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Connecting the Dots: An Economic Study of Parental Factors Shaping Early Childhood Cognitive Development

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CONNECTING THE DOTS:

AN ECONOMIC STUDY OF PARENTAL FACTORS SHAPING EARLY CHILDHOOD COGNITIVE DEVELOPMENT

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INTRODUCTION

Societies wonder why some toddlers are better than others in their ability to reason, solve problems and think consciously. What makes it possible for one three year old to solve a puzzle whereas another is unaware that a puzzle even needs to be solved? The relevancies of nature versus nurture, parental work-leisure characteristics, and parenting styles comprise, among others, significant factors of inquiry in research (Blau (1999), Bernal and Keane (2009), Cabrera et al (2011) Lindsay et al (2003), Schady (2011) and Verropoulou and Joshi (2007)) on the topic today. Every parent knows it takes time, money, patience and focused attention to raise a child who can meet his or her intellectual potential. Yet parents have other time obligations that include working, doing chores, and fulfilling their individual needs for personal time. Finding the appropriate balance in how a parent's time is allocated to meet these time-conflicting goals is a long standing quandary in American society.

This national dilemma becomes more complex, however, as women leave their traditional roles as homemakers and become more prevalent participants in the labor force. Additionally, the role of fathers in childrearing has also shifted from serving as the traditional breadwinner to being more actively engaged in parenting, as more mothers have entered the workforce. Equating time with money through the concept of opportunity cost, one recognizes time spent raising a child is time that could have been used earning income needed to support a child. It is estimated that in 2013 the cost of raising a child through age 18 is $241,080.[1] This stark statistic highlights the

[1] Years, It Will Cost an Estimated $241,080 for a Middle-income Couple to Raise a Child Born Last Year for 18. "Average Cost to Raise a Kid: $241,080." *CNNMoney*. Cable News Network, 14 Aug. 2013. Web. 16 Oct. 2013.

disconcerting trade-off between how much time to spend raising a child and how much time to work to provide for a child while attaining personal parental goals. Today's calls for work-family balance emanate from both mothers and fathers, although they appear more emphatic from working mothers since their strides in the labor force have outstripped the retractions in the workforce by fathers.

This study investigates how maternal and paternal employment status and educational attainment, coupled with parental time and educational inputs such as toys, books, etc. devoted to children, have impacted young children's cognitive development in the U.S. Cognitive development comprises the intellectual and conscious thinking growth that begins in infancy. [2] It involves problem solving, reasoning and memory aptitudes and is tested for throughout each year of childhood in various ways. The impact of the use of external childcare in lieu of parental time on development is also evaluated. This paper will outline reviewed literature, a theoretical model, data discussion, model construction and verification, results, and conclusive findings of the research.

[2] "Cognitive." *Merriam-Webster*. Merriam-Webster, n.d. Web. 30 Nov. 2013.

BACKGROUND

Generating income for households has increasingly become a dual parent reality as shown by the trend of greater numbers of mothers participating in the labor force. The US Department of Labor reports that the number of dual-income households increased by 31%, from 25.5 to 33.4 million families from 1996 to 2006. [3] As shown in **Figure 1**, dual income earning couples is a trend that has been on the rise for decades now, demonstrating how this growth in both spouses working will shape new family dynamics. Since World War II, women increasingly joined the labor force. In 1950, the labor force participation rate of women was approximately 34%, rising to nearly 52% by 1980, and reaching almost 60% by 2010. The Bureau of Labor forecasts the women's labor force participation rate between 2020 and 2050 will remain between 58% and 60%, as seen in **Figure 2**.[4]

[3] "Women's Bureau (WB) - Employment Status for Women and Men in 2007." *Women's Bureau (WB) - Employment Status for Women and Men in 2007.* United States Department of Labor, Nov. 2007. Web. 08 Oct. 2013.

[4] "Changes in Men's and Women's Labor Force Participation Rates : The Editor's Desk : U.S. Bureau of Labor Statistics." *Changes in Men's and Women's Labor Force Participation Rates : The Editor's Desk : U.S. Bureau of Labor Statistics.* N.p., 10 Jan. 2007. Web. 09 Oct. 2013.

Figure 1

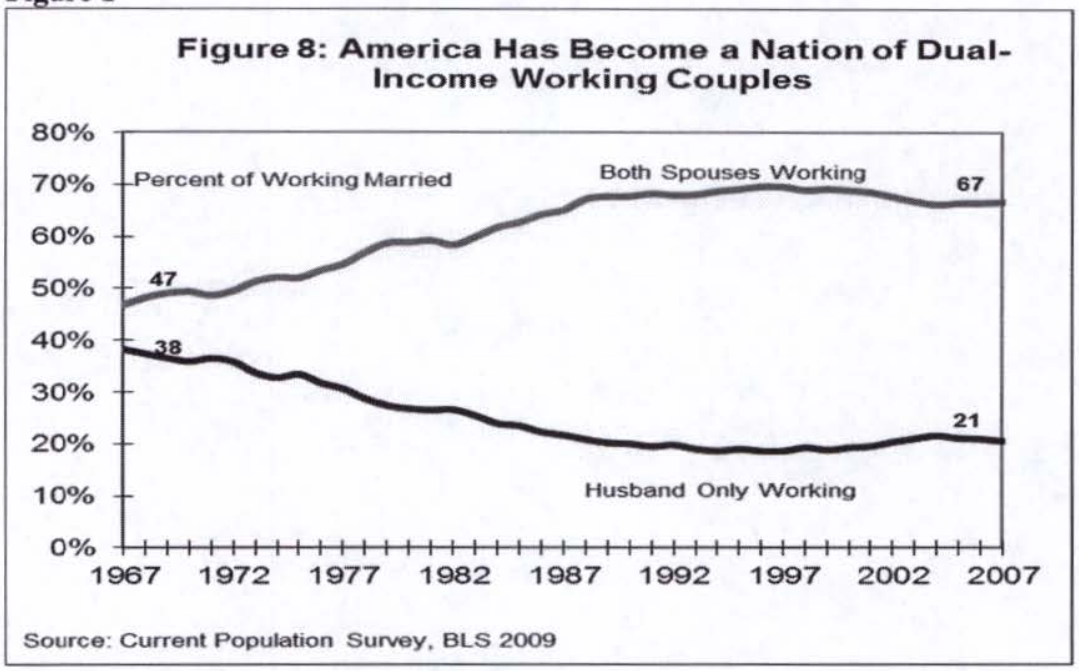
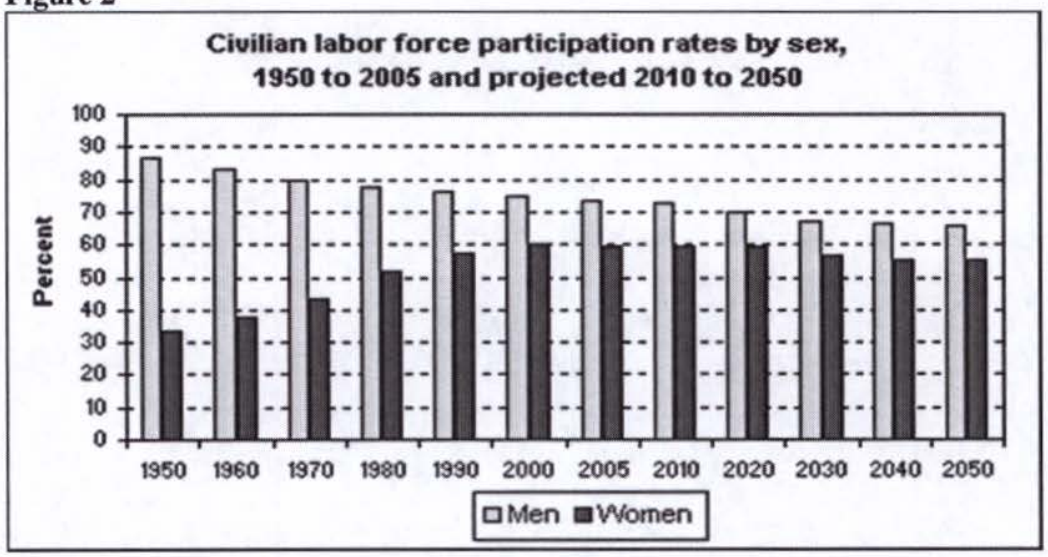


Figure 2



One key reason for the increase of women in the labor force derives from the increased educational attainment of women. With women earning proportionally more high school and college degrees than men now, compared to years past, their

occupational opportunities have grown significantly throughout the past 40 years. A 2012 Census report detailed that 35% were women aged 25 to 34 attained a bachelor's degree or higher compared to 27% of similarly aged men.[5]

As more mothers seek education and employment, how are their parenting styles and income changes affecting their children's cognitive development? Similarly, how has the changing role of the father influenced child development? Understanding how optimal cognitive development of children arises relative to parental choices can potentially help families do what is best for their children and provide parents greater direction in raising the next generation of children. Furthermore, understanding how parental income and education affect children's cognition can give insight to policymaker's decisions. Should policymakers support a parent staying home to raise a child or advocate day care? How will initiatives aimed at increasing family income impact child development? Such questions illuminate how this issue affects future generations, economic policies, and family life nationally.

A 2013 *New York Times* article, children's cognitive development before kindergarten represents a high determinant of future adult cognitive outcomes and achievement. Additionally, the article detailed that greater cognitive development in preschool years yields better adult behavioral traits as well, specifically in sociability, motivation and self-esteem. With a national focus on higher education, such findings highlight alternative educational institutions in which to concentrate:

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[5] United States. US Department of Commerce. US Census Bureau. N.p.: n.p., 2012. Web. <census.gov>.
Educational Attainment by Gender

early education. A 2008 study cited in the article found that federal and state governments spent more than $10,000 on average per child from kindergarten through high school graduation. However, three to five year olds received less than $5,000 per child and a child younger than three only gained $300 toward their education. Understanding the influencing factors of child cognition and its later-in-life implications can give policy maker's insights for better informed decisions. [6]

LITERATURE REVIEW

Although nature plays a deterministic role in cognitive development, the nurture factors on previous researchers focused underpin this study. Psychologists have developed several tests to measure cognitive ability in toddlers ranging from age two to five. Linking these assessments with reported parental characteristics enable an analysis of the predictors of formative child development. Blau (1999) examines how parental income impacts children's cognitive, social and behavioral developments. Using the National Longitudinal Study of Youth (NLSY) from the 1979 cohort, Blau employs the Peabody Individual Achievement Tests (PIAT) in Mathematics and Reading Recognition for children aged 5 and older to measure cognitive ability in mathematics and reading. The Peabody Picture Vocabulary Test (PPVT) for children aged 3 and older measures verbal intelligence and scholastic aptitude. Blau also tests short-term memory based on responses to interviewer

[6] Porter, Eduardo. "Investments in Education May Be Misdirected." *The New York Times*. N.p., 2 Apr. 2013. Web. 1 Dec. 2013.

questions for children aged 3 to 6. These assessments comprise his dependent variables.

