mothers say it is difficult for them to balance work and family compared to 50 percent of fathers making such claim, and this holds particularly for mothers working full time. In particular, one-in-five full-time working mothers report balancing work and family life is very difficult for them, compared with 12 percent of fathers working full time and 11 percent of mothers working part time (Pew Research Center, 2015). There are several adverse outcomes associated with work-life conflict including job dissatisfaction, life dissatisfaction, marital dissatisfaction, stress and depression (Adams et al., 1996; Frone et al., 1992). There are serious health implications associated with stress resulting from work life imbalance such as cardiovascular disease and gastric disorders. In addition, there is also substantial costs associated with stress-related diseases (Allen et al., 2000). For instance, it has been estimated that stress-related ailments cost American business between $50 billion and $150 billion a year (Hatfield, 1990).

Arber et al. (1985) explains two conflicting theories regarding the effect of maternal employment on mothers' wellbeing. The first one is what is termed as 'role accumulation' which highlights the beneficial effects of maternal employment on mothers' well-being. Taking additional role as an employee helps protect mothers from the monotonous nature of housework and provides them with an alternative source of gratification outside their own families. In addition, being able to work gives mothers a sense of self-esteem, extended social network and an additional source of finance. On the contrary, the 'role strain' theory suggests that employment has a harmful effect on mothers' health because employed mothers assume multiple roles as mothers taking care of their children at home, unpaid domestic work in the house as well as paid work outside the home. This work overload eventually leads to weariness which results in various illnesses.

Although job participation may have its own benefit in terms of increasing financial resources and social support (Lee and Powers, 2002), the level of benefit is highly dependent on the quality of the job (Cooklin et al., 2010). Although there might be different criteria for determining the quality of the job, those types of jobs characterized by high levels of pressure, low workplace flexibility and low level of control over work can be classified as 'low quality' jobs and these are usually associated with employee depressive symptoms (Barnett & Brennan, 1995; Paterniti, Niedhammer, Lang, & Consoli, 2002). Similarly, employment may negatively affect the psychological well-being of women if their work conditions create conflict with their family responsibilities (Cooklin et al., 2010). According to Karasek (1979), high-status, highly skilled employees are more likely to have better quality jobs that allow more control in what they do and how they do it. In the context of mothers, this implies that they can mold their workload and commitments to better accommodate their family needs.

In line with this, the purpose of this paper is to investigate the effect of maternal employment on mothers' psychological and overall health. In particular, this study analyzes the effect of maternal employment on maternal psychological distress and self-reported health. In addition, this study aims to determine if the effect of maternal employment on maternal well-being depends on the type of job. Since specific measures of job quality are not available in the survey, the type of occupation is used to proxy for job quality. Four types of occupation are considered in this analysis i.e., managerial, professional: non-managerial, low supervisory and manual.

4.2 Literature Review

Chatterji et al. (2012) examined the effect of maternal employment on maternal mental health, maternal overall health, parenting stress (using Abidin Parenting Stress Index), and parenting quality (using maternal sensitivity from trained observers' recording of mothers' behavior toward their children). Using data from phase I of the National Institute of Child Health and Human Development (NICHD) Study on Early Child Care (SECC), this study found that among employed mothers, work hours are positively related to maternal depressive symptoms, parenting stress, as well as a reduction in self-reported overall health. The data set consists of 1,364 infants with English-speaking, adult mothers from 10 sites across the United States. The survey was conducted when children were 6 months old and maternal employment is measured by mothers' work hours when children were 3 months old. The authors used OLS regression for continuous outcomes (i.e., depressive symptoms, parenting quality, parenting stress) and probit regression for binary outcomes (poor health vs. good health and depressed). In addition, they used ordered probit model for self-assessed health rating (1 = fair/poor health, 2 = good health, 3 = excellent health).

Cooklin et al. (2010) used data from the first wave of Growing Up in Australia, the Longitudinal Study of Australian Children (LSAC). The data set consists of 1300 mothers with children less than 1 year of age who participated in the LSAC. This study used logistic regression to estimate the association between job quality and maternal psychological distress. More specifically, this study examines the relationship between access to family-friendly and supportive employment conditions and maternal mental health in the period following child birth. The outcome of interest was maternal mental health measured using the Kessler-6 (K6) which is a six-item screening tool aimed to identify probable mood and anxiety disorders.

Quality of job or employment characteristics is measured using Job Quality Index for Parents (JQIP) which is a measure for identifying employment conditions designed to mitigate difficulties arising from combining employment and parenting. The results of this study show that the odds of reporting psychological distress was significantly higher for women with limited access to favorable employment conditions compared to those with access to favorable employment conditions (i.e. mothers with better quality jobs).

Yeo and Teo (2013) examined parenting stress and children's behavioral problems among pre-school children taking a sample of 60 children with employed mothers and another 60 children with stay-at-home moms in Johor Bahru, southern part of Malaysia. Parental Stress Scale (PSS) was used to measure mothers' parenting stress level and Child Behavior Checklist (CBCL) was used to assess children's behavior problems. The result of the study revealed that there were no significant difference in parenting stress between employed and stay-at-home moms. In addition, the levels of parenting stress between employed and stay-at-home moms were relatively the same. The result also shows that those mothers whose children exhibit behavioral problems are more likely to experience parenting stress.

Goodman and Crouter (2009) conducted a research analyzing the relationship between three types of workplace stressors i.e., nonflexible work arrangements, work pressure, low self-direction and depressive symptoms among a sample of 414 employed mothers with young children living in six predominantly low-income, nonmetropolitan counties in eastern North Carolina and central Pennsylvania. This is based on the observation that pressure in the workplace, including frequent deadlines, insufficient time to complete work and extreme workloads is more likely to be a source of stress that leads to increased depressive symptoms.

