Long-term Effects of Head Start Enrollment on Adulthood Educational Attainment and Economic Status: A Propensity Score Matching Approach

A DISSERTATION

SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL

OF THE UNIVERSITY OF MINNESOTA

BY

Eunsu Ju

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

Clifton David Hollister, Ph.D., Adviser

August 2009

This work could not be done without the support, help, and sacrifice of many people including my committee professors, friends, and family.

However, I would like to dedicate this work to Nami Youn, my companion for life.

I can’t imagine today without her sacrifice and encouragement.

She is the one who made all this work possible.

Abstract

In 1965, the Head Start program was introduced as part of War on Poverty. There was a hope that intergenerational transmission of poverty could be broken down by a comprehensive preschool program for low income children and their families. Since then, a number of studies have explored the impact of the program. The majority of those studies have focused on cognitive development and educational outcomes, and they generally suggest that the program produces short-term effects, but that most of them disappear in the long-term. However, most previous studies suffered from comparability problems (i.e. different background characteristics) between program participants and non-participants. Further, although the main purpose of the program was to reduce poverty in the long run, confirmation of the idea has been almost ignored from the research for the last 40-plus years. The main purpose of this study is to conduct a more rigorous evaluation in regard to the long-term effects of the Head Start participation on adulthood educational attainment and economic status (as measured by personal earned income, the family income to poverty ratio, and welfare dependency).

This study utilized data from the Panel Study of Income Dynamics (PSID) from 1970 to 2005. To examine the effects of Head Start participation on adulthood income, a total of 1,765 young adults (aged 19 to 35 in 2005) were selected from the original PSID sample: 161 with long-term Head Start participation, 171 with short-term Head Start participation, 611 with other preschool participation, and 822 with no preschool participation. Propensity Score Matching (PSM) analysis was employed to control pre-existing differences that might have an influence on preschool experience. To ensure whether the findings are consistent regardless of how control groups are matched, four matching models were examined: one-to-one matching without replacement, one-to-one

matching with replacement, two-nearest neighborhood matching, and radius matching. Using the matched samples, a series of multivariate analyses were conducted: ordered logistic regression for educational attainment, Tobit analysis for personal earned income, OLS regression for family income to poverty ratio, and logistic regression for welfare dependency. To control the influence of other factors, a variety of variables at the community, family, and child levels were also included in the analyses.

Most of the pre-existing differences between groups were sufficiently controlled by the PSM. According to the results of the following multivariate analyses, Head Start provided sizeable gains to its participants in terms of educational attainment if they attended the program at least one year. Long-term Head Starters were more likely to have higher level of educational attainment by approximately 1.5 to 2 times than no preschool children, 2 to 3.2 times than other preschool children, and 1.9 to 2.1 times than short-term Head Starters. However, no significant effects were found among short-term Head Start participants. Regarding the effects on economic status, long-term Head Start participation had indirect effects on personal earnings and family income to poverty ratio through higher educational attainment as compared to short-term Head Start participation or no preschool experience. However, the effects on welfare dependency were not clear.

Although some studies have questioned the long-term effects of Head Start participation, this study confirmed that Head Start had provided long lasting effects to its participants on their adulthood educational attainment and economic status. Consequently, more efforts should be made to minimize the barriers that interfere for low income children to attend the program. The programs' coverage should be expanded and the quality of the program increased to reduce intergenerational poverty.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

Over 40 years former President Johnson signed a declaration of the War on Poverty in 1964. Following the Economic Opportunity Act, various War on Poverty programs including VISTA, Job Corps, Head Start, and Community Action Program were established to minimize poverty and alleviate problems which stem from poverty. Although these programs have existed for more than 40 years, poverty is still one of the most serious problems in America, especially for children. In 2006, the official poverty rate in the U.S. was 12.3 percent (36 million), which was only 2.4 percent smaller than the rate 40 years ago (U.S. Census Bureau., 2007). The reduction mostly came from older Americans aged 65 or over, where the rate decreased from 28.5 to 9.4 percent. During the same time period, child poverty rates dropped just .2 percent, so by 2006 about 13 million (17.4 percent) children under 18 years of age were living in poor families (U.S. Census Bureau., 2007).