Blau tests the direct impact of family income on the various cognitive scores and finds a small, but statistically significant positive impact on all measures. He finds a $10,000 increase in total family income (in 1979 dollars) increases the assessment measures by 6.9% to 26.2% of a standard deviation of the respective outcomes. By adding core parental traits, such as mother and father's educational attainment, race, and mother's birthplace, all the income effects remain significant but with half the magnitude. Adding a measure of the mother's IQ further reduces the income effects by 46%, on average, across the board. Lastly, incorporating family structure, such as number of siblings, grandparent connections, etc. along with the aforementioned independent variables, Blau's most extensive models shows another 35% decrease in the income effects. Ultimately, the income effect is materially small, whereas the mother's IQ, family background, parental education and household structure impact cognitive development more greatly. Bernal and Keane (2009) also find positive, yet notably small, family income effects on cognitive scores of 4 to 6 year olds, namely a doubling of family income leads to a 1.3% increase in a PIAT score.

Blau creates another dependent variable, HOME, which denotes the quality and frequency of home environment conditions that enhance child development. These various inputs span time intensive activities, such as visiting museums, learning the alphabet, hugging, spanking, etc. and goods inputs such as the number of toys, records, books, etc. available to the child. The HOME measure derives from specific interview questions and home environment observations surrounding mother-child

relations. If these inputs are positively associated with income and the inputs increase cognitive development, then a secondary impact of income on child development occurs. In Blau's most extensive model, a $10,000 increase in total income is expected to increase HOME by 17% of a standard deviation in HOME. This signifies income does not greatly increase home inputs, relegating their effects on cognition to be small. Despite the innovation to create an index of inputs that impact cognitive development, the inclusion of both time intensive activities and goods inputs diminishes its usefulness. Economists prefer to segregate the two as separate inputs in producing child development outcomes. In addition, HOME precludes specific father-child relations, reducing its ability to capture the overall home environment. Since Blau finds income to have a notably small impact on a child's behavioral, cognitive and social outcomes, he suggests that increasing family income through tax credits and governmental income transfer programs would need to be substantial in order to noticeably impact child development.

Turning from income toward two factors affecting of income, maternal education and maternal employment form the primary focus on child cognitive development in the study of British children by Verropoulou and Joshi (2007). Verropoulou and Joshi use the National Child Development Study (NCDS) from British mothers born in 1958 and their preschool-to-school-aged children born by 1991 for analysis. To measure children's cognition, they also employ PIAT scores. Their results show that mothers who graduate from high school have a strong positive effect on children's PIATMATH scores, ceteris paribus. Children from mothers who graduate college show higher PIATMATH and PIATREAD scores. The transmission of maternal

education to the child's outcomes occurs indirectly. Higher maternal education improves the mother's cognitive abilities, which, in turn, increase the cognitive endowment of the child. Bernal and Keane (2009) couple maternal education and IQ as determinants of the child's cognitive endowment and show more highly educated mothers and mothers with higher IQs have brighter children.

Verropoulou and Joshi (2007) focus on children age 5 and look back to see whether the mother was employed at any time during the child's first year of life. If so, they find a 2% reduction in the PIATREAD score at age 5, but no impact on math cognition. Children aged 2 to 4 of mothers transitioning from welfare to work show no decline in cognitive ability in a study of 2,402 children by Lindsay et al (2003). The authors believe the trade-off between more income and less time spent with children due to leaving welfare and going to work leads to offsetting impacts on cognition.

Schady (2011) extends the literature on education by including both parents' educational attainments in an Ecuadorean study of 2,118 children. Most of the families lived with poorer means. Children aged 3 to 5 were tested on vocabulary, memory, and visual integration skills through a Spanish version of the PIAT, known as the Test de Vocabulario en Imágenes Peabody (TVIP). Since the child's vocabulary is tested, the mother's vocabulary serves as an additional independent variable. The results show a strong positive association between mother's vocabulary skills and years of completed education with higher child TVIP scores. With each additional year of maternal education, the vocabulary, memory and visual integration scores of the child increased by 0.053, 0.023, and 0.037 standard deviations,

respectively, ceteris paribus. With a mother's vocabulary score increasing by 1 standard deviation, the same child score measures above increase by 0.24, 0.24, and 0.20 standard deviations, respectively. A father's schooling did not bear as much weight but still had statistically significant results with a positive association with child cognition. These findings suggest maternal education plays a prominent role in child cognitive development, specifically vocabulary. Given the time intensive nature learning vocabulary takes, the process a child undergoes in developing intelligence depends largely on the extent of the mother's vocabulary. The study did not include the father's vocabulary as a predictor.

While the above studies focus more intensively on maternal factors, Cabrera et al (2011) assess the simultaneous influences of the environmental risks of each parent, the couple, and the child on child development. Parental risk includes three overall categories- poverty, poor emotional/physical health and deficient social behavior- which are broken down into eight specific risk variables. High risk in the poverty category comprises English speaking inability, unemployment, teenaged parents and low levels of education. Being depressed or exhibiting poor health constitute high levels of risk in the middle category. Parents exhibiting excessive drinking or criminal records reflect deficient social behavior. Higher parental risks are expected to be linked to less parental engagement and supportiveness of the child and harsher disciplining of the child.

Unlike other researchers who associated high levels of parental risk with greater developmental problems, Cabrera et al (2011) examine the transmission of the risks through parenting actions. Their study follows 4,200 toddlers aged 9 to 24 months

from the Early Childhood Longitudinal Study Birth Cohort. They use the Bayley Short Form-Research (BSF-R) measure for child cognition. Higher maternal risk when a child is 9 months old leads to a reduction in the child's cognitive score at 24 months as the mother's risk circumstances stunt the child's development. Higher paternal risk, however, when the child is 9 months old does not directly reduce the child's cognitive score at 24 months, contrary to what many people believe. It does reduce the mother's supportiveness when the child is 9 months old, which, in turn, reduces the BSF-R at 24 months. The father with more risks, such as having low educational attainment or drinking excessively, adversely affects the mother's ability to be a supportive mother, which harms the child. Cognitive development is a cumulative process where events early in life affect outcomes down the road. In addition, a child at 24 months also shows higher BSF-R scores when supportive mothers and fathers engage in cognitive-stimulating interactions with the child at 24 months, suggesting simultaneous impacts also matter.

THEORETICAL MODEL

Becker (1965) provides a conceptual framework for household production of child outcomes relative to the other activities households' desire.[7] Using his theories, one can focus specifically on child development. The economic theory maintains families have preferences for numerous activities. For example, households desire clean surroundings, eating meals, sleeping comfortably, watching movies, and raising well-developed and well-behaved children, etc. All of these activities require

[7] Becker, Gary S. "Revised Approach to Consumer Choices." *Economic Theory*. New York: Knopf; [distributed by Random House, 1971. 45-47. Print.

inputs of goods and services, as well as time. For example, raising a child requires expenditures on health care, education services, food, childcare, etc. and time for teaching, supporting, loving, transporting, etc. a child. Producing a meal or having a clean house requires a different set of goods and services inputs and time. Additionally, all production activities face environmental factors that reflect the state of technology in which production can occur.[8] For example, a higher quality vacuum cleaner requires less usage of other inputs and time to achieve the same level of cleanliness compared to using a poor quality vacuum. Similarly, greater innate intelligence of a child, noted as a higher child endowment, requires fewer inputs to achieve a certain cognitive development level. Likewise, a parent with more education may be able to produce activities with less effort or other goods if their education makes them more efficient.

A household seeks to maximize its satisfaction derived from its activities, which are dictated by their production functions, but is subject to time and income constraints. Given a fixed number of hours per week, their allocation between working for wage income versus all other activities is a household choice. A second source of income, nonwage income, is unrelated to time and derives from inheritances, government transfers, lottery winnings, etc., and can also be used to purchase things. The weekly time constraint is shared between working and other activities, while nonwage and wage income pay for the inputs of goods and services.

[8] Becker, Gary S. "Revised Approach to Consumer Choices." *Economic Theory*. New York: Knopf; [distributed by Random House, 1971. 47-48. Print.

Becker shows that using the wage as the hourly value of time, the full cost or price of an activity is monetized as the sum of the inputs prices and time cost of production. In equilibrium, the constrained utility maximization condition yields the usual result that the marginal utility per dollar spent is the same for all activities. This means that the last dollar spent on cleaning a house, which captures both time and input prices for cleaning, yields the same marginal utility as the last dollar spent on preparing a meal. Another way of looking at this condition is that if a household values a clean house twice as much as eating a meal, the household will pay twice as much for house cleaning than a eating a meal. Graphically, this condition is shown as the budget line being tangent to the highest indifference curve possible, since the slope of the budget line is the full price ratio and the slope of the indifference curve is the ratio of marginal utilities.

Becker's innovation is the second equilibrium condition, which is related to allocating time and other inputs in producing the activities to minimize the cost of production. Two results follow. First, if the same input is used in two activities, say time or energy usage in house cleaning versus meal preparation, the input is allocated to produce the marginal products consistent with equal utilities across the activities. For example, the additional productivity from spending another hour on cleaning must provide the same increase in household satisfaction as spending another hour on teaching a child to read. Conversely, if an additional hour spent on developing the child leads to more happiness than one spent on cleaning, the hour will be spent on working with the child rather than cleaning. Second, two inputs used in one activity should be allocated so that the ratio of the marginal products of

the inputs equals their price ratios. Here, if the marginal product on a child's cognitive ability due to an hour a parent spends teaching a child is four times that from an hour spent at a daycare, the price of the daycare should be one fourth that of the parent's wage on the margin. Similarly, if the parent's teaching is ten times more productive than the purchase of another book, the book price should be one-tenth the parent's wage.

Traditional consumer theory that excludes time costs in the full cost or price of consumption breaks down how a change in price affects consumption into the substitution and income effects. It provides the underpinnings for a downward sloping demand curve. An increase in a good's price with no change in income or another good's price causes the relative price of the good to rise. This causes consumers to substitute out of the relatively more expensive good and into the relatively cheaper one, shown by a movement along the indifference curve consistent with the new price ratio. The increased price, however, reduces real income since less can be consumed for a given income level. This income effect shifts the rotated budget line inward and yields the new equilibrium to lie on a lower indifference curve. The reduction in the good's consumption from the substitute effect and the change in its consumption from the income effect lead to the observed reduction in consumption. Suppose there is an increase in the price of daycare and no change in the price of babysitting in one's home and one's income. This raises the relative price of daycare, leading to a substitution out of daycare hours and into in-home babysitting hours via the substitution effect. The higher cost of daycare also reduces real income (as long as some daycare is consumed), which reduces the consumption

of both daycare and in-home babysitting hours via the income effect. The total decrease in daycare consumption is attributable to both the income and substitution effects and the family is worse off since a lower indifference curve is now attained. The increase in the price of daycare reduces the quantity demanded for daycare as shown by the upward movement along a daycare demand curve. Additionally, traditional theory shows that an increase in income without any changes in prices leads solely to an income effect or parallel outward shift in the budget line. This means more of both goods can be consumed with the higher income, and the household is better off. Given no changes in the price of daycare or in-home babysitting, higher income allows for more consumption of both forms of childcare. This is shown as an increase in the demand for daycare and in-home babysitting as outward shifts in both demand curves.