The result of this study shows that a less flexible work environment and greater work pressure is associated with higher levels of depressive symptoms.

Buehler and O'Brien (2011) did a multivariate analysis of covariance with extensive control variables to compare depressive symptoms between mothers employed part time and those employed full time and unemployed mothers. The study made use of the seven waves of the National Institute of Child Health and Human Development (NICHD) study of Early Child Care and Youth Development data collected when children were 6, 15, 36, and 54 months old and when they were in the first, third and fifth grade. The sample consists of children at 10 different geographic sites that were followed from birth to fifth grade. Comparisons in depressive symptoms, overall health and parenting quality were made between families where mothers were employed full time, part time, and not employed.

The findings of this study suggest that mothers employed part time exhibit fewer depressive symptoms during their children's preschool years and infancy and better self-reported health for most of the time points than those mothers who were not employed. In addition, across the time span considered in the analysis, mothers who worked part time reported less conflict between work and family than those who worked full time. During children's preschool years, mothers employed part time showed more sensitive parenting than mothers employed full time and not employed at all. During school age years, mothers employed part time were more involved in school and provided more learning opportunities to their children than did mothers employed full time.

Thomas and Ganster (1995) investigated the direct and indirect effects of family supportive organizational policies and practices on work-family conflict and the resulting psychological, physical and behavioral levels of strain. The sample comprises 398 health

professionals who had children 16 years of age or younger from 45 acute-care facilities in Nebraska. Family supportive policies included dependent-care services, information and referral services as well as flexible work schedule. Work-family conflict is measured by employees' self-reported measure that ranges from a scale of 1 to 5. The outcome variables include psychological, physiological, and behavioral indicators of strain. These indicators consisted of depression, job satisfaction, diastolic blood pressure and somatic complaints which were measured by employees' report of health symptoms including headaches, insomnia, and sweaty palms. In addition, absenteeism was measured by employees' report of number of days they were absent from work in the last 2 months, excluding vacation and personal leave. The result of this study shows that family supportive practices, especially flexible scheduling and supportive supervisors, had a direct positive effect on employees' perception of control over work, which in turn was associated with lower levels of work-family conflict, job dissatisfaction, depression, somatic complaints, and blood cholesterol level.

In light of these previous findings, this paper contributes to the economics literature by investigating if the effect of maternal employment on maternal mental and overall health differs by type of occupation which is used as a proxy for job quality. To the best of my knowledge, only one paper in the economics literature (Chatterji et al., 2012) specifically examined the effect of maternal employment on mothers' overall and mental health. In addition to adding extensive control variables, this study attempts to lessen possible bias arising from endogeneity of maternal employment using state level unemployment rate as an instrument.

4.3 Data

The data for this study comes from two sources: Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011) and the U.S. Bureau of Labor Statistics. The Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011) is a longitudinal data set consisting of 18,174 children whose parents participated in the fall 2010 and/or spring 2011 data collection sessions. This study is designed to follow children in the sample up to 5^{th} grade. When children were in kindergarten, first and second grade, data was collected in fall and spring of each academic year; but starting from spring 2013, data is collected only in the spring of each academic year. This study makes use of data from the spring 2011 wave where most children were in kindergarten and from spring 2014 wave where most children were in third grade. These two waves are selected for this study because information on mothers' psychological well-being was available only in these two waves. Currently, public use data file is available up to spring 2013 but I am able to include third grade cohort using restricted version which is available through a contract with the U.S. Department of Education. Using the restricted version has an added advantage since information on children's state of residence can be accessed. Data on state level unemployment rate is obtained from the U.S. Bureau of Labor Statistics website (U.S. Department of Labor, Bureau of Labor Statistics, 2017)

4.4 Empirical Model

4.4.1 Estimation Strategy

The econometric model that is used in this study is ivprobit using maximum likelihood estimation technique. This model is appropriate when the dependent variable is binary and the endogenous regressor is continuous. In this paper, we have two measures of maternal outcome

which are both binary. The first one is a measure for maternal overall health which takes a value of 1 if the mother's health is in good condition and 0 otherwise. The second outcome variable is an indicator for maternal psychological distress which takes on a value of 1 if the mother is psychologically distressed and 0 otherwise. The endogenous regressor is mothers' work hours in a typical week which is continuous. Mothers' work hours is treated as endogenous because mother's own health and psychological well-being also affects the number of hours the mother works. For instance, mothers with poor health are more likely to work less number of hours compared to healthy mothers. In addition, there might be some unobserved factors that affect mothers' overall health and psychological well-being that are also correlated with work hours. In order to reduce any bias arising from reverse causality and omitted variables, I use instrumental variables regression where state level unemployment rate is used as an instrument for mothers' work hours.

Local labor market conditions including state level unemployment rate are commonly used instruments for maternal employment in most previous studies (Gwozdz et al., 2013; Datar et al., 2014; Anderson et al., 2003). The reasoning behind using state level unemployment rate as an instrument for maternal employment is that adverse local labor market conditions might make it difficult for mothers to work more hours, which implies that mothers' work hours is highly correlated with local unemployment rate. However, local labor market conditions do not have a direct effect on mothers' overall health or psychological well-being. Therefore, it can be reasonably argued that state level unemployment rate serves as a good instrument for mothers' work hours.