Living in poverty during childhood has a great impact on children's life from birth to adulthood. Research indicates that children raised in poverty show inferior results in health, cognitive development, school achievement and adulthood economic status as compared to children who have never lived in poverty (Blau, 1999; Duncan & Brooks-Gunn, 1997; Duncan, Yeung, Brooks-Gunn, & Smith, 1998; Hill & Sandfort, 1995; S. E. Mayer, 1997; McLoyd, 1998; Sherman, 1994).

According to Sherman (1994), poor children have a 1.3 times higher risk of death during infancy and three times higher risk during childhood than non-poor children. They

are also about two times more likely to have physical or mental disabilities and three times more likely to be in poor health. Researchers explain that the higher rate of health problems of poor children is due to some degree to limited access to qualified medical services and to nutrition (Bhattacharya, Currie, & Haider, 2004; Cunningham & Hahn, 1994; Monheit & Cunningham, 1992). Using the National Longitudinal Survey on Youth (NLSY) data set, Case-Lansdale et al. (1991) found that family income was largely related to intelligence and verbal test scores at ages two, three and five years where other family characteristics were constant. Similar results have been found in many similar studies (Bolger, Patterson, Thompson, & Kupersmidt, 1995; Costello, Compton, Keeler, & Angold, 2003; Duncan & Brooks-Gunn, 1997; Ghase-Lansdale et al., 1991; Yeung, Linver, & Brooks-Gunn, 2002).

Children raised in poverty also generally present lower school achievement and have higher dropout rates (Adair, 2001; Dubow & Ippolito, 1994; Duncan & Brooks-Gunn, 1997; Eamon, 2002; Laird, Lew, DeBell, & Chapman, 2006; National Center for Education Statistics, 2006; Sherman, 1994). From observations of elementary school-age children in the NLSY data, Dubow and Ippolito (1994) found that poor children had lower scores in math and reading by 21 to 34 percent compared to their non-poor peers. Laird et al. (2006) also reported that the dropout rate in 2003 of the youths from the bottom 20 percent of family income levels was about 8 percent, which was two times higher than middle income peers and four times higher than the wealthy.

Child poverty has an influence on adulthood income and welfare dependency. From a study of the intergenerational correlation of welfare participation, Gottschalk (1992) found that children of welfare recipients showed about a two times higher

likelihood of receiving welfare when they are adults than children of non-welfare recipients. Corcoran (1995) found a significant correlation of income between parents and children. Where several background variables were constant, individuals from poor families showed 25 to 40 percent lower earnings and wages than those from non-poor families. Using data from the Panel Study of Income Dynamics (PSID), Solon (1992) obtained similar results but with a slightly higher correlation.

In response to the growing recognition that poverty was the root of many social problems, Head Start was implemented as part of the War on Poverty in 1965 and intended to minimize the problems listed above (Butler, Gish, & Shaul, 2004; Zigler & Muenchow, 1992). The support of the program came more out of political interests rather than scientific knowledge. While Head Start was influenced by theories such as culture of poverty theory, theories of cognitive development, and human capital theory, which gained popularity during the 1960s, little was known about the effectiveness of early intervention for low income children and their families (Fukahori, 2000). In short, it began as a social experiment without sufficient knowledge to guide effective implementation.

Although there are variations in local program designs and administrations, it has been a federal program from the beginning and the details of the program are guided by the Head Start Performance Standards.[1] While it is generally known as a preschool program for low income children, it actually provides a wide range of educational and social services which includes early childhood education, child care, health service and parents-education. Originally, the program's target population was low income children,

[1]. During the early years, there was no Head Start performance standard, and the first Performance Standard was published in 1974.

aged three to five, and their families, but the coverage was extended to younger children, from birth to age three, and their families in 1995 by the implementation of the Early Head Start. Program eligibility is generally determined by family income (up to 100% of federal poverty guideline). Children with a diagnosed disability or children in foster care are also eligible for the program even though their family income is greater than 100% of federal poverty guideline. However, the number of children from over-income-families in each agency should not exceed 10% of entire children attending the agency.

Since Head Start began, many studies have examined the impact of the program. They generally suggest positive program effects in the short-term (Abbott-Shim, Lambert, & McCarty, 2003; Barnett, 2007; Bryant & Maxwell, 1997; Lazar & Darlington, 1982; Reynolds, 1994), but the long-term effects seem less evident than the short-term effects. Some criticize the program since positive gains in cognitive test scores fade after the program ends (Haskins, 1989; Locurto, 1991; Spitz, 1986), and others praise it because program participants produce desirable outcomes on other domains such as grade repetition, special education placement, and high school completion (Barnett, 1998; W. S. Barnett, 2004; Currie & Thomas, 1995).