Becker's inclusion of time cost in the full price of activities alters the effect of a change in income on the composition of activities, depending on the source of the income change. An increase in nonwage income yields the same results as traditional theory suggests. An increase in nonwage income from an inheritance does not change the full prices of activities, thus serves to shift out the budget constraint in a parallel fashion, i.e., an income effect. This enables increased consumption of both activities as the household achieves greater satisfaction on the higher indifference curve. Nonwage money buys happiness.

Increases in income generated from a wage increase, however, raise the full price of all activities due to the rising opportunity cost of time. Activities that are more time intensive, however, will have a greater proportional increase in their cost than less

time intensive activities, resulting in an increase in the relative price of the time intensive activity. This alters the slope of the budget line, leading to a substitution effect away from the time-intensive activity. However, the increase in wage raises income, shown as an outward shift in the rotated budget line, and enables more consumption via the income effect. In sum, higher wages lead households to consume relatively less time-intensive activities and favor more goods-intensive activities. For example, given an increase in a mother's wage, she will spend less time child rearing and use more books, daycare, etc. to keep the child cognitive development constant from the substitution effect. For the income effect, the higher income enables a mother to spend more time childrearing and using other inputs since her income needs are met from the higher wage. These increase child cognitive development. The higher maternal wage, ceteris paribus, is predicted to: increase the quantity demanded for time-saving goods and services, such as daycare, microwaves and take-home food; reduce the quantity demanded for time-intensive goods and services, such as home schooling, household landscaping and waiting in lines at places that do not take reservations; increase child cognitive development; increase hours worked when the substitution effect dominates the income effect; and, increase the likelihood of joining the labor force for those mother's not working for a wage. [9]

The same predictions hold for an increase in a father's wage, but the difference in base wages between the parents is expected to lead to differences in the magnitude of changes. If the father's wage exceeds the mother's, equiproportional increases in each wage will lead to greater differences in relative full price ratios and therefore

[9] Becker, Gary S. "Revised Approach to Consumer Choices." *Economic Theory*. New York: Knopf; [distributed by Random House, 1971. 162-65. Print.

more dramatic changes in the father's activities blends. It is not surprising that fathers who were the sole breadwinners in the 1950's spent relatively little time on many household production activities, while fathers today married to working women are more engaged in doing household chores and childrearing than their predecessors.

Becker also uses his home production model to show that family size depends on income, wages, and time needed to raise children compared to other satisfying activities.[10] Greater income, with no change in prices, allows for more children and more spending (quality) per child. He finds a small increase in family size in the US, but significantly larger increases in education expenditures and other quality measures. For wage increases, especially maternal wage increases, the increased time cost of childrearing reduces the number of children per family. Having siblings can impact a child's cognitive development in a variety of ways. Siblings may engage with the child and enhance development, steal parental time away from the child and reduce quality expenditures to hinder development, and lead to an increase in daycare costs that prohibit a mother from working. The inclusion of number of siblings serves as a control variable since its impact is beyond the scope of this paper.

Since Becker's constrained utility maximization theory generates the law of demand that higher full prices reduce quantity demanded, the demand for the cognitive development of a child follows. Given such development requires the usage of time

[10] Becker, Gary S. "Revised Approach to Consumer Choices." *Economic Theory*. New York: Knopf; [distributed by Random House, 1971. 160-61. Print.

and goods/services inputs for given child and parental endowments, one hypothesizes the production of a child's cognitive development is determined by the aforementioned interplay of parental wages (or employment status), family nonwage income, time intensities of activities, and prices of relevant goods and services inputs. Without a direct measure of the child's cognitive endowment, it is assumed to be partly determined from inherited traits from parents, including parent's educations and IQs and the mother's age at childbirth as in Bernal et al (2010). Child traits, such as gender, race, and geographic birthplace serve as control variables. Including the environmental variable of parental education for parental endowment in the demand function for child cognitive development represents parental education's ability to affect household productive efficiency, and does not simply represent an ad hoc change in tastes, which Becker argues is a major flaw of traditional consumer theory.

The economic theory leads to the following regression function with the variables' descriptions given in **Table 1:**

$$\begin{aligned} \textit{Child Cognitive Development}_i = {} & \beta_0 + \beta_1 MWAGE_i + \beta_2 PWAGE_i + \beta_3 NONWAGE_i + \\ & \beta_4 GOODS_i + \beta_5 MIQ_i + \beta_6 PIQ_i + \beta_7 MEDUC + \\ & \beta_8 PEDUC_i + \beta_9 GENDER_i + \beta_{10} RACE_i + \\ & \beta_{11} BPLACE_i + \beta_{12} SIBLING_i + \beta_{13} CHILDCARE_i + \\ & \beta_{14} MAGE_i + \in_i \end{aligned}$$

where i denotes the child observation

The ability to evaluate the cognitive ability for 3-5 year olds depends on the data available. Ideally one would like to follow the development of a child over this three year period in conjunction with changes in the parent's income and employment decisions. Given cross sectional data for families with a 3-5 year old child limits the analysis in that changes in variables within the family are not being measured, rather differences across families are observed. Hence changes in a mother's wage leading to changes in employment status and childcare are not able to be estimated, whereas differences in cognitive test scores for children with mothers of varying wages is estimated.

As an attempt to mitigate the limitations associated with cross sectional data, this study focuses on two years to analyze the impacts parents' employment and wages have on early child cognitive development. The year 1994 was chosen because there are a sufficient number of mothers, 1065, with an average age of 33. The desire was to have mothers included who were not too young or not too old for 3-5 year old children. Having mothers too young - perhaps teenage mothers -could potentially have the mother's age impact the child cognition in an atypical way, resulting in potentially concealing some of the effects employment or wages have on young children's cognition. The second year chosen is 2002. Along with a desire to have a substantial time gap between the two years to allow for marketplace and workforce changes to occur, 2002 shows mothers of a slightly older demographic with an average age of 40. Although the 2002 data set contains fewer women, only 570

respondents compared to 1065 people in 1994 because older women are less likely to have children that young. Nonetheless, the sample size is sufficient to allow a contribution to contemporary dialogue regarding work-life balance.

Table 1: Variable Descriptions

Child Cognitive Development	PPVTPERC: Dependent Variable: represents child's percentile score in the Peabody Picture Vocabulary Test for children aged 3-5 with higher values signifying better cognitively developed children.
MWAGE	MOMWAGE1: The mother's hourly wage during the previous calendar year.
PWAGE	DADEARNLY : The father's hourly wage uses the father's previous year's annual income as a proxy for his wage
NONWAGE	Nonwage income data not available in NLSY79. Therefore, net family income used as a proxy and divided into LOWINC and HIGHINC brackets. LOWINC: Dummy variable signifies net family income is below $8,300 for 1994 or $10,000 for 2002, indicating below the sample's10th percentile in either year. HIGHINC: Dummy variable signifies net family income is above $50,000 in 1994 or $79,000 in 2002, representing above the 90th percentile.
GOODS	HOMETOTPERC: The home environment inputs present in a child's life given in percentile form. Such inputs include: number of books a child has; number of museum visits annually; degree to which the mother is supportive; among others, per Blau (1999).
MIQ	AFQT89: Represents the mother's aptitude and intelligence scores based

	on a test created by the Air Force for public use: Air Force Qualifications Test score in percentile form.
PIQ	Variable not available in NLSY79 and no proxy available.[11]
MEDUC	MOMHS: Dummy variable indicating if mother graduated high school compared to no high school degree. MOMCOLLEGE: Dummy variable indicating if mother graduated college compared to no high school degree. MOMGRAD: Dummy variable indicating if mother engaged in some form of graduate school relative to having no high school degree.
PEDUC	Variable not available in NLSY79 and no proxy available.
GENDER	MALE: Dummy variable indicating the child is male.
RACE	HISPANIC: Dummy variable indicating the mother is Hispanic, not white. BLACK: Dummy variable indicating the mother is black, not white.
BPLACE	URBAN: Dummy variable indicating if child was born in an urban setting, not rural. MIDWEST: Dummy variable indicating if child was born in the Midwest, not East. SOUTH: Dummy variable indicating if child was born in the South, not East. WEST: Dummy variable indicating if child was born in the West, not East.
SIBLING	SIBS: Variable indicating the number of siblings a child has.
CHILDCARE	Y2CC: Dummy variable indicating if mother has sent any of her children to child care at age 2.

[11]A father's IQ or aptitude abilities and his educational attainment are not available in this data set. Therefore, these omissions will most likely bias the father's earnings variable as the error from these omitted variables will be included in the error of the father's earnings, creating omitted variable bias upwards. Since both a father's IQ and educational attainment is expected to have positive impacts on child cognition, the omitted variable bias will overstate the father's earnings results. Therefore, fathers with no earnings may actually be negatively impacting their child's cognition.

	Y3CC: Dummy variable indicating if mother has sent any of her children to child care at age 3.
MAGE	AGE: Variable indicating the mother's age in years.

An increase in a working mother's wage causes her to reallocate her time away from time-intensive activities, which may be her time spent caring for her child. To assure her child's cognitive development is not impaired, she will use the higher wage to purchase other goods and services to bolster her child's learning. Her subsequent increase in income, assuming she does not reduce hours worked so much that her earnings fall, can enable more time spent with her child and more inputs, which again increase her child's cognitive development. Higher maternal wages are hypothesized to have a positive relationship with cognitive development, i.e., $\beta_1>0$, ceteris paribus. Similarly, increases in the father's wage is expected to enhance cognition, $\beta_2 >0$. Since increases in non-wage income do not alter relative prices and provide a pure income effect, greater consumption of all normal goods and services that enhance a child's ability implies $\beta_3 > 0$. Unfortunately, the data set does not contain nonwage income; rather, HIGHINC and LOWINC are used as proxies to estimate the impact.

Following Blau's (1999) analysis, the use of more inputs augments cognition, therefore $\beta_4>0$, ceteris paribus. For example, having more books and toys raise a child's cognitive development score. Stipulating all things are held constant means that increases in parental wages are not the cause of the increase in inputs.

Presumably gifts, inheritances, the largesse of other family members such as grandparents, etc. create these inputs independently of wages.

A mother and father with higher IQs are predicted to endow greater cognition to their child, therefore, $\beta_5>0$ and $\beta_6>0$ are expected, ceteris paribus per Bernal et al (2010) Not having data on the father's IQ will not allow β_6 to be estimated. Maternal and paternal educational attainment are anticipated to have positive relationships with cognitive development, $\beta_7>0$ and $\beta_8>0$, ceteris paribus, because household activities are able to be produced more efficiently according to Verropoulou and Joshi (2009).