Using the approach given by Wooldridge (2011), we can express the model as:

$$Y_1^* = Z_1 \delta_1 + \alpha_1 Y_2 + u_1 \qquad (1)$$

$$Y_2 = Z_1 \delta_{21} + Z_2 \delta_{22} + v_2 = Z\delta_{2+} v_2 \quad (2)$$

$$Y_1 = 1[Y_1^* > 0] \quad (3)$$

where (u_1, v_2) has a mean of zero, bivariate normal distribution and independent of Z. In this case, u_1 and v_2 are correlated which makes Y_2 an endogenous variable. Y_1^* is the latent variable and Y_1 represents the outcome of interest. In this case, we have two outcome variables which in the first case measures mothers' overall health which takes on a value of 1 if the mother is in good health and 0 otherwise. The second outcome variable is a measure for mothers' psychological distress which takes on a value of 1 if the mother is psychologically distressed and 0 otherwise. Y_2 is the key predictor and endogenous variable which captures maternal employment measured by mothers' weekly work hours. Z represents a set of independent variables including the instrument Z_2. We can then estimate Eq. *(1) -(3)* using maximum likelihood to obtain the joint distribution of (Y_1, Y_2) conditional on Z.

4.4.2 Description of Variables

There are two outcome variables used in this study. The first one is a binary dependent variable taking a value of 1 if the mothers' overall health is in good condition and 0 otherwise. The second outcome variable is also binary taking a value of 1 if the mother is psychologically distressed and 0 otherwise. Mothers' overall health is based on self-reported health measure where mothers rate their own health as 'excellent', 'very good', 'good', 'fair' and 'poor'. From this, a binary indicator variable was constructed that combined those that reported 'excellent', 'very good' and 'good' as generally having good health and those that reported 'fair' and 'poor' health as mothers with poor health. In order to account for mothers' level of psychological distress, an 11-item scale was used which consists of questions such as 'I felt sad', 'I couldn't shake the blues', 'I could not get going', 'my sleep was restless' that measure mothers' probable

mood and depressive symptoms in the past week. For each question there is a scale ranging from 1 to 4 where higher values represent the mother experienced the psychological episode at a higher frequency during the past week. The total score for all the 11 questions ranges from 11 to 44, a score of 22 and above is considered as suggestive of higher psychological distress. If a respondent receives a score of 22 and above, it gets a value of 1 for the dependent variable measuring psychological distressed and 0 otherwise.

The key indicator variable is maternal employment which is measured by the number of hours the mother works in a typical week. For the spring kindergarten cohort, information on hours worked was not available. Therefore, mothers' weekly hours of work from the fall kindergarten session was used as a proxy. Similarly, for the spring 2014 cohort, data on mothers' hours of work was not available, so weekly work hours from the spring 2013 data collection session was used as a proxy. The same holds for fathers' weekly work hours which is used as one of the control variables in the regression analysis. To account for mothers' type of occupation, four dummy variables were constructed from the available 21 lists of occupation. These are; managerial, professional: non-managerial, low supervisory and manual (manual is used as a reference category in the regression analysis.

The other control variables included in the analysis include: mother's age, number of household members less than 18 years of age, household level of income which is a categorical variable ranging from 1 to 18 where each category represents an increment of 5000 dollars. Other socio-economic status indicators including mothers' race, education level, and marital status are also included. Four racial categories are included; White, Black, Hispanic and other racial minorities. White is used as a reference category. Three categories for mothers' education;

high school, some college[11] and college degree[12] (where college degree is the reference group) are used for analysis. In addition, a binary indicator variable for marital status taking a value of 1 if the mother is single[13] and 0 otherwise is used. Based on the findings of Warfield (2001) that suggests that mothers of children with disability face extra burden if employed, an indicator variable taking a value of one if the child has disability and 0 otherwise is used. Similarly, an additional control variable taking a value of 1 if the child has poor health and 0 otherwise is included based on the same reasoning that mothers of children with poor health face extra burden and stress if they work for pay. An indicator variable taking a value of 1 if the mother reports having no child care prevents her from participating in her child's school activities, and 0 otherwise is another control variable included in the analysis based on the reasoning that having no child care puts an additional stress on the mother, which has a direct implication on her health and psychological well-being.

4.5 Results

4.5.1 Descriptive Statistics

Table 4.1 presents the summary statistics for the spring kindergarten cohort. On average, mothers work 22 hours per week. About 27% of the mothers in the sample have some college experience, 35% have a high school diploma or less, and about 37% have a college degree. Households on average earn 45,000 to 50,000 dollars per year. About 56 percent of the mothers in the sample are white, 11% are black, close to 22% are Hispanic and the remaining 10 percent belong to other racial minority groups. About 22% of the mothers in the sample are single. With

[11] Some college includes those with some college experience including associate's degree.
[12] College degree incudes those mothers that have a bachelor's degree or higher.
[13] Single refers to those mothers who do not have a partner or spouse living with them.

Table 4.1: Spring 2011 Kindergarten Cohort

Variable	Mean (SD)
Mother work hours	21.65(19.45)
Mom's age	34.06 (6.19)
Mom's education level	
Some college	0.27(0.45)
High school	0.35 (0.48)
Degree	0.37 (0.48)
Household members less than 18	2.54 (1.12)
Household Income	10.48 (5.62)
Race	
White	0.56 (0.50)
Black	0.11 (0.32)
Hispanic	0.22 (0.41)
Other	0.11 (0.31)
Type of Occupation	
Managerial	0.11 (0.31)
Professional	0.23 (0.42)
Low supervisory	0.60 (0.49)
Manual	0.06 (0.24)
Child has disability	0.20 (0.40)
Child in poor health	0.02 (0.15)
No child care	0.25 (0.43)
Single	0.22 (0.41)
Psychologically distressed	0.07 (0.26)
Mom in good health	0.90 (0.29)

regards to mothers' type of occupation, the majority belong to the low supervisory category (close to 60 percent) and about 23% have professional job. The least represented ones are those that are in managerial position and those that do manual work (11% and 6% respectively). About

20% of mothers reported that their child has disability and close to 25% indicated that having no child care prevents them from participating in their children's school activities. In terms of the outcome variables of interest, about 7% of the mothers are psychologically distressed and 90 percent report they are in good health condition.