Whatever the findings of previous studies, the majority of them have focused on cognitive development and educational outcomes although the main purpose of the program was originally to reduce poverty transmission from parents to their children in the long run. Moreover, most studies have suffered from comparability problems between program participants and non-participants. Although the program effects should be examined from children of similar backgrounds except for the program participation, many Head Start evaluation studies have applied simple pre- and post-test designs

without constructing a comparison group. Even for studies that included non-participants for comparison, the program effects were examined without considering the dynamic nature of family income. In most cases, family income was examined at age three or four, and it was assumed that the cross-sectional economic status remained constant. That is, once children were categorized as poor, they were regarded as having similar economic backgrounds even though some of them could be better-off or worse-off within a year or two. Given that family income is one of the most powerful indicators of child development and adulthood economic, overlooking the dynamic nature of family income may result in erroneous findings. Hence, further research with a more robust research design is needed to examine the effectiveness of the Head Start program, especially for the long-term effects.

The main purpose of this study is to provide more accurate estimates on the long-term effects of the Head Start program. Considering the main objective of the program at the beginning, which is to reduce intergenerational poverty by helping low income children improve educational attainment, the focus of this study is given to educational outcomes and economic status when they grow up. Educational outcomes are measured by the level of highest education (less than high school, high school, and college or higher) and adulthood economic status is examined by personal earned income, family income to poverty ratio, and welfare dependency. To overcome the limitations of prior research and to provide more accurate estimates on the effectiveness of Head Start, this study uses Panel Study of Income Dynamics (PSID) data which are population-based representative data. The background information is available for each year since 1968[2] making it possible to consider income dynamics and to follow the same children from

[2]. Since 1995, the PSID survey has been conducted every two years.

birth to adulthood. To control the pre-existing difference in background characteristics between Head Start children and their comparison peers, Propensity Score Matching analysis was performed.

Before presenting the detailed research methods and findings, the historical and theoretical background of the Head Start program is briefly reviewed in chapter 2. In chapter 3, the findings of previous research and their limitations are discussed. Then, detailed research methods, findings and conclusions are presented correspondingly in chapters 4, 5, and 6.

Chapter 2

Historical/Theoretical Background

Development of Head Start

In 1964, President Lyndon Johnson declared "War on Poverty" in his State of the Union Message, and Congress launched several programs towards ending poverty by passing the Economic Opportunity Act (EOA), which was one of the key parts of the Great Society agendas. All of the programs were initiated during this time including the Job Corps, which provided youth with education and vocational training for free, the Community Action Program (CAP), which empowered the poor to fight poverty by themselves, and Volunteer In Service To America (VISTA), which was a domestic Peace Corps program (Zigler & Muenchow, 1992).

Head Start was one of the programs of the war. It was started in 1965 with the hope that it would end poverty transmission from parents to their children by providing a comprehensive preschool program. At the beginning, Head Start was implemented as an eight-week summer program serving over 560,000 children nationally (Shonkoff & Meisels, 2000). Since the program was implemented, it steadily expanded in both quantity and quality.[3] It became a year-long program, and the eligibility has been extended to migrants, handicapped children, and younger children from birth to age three (Zigler & Muenchow, 1992).[4] The served population has grown to 908,424 in 2007, and more than 25 million children have enrolled in the program since it began (Office of

[3]. See Appendix A for more details about the changes in Head Start program.
[4]. Handicapped children were included in the program by the amendment of Economic Opportunity Act (EOA) in 1972, and the Early Head Start program, targeting children less than three years, began in 1995.

Head Start, 2008). As shown in Figure 1, the appropriation for Head Start has dramatically increased for the last 40 years. It began with about 96 million dollars in 1965 and grew to over 6 billion dollars in 2007 (Office of Head Start, 2008). Head Start expenditure increased by more than 400 million dollars, even during the Reagan era, which was well-known for cutting welfare programs targeting low income families such as Aid to Families with Dependent Children (AFDC), the National School Lunch Program (NSLP), and the subsidized housing program. During the 1990s, legislation dramatically increased Head Start funding with measures such as the Human Services Reauthorization Act in 1990 and the Head Start Reauthorization Act of 1994 (National Head Start Association, 2005). Most of the growth was attained over the last fifteen years, from 1990 to 2005. Although some portion of the increase can be accounted for by inflation, there has still been significant and continuous growth since its initiation, even after adjusting for inflation.