While the focus of this study is not on the control variables, discussion of their impacts pertains. No literature reviewed or economic theory supports a child's gender, a mother's race, or child's birthplace to play a role in determining a child's cognitive development. These serve as control variables and their signs, β_9 through β_{11}, do not have an anticipated signs. While research including Blau (1999) and others have incorporated siblings into models to examine the effects they have on the child development process, β_{12} does not have an anticipated sign because different studies have found different relationships. Similarly, Bernal et al (2010) and other have incorporated mother's age, but by excluding teenage mothers in this study, β_{14} does not have an anticipated sign.

Lastly, the sign of β_{13} is expected to be positive. Increases in good childcare are expected to raise children's cognitive abilities and parents seek such services. Data on child care setting, quality, and time spent in child care are not available. Whether

the actual childcare provided is as beneficial as the parents desire or anticipate is not known, which can affect the estimated coefficient.

DATA

The data for this study derives from the National Longitudinal Study of Youth of the 1979 cohort (NLSY79) conducted by the Bureau of Labor Statistics (BLS). This longitudinal study provides panel data for 12,686 men and women born from 1957-1964 who were interviewed biennially starting in 1979. Beginning in 1986, the BLS began asking questions of the cohort about the cohort's children, if they had children, developing the NLSY79 Children and Young Adults Surveys. As the children aged, they too were surveyed biennially. To supplement the mothers' responses, demographic data were gathered for each of the mothers' children. Hour-long interviews consisted of both the mother and child responding when possible. [12] This research study focuses only on children aged 3 through 5 and is limited to traditional families with a married mother and father living together throughout the child's life. This restriction enables one to investigate direct maternal and paternal influences, as well as the interaction of one spouse's decision on the other's activities, on early child cognitive development.

[12] "NLSY97." *U.S. Bureau of Labor Statistics*. U.S. Bureau of Labor Statistics, 14 Sept. 2006. Web. 08 Oct. 2013.

The beginning summary statistics in **Table 2** focuses on 1,065 families with children aged 3 to 5 in 1994. **Table 2** outlines the summary statistics of what will be considered the base model's variables. Although the mother's age is a control variable in the model, for descriptive and informational purposes, ages are found and the mothers range from 29 to 37 years old, with the average at 33 years. The mother's aptitude, achievement and intelligence score is based on the results of taking an oft used test, the Air Force Qualification Test, AFQT89. Upon testing the respondents in 1980, the scores were scaled and put into percentiles so that they range from 1 to 99 to offer a system to rank the mothers in terms of natural intelligence. [13] The average mother shows a score of 43.2 with a standard deviation of 27, implying 43% of all respondents, not just those in this sample, have scores below the average mother in the sample. For this study, these scores stand as a proxy for a mother's IQ. Given that the NLSY79 Children and Young Adults Surveys only link the biological mother to the child, father IQ's are not supplied in the data set as those males in the NLSY79 adult cohort are not necessarily spouses of the mothers. Therefore, no father IQ variable exists in this study.

[13] "Aptitude, Achievement & Intelligence Scores." *National Longitudinal Surveys*. Bureau of Labor Statistics, n.d. Web. 09 Apr. 2014.

Table 2: 1994 Summary Statistics of Base Model

Variable	N	Mean	Std Dev	Minimum	Maximum
PPVTPERC	1065	40.4178404	29.6513427	0	99.0000000
MOMWAGE1	1065	7.9499155	10.1254300	0	177.7700000
DADEARNLY	1065	30.5598732	27.0228721	0	206.6740000
HOMETOTPERC	1065	55.4741784	27.4278195	0	97.0000000
AFQT89	1065	43.2000000	27.3920712	1.0000000	99.0000000
MOMHS	1065	0.4159624	0.4931187	0	1.0000000
MOMCOLLEGE	1065	0.4169014	0.4932779	0	1.0000000
MOMGRAD	1065	0.0619718	0.2412177	0	1.0000000
Y2CC	1065	0.1661972	0.3724324	0	1.0000000
Y3CC	1065	0.2807512	0.4495773	0	1.0000000
MALE	1065	0.4835681	0.4999647	0	1.0000000
SIBS	1065	2.5652582	1.0750566	0	9.0000000
URBAN	1065	0.7812207	0.4136128	0	1.0000000
MIDWEST	1065	0.2901408	0.4540404	0	1.0000000
SOUTH	1065	0.3521127	0.4778533	0	1.0000000
WEST	1065	0.1962441	0.3973419	0	1.0000000
HISPANIC	1065	0.1990610	0.3994816	0	1.0000000
BLACK	1065	0.1784038	0.3830321	0	1.0000000
AGE	1065	33.0253521	2.1915584	29.0000000	37.0000000

Additionally, similar to how there is no father IQ variable, there is no record of the father's educational attainment. This represents another shortcoming in the data set. Mother's educational attainment derives from highest grade completed.

Approximately 42% of the mothers completed high school, another 42% completed college and 6% completed some form of graduate school, leaving 10% with less than a high school degree. The sample displays slightly more female, 52%, than male children. The average family has 2.5 siblings. A large majority of the respondents, 78%, are from an urban, as opposed to a rural, setting. Spanning the country by birthplace region, 29% of the toddlers were born in the Midwest, 35% in the South, 20% in the West and 16% in the East.

This sample comprises more Caucasian mothers than other races, with 62% white mothers, 18% black mothers and 20% Hispanic mothers interviewed. With these demographic variable statistics setting the scene, the latter half of this discussion of summary statistics will focus on the primary independent variables.

To begin, HOMETOTPERC stands for the total home inputs percentile, which captures the quality and frequency of what is defined as home inputs that presumably positively affect a child's development. All respondents are observed and given a rating. Listing the ratings from top to bottom allows for percentile scores to be created. A higher percentile implies input number means a greater frequency and quantity of resources available to the child. The average is at the 55th percentile, with a standard deviation of 27.4. This suggests that for the women used in this sample, the average mother's rating for HOMETOTPERC shows 55 percent of other respondents' ratings below her rating. The average mother's wage, MOMWAGE1, is $7.95 per hour in 1994 dollars. The average father's wage is not available, but the father's annual earnings from the previous year may serve as a proxy for father's earnings. DADEARNLY represents these annual earnings in 1993 in $1,000s of

1994 dollars and shows a mean of $30,600. There are instances where either parent's income is zero, implying no earnings from work outside the home, i.e., not working.

A second model building from the base model will be constructed to incorporate employment statuses. Due to a large number of respondents who did not give responses to the questions of hours worked, the sample size drops to 809 respondents. **Table 3** outlines the additional variables included in the alternative regression models and the summary statistics of the previously discussed variables did not change significantly.

Table 3: 1994 Additional Summary Statistics Used in Alternative Regression Model 2 Using Employment Status

Variable	N	Mean	Std Dev	Minimum	Maximum
MOMPARTLY	809	0.1470952	0.3544199	0	1.0000000
MOMFULLY	809	0.5525340	0.4975401	0	1.0000000
DADPARTLY	809	0.0432633	0.2035751	0	1.0000000
DADFULLY	809	0.9048208	0.2936439	0	1.0000000
Q1	809	0.2064277	0.4049914	0	1.0000000
Q2	809	0.0766378	0.2661805	0	1.0000000
Q34	809	0.0815822	0.2738965	0	1.0000000
Q58	809	0.0803461	0.2719964	0	1.0000000
Q912	809	0.0482077	0.2143373	0	1.0000000
Q1317	809	0.0296663	0.1697698	0	1.0000000
Q18	809	0.1619283	0.3686129	0	1.0000000

Employment statuses serve as additional ways to measure working parents, besides wages, and are created using dummy variables for differing degrees of parental employment. Current measures of hours worked are not available so the status of the previous year is used as its proxy. Compared to mothers not working outside the home, 15% work part time, MOMPARTLY, as defined as less than 30 hours a week, and 55%, MOMFULLY, work full time. In comparison, only 4% of fathers work part time, DADPARTLY, and 90% work full time, DADFULLY. These statistics illustrate that 30% of mothers do not work for income compared to only 6% of fathers.

When a mother specifically returned to work after having the child can also represent an indicator for employment choices. The Q variables listed on the latter half of **Table 3** represent which quarter of the year the mother returned to work after the child's birth. Nearly 21% of mothers returned to work within the first three months of the child's life, Q1. After this immediate return, lower percentages of women return to work in following quarters as seen by 8% returning in the second quarter, 8% in the 3rd and 4th quarter, 8% in quarters 5 through 8, 5% in quarters 9-12 (or three years out), 3% four years out and so on. Not surprisingly, 16% return during the child's fifth year as school enrollment begins. Twenty eight percent of the mothers do not work outside the home after the birth of their child.

As mothers return to work, child care of some sort becomes the primary substitution for the mother as the mother is no longer home with the child. While it is quite possible the father remains home when the mother returns to work, this is not always the case and therefore variables to measure the parent's inclination to use child care

are incorporated. The first variable Y2CC measures if the mother has ever had any of her children go to some form of child care during the second year of a child's life, compared to no child care. Since this dummy variable is not child specific to just the 1994 3-5 year olds, it captures the mother's inclination to use child care in the second year of her child's or children's life. About 17% of the mothers reported sending one or more of their children to child care at age 2, whereas 27% of the mothers reported sending their child to child care at age 3, Y3CC. These variables illustrate the propensity a mother has to use child care when returning back to work[14]

Finally, the dependent variable of the model is PPVTPERC. This stands for the Peabody Picture Vocabulary Test Percentile Score, which measures verbal intelligence and scholastic aptitude of children aged 3-5. It ranges from 0-99 and is scaled to the child's age to provide comparisons in cognition for children similar ages. This score compares only 3 year olds to 3 year olds, 4 year olds to 4 years olds, etc. by providing the percentile score of each child. It does not compare all children within the age bracket of 3 to 5 years because children aged 5 would on average do much better than children aged three due to the sensitive and instrumental role each additional year plays in child cognitive development. The mean value in percentiles is 38.87 with a standard deviation of 29.8.

Fast forwarding eight years, to 2002, the summary statistics may change. Beginning with the base model, **Table 4** displays the 2002 summary statistics. The 570 mothers with 3-5 year olds are now between 37 and 45 years old, with the average mother 40

[14] Child care for the first year of a child's life (Y1CC) was not incorporated in the model due to too small of a sample size. Additionally, there were no measures beyond three years to discern the inclination to use child care.

years old. The reduced sample size can be explained by the rise in age of mothers since older mothers tend to have fewer toddlers. The mothers' AFTQ scores have risen on average 8 points to the 51st percentile from the 1994 mothers. While fewer mothers have their highest grade completed as graduating high school, 31% in 2002, more mothers have completed college and attended graduate school, 47% and 16% respectively. This suggests that women with higher education and greater career potential waited longer before they started a family. In 2002, only 6% of mothers did not have a high school degree compared to 11% in 1994. This sample also displays slightly more female children at 55%. The average number of siblings remains between 2 and 3.