The descriptive statistics results for spring third grade cohort are shown in Table 4.2. The results are by and large the same as those in the spring kindergarten cohort. Mothers in the third-grade cohort are older than the mothers in the spring kindergarten cohort (37 vs, 34) which is to be expected. Only 18 percent of mothers in the third-grade cohort reported that having no child care prevents them from participating in their children's school activities compared to 25% in the kindergarten cohort. This might be because as children get older, the need for child care starts to diminish.

4.5.2 Regression Results

Table 4.3 shows the baseline regression results for the spring kindergarten cohort. The full sample is used in this regression analysis which shows the effect of mothers' work hours on mothers' psychological distress and overall health along with other control variables. It can be seen from Table 4.3 that the effect of mothers' work hours on both psychological and overall health is not significant. A mother with child that has disability is 13.6 percentage points more likely to be psychologically distressed compared to a mother whose child does not have disability. This result is consistent with the finding of Warfield (2001) that mothers of children with disabilities are more stressed because of the extra burden of meeting the special needs of these children. Single mothers are 35.6 percentage points more likely to be psychologically distressed compared to married mothers or mothers that have partners living with them. This result is expected given the role strain single mothers face compared to married mothers. In

addition, if a mother has a child with poor health, the probability of her becoming psychologically distressed goes up by 56 percentage points.

Table 4.2: Spring 2014 Third-grade Cohort

Variable	Mean (SD)
Mother work hours	24.53 (19.30)
Mom's age	37.46 (6.13)
Mom's education level	
Some college	0.25 (0.44)
High school	0.38 (0.49)
Degree	0.37 (0.48)
Household members less than 18	2.59 (1.11)
Household Income	11.25 (5.53)
Race	
White	0.55 (0.50)
Black	0.10 (0.30)
Hispanic	0.25 (0.43)
Other	0.10 (0.30)
Type of Occupation	
Managerial	0.11 (0.32)
Professional	0.25 (0.43)
Low supervisory	0.58 (0.49)
Manual	0.06 (0.24)
Child has disability	0.15 (0.36)
Child in poor health	0.02 (0.15)
No child care	0.18 (0.38)
Single	0.22 (0.41)
Psychologically distressed	0.06 (0.24)
Mom in good health	0.90 (0.30)

Table 4.3: Baseline Regression for Spring Kindergarten Cohort (Full Sample)

Variables	Psychological Distress (1)	Overall Health (2)
Mother work hours	-0.025 (0.019)	-0.011 (0.022)
Household members <18	-0.065 (0.057)	-0.026 (0.064)
Household ncome	-0.023 (0.022)	0.060*** (0.011)
Mom's age	-0.002 (0.004)	-0.007* (0.004)
Black	0.172 (0.106)	-0.051 (0.135)
Hispanic	0.027 (0.057)	-0.215*** (0.063)
Other	0.033 (0.076)	-0.189** (0.076)
Child has disability	0.136** (0.067)	-0.226*** (0.047)
No child care	0.077 (0.138)	-0.144 (0.111)
Single	0.356*** (0.084)	0.045 (0.137)
High School	0.032 (0.107)	-0.393*** (0.077)
Some College	0.029 (0.073)	-0.287*** (0.063)
Child in poor health	0.559*** (0.157)	-0.926*** (0.132)

Note: The estimates represent marginal effects. Robust Standard errors are in parentheses. N=8594 for model (1) and N=8606 for model (2). * represents 10% significance level, ** and *** represent 5% and 1% significance level respectively.

Column 2 of Table 4.3 shows the regression results when mothers' overall health is the outcome variable. For each additional 5000 dollars earned by the family, the mother is 6 percentage points more likely to be in good health condition. Older mothers are less likely to be in good health condition compared to younger mothers which is not a surprising result as health tends to depreciate with age. Hispanic mothers and mothers of other racial minorities are less likely to be in good health condition compared to white mothers. Mothers with a high school diploma and those with some college experience are less likely to be in good health compared to mothers with a college degree. This might be because better educated mothers are more health

conscious than less educated ones or it can also be because more educated mothers are likely to earn higher income which gives them access to a healthy lifestyle.

For a mother with a child that has disability, the probability of being in good health decreases by 22.6 percentage points compared to a mother with a child that does not have disability, and this is significant at 1% significance level. Mothers with children that have poor health are less likely to be in good health. This might be due to additional pressure and stress such mothers go through. The first stage regression results are shown in Appendix F. The result shows that an increase in state level unemployment rate leads to a reduction in mothers' weekly work hours which is in line with the initial argument that unfavorable local labor market conditions have a negative impact on mothers' employment. This result is significant at 1% significant level which shows that the instrument is a good predictor of the endogenous variable.

Table 4.4 presents the regression estimates for the effect of mothers' weekly work hours on mothers' well-being by type of occupation. When job characteristics are of interest, it makes more sense to limit the sample to those mothers who are employed. Therefore, the results of Table 4.4 are limited to the sample of mothers who reported positive work hours. The effect of mothers' work hours on mothers' psychological distress does not differ by type of occupation as none of the interaction terms for type of occupation are significant.