While the expenditure has grown exponentially, the number of enrolled children fell off for the first few years and rose after 1970. Since Head Start was a summer program at the beginning, it was possible to serve millions of children with limited resources. However, the number of children served rapidly dropped for the first few years, during which the programs were switching to year-round programs,[5] despite increased resources. Due to the increased resources and decreased recipients, per capita expenses in 1970 rose approximately five to seven times more than the original summer programs (Vinovskis, 2005).

Besides the changes in expenditure and the number of participating families, changes in administration also occurred. Four years after its initiation, Head Start was

[5]. By 1970, virtually all Head Start programs became year-round programs (ACYF, 1995).

transferred from the Office of Economic Opportunity (OEO) to the Office of Child Development in the Department of Health, Education, and Welfare (HEW). In 1979, the Department of Education (ED) was separated from HEW by the Department of Education Organization Act, and HEW was renamed as the Department of Health and Human Services (DHHS). The program has been run ever since by the Administration for Children and Families (ACF), a division of DHHS, and administered locally by non-profit organizations and local education agencies.

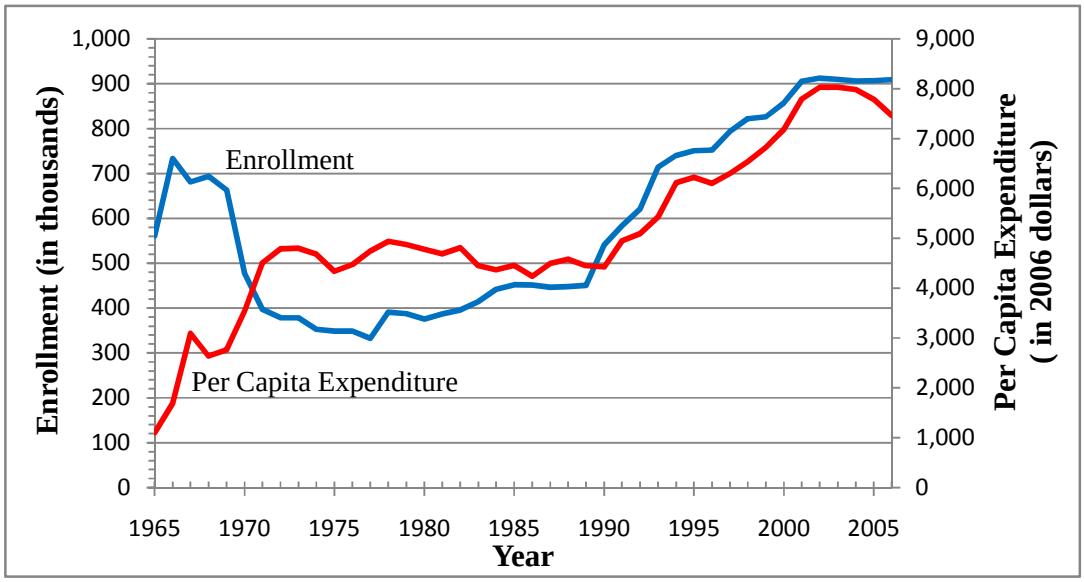

Figure 2-1. Head Start Enrollment and Per Capita Expenditure

Source: Head Start Program Fact Sheet from http://www.acf.dhhs.gov

Although the program has remained under the control of HHS, President Carter originally proposed to transfer Head Start to the ED in 1978 (Vinovskis, 2005). Recently, President Bush also presented a similar plan to move the Head Start program from DHHS to ED as part of an effort to prioritize the education component of the program (DHHS, 2003; The White House, 2003). The underlying rationale of the proposals was that pre-

reading and numeracy skills should be Head Start's top priority, and ED would be more efficient to achieve these goals than DHHS (Butler et al., 2004). However, Edward Zigler, one of the original architects who designed the program and many other Head Start advocates objected to the plan and urged the administration to keep it in DHHS (Zigler & Muenchow, 1992). From their points of view, Head Start was not just an education program for low income children at a preschool age; rather, it was a program providing a wide variety of services such as health, nutrition, and social services. Accordingly, they were concerned that the transfer to ED could restrict the program to a narrow classroom program with no comprehensive services and that the focus on education would compromise the parental and community action strengths of Head Start (Zigler & Muenchow, 1992). Due to the persistent social opposition, neither of the proposals has been actualized, and Head Start is still run by DHHS.