As for urban setting, this sample contains less urban families, 69% compared to 78% in 1994. The birthplace regions, mother's races and total home percentage remained relatively consistent between the two time periods. Mother's average wage rose by approximately $5 to $13.11 in 2002 dollars, some of which can be attributed to inflation. Not surprisingly, father's previous year's earnings also rose notably to $56,000 in 2002 dollars. Noticeably fewer mother's chose to put their children in child care at age 2 in 2002 compared to 1994 with only 2.2% showing this inclination, Y2CC. Similarly, there was also less of an inclination by mothers in 2002 to put their 3 year olds in child care as only 10% made this choice compared to 28% in 1994. As the mother's aptitude test scores rose from 1994 to 2002, it is not surprising that the children's PPVT scores rose from 40.4 to 49.5 percentiles for the averages.

Table 4: 2002 Summary Statistics of Base Model

Variable	N	Mean	Std Dev	Minimum	Maximum
PPVTPERC	570	49.5035088	30.7209360	1.0000000	99.0000000
MOMWAGE1	570	13.1088772	15.1848668	0	200.0000000
DADEARNLY	570	56.0434982	55.2733241	0	266.6870000
HOMETOTPERC	570	56.4754386	27.4271733	0	96.0000000
AFQT89	570	51.0245614	28.0075202	1.0000000	99.0000000
MOMHS	570	0.3105263	0.4631155	0	1.0000000
MOMCOLLEGE	570	0.4771930	0.4999183	0	1.0000000
MOMGRAD	570	0.1561404	0.3633072	0	1.0000000
Y2CC	570	0.0228070	0.1494190	0	1.0000000
Y3CC	570	0.1000000	0.3002635	0	1.0000000
MALE	570	0.4543860	0.4983524	0	1.0000000
SIBS	570	2.6403509	1.1762679	0	8.0000000
URBAN	570	0.6947368	0.4609233	0	1.0000000
MIDWEST	570	0.2543860	0.4358980	0	1.0000000
SOUTH	570	0.3403509	0.4742433	0	1.0000000
WEST	570	0.2035088	0.4029613	0	1.0000000
HISPANIC	570	0.1842105	0.3879963	0	1.0000000
BLACK	570	0.1438596	0.3512556	0	1.0000000
AGE	570	40.2578947	2.0188433	37.0000000	45.0000000

To facilitate another regression model including the supplementary employment status variables, **Table 5**, shows the summary statistics for the reduced sample size of 415.

Table 5: 2002 Additional Summary Statistics for Alternative Regression Model 2 Using Employment Status

Variable	N	Mean	Std Dev	Minimum	Maximum
MOMPARTLY	809	0.1470952	0.3544199	0	1.0000000
MOMFULLY	809	0.5525340	0.4975401	0	1.0000000
DADPARTLY	809	0.0432633	0.2035751	0	1.0000000
DADFULLY	809	0.9048208	0.2936439	0	1.0000000
Q1	809	0.2064277	0.4049914	0	1.0000000
Q2	809	0.0766378	0.2661805	0	1.0000000
Q34	809	0.0815822	0.2738965	0	1.0000000
Q58	809	0.0803461	0.2719964	0	1.0000000
Q912	809	0.0482077	0.2143373	0	1.0000000
Q1317	809	0.0296663	0.1697698	0	1.0000000
Q18	809	0.1619283	0.3686129	0	1.0000000

About 10% of mothers reported working part time throughout 2001, less than the 14% that reported working part time in 1993; however, 59% reported working full time in 2001, whereas only 55% worked full time in 1993. The same pattern existed for the fathers. Less worked part time in 2001, specifically 3% compared to 4% in 1993, and more worked full time, 97% in 2001 versus 90% in 1993. Every quarter and year after the child's birth, a lower percentage of 2002 mothers returned to work than in 1994.

RESULTS

The first discussion of results focuses on the 1994 base model regression output outlined in **Table 6**. The model was tested for multicollinearity and the variance inflation factor did not exceed 2.2, showing no signs of excessive multicollinearity. Additionally, a statistically significant chi square value indicated heteroskedasticity and the model was corrected with heteroskedasticity consistent estimates that are shown in **Table 6**.

The control variables of mother's age, living in an urban setting, and living in the West as opposed to the East, were not found to be statistically significant. Contrary to expectations, a mother's second year child care inclination (Y2CC) was not found to be statistically significant. The remaining variable estimates are statistically significant with p-values shown and resulted in the expected signs, except for MOMWAGE1 and Y3CC. The model contains an adjusted R^2 value of .33.The remaining discussion centers on statistically significant results.

Table 6: 1994 OLS Regression Output Results (significant values in bold)

	Model 1:		Model 2:		Model 3:	
	Base Model		Employment Status		Wage Interaction	
Variable	Parameter Estimate	p value	Parameter Estimate	p value	Parameter Estimate	p value
MOMWAGE1	**-0.2034**	0.0107	**-0.2332**	0.0106	**-0.2329**	0.0039
DADEARNLY	**0.0525**	0.0891	0.0388	0.3130	0.0377	0.2603
HOMETOTPERC	**0.1781**	<.0001	**0.1893**	<.0001	**0.1686**	<.0001
AFQT89	**0.2471**	<.0001	**0.2693**	<.0001	**0.2389**	<.0001
MOMHS	**5.6042**	0.0256	3.5101	0.2270	**5.4202**	0.0302
MOMCOLLEGE	**11.3416**	0.0001	**10.4770**	0.0020	**10.7303**	0.0002
MOMGRAD	**18.2841**	<.0001	**14.7837**	0.0047	**17.9655**	<.0001
Y2CC	-0.0358	0.9881	-1.9769	0.4694	-0.0181	0.9939
Y3CC	**-3.8772**	0.0497	**-5.2308**	0.0275	**-4.2781**	0.0336
MALE	**-3.1308**	0.0365	-1.8160	0.2940	**-3.0770**	0.0392
SIBS	**-2.5244**	0.0002	**-2.0189**	0.0059	**-2.5036**	0.0002
URBAN	-0.3297	0.8569	0.9973	0.6497	-0.4513	0.8057
MIDWEST	**-5.0646**	0.0367	-3.6039	0.2147	**-4.3729**	0.0726
SOUTH	**-5.3894**	0.0189	**-4.9585**	0.0634	**-5.2567**	0.0231
WEST	-3.2331	0.2261	-1.3979	0.6479	-2.6592	0.3187
HISPANIC	**-11.4825**	<.0001	**-12.1938**	<.0001	**-11.7863**	<.0001
BLACK	**-15.2419**	<.0001	**-15.2987**	<.0001	**-15.4241**	<.0001
AGE	0.0950	0.7861	0.1213	0.7610	0.1683	0.6316
DADPARTLY			-4.3183	0.3922		
DADFULLY			0.0967	0.9809		
MOMPARTLY			3.4828	0.2275		
MOMFULLY			**5.0138**	0.0422		
Q1			-0.9748	0.7015	-0.0885	0.9677
Q2			-4.0994	0.1777	-0.6099	0.8155
Q34			-1.4790	0.6251	1.2953	0.6274
MOMWAGEQ34						
Q58			2.9050	0.4056	2.4171	0.4025
Q912			**-7.5696**	0.0476	-8.1430	0.1315
MOMWAGEQ912					-0.3065	0.6178
Q1317			-4.8063	0.3344	-3.0376	0.4768
Q18			0.0167	0.9956	-1.1611	0.6617
LOWINC					-2.9705	0.1664
HIGHINC					2.1124	0.3030
n	1065		809		1065	
Adjusted R-Sq	0.3333		0.34		0.3366	

Table 6: 2002 OLS Regression Output Results (significant values in bold)

	Base Model		Employment Status		Wage Interaction	
Variable	Parameter Estimate	p value	Parameter Estimate	p value	Parameter Estimate	p value
MOMWAGE1	-0.0615	0.4555	0.0542	0.7677	-0.1046	0.2236
DADEARNLY	0.0191	0.3946	0.0188	0.4935	0.0170	0.4911
HOMETOTPERC	**0.0819**	0.0847	0.0512	0.3527	0.0725	0.1279
AFQT89	**0.2379**	0.0002	**0.2149**	0.0050	**0.2453**	0.0001
MOMHS	2.9492	0.6010	7.9172	0.2853	1.1746	0.8355
MOMCOLLEGE	9.2569	0.1235	**13.7268**	0.0778	7.9419	0.1880
MOMGRAD	**13.9692**	0.0412	**20.4294**	0.0191	**11.2160**	0.1024
Y2CC	7.7228	0.3755	10.6090	0.2856	7.4732	0.3891
Y3CC	-5.1170	0.2521	-4.0705	0.4550	-4.5183	0.3115
MALE	-3.1336	0.1948	-3.2021	0.2552	-3.5097	0.1442
SIBS	**-2.1587**	0.0391	-0.5173	0.6956	**-1.6467**	0.1177
URBAN	2.0424	0.4428	1.2368	0.7007	3.1149	0.2457
MIDWEST	-0.7375	0.8334	-4.4027	0.3143	0.3262	0.9264
SOUTH	**-6.7820**	0.0485	**-11.5047**	0.0059	**-6.4401**	0.0624
WEST	**-9.8525**	0.0133	**-13.5224**	0.0054	**-9.6465**	0.0149
HISPANIC	-3.3893	0.3753	-5.5184	0.2309	-5.0450	0.1857
BLACK	**-9.6640**	0.0187	**-8.7559**	0.0680	**-11.2244**	0.0066
AGE	**-1.2363**	0.0397	-1.0610	0.1341	**-1.3704**	0.0238
DADPARTLY						
DADFULLY			-2.2322	0.7795		
MOMPARTLY			1.1566	0.8336		
MOMFULLY			-5.6323	0.2158		
Q1			4.1799	0.2990	3.8716	0.2527
Q2			-7.7831	0.2663	-4.2668	0.4337
Q34			**-13.9196**	0.0293	**-26.8211**	0.0008
MOMWAGEQ34					**2.1474**	0.0005
Q58			1.3994	0.8159	6.9597	0.1588
Q912			**-9.1717**	0.2092	-6.5586	0.2406
MOMWAGEQ912						
Q1317			-2.4291	0.9037	-11.5617	0.2786
Q18			-5.2989	0.2508	-3.5011	0.3664
LOWINC					3.4727	0.3668
HIGHINC					0.1356	0.9646
n	570		415		570	
Adjusted R-Sq	0.1880		0.1878		0.2063	

Contrary to expectations, the mother's wage shows a negative association with child cognition with a .0107 level of significance. With each additional dollar of wage earned by the mother, the child's PPVTPERC score is expected to decrease by about .2034 points, ceteris paribus. It would take an increase of $5.00 (which is a 71% increase of the average wage) in a mother's hourly wage to cause a fall of 1 percentile in the child's PPVT percentile score, ceteris paribus, which represents a 2.4% decline from the mean PPVT of 40.42. While the direction is contrary to expectations, the effect it has on child cognition remains materially small. Given the unexpected nature of the mother's wage variable, several explanations are possible. Given cross sectional data, high wage mothers may find their time at work thinking critically and using their intellect, embraces their comparative advantage, suggesting time spent with toddlers does not develop their child's cognition effectively. Mothers with low wages may be involved in less interesting or more mundane work such that time with their child is more fulfilling and enhances cognition more. Alternatively, mothers with high wages may have cut back on work hours and engage in time-intensive activities that please the mothers more than focusing the extra time on their child. High wage mothers may choose activities such as golf, tennis, volunteering, etc. that may not enhance their child's cognition.[15] Father's income, on the other hand, shows a positive relationship to PPVT, as expected. With each additional $1,000 of income earned by the father, the child's cognition score is expected to improve by approximately.0525 percentile points, ceteris paribus, at a .0891 level of significance. It, too, is materially small. A $20,000 increase in father's income,

[15] A regression with a quadratic form of MOMWAGE1 did not yield statistically significant results, implying the differences in cognition due to differences in wage are not dependent upon the level of wages.

slightly less than the standard deviation of $27,000 for fathers' incomes, would lead to only a 1 point increase in the predicted percentile cognitive score, ceteris paribus.