Column 2 of Table 4.4 shows that mothers who are in managerial, professional and low supervisory jobs have a higher probability of being in good health for each additional hour worked per week compared to mothers in manual job. Specifically, mothers in managerial job are about 34 percentage points more likely to be in good health condition compared to mothers in manual job. Similarly, mothers in professional and low supervisory jobs are 34 percentage points and 33.5 percentage points more likely to be in good health condition compared to mothers in

manual jobs respectively; and these effects are significant at 1% significance level. This supports the findings of Thomas and Ganster (1995) that the effect of maternal employment on mothers' well-being differs by quality of job; those mothers with favorable job environment report better psychological and physical health compared to mothers with unfavorable work environment. In addition, single mothers have higher probability of being in good health for each additional hour

Table 4.4: Regression Results by Type of Occupation for Spring Kindergarten Cohort

Variables	**Psychological Distress (1)**	**Overall Health (2)**
Mother work hours	-0.309 (0.268)	-0.352*** (0.084)
Managerial* work hours	0.308 (0.252)	0.339*** (0.085)
Professional*work hours	0.303 (0.259)	0.339*** (0.086)
Lowsupervi* work hours	0.300 (0.251)	0.335*** (0.082)
Single* work hours	0.008 (0.014)	0.015** (0.006)
Black* work hours	0.027 (0.042)	0.031 (0.022)
Hispanic* work hours	0.036 (0.036)	0.041*** (0.014)
Other* work hours	0.020 (0.035)	0.026** (0.010)
Household members <18	-0.010 (0.024)	-0.002 (0.024)
Household Income	-0.032 (0.055)	0.030 (0.026)
Mom's age	-0.002 (0.004)	-0.002 (0.003)
Child has disability	0.117 (0.205)	-0.113 (0.105)
No child care	0.166 (0.308)	-0.079 (0.060)
High School	0.027 (0.116)	-0.051 (0.133)
Some College	0.095 (0.080)	0.012 (0.103)
Child in poor health	0.587 (0.856)	-0.430 (0.451)

Note: The estimates represent marginal effects. Robust Standard errors are in parentheses. N=5406 for model (1) and N=5412 for model (2). * represents 10% significance level, ** and *** represent 5% and 1% significance level respectively.

worked compared to married women or women living with their partners. Hispanic mothers and mothers of other racial minorities are more likely to be in good health condition for each additional hour worked compared to white mothers.

Table 4.5 shows the baseline regression for the full sample for spring third grade cohort. Column 1 shows that the effect of mothers' weekly work hours on mothers' psychological distress is not significant when the full sample is considered. Hispanic and mothers of other racial minorities are less likely to be psychologically distressed compared to white women. Similar to the findings of the spring kindergarten cohort, mothers with children that have disability are more likely to be psychologically distressed compared to mothers who do not have children with disabilities. Single mothers are more psychologically distressed compared to married mothers or mothers with partners. A mother with a child that has poor health is 39 percentage points more likely to be psychologically distressed compared to a mother with a healthy child. In addition, mothers with a high school diploma and those with some college experience are more likely to be psychologically distressed compared to mothers with a college degree.

Column 2 of Table 4.5 shows the baseline regression when mothers' overall health is the dependent variable. For each additional hour the mother works per week, the probability of her being in good health goes up by about 4 percentage points and this is statistically significant at 1% significance level. This result is contrary to the findings of Chatterji et al. (2012) that work hours are associated with a reduction in mothers' self-reported health. This finding is more in line with the 'role accumulation' theory explained by Arber et al. (1985) which suggests that mothers who work have access to extended social network and better financial resource which contributes positively towards their health and well-being. As the number of household members

younger than 18 years of age increases, the probability that the mother is in good health goes down by 12.7 percentage points. This might be due to additional stress faced by the mother in taking care of these children. For each additional 5000 dollars the family earns, the probability that the mother is in good health goes up by 7 percentage points. This result is expected given that households with higher income are more likely to afford healthy lifestyle.

Table 4.5: Baseline Regression for Spring Third-grade Cohort (Full Sample)

Variable	Psychological Distress (1)	Overall Health (2)
Mother work hours	-0.014 (0.025)	0.037*** (0.011)
Householdmembers<18	0.012 (0.079)	-0.127*** (0.030)
Household Income	-0.018 (0.025)	0.072*** (0.005)
Mom's age	-0.001 (0.006)	-0.012*** (0.003)
Black	0.138 (0.150)	0.140 (0.093)
Hispanic	-0.208*** (0.080)	-0.108* (0.060)
Other	-0.202** (0.092)	-0.089 (0.067)
Child has disability	0.192** (0.085)	-0.216*** (0.051)
No child care	0.234 (0.182)	-0.182** (0.077)
Single	0.326* (0.190)	0.275*** (0.104)
Child in poor health	0.392*** (0.145)	-0.876*** (0.200)
Some College	0.222** (0.087)	-0.221*** (0.061)
High School	0.224* (0.120)	-0.303*** (0.058)

Note: The estimates represent marginal effects. Robust Standard errors are in parentheses. N=7740 for model (1) and N=7816 for model (2). * represents 10% significance level, ** and *** represent 5% and 1% significance level respectively.

Older mothers are less likely to be in good health condition which is similar to the findings from the kindergarten cohort. Consistent with the findings of the spring kindergarten

cohort, Hispanic mothers are less likely to be in good health compared to white mothers and mothers with children that have disabilities are less likely to be in good health compared to mothers who do not have children with disabilities. Having no child care reduces the probability that the mother is in good health by 18 percentage points. This result is not surprising given that mothers who do not have help with child care are more likely to be overwhelmed and stressed which has a negative implication on their health. Similar to the findings from the kindergarten cohort, mothers with children that have poor health and less educated mothers are less likely to be in good health condition.

A rather unexpected result is that single mothers have a higher probability of being in good health compared to married mothers or mothers that have partners living with them. The first stage regression results are shown in Appendix E. State level unemployment rate is negatively related to mothers' work hours, which is consistent with the initial expectation. This result is significant at 1% significance level which indicates that the instrument is a strong predictor of the endogenous variable.