Factors That Affected the Initiation of Head Start

Rediscovery of American Poverty and the Culture of Poverty

After World War II, the American economy grew considerably. Most Americans were unaware of the extent of the poverty and the predicament of their disadvantaged neighborhoods until the early 1960s. They commonly believed that poverty was caused by individual flaws or by the geographical accident of living in a pocket of poverty such as Appalachia (Zigler & Valentine, 1979). Michael Harrington played a key role in helping Americans rediscover "the other America" through his book, published in 1962, with the same title (Vinovskis, 2005). He highlighted the presence of widespread poverty and economic disparities in the U.S. and documented that about a quarter of Americans,

at the time, lived in poverty and lacked adequate food, housing, and health care (Harrington, 1962).

As awareness of persistent poverty rose, the linkage between poverty, lower educational attainment and the unqualified labor force was investigated and substantiated by research (Council of Economic Advisors, 1964; President's Task Force on Manpower Conservation, 1964). Lower education was generally associated with a higher risk of being poor and unskilled. The Council of Economic Advisors (1964), using the poverty line of $3,000 for a family and $1,500 for an individual living alone, reported about 20 percent of the total population lived in poverty in 1962, and 37 percent of the families headed by a person with less than an eighth-grade education were poor. According to the President's Task Force on Manpower Conservation (1964), half of the men called by the draft were unqualified for military service due to poor health and inadequate education. The task force suggested that the inferior living conditions and social behaviors that characterized the poor were inherited from generation to generation in a cycle of poverty.

Increasing Interests in Early Childhood Education

Head Start is generally regarded as a national specimen of helping poor children escape from poverty by providing early education. However, it was influenced by smaller local initiatives that preceded the program.

The oldest and one of the most outstanding programs was the High/Scope Perry Preschool Project, which commenced in 1962 in a public school in Ypsilanti, Michigan by David Weikart and his colleagues (Schweinhart, 2002; Weikart, Bond, & McNeil, 1978). Its goal was to evaluate the teaching program, High/Scope model, designed to promote children's social and cognitive development through active participatory

learning (Schweinhart, 2002). Although the initial purpose of the project was to evaluate the newly developed pedagogy rather than the effects of the educational interventions on alleviation of the poverty, it was closely related to the latter since its target population was disadvantaged, and the goal was to explore the program's long-term effects on participants. .

Around the time that the Perry School Project was initiated, many poor students moved into the neighborhood of Ypsilanti and had never had any preschool education (Schweinhart, Berruetaclement, Barnett, Epstein, & Weikart, 1985). Grade retention was one of the greatest burdens for the school district (Schweinhart, 2002). Thinking that it could reduce the problem by providing preschool education to the children in need, Weikart and his colleagues decided to provide the High/Scope program for low income preschool children at ages 3 or 4 (Hohmann & Weikart, 1995; Weikart et al., 1978). A total of 58 African-American children received the preschool program for one to two years, and 65 comparison peers with no preschool intervention were included in the project. This program was the first preschool program in Michigan.

In addition to the Perry School Project, other projects nationwide provided educational services to preschool-age children with potential risk of school failure, such as the Early Training Project, which began in 1962 in Tennessee and served retarded children, and the New Haven Pre-kindergarten Program that started the next year in Connecticut targeting poor children (Gray, 1987; Stone, 1979).[6] Both of these programs provided 10-week summer programs which were similar to a traditional nursery school

[6]. The Carolina Abecedarian project and Chicago Parent Child Center project were regarded as model programs. Since these programs began after project Head Start, discussions on these programs are excluded, although the continuation of the Head Start program was influenced by the performance of these programs.

program but focused on stimulating attitudes necessary for later school success. They were both funded by the Ford Foundation, a philanthropic organization that played a prominent role in supporting early childhood education projects at that time.