The total home percentile displays a positive relationship, as expected, at the .0001 level of significance. A 1 percentile increase in home inputs is expected to increase the PPVT percentile by .1781 percentile, indicating its positive effects on cognition to be small. Since wages are to be held constant when evaluating this individual effect, the coefficient should not be associated with increases in wages enhancing the inputs, which in turn increase cognition. The stock of inputs, however, may be due to previous wages in that higher wage mothers have built up their input inventories, which then enhance their child's cognition.

As well as external inputs into the home aiding a child's cognition, internal inherited traits related to intelligence of the mother also benefit early child cognition. A mother's AFTQ score has a positive relationship with child cognition at the .0001 level of significance. Although a mother's AFTQ score does not tend to change much, as it measures natural aptitude and intelligence, hypothetically, a mother with a one percentile higher score is expected to increase her child's cognition score by .2471 percentile, ceteris paribus. This positive relationship reinforces that smarter mothers are expected to have smarter kids.

Not surprisingly, as these mothers enhance their intelligence through schooling, their child's cognition improves. The positive coefficient on mothers completing high school is statistically significant at a .0256 level of significance. Mothers who have completed high school, compared to those who have not, find their child is expected

to have a higher PPVT score by 5.60 percentiles, ceteris paribus. If she were to continue and complete college, her child's PPVT score is expected to increase by an additional 5.74 percentiles, ceteris paribus. Furthermore, if the mother completes some form of graduate school, her child's PPVT score is expected to rise even more by 6.94 percentiles, ceteris paribus. Both the mother's college and graduate school completion are at a .0001 level of significance. Greater educational achievement by the mother is presumed to make the mother more efficient in teaching her child.

Although Y2CC was not found to be statistically significant, child care in the third year of a child's life (Y3CC) was found to be statistically significant at the .0497 level of significance. When a mother is inclined to put her child in a form of child care during the third year of the child's life, the PPVT score is expected to drop by 3.88 percentiles, ceteris paribus. This signifies a relative drop of 9.6% compared to the mean PPVT percentile. It is not clear why an inclination to use child care in the child's third year would decrease cognition.

In focusing on the remaining control variables, one can see several variables of statistical significance. Male children show lower PPVT percentile scores by 3.13 percentiles compared to female children, ceteris paribus. Siblings also display a negative relationship, with each additional sibling expected to lower a PPVT score by 2.52 percentile points, ceteris paribus. Both the Midwest and South have negative relationships compared to children born in the East, with an expected fall in PPVT scores for children born in those regions by 5.06 and 5.39 percentile points, respectively. Hispanic and Black, both at a .0001 level of significance, show detrimental effects on cognition as having a Hispanic mother is expected to lower a

PPVT score by 11.48 percentile points , ceteris paribus, and having a Black mother is expected to lower a child's PPVT score by 15.24 points, ceteris paribus.

While the 1994 base model discussed above focuses on parent's wages and earnings impacting early child cognition, the second 1994 model with OLS output outlined in **Table 6** (Model 2: 1994 Employment Status) incorporates additional variables revolving around parental employment status before and after the child's birth to assess how employment impacts child cognition. Due to a large number of respondents who did not give responses to the questions of hours worked, the sample size drops to 809 respondents. However, the adjusted R^2 of .34 shows that loosing roughly 200 people in the sample still enables having a similar fit. This model also displays heteroskedasticity and corrects for it using heteroskedasticity consistent estimates. Its variance inflation factors did not exceed 2.2, showing little evidence of multicollinearity.

A mother's wage remains statistically significant with a similar magnitude of -.233. Father's earning, however, is no longer significant in this model. Total home percentile, a mother's aptitude score, and each educational attainment degree for the mother remain statistically significant with similar magnitudes from the previous base model. Additionally, the second year of child care remains insignificant while the third year of child care continues to be significant with a larger negative magnitude of -5.23.

The variables revolving around the father's part time and full time employment last year (DADPARTLY, DADFULLY), as opposed to no employment, show no

statistical significance. This implies a father's employment status does not bear significant impacts on child cognitive development. A mother's employment status, on the other hand, does not bear significance if she worked part time last year, but does impact her child's cognition if she worked full time last year at the .0422 level of significance. This indicates that if a mother worked full time last year, in 1993, her child's cognitive score is expected to improve by 5 percentile points, ceteris paribus. This represents a 7.77% improvement compared to the mean PPVT percentiles score of 38.87.

Looking to when a mother began working after the child's birth, each period showed no statistical significance except when the mother began to work in the third year of the child's life (Q912). At a .0476 level of significance, a PPVT score of a child of a mother who goes to work the third year of the child's life is expected to fall by 7.57 percentile points, ceteris paribus. Interestingly, this corresponds to the statistically significant negative relationship displayed when a mother is inclined to put her child in child care during its third year of life. Both variables highlight the sensitivity associated with child cognitive development in the third year of life and a mother leaving the home for extended time periods during that year. Interestingly, returning to work immediately and up to age two do not negatively impact the child's development score, nor does waiting until the child's fourth or fifth year.

If a mother waits three years until going to work and works full time, one can test if the sum of the coefficients is statistically significant. Testing shows her child's cognitive score is expected to fall 2.55 percentile points or 6.6% from the mean, ceteris paribus, at a .0103 level of significance. Conversely, a mother who goes to a

part time job after three years is expected to reduce her child's cognitive score by 4.08 percentile points or 10.50% from the mean, ceteris paribus, at a .0368 level of significance. These findings show how a mother who waits three years but returns full time has a smaller detrimental effect on her child's cognition as opposed to returning part time.

The control variables differ somewhat from the base model, specifically by gender and Midwest birthplace losing statistical significance. Age and an urban and Western birthplace remain statistically insignificant. Siblings continue to display a negative relationship with a magnitude around 2, as well as Hispanic and Black mothers indicating disadvantageous cognitive scores.

The last model used to assess the impacts on child cognitive development incorporates a variety of variables with an added twist: it separates the families into low and high income brackets. Using data regarding the net family income for each household, low and high income brackets were created. The low income families have an income below the sample's 10th percentile which is $8,300 a year, and the high income families exceed the sample's 90^{th} percentile, which is $50,000 a year. The purpose of separating families into different income brackets is to remedy the problem inherent in the data that there is no measure of the quality of child care, Serving as a proxy for nonwage income, the thought is that high income families spend more on child care and receive better quality child care, which help their child's cognition more than poorer quality child care. How may child care differ? The child to caretaker ratio, the amount of toys and supplies, environmental features,

and the ability of the care giver create varying levels of child care that differentiate the cognitive experience for a child.

This third model also incorporates a variety of interaction terms to test how a mother's wage interacts with when she decides to work following child birth. Previously, both variables had been tested for with MOMWAGE1 and a variety of Q variables symbolizing when a mother decided to join the workforce after childbirth (Q1, Q2, Q34, Q58, etc.). After testing each period after birth when the mother began work with its interaction to wage, all periods except Q912 were found to be statistically insignificant. Therefore, only the mothers who returned back to work during the third year of the child's life and the wage is interacted and shown in Model 3. This model was tested for multicollinearity and the variance inflation factor did not exceed 2.2, therefore indicating no excessive multicollinearity. A statistically significant chi square value indicates heteroskedasticity is present, and the model is therefore corrected using heteroskedasticity consistent estimates. The model shows a good fit with an adjusted R^2 value of .3366. The OLS regression output is outlined in **Table 6** (Model 3: Wage Interaction on Entering Labor Force).

Prior to discussing the effects of the interaction term, it is first necessary to note the variables that were not statistically significant versus those that continued to be. To begin, both low and high income show statistical insignificance, indicating a family's income bracket, which aims to delineate better and poorer quality child care, does not bear significance on their child's cognitive development. Furthermore, a model, not shown, incorporating an interaction between the variables showing a mother's

inclination to use child care (Y2CC and Y3CC) and the high and low income brackets did not indicate any statistical significance as well.

As for the independent variables of interest, a father's 1993 earnings, a mother's inclination to use childcare in the second year of her child's life, and what quarter and year a mother chose to work after birth all indicate no statistical significance. As for control variables, an urban and Western birthplace remains statistically insignificant, as does a mother's age. The remaining discussion for Model 3 will focus on statistically significant findings.

A mother's wage continues to show statistical significance at the .0039 level of significance. The magnitude and direction remains consistent with other models, being around -.23. The total home input percentile also continues to be significant with a p value of .0001 and a magnitude around where it has been for all the 1994 models, approximately .168. A mother's aptitude score continues to have a positive relationship with each percentile increase in AFTQ expected to increase a child's PPVT by .239 percentile points, ceteris paribus, at a .0001 level of significance. All degrees of educational attainment for mothers continue to be statistically significant, with similar magnitudes and levels of significance. A mother's inclination to put her child in child care during the child's third year of life is statistically significant at the .0336 level of significance.

Finally, being male shows a detrimental impact on child cognitive scores, remaining around a drop in 3 percentile points, ceteris paribus. Also, each additional sibling is expected to lower a child's cognitive score by 2.5 percentile points, ceteris paribus.

A birthplace in the Midwest or South continues to show detrimental impacts on children's cognition, holding akin magnitudes to previous 1994 models. Hispanic and Black mothers display similar degrees of having disadvantageous impacts on child cognition from other models, both at a .0001 level of significance. These vast similarities among the majority of variables indicate a strong continuity in variable significance across models.