Table 4.6 gives the regression results for the effect of mothers' work hours on mothers' psychological and overall health by type of occupation for the spring third-grade cohort. Those mothers in managerial, professional, and low supervisory jobs are more psychologically distressed than those in manual job. This is contrary to the findings of Cooklin et al. (2010) that mothers who have access to favorable employment condition are less psychologically distressed compared to those mothers with limited access to favorable condition or those with poor quality jobs. One possible explanation for this might be that those mothers with highly skilled professional and managerial jobs have more responsibility and accountability associated with their position which might add to their stress level. Single mothers are 1 percentage point more

likely to be psychologically distressed compared to married mothers for each additional hour worked. Black, Hispanic and mothers of other racial minorities are more likely to be psychologically distressed compared to white mothers for each additional hour worked. In addition, less educated mothers are more likely to be psychologically distressed compared to more educated mothers.

Table 4.6: Regression Results by Type of Occupation for Spring Third-grade Cohort

Variable	**Psychological Distress (1)**	**Overall Health (2)**
Mother work hours	0.413*** (0.025)	-0.408*** (0.072)
Managerial* work hours	0.406*** (0.025)	0.400*** (0.072)
Professional* work hours	0.406*** (0.025)	0.396*** (0.086)
Lowsupervi* work hours	0.394*** (0.026)	0.386*** (0.079)
Single* work hours	0.012** (0.005)	0.014* (0.008)
Black* work hours	0.023*** (0.007)	0.021** (0.008)
Hispanic* work hours	0.054*** (0.008)	0.055*** (0.008)
Other* work hours	0.029*** (0.006)	0.028*** (0.007)
Household members <18	0.008 (0.024)	-0.003 (0.029)
Household Income	0.005 (0.013)	0.018 (0.040)
Mom's age	0.000 (0.003)	-0.002 (0.006)
Child has disability	-0.047 (0.101)	-0.110 (0.173)
No child care	-0.036 (0.148)	-0.093 (0.109)
Child in poor health	0.005 (0.179)	-0.295 (1.060)
Some College	0.117* (0.064)	0.050 (0.231)
High School	0.161* (0.090)	0.086 (0.249)

Note: The estimates represent marginal effects. Robust Standard errors are in parentheses. N=5457 for model (1) and N=5510 for model (2). * represents 10% significance level, ** and *** represent 5% and 1% significance level respectively.

Column 2 of Table 4.6 shows that mothers in professional, managerial and low supervisory jobs are about 39 to 40 percentage points more likely to be in good health compared to those mothers in manual jobs for each additional hour worked per week. This finding is consistent with the results from Thomas and Ganster (1995) as well as the spring kindergarten cohort which is in line with the explanation that mothers with better quality jobs are more likely to be in good health compared to those with unfavorable work environment. In addition, similar to the findings from Table 4.4, black mothers, Hispanic mothers and mothers of other racial minorities are more likely to be in good health compared to white mothers for each additional hour worked per week. Single mothers are 1 percentage point more likely to be in good health compared to married mother for each additional hour the mother works.

Table 4.7 gives a comparison of mean values across cohorts. On average, mothers in spring third-grade cohort work more hours per week compared to those in spring kindergarten cohort (24.5 vs, 21.6) and this difference is statistically significant at 1% significance level. The percentage of mothers that are psychologically distressed is greater in the spring kindergarten cohort compared to the spring third-grade cohort (7% vs, 6%) and this difference is statistically significant. There is no significant difference in the average number of mothers that are in good health in both cohorts. On average, about 90% of the mothers in both cohorts reported to be in good health. On average, mothers in the spring third-grade cohort are older than mothers in the spring kindergarten-cohort which is expected given that the same mothers are being surveyed in both years for the most part. About 25% of the mothers in the spring kindergarten cohort report that having no child care prevents them from participating in their children's school activities as opposed to only 18% in the spring third grade cohort, and this difference is statistically significant at 1% significance level.

Table 4.7: Comparison of Mean Value by Cohort

Variables	Spring Third-grade	Spring Kindergarten	Difference	Significance
Mother work hours	24.525	21.647	2.878	***
Psychologically distressed	0.064	0.072	-0.009	**
Mom in good health	0.899	0.904	-0.005	
Household members<18	2.587	2.542	0.045	***
Household Income	11.249	10.479	0.770	***
Mom's age	37.457	34.064	3.393	***
White Mom	0.554	0.564	-0.001	
Black Mom	0.099	0.112	-0.013	***
Hispanic Mom	0.246	0.218	0.028	***
Other Mom	0.101	0.106	-0.005	
Managerial	0.115	0.111	0.004	
Professional	0.245	0.232	0.013	*
Low Supervisory	0.581	0.595	-0.014	*
Manual	0.059	0.062	-0.002	
Child has disability	0.151	0.203	-0.052	***
No child care	0.179	0.250	-0.070	***
Single	0.216	0.221	-0.005	
Child in poor health	0.023	0.023	0.000	
Some College	0.254	0.273	-0.019	***
High School	0.380	0.353	0.027	***
Degree	0.366	0.374	-0.008	

Note: * represents 10% significance level, ** and *** represent 5% and 1% significance level respectively. Significance refers to the significance of the difference in mean value between the spring third grade and spring kindergarten cohort.

4.6 Conclusion

This paper intends to examine the effect of maternal employment on mothers' psychological distress and overall health. In addition, this study investigates if the effect of maternal employment on mothers' psychological distress and overall health differs by type of occupation which is used as a proxy for job quality. The results show that the effect of mothers' work hours on maternal psychological distress and overall health is not significant for the kindergarten cohort when the full sample is considered. When the sample is restricted to those mothers who report positive work hours, those mothers in managerial, professional and low supervisory jobs are more likely to be in good health condition compared to those in manual jobs for each additional hour worked. However, this effect is not significant when maternal psychological distress is the dependent variable.