Although these projects were less comprehensive than today's Head Start program in service components, the idea of using early educational intervention as an antidote to poverty influenced Head Start. Specifically, the Early Training Project affected the birth of Head Start by impressing Sargent Shriver who was the first director of OEO under which Head Start was administered and a key person from whom the idea of Project Head Start originated (Zigler & Muenchow, 1992).

Political Background and the Influence of Shriver

The single most important factor that resulted in Head Start was the War on Poverty because the program was initiated as a program of this effort. However, poor children were not a prime concern of the war at the beginning, and most War on Poverty programs were aimed at youths and adults in poverty (Rank, 1994).

The birth of the Head Start program stemmed partly but decisively from the disappointing performance of the Community Action Program (CAP), which was established by the Economic Opportunity Act (EOA) in 1963 during the War on Poverty (Vinovskis, 2005; Zigler & Muenchow, 1992). The main purpose of the CAP was to empower and organize poor people so that they could fight against poverty by themselves. Sufficient support from the federal government was given to the program. In the first year, Congress had assigned $300 million for the program; however OEO had spent only about 10 percent of that appropriation by midyear (Zigler & Muenchow,

1992). Because CAP was believed to be associated with Communist ideals and radical ideas, mayors were reluctant to adopt the program (Vinovskis, 2005).

Faced with the possible surplus of CAP funds, Sargent Shriver, who was the director of OEO and chief general in the War on Poverty, asked OEO's research division to investigate the total problem of poverty. He found from the research that almost half of the American poor were children and most of them were younger than 12 years old (Zigler & Muenchow, 1992). Thinking that it was hard to blame preschool children for being lazy or responsible for their own financial miseries, he decided to launch a new program for poor children with the remaining CAP funds, which would become Project Head Start (Stossel, 2004).

The beginning of the Head Start program was also influenced by Shriver's personal experience as president of the Chicago School Board. From his experience, he aimed to resolve the issues he observed: school summer breaks resulting in teacher unemployment, student disengagement, and inadequate use of school resources (Stossel, 2004). He thought that Project Head Start would use tax-supported school facilities more efficiently, provide summer jobs for teachers, and find a way to introduce a preschool program for poor children to the school environment during the summer before their first year of school (Zigler & Muenchow, 1992).

Theoretical Underpinnings of Head Start

The initial premise that led the development of Head Start was that the provision of early education program for poor children could prevent them from becoming poor adults in the future. Several ideas were embedded in this hypothesis. The thought that

poor children lack opportunities to learn appropriate social values and attitudes from their parents is linked to the culture of poverty theory. The belief that it is better to provide children with educational treatments during early years because most of the development in human intelligence takes place at that time is associated with the neuropsychological theory and research findings that support early childhood education. Finally, the idea that the odds of higher income would increase and the odds of falling into the poverty decrease as the level of education goes up is influenced by the human capital theory. A brief review of these theories will be presented in the following section.

Culture of Poverty

The culture of poverty is a social theory that explains how poverty is transmitted from one generation to the next. Based on the idea that poor families have a unique value system, the theory posits that their value system, often called *subculture of poverty*, is the main cause of intergenerational poverty.

This theory was first introduced by Oscar Lewis (1959) who found the existence of a unique subculture among the poor from a case study of five Mexican families. Characterizing the subculture as a strong feeling of marginality, hopelessness, dependency, exclusion from the mainstream, powerlessness, and inferiority, he argued that poverty was inherited from parents and passed onto children because children were socialized into the same subculture that perpetuated their inability to get out of poverty (Lewis, 1966). Although Lewis (1959, 1966) concluded that the culture of poverty brought about the cycle of poverty, he made it clear that the culture is not the cause of the poor's response to poverty but the result of positive adaptation to it. That is, he placed

blame on restricted opportunities for the formation of the subculture and intergenerational poverty rather than the poor's flawed character.

The culture of poverty theory significantly influenced the Moynihan Report (Moynihan, 1965), but the concept was interpreted differently from the author's intention and the contents of the report (Valentine 1968; Leacock, 1971; Stack, 1974; Ogbu, 1986; Wilson, 1987; Gould, 1999).[7] After examining the problems of African-American families, he argued that the roots of their problems lay in the legacy of slavery, growing urbanization, discrimination, and a tradition of matriarchy. Although he devoted a whole chapter to explain the systematic barriers that faced African-Americans such as racial segregation, urbanization, unemployment and poverty as the main causes of the problems, his argument was often ignored by the media (Wilson, 2007). Instead, individual flaws of African-Americans were highlighted as the main image of his work as well as the concept of the culture of poverty theory.