Ultimately the findings most informative from this model, as compared to other models, are those involving the interaction term of a mother's wage and her decision to begin working within the child's third year of life. None of the other times going back to work are significant. The model tested for significance for wages of $6.50, $7.68, $11.06 and $15.86. These values comprise the median, mean, 75th percentile and 90th percentile for this 1994 group of mothers. At each wage, a mother beginning work in the third year of a child's life showed statistically significant results. As a whole, each result showed a negative association with child cognition, indicating all mothers who waited until the child was 3 years old to work show lower child cognitive scores, and the higher the wage, the larger the reduction. For a median wage earner of $6.50, a mother who began work in this period is expected to reduce her child's cognition by 10.13 percentile points, ceteris paribus, at a .0659 level of significance. The expected drops in PPVTPERC that follow for the following values corresponding to wages of $7.68, $11.06 and $15.86 are -10.49, -11.53 and -13.00, respectively, each more negative than the previous score.

2002 Results

Investigating how the same models vary from 1994 to 2002 gives useful insights into how the changing environment of working mothers impact their future children's cognition. Given this data set has nearly half the respondents as the 1994 sample has, due to the higher mean age of 40 for mothers, it also has a lower adjusted R^2 of .188. This model displays many more variables that are not statistically significant compared to the 1994 models. After testing, there was no evidence of excessive multicollinearity or heteroskedasticity. The OLS regression output for the base model for 2002 is outlined in **Table 6** (Model 1:2002 Base Model).

An important difference to note between the 1994 sample and the 2002 sample OLS results is the noticeable disparity in the average PPVT percentile scores. The 1994 sample has an average PPVTPERC of 40.41, whereas the 2002 sample has an average PPVTPERC of 49.5. This higher average in the 2002 sample can be attributed to a variety of variables. The older demographic of mothers display higher aptitude scores, with an average of mother scoring 51.02 in 2002 compared to 43.20 in 1994. Furthermore, 2002 mothers achieved higher levels of educational attainment by greater numbers with 31% completing high school, 48% completing college and 16% achieving graduate school degrees, compared to 42%, 42% and 6%, respectively for 1994. While the 1994 sample had 10% of its mothers not complete high school, only half that percentage did not complete high school in 2002. A higher PPVT percentile score for their children is not surprising due to this group of mother's greater life experiences with age and higher educational attainment. Lastly,

the previous year's earnings for fathers increased noticeably between data sets, with the average father earning roughly $25,400 more in 2001 compared to in 1993. The twofold effect of father's increase in earnings and the mother's educational attainment generated higher cognitive scores for their children.

To begin, unlike the 1994 model, this model shows mother's wages, father's earnings and a mother's high school completion are not statistically significant. A mother who is inclined to put her children in some form of child care the second year of the child's life still shows no impact on PPVT., Now the child care inclination variable for three year olds is a newly statistically insignificant variable. Furthermore, in terms of control variables, a child's gender, urban or Midwest birthplace, or having a Hispanic mother all show no statistical significance. The remaining discussion will focus on the statistically significant results.

Total home input percentile continues to be statistically significant at a .0847 level of significance. It remains materially small in magnitude and positive, similar to the 1994 results, illustrating its impact did not fluctuate dramatically across eight years. A mother's aptitude score also remains consistent with a magnitude of .2379 compared to the 1994 model's magnitude of .2471. Although a mother's high school completion does not bear statistical significance, college and graduate school degrees continue to show beneficial effects on early child cognitive development with analogous magnitudes to the 1994 findings. The number of siblings remains statistically significant at a .0391 level of significance, inching toward 2 percentile point declines for each additional sibling. South and West birthplace regions also continue to display statistical significance with the South maintaining a similar

magnitude but the West showing a larger jump to -9.85 percentile points. Having a black mother indicates less of a detrimental impact compared to the previous two 1994 models, with an expected fall in PPVT percentile score of 9.66 compared to 15.24 percentile points. This model incorporated less black mothers, 14% specifically, compared to 18% in the 1994 data set. Since having a black mother is expected to show detrimental effects on cognitive scores and this model had both lower magnitudes for this variable and lower percentages of black mothers interviewed, it lends itself another reason as to why the PPVT average score is higher in this sample. Lastly, a mother's age, a variable that was not previously significant shows statistical significance in a negative direction at the .0397 level of significance. With each additional year a mother ages, her child's cognitive score is expected to decrease by 1.24 percentile points. This variable is most likely appearing significant in this data set as opposed to the 1994 sample because the mothers comprise an older demographic and mothers in their 40's giving birth may pose health risks to their children.

Model 2, which incorporates employment status and when a mother began working after birth, was run using the 2002 group of mothers. This model's regression output are delineated in **Table 6** (Model 2: 2002 Employment Status). As with the 2002 base model, this model does not exhibit evidence of multicollinearity or heteroskedasticity. Since fewer mothers responded to employment statuses, as some mothers did not work, the sample size falls to 415 respondents. However, the fit of the model was not jeopardized from the base model as it continues to have an adjusted R^2 of .188.

This model did not have as many statistically significant variables as did the Model 2 using the 1994 mothers. Mother's wage, father's earnings, total home input percentile, a mother's high school graduation, a mother's inclination to use child care during years 2 or 3 of her children's lives, father's full time work last year, mother's full and part time work last year and almost all of the quarters and years returning back to work after childbirth show insignificant results. [16] What remain of the independent variables of interest that bear statistical significance include a mother's AFTQ score, a college graduate, and beginning work six to twelve months after childbirth.

A mother's aptitude score is statistically significant at the .005 level of significance and dropped slightly from .2379 in previous tests to .2149 in magnitude. A mother graduating college, compared to not completing high school, is expected to increase her child's cognitive score by 13.73 percentile points, ceteris paribus, at the .0778 level of significance. Compared to the 2002 base model, which carried a magnitude of 9.25 for a college graduation, this second model shows an even stronger presence of this educational attainment. Finally, a mother who attends a graduate school compared to one not graduating from high school is expected to enhance her child's cognitive score by 20.43 percentile points, ceteris paribus, at the .0191 level of significance. This larger magnitude by approximately 6 percentile points for a mother's graduate school completion from 1994 to 2002 further reinforces the important role a mother's education plays in her child's cognition. Starting work

[16] Due to a low sample size, too few observations existed for a father's part time work (DADPARTLY) and it was therefore combined with those who did not work. In any regression run, it never came up statistically significant.

post-childbirth of six months indicates a 13.9 decline in the PPVT score, a larger decline than the three year post-childbirth impact in 1994.

As for the control variables, a child's gender, the number of siblings a child has, an urban or Midwest birthplace, and having a Hispanic mother all show statistically insignificant results. The South continues to show a disadvantageous effect as a being born in the south is expected to reduce a child's cognitive score by 11.50 percentile points, ceteris paribus, at a .0059 level of significance. Similarly, a Western birthplace shows a deleterious impact of -13.52 percentile points, approximately 4 percentile points higher compared to its magnitude in the 2002 base model. Lastly, a black mother and the age of the mother remain statistically significant at the .0680 and .1341 (statistically significant for a one sided test) levels of significance, respectively. Having a black mother shows a lower magnitude compared to other models of -8.76, as does a mother's age, which has a lower 2002 magnitude at -1.06. The statistical significance attached to the mother's age is again explained by the older demographic of women interviewed in 2002.

The 2002 Model, 3 which incorporates low and high income brackets, and interaction terms between mother's wages and when a mother began working after childbirth, shows interesting new findings. The low income bracket uses net family incomes below $10,000, below the sample's 10^{th} percentile. Conversely, the high income measure incorporates those families above the 90^{th} percentile, or $79,000. This model originally tested for interaction terms with each quarter after birth when a mother began working, but found the beginning to work after the baby's sixth month, Q34, to be the only time period that indicates statistically significant results.

Furthermore, interaction terms between the child care variables (Y2CC and Y3CC) and both income brackets were tested and not found to be statistically significant. The model shows no evidence of excessive multicollinearity nor heteroskedasticity. The OLS Regression output for this model lie in **Table 6** (Model 3: 2002 Wage Interaction).

Of the variables of interest, only a mother's aptitude score, graduate school attendance, and a mother beginning work during a child's 6-12 months of life interacted with her wage show statistically significant results. All the other independent variables do not show statistical significance with the income brackets added, including low and high income. As for the control variables, a Southern or Western birthplace, a Black mother and a mother's age show statistical significance. The remaining control variables do not indicate statistical significance. Given the fewer numbers of statistically significant variables, this model has a slightly low adjusted R^2 of .2063 compared to the same model for the 1994 data set.

A mother's aptitude score remains consistent in magnitude and direction, approximately .24, as with previous 2002 models, at a .0001 level of significance. A mother's graduate school degree however, is nearly half the magnitude of the Model 2 MOMGRAD, with only 11.21 percentile point expected increase, ceteris paribus, compared to 20.42 percentile point increase in PPVT. Additionally, a Southern birthplace shows an expected decrease in PPVT by 6.44, whereas in Model 2, it showed an expected fall by 11.50 percentile points, ceteris paribus. Similarly, a Western birthplace shows a detrimental impact of -9.64 percentile points in PPVT, whereas in Model 2, it indicated an expected fall by 13.52 percentile points, ceteris

paribus. While these birthplaces indicated smaller magnitudes and less deleterious impacts, having a Black mother appears to be more disadvantageous in this model compared to Model 2. Here, having a Black mother is expected to decrease a child's cognitive score by 11.22 percentile points, ceteris paribus, at a .0066 level of significance. Conversely, in Model 2, having a Black mother only lessened a child's score by 8.76 percentile points, ceteris paribus.

While these effects show similar overall findings from previous models, solidifying previous indicators of child cognitive development, a new finding from this model revolves around a mother's high wage and beginning work when the child is 6-12 months old. For a mother who begins work in the first 6-12 months of her child's life, the models test results indicate a positive relationship with PPVT scores, but only at relatively high wages. Specifically, once a mother reaches a high wage of $18.18 or $27.00, the 75th and 90th percentile wages of this 2002 sample, the mother's high wage impact in beginning work in quarter 3 or 4 has beneficial impacts. If a mother earning $18.18 began working in the third or fourth quarter of her newborn's life, her child's PPVT is expected to increase by 12.12 percentile points, ceteris paribus, at a .1035 level of significance. For a mother earning the 90th percentile wage of $27 in this period, her child is expected to increase their cognitive score by 31.16 percentile points, ceteris paribus, at a .0090 level of significance. The median and mean wage mothers do not show statistically significant results for these quarters, however, for mothers with low wages, say $5.00 per hour, predicted PPVT falls by 16.12 points for those who begin working in this period. Low wage mothers starting work after six months after giving birth, indicate lower child cognition

scores, whereas mothers with wages above the 75th percentile in wages predict higher PPVT scores for their child. Wages in the middle of the distribution do not alter the impact from returning six months post-partum.