For the spring third grade cohort, the effect of maternal weekly work hours on mothers' overall health is positive and significant highlighting the beneficial effects of maternal employment on mothers' well-being. This finding is more in line with the 'role accumulation' theory which explains the benefit of maternal employment stemming from extended social network and increased financial resource. Considering the full sample, the effect of maternal employment on mothers' psychological distress is not significant which is similar to the findings from the spring kindergarten cohort. When the analysis is limited to those mothers who work, mothers in managerial, professional and low supervisory jobs have higher probability of being psychologically distressed compared to those in manual jobs. This finding is contrary to the findings of some previous studies (Cooklin et al., 2010; Goodman and Crouter, 2009) which suggest that mothers in favorable work environment are less likely to be psychologically distressed compared to those with low quality jobs. One possible explanation for this finding is

that the responsibility and accountability attached with these positions might put more strain on the mothers which leads to stress and depression. When considering the effect on mothers' overall health, those mothers with managerial, professional and low supervisory jobs are more likely to be in good health compared to those in manual jobs. It is important to note that, the psychological distress measure in this study refers to respondents' experience in the past week which makes it a short-run phenomenon, but it is reasonable to assume that if psychological distress persists it might affect physical health in the long-run.

There is evidence that mothers of children with disabilities and poor health are more likely to be psychologically distressed and less likely to be in good health condition probably due to the extra burden these mothers face in taking care of children with special needs. In addition, the finding of this paper suggests that mothers with lower level of education are more likely to be psychologically distressed and less likely to be in good health condition.

This study has some limitations related to data availability. It is reasonable to assume that maternal pre-existing mental and physical health has a considerable effect on mothers' current well-being, but it was not possible to do such analysis because data on mothers' pre-existing medical condition is not available in the survey. In addition, some incidents within a family like the death of family member or close relative might have a significant impact on mothers' current psychological well-being, but it was not possible to include these factors as additional covariates because such information is not available in the data. Nevertheless, based on the findings that mothers with better quality jobs are more likely to be in good health condition but also more likely to be psychologically distressed, public policy should be directed towards ensuring equitable distribution of favorable working environment across occupations.

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Appendix A

Detailed Description of Variables for Chapter 2

Detailed Description of Variables for Chapter 2

Variables
Maternal employment: 1= if mother is employed ; 0= if mother is not employed
Days child does exercise: The number of days in a typical week the child does exercise that causes rapid breathing for 20 minutes or more
Watch TV: dummy variable where 1= if the child watches TV for an hour or more during a typical weekday and 0=otherwise
Play video games: dummy variable where 1= if the child plays video game for an hour or more during a typical weekday and 0=otherwise
Days eat dinner together: the number of days the family eats dinner together in a typical week
Mom's age at first birth: Biological mother's age at first birth
Child age : child's age in months
Child sex: dummy variable where 1=female , 0= male
Number of siblings: focal child's number of siblings
Socio-economic status: categorical variable where middle tertile is the reference group Lowest tertile (1=if in lowest tertile; 0=otherwise) Middle tertile (1= if in middle tertile; 0=otherwise) Upper tertile (1=if in upper tertile; 0= otherwise)
Child race Black Hispanic Other (other racial minorities including Asians, people of mixed race, native Hawaiian or Pacific islander) White (reference group)
Child had high birth weight (dummy where 1=yes, 0= no)
Single: indicator for marital status where 1=if mother is single and 0 if mother is married
Child care pre-kindergarten Center-based Care Informal Care Parental care (reference group)
Current child care use (before and-after school care) Center-based Care Informal Care No before-and-after school care in formal or informal setting (reference group)
Physical Education in school: dummy variable taking a value of 1 if the child attends school that gives physical education class where children exercise for half an hour or more in the days this course is given; and 0 otherwise
Free/reduced price meal: dummy variable taking a value of 1 if child attends school where 75 percent or more of the children are eligible for free/reduced price meal; and 0 otherwise.

Appendix B

Regression Estimates for the Association Between Maternal Employment and Child Activities

Regression Estimates for the Association Between Maternal Employment and Child Activities

	TV watching (2)	Playing video game (2)	Child exercise (3)
Mother employed	-0.080 (0.303)	0.724 (0.435)	-0.039 (0.426)
Center-based care pre-kindergarten	0.008 (0.030)	-0.056 (0.044)	-0.032 (0.036)
Informal care pre-kindergarten	0.042 (0.057)	-0.132 (0.086)	-0.106 (0.079)
Female	0.000 (0.023)	-0.137*** (0.033)	-
Child age	-0.002 (0.003)	0.002 (0.004)	0.000 (0.003)
Days eat dinner together	-0.003 (0.009)	0.007 (0.013)	0.018 (0.012)
Black	0.058 (0.037)	0.104 (0.060)	-0.086 (0.056)
Hispanic	-0.014 (0.037)	0.105** (0.053)	-0.050 (0.050)
Other	-0.080 (0.045)	0.065 (0.060)	-0.081 (0.052)
Informal (current)	0.071 (0.110)	-0.193 (0.158)	0.039 (0.162)
Center-based Care (current)	-0.027 (0.080)	-0.278** (0.117)	0.053 (0.115)
Single	-0.023 (0.028)	-0.039 (0.043)	-0.008 (0.039)
Mom's age at first birth	-0.004 (0.003)	-0.009** (0.004)	0.000 (0.003)
Child had high birth weight	0.031 (0.050)	0.015 (0.070)	0.019 (0.059)
Lowest tertile	-0.003 (0.042)	0.092 (0.064)	-0.095 (0.059)
Highest tertile	-0.141*** (0.032)	-0.025 (0.041)	0.031 (0.032)
Physical Education in school	0.010 (0.034)	-0.052 (0.047)	0.026 (0.043)
Free/reduced price meal	0.024 (0.027)	0.054 (0.044)	0.025 (0.039)
Number of siblings	-0.009 (0.015)	0.005 (0.019)	0.017 (0.018)
N	1429	1429	1399