In the long run, it was commonly believed that flawed characteristics of the poor such as strong feelings of fatalism and belief in chance, a strong present time orientation, the inability to delay gratification, feelings of inferiority, acceptance of aggression and illegitimacy, and authoritarianism resulted from their culture (Wilson, 2007). In addition, the socialization of poor children into the same problematic culture of their parents' generation was considered a problem that needed societal intervention. As this viewpoint became widespread in America (Ausubel, 1964; Deutsch, 1968; Riessman, 1962), it was

[7]. Ryan (1972) criticized the Moynihan Report as the work of *blaming the victim*, and it became repeatedly used by critics of the culture of poverty theory. However, Ryan's work was regarded as a misinterpretation of the Moynihan Report. Even though conservatives might utilize the theory or misinterpret the theory to blame the victim rather than social system, Moynihan (1965) and Lewis (1966) clearly related cultural characteristics to structural factors and more weighted the latter (Wilson, 2007).

generally accepted that poor children should have a chance to obtain middle-class values so that the influence of an unfavorable culture could be minimized.

Theories of Cognitive Development

There were many attempts in the 1960s to design and carry out preschool programs in an effort to counteract the effects of poverty on preschool age children. The idea of using education to solve social problems goes back to Rousseau, Montessori, Pestalozzi, and Robert Owen (Fowler 1968); however, the initiation of Project Head Start and other preschool programs that began in the 1960s was more directly influenced by Hunt (1961), and the work is generally considered the modern theoretical foundation that opened the discussion on the importance of early childhood programs for low-income children (Steiner, 1976).

Before World War II, it was generally believed that human intelligence was fixed and development was predetermined. The conceptual roots of these beliefs were in Darwin's (1859) theory of evolution, which explained that evolution took place not by changes worked through use or disuse, but by changes that arose from variations in the descendants of every species. Since the prevalent conviction was that the improvement of human lot lay in eugenics rather than euthenics, preschool education was not accepted as an essential thing. In addition, there was a belief that the experience of early years, especially preverbal years, was unimportant for intellectual development. Even Freud (1905), who stressed the importance of the experience before the advent of language, thought that the early experience was not essential for intellectual development but for emotional development only (Hunt, 1969).

Hunt (1961) argued against the idea of fixed intelligence, predetermined development. He placed greater importance on the preverbal period. Influenced by Hebb's (1949) neuropsychological theory, which explains that an organism's ability to learn in later life depends on the quality and quantity of its early primary experience and learning, he emphasized the much greater role of early experience in shaping human intelligence and development.

Regarding the motivation to learn, Hunt (1961) was influenced by Piaget's (1936) theory of intelligence, which described the way in which human cognition develops. According to Piaget (1936), infants are born with schemes, what he called reflexes, and uses the reflexes to adapt to the environment. These reflexes are quickly replaced with constructed schemes through assimilation and accommodation processes. Assimilation is the process of using or transforming the environment so that it can be located in pre-existing cognitive structures, and accommodation is the process of changing cognitive structures in order to accept something from the environment. Under the influence of Piaget's assimilation and accommodation processes, Hunt (1961) emphasized that the learning process is led by *intrinsic motivation* which is inherent in information processing and action. Refuting the traditionally dominant views that learning needed to be motivated by painful stimulation, homeostatic need, or the acquired drives based on these, he suggested Montessori's method to enrich the experience of culturally deprived preschool children (Hunt, 1969).

From the review of longitudinal research, Bloom (1964) found that 50 percent of intellectual development occurred by age four and emphasized the importance of

environmental manipulations on cognitive development. His findings, along with others presented above, supported the need of early interventions for intellectual development.