CONCLUSION

Understanding how cognition of children is affected by parental employment choices and educational decisions can help parents make the best choices for their children and provide parents with greater direction in raising the next generation of children. As more mothers continue to join the labor force and opt to leave the home, knowing how this impacts their child's cognition represents an important element of the parental decision making process. Since children's early cognitive development impacts their ability to succeed and meet their greatest potential later in life, developing a child's early cognition optimally represents a unanimously desirable and important mission worldwide. Through this analysis of the economic factors involved in the parental decision making process of raising children, a solid grasp of which triggers truly impact early child cognition become apparent. However, with that being said, an important aspect to remember regarding this study is its omitted variable bias. Since a father's IQ and educational attainment do not exist in the data set, the absence of both, which are expected to be positively correlated with dad's earnings and PPVT scores, causes these variables' impacts to all be captured together in the dad's earnings variable. Thus, a dad's earnings impact appears overstated in the results. However, most models show a father's earnings to be statistically insignificant; hence it may not have a significant positive effect on its own when the coefficient's value falls toward zero.

Besides this omitted variable bias, the remaining estimates appear more reliable. This study separates mother's and father's incomes and their impact on cognition, categorizations Blau (1999) Bernal and Keane (2009), and Cabrera et al (2011) did not examine. A mother's wage was found to be statistically significant in all 1994 models and in no 2002 models. Furthermore, when it was found to be statistically significant across 1994 regressions, it is in an unexpected negative direction. While Blau (1999), Bernal and Keane (2009), and Cabrera et al (2011) find mother's income to have a small positive, but statistically significant, effect on child cognition, this study shows that higher mothers' wages decrease child cognition in each 1994 Model. By 2002, neither mother's wage nor father's income impact cognition. Dads' earnings produce a small increase in cognition in only Model 1 in 1994 and is statistically insignificant in all remaining models for both years.

While mothers' wages indicate statistical significance throughout the 1994 models in an unexpected direction, the detrimental impacts on child cognition remain materially small, about -.22. Given the unexpected nature of the mother's wage variable, several explanations are reasonable. Given cross sectional data as opposed to longitudinal data on the mothers, high wage mothers may find their time at work thinking critically and using their intellect embraces their comparative advantage, suggesting time spent with toddlers does not develop their child's cognition effectively. Mothers with low wages may be involved in less interesting or more mundane work such that time with their child is more fulfilling and enhances cognition more. Alternatively, mothers with high wages may have cut back on work hours and engage in other time-intensive activities that please the mothers more than

focusing the extra time on their child. High wage mothers may choose activities such as golf, tennis, volunteering, etc. that may not enhance their child's cognition. As shown shortly, these reasons are consistent with results from Model 2 and Model 3 in 1994 that seek to shed more light on the negative wage impact. Unlike a mother's wage and a father's earnings, the total home input percentile remained statistically significant throughout the majority of models in the expected positive direction. This reinforces previous literature by Blau (1999) where more home inputs enhance a child's cognition. While Blau allowed for increases in income to impact home inputs, which in turn affected development, home inputs were segregated from income in this study. Doing so allowed for isolated changes in home inputs, holding income constant, to change cognition. Not surprisingly, providing appropriate home environments enable children to reach their intellectual potential. Surrounding a child with resources thought to improve a child's development also leads to smarter children. When working parents are spending time with their children, exploring places and museums and connecting with books and thought-provoking toys, this is time well spent in raising well developed children.

A mother's aptitude test scores and educational attainment additionally provide positive statistically significant results in expected directions in all models. A mother's AFTQ score impact remains around .23 with a consistent level of significance around .0001 indicating the natural way a mother passes on cognitive endowment to her children. Maternal educational attainment through high school, college, and graduate school, similar to the findings of Verropoulou and Joshi (2009) and Schady (2011), find a positive effect on early child cognitive development.

Although Verropoulou and Joshi find the improvement in a child's behavior began with mothers who had completed high school, this study demonstrated additional improvements beyond high school graduation and into college and graduate school. It is hypothesized that the mothers become more efficient in enabling their children to grow cognitively as their years of education increase. Given a mother's graduate school attendance shows statistical significance in every model, it is apparent this level of educational attainment positively impacts her child's cognition in a notable way. This impact ranges in magnitude from 11.2 to 18.2 percentile points across the six models, illustrating the noteworthy material impact a mother's graduate education can have on child cognitive scores relative to those not graduating high school.

As a mother opts to seek higher education and join the labor force, she typically, assuming a father is working as the vast majority are in both year's data sets indicate, relies on some form of child care when she and her husband cannot be with their child. Given the necessity of child care for many parents, the inclination of a mother to send her children to child care during the second or third year of their children's lives were incorporated into the models. Since there is no expected relationship with early cognitive development and child care, the findings reveal new information regarding a mother sending her child to child care in the third year of life, showing statistical significance in a negative direction in each 1994 model, but in none of the 2002 models. For 1994, with magnitudes averaging around -4.4 percentile points, a mother who is inclined to use child care in the third year of a child's life appears to

affect her child's cognition in a disadvantageous way. The use of day care may be detrimental if it is not of good quality.

Seeking to understand why higher mother's wage may reduce a child's cognitive test score in 1994, Model 2 finds the period when a mother begins working after the child's birth shows no statistical significance except when the mother begins to work in the third year of the child's life (Q912). Testing from the 1994 Model 2 using full time employment status interacting with waiting three years shows a smaller detrimental effect on her child's cognition, specifically with a -2.55 percentile points decline or 6.6% from the mean, ceteris paribus. Conversely, a mother who goes to a part time job after three years is expected to reduce her child's cognitive score by 4.08 percentile points or 10.50% from the mean, ceteris paribus. Additionally, as seen in the 1994 Model 3 using wage interaction instead of employment status , the higher a mother's wage, the larger the reduction in child cognition for a mother returning to work in this third year. Specifically looking at the mean, 75th percentile and 90th percentile for this 1994 group of mothers, the expected drops in PPVTPERC that follow for the following values corresponding to wages of $7.68, $11.06 and $15.86 are -10.49, -11.53 and -13.00, respectively, each more negative than the previous score. These combined findings show waiting three years for a mother to work after child birth and using child care can have deleterious impacts on early cognitive development.

Although mothers' wages are insignificant individually in all 2002 models, its interaction with beginning work after child birth differs greatly than in the 1994 sample. First, the only significant time period is now Q34, or six to twelve months

post-childbirth, otherwise that decision indicates no bearing on PPVT. The statistical significance of the -13.9 impact from Model 2 leads to how this impact is affected via mother's wages in Model 3. The 2002 Model 3 test results find that a mother deciding to work within the child's first 6-12 months of her child's life indicates a positive relationship with PPVT scores for relatively high wages, those above the 75^{th} percentile. Very low wage mothers earning less than $5.00 indicate lower child cognition scores. Mother's wage in between do not interact significantly Thus unlike 1994, when higher wages increased the decline in the PPVT, here they offset it at high wages.

Along with studying wages and earnings of parents, this research also investigates parental employment status effects on cognition. As examined in Model 2 for 1994, a mother working full time indicates statistical significance in a positive direction. This result is contrary to Lindsay et al (2003), who find mothers transitioning into work not impacting a child's cognition. The father's employment status and the mother's part time work bear no statistical significance.

While the study is not designed to focus on periphery variables for their statistical significance to children's cognition, but rather serves to use these demographic variables as controls, interesting findings still resulted that need to be recapped. The male gender showed statistical significance in a negative direction in Model 1 and 3 of 1994, indicating being male lowered a child's cognition. Siblings in every model except the 2002 Model 2 indicate a statistically significant effect in a negative direction, with each additional sibling lowering a child's cognition between 2 to 3 percentile points, ceteris paribus. Additionally, a Southern birthplace shows

statistical significance in every model, indicating deleterious impacts ranging from -4.9 to 11.5 percentile points on child cognition. Lastly, having a Hispanic mother in the 1994 dataset showed deleterious impacts that are statistically significant, but did not bear statistical significance in any 2002 model. Conversely, across each model, having a Black mother is statistically significant and indicates disadvantageous impacts on child cognition ranging from -8.8 to -18.4 percentile point decreases.

Differences between the 1994 and 2002 statistical significance in variables can be attributed to a variety of reasons. The first is the difference in mother's ages with older mothers in the 2002 sample. The mothers in 2002 also comprise higher levels of education, higher aptitude test scores, and higher wages. This group most likely waited longer to have children compared to the 1994 group of mothers, choosing to focus on their careers and education as opposed to having children in their twenties. The 2002 group has more intellectually cognitive children due to these choices they made, illustrating why the key indicators in the 2002 regressions comprise a mother's aptitude test score and higher education levels. Since the 1994 mothers have less education comparably and lower AFTQ scores, the model picks up more indicators of child cognition as these scores and educational levels do not overwhelm a child's cognitive endowment and development.

Due to data restrictions, one cannot investigate what occurs for older mothers in 1994 or younger mothers in 2002. But if the results translate over time, then for older mothers who spent time continuing their education, their children benefit

cognitively, even more than for younger mothers with similar educational attainment. Older mothers who go back to work six months post-childbirth have a positive impact on their child's development if they earn high wages, whereas there is no difference on the child for those who go back at other times or stay at home. This may be due to high wage mothers using better quality child care services, i.e., having people with a comparative advantage in child rearing while they specialize in their career that affords a high wage. For younger mothers, higher wages are associated with lower cognitive scores generally, but bigger declines for mother who three years to enter the labor force after childbirth. Otherwise, staying at home versus going to work at any other period makes no difference on the child's development. It appears higher wages are not put to good use with younger mothers, perhaps due to their relative immaturity.

Shortcomings exist within this research project. The low adjusted R^2 of the 2002 models show a significant amount of the variation in the PPVT scores can be attributed to outside factors not present in the model. Including omitted variables, such as a father's IQ, a father's educational attainment, and the quality of day care, may benefit the predictive power of the model. Additionally, unobserved heterogeneity poses a potential shortcoming as aspects such as a mother's work ethic and determination to raise a well-developed child are not present in the data set. Due to time and data constraints, such variables, among others, were not plausible to include. A future paper could analyze the cognition of a child from infancy to age 18 to see if the impacts from parental choices differ over the years of childhood. Obviously data potentially more reflective of current times where the majority of

mothers work, as opposed to data from almost 20 years ago, would be useful to see if the two parents' wages and employment decisions yield different impacts than those discussed. If so, the magnitudes associated with the mother's wage and father's income impacts will have changed, leading to differences in child cognition.

The true indicators across all models comprise a mother's education. This is presumably the key to more efficient child rearing, as more educated mothers can teach their children more effectively. Given the lack of significance in so many time periods as to when to begin working following childbirth and whether employment status is part time or fulltime suggests parents seem to figure out what to do. They do no harm, meaning their child's development does not wane based on these decisions. Dual working parents need not be overly fearful that they will hinder their child's cognitive development. Dual earning parents can feel less guilty about not being home with their children due to work schedules and enjoy the fruits of their work and biological efforts.

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