Note: Robust standard errors are in parentheses. (1) and (2) represent coefficient estimates from 2SLS regression where the probability the child watches TV and plays video game for an hour or more during weekday are the dependent variables respectively. (3) represents coefficient estimates from additive log-linear IV poisson regression. ** and *** represent 5% and 1% significance level respectively.

Appendix C

Detailed Description of Variables for Chapter 3

Detailed Description of Variables for Chapter 3

Variables
Maternal employment: 1= if mother is employed ; 0= if mother is not employed
Teacher's years of experience
Has any family member visited library with child in the past month: dummy variable where 1=yes, 0=no
Small class: dummy for class size taking a value of 1 if class size is less than 20
Number of siblings
Mother's age
Child's age: child's age in months
Sex: dummy variable where 1=female , 0= male
Mother's education: categorical variable for high school, some college and degree (reference group= degree)
Child race Black Hispanic Other(other racial minorities including Asians, people of mixed race, native Hawaiian or Pacific islander) White (reference group)
Child has disability(dummy where 1=yes,0= no)
Child had low birth weight (dummy where 1=yes, 0= no)
Child from low income family (dummy where 1=yes, 0=no)
Child care: Pre-kindergarten Center-based Care Informal Care Parental care (reference group)
Number of minutes child reads outside of school
Single: indicator for marital status where 1=if mother is single and 0 if mother is married
Current child care use (before and-after school care) Center-based Care Informal Care No before-and-after school care in formal or informal setting (reference group)
Computers with internet access: number of computers with internet access in class
English as primary language: dummy variable taking a value of 1 if English is the primary language used at home
Child attends public school: dummy variable taking a value of 1 if child attends public school and 0 of private school

Appendix D

First Stage Results from 2SLS Regression

First Stage Results from 2SLS Regression

Outcome Variable: Mother employed	Table 3.2 (1)	Table 3.2 (2)	Table 3.3 (1)	Table 3.3 (2)	Table 3.4 (1)	Table 3.4 (2)
Youngest Sibling Eligibile	0.062*** (0.023)	0.060** (0.025)	0.061*** (0.023)	0.059** (0.025)	0.062*** (0.023)	0.060** (0.025)
F statistic	29.52	25.86	29.51	25.84	29.55	25.88

Note: (1) and (2) above refer to column (1) and column (2) from Tables 3.2, 3.3, and 3.4.

Appendix E

First Stage Regression Result for Spring Third-grade Cohort

First Stage Regression Result for Spring Third-grade Cohort

Dependent Variable: Mother's Weekly Work Hours

Variables	**Psychological Distress**	**Overall Health**
Household members<18	-2.873*** (0.200)	-2.892*** (0.199)
Household Income	0.829*** (0.056)	0.832*** (0.056)
Mom's age	-0.148*** (0.038)	-0.144*** (0.038)
Black Mom	5.756*** (0.754)	5.623*** (0.749)
Hispanic Mom	1.190** (0.585)	1.198** (0.581)
Other Mom	0.258 (0.733)	0.271 (0.727)
Child has disability	-1.605*** (0.600)	-1.675*** (0.597)
No child care	-5.344*** (0.558)	-5.373*** (0.554)
Single	8.289*** (0.582)	8.292*** (.578)
Child in poor health	-1.250 (1.472)	-1.247 (1.479)
Some College	-1.095* (0.565)	-1.088* (0.562)
High School	-2.743*** (0.615)	-2.705*** (0.611)
Unemployment Rate	-0.649*** (0.149)	-0.659*** (0.148)
Constant	33.117 (2.103)	33.063 (2.081)

Note: Robust Standard errors are in parentheses. N=7740 for model (1) and N=7816 for model (2). * represents 10% significance level, ** and *** represent 5% and 1% significance level respectively.

Appendix F

First Stage Regression Result for Spring Kindergarten Cohort

First Stage Regression Result for Spring Kindergarten Cohort

Dependent Variable: Mother's Weekly Work Hours

Variables	**Psychological Distress**	**Overall Health**
Household members<18	-2.835*** (0.184)	-2.831*** (0.184)
Household Income	0.681*** (0.051)	0.682*** (0.051)
Mom's age	-0.061* (0.036)	-0.063* (0.036)
Black Mom	5.138*** (0.726)	5.129*** (0.723)
Hispanic Mom	1.071* (0.586)	1.088* (0.586)
Other Mom	-0.105 (0.775)	-0.098 (0.775)
Child has disability	-0.946* (0.495)	-0.984** (0.494)
No child care	-4.829*** (0.468)	-4.880*** (0.467)
Single	5.767*** (0.574)	5.794*** (0.574)
High School	-3.551*** (0.594)	-3.577*** (0.593)
Some College	-1.653*** (0.545)	-1.660*** (0.544)
Child in poor health	0.199 (1.444)	0.222 (1.444)
Unemployment Rate	-0.498*** (0.116)	-0.497*** (0.116)
Constant	29.207 (1.805)	29.272 (1.802)

Note: Robust Standard errors are in parentheses. N=8594 for model (1) and N=8606 for model (2). * represents 10% significance level, ** and *** represent 5% and 1% significance level respectively.