Human Capital Theory

The concept of human capital was developed in the 1960s by Chicago economists Mincer (1958), Schultz (1963) and Becker (1964). They proposed that human capital could be accumulated like physical capital, and higher human capital could result in higher productivity and increased earnings. According to Schultz (1963), human capital can be improved by an investment in education such as organized education, on-the-job training, and migration for job enhancement. From an analysis of monetary returns to the investments in human capital, Becker (1964, 1976) found that the investment raised practical earnings at older ages and exceeded direct and indirect opportunity costs. Schultz (1970, 1981) also found that investments in human capital produced higher returns on investments in physical capital.

Human capital theory has contributed to understanding the difference in wages and income, i.e., higher earnings result from higher human capital. Empirical data support this theory to some extent (Ashenfelter & Krueger, 1994; Krueger & Bowen, 1993; National Center for Education Statistics, 2006; Thompson, 1993). Using a current population survey, Krueger and Bowen (1993) examined annual earnings of men and women working in 1990 and found that college graduates earned considerably more than high school graduates. Ashenfelter and Krueger (1994) also found from a sample of twins that wages were increased by 16 percent per additional year of schooling. In 2004, the median annual earning of workers who held bachelor's degrees or higher was

approximately $43,000 while that of high school graduates was only about $28,000 (National Center for Education Statistics, 2006).

Researchers were not originally specifically interested in the investment in early childhood education, like Head Start, because it was not very common when the human capital theory was developed. More attention was paid to the monetary returns of education costs which include both direct and indirect costs. However, the Head Start program was grounded on the idea that higher education is closely related to higher earnings. During the War on Poverty era, there was a prevalent belief in the concept among policymakers, and the lack of education was considered a main reason for poverty (Rank, 1994). As a result, most programs in the War on Poverty were designed to boost the human capital of the poor (e.g., Job Corps, the Neighborhood Youth Corps, etc). Head Start was one of those programs and was introduced as an anti-poverty program (Zigler & Valentine, 1979).

Chapter 3

Literature Review

Effects of Head Start Programs

For the last 40 years, hundreds of studies have examined the effects of the Head Start program on various outcome measures.[8] Although the research has not always reported consistent findings, it is generally accepted that early childhood education has significant positive effects on child development during the program years and for a few years after the program ends (Abbott-Shim et al., 2003; Barnett, 2007; Bryant & Maxwell, 1997; Lazar & Darlington, 1982; Reynolds, 1994). In most cases, the debates or disagreements on the effectiveness of Head Start arise from studies on its long-term effects (Barnett, 1998; W. S. Barnett, 2004; Barnett, 2007; Currie, 2007; Currie & Thomas, 1995; Haskins, 1989; Herrnstein & Murray, 1994; Locurto, 1991; Spitz, 1986). However, despite the inconsistency, research findings can be summarized as follows: Head Start produces significant short-term gains, but the gains *fade out*[9] after children

[8]. According to Fosburg and Brown (1984) who compared the health status between Head Start children and non-Head Start children, Head Start children had better access to medical examinations and preventive health services than non-Head Start children. From the review of medical records, Hale, Seitz, and Zigler (1990) found similar results: Head Starters were more likely to receive age-appropriate health screenings than children on a Head Start waiting list and middle class children.[8] Clarke and Campbell (1998) examined whether early childhood intervention would prevent adult crime among the program participants using data from the Abecedarian project . They found a significant difference between program participants and their control peers. Similar findings were detected from Head Start participants as well. Garces, Thomas and Currie (2002) found that African-American Head Starters were less likely to face criminal charges in adulthood. In addition, researchers reported that Head Start helped parents to better support a child's education and development, and that the program even helped parents change their lives (O'Keefe, 1980; Robinson & Choper, 1979; Slaughter, Lindsey, Nakagawa, & Kuehne, 1989). Although all of the outcomes presented above are important and should be counted in the evaluation of Head Start and other early intervention programs, literature on those outcomes is excluded from the review of the current study.

[9]. McGroder (1990) and Zigler (1994) question if the positive outcomes might not fade out, because the comparison group caught up to the participants. Also, Barnett (2004) calls it "myth of fade out" since the "fade-out effect" was the faulty interpretation of studies that could not really answer the question. Details on the limitations of previous research will be discussed in the following section.

leave the programs. Most of the short-term gains in cognitive test scores are lost in the long run, while some effects may persist in other domains such as grade repetition, special education placement, and high school completion (Barnett, 1998).

In this chapter, findings of previous research in regard to the effects of Head Start programs on child development are reviewed focusing on education and economic status. Although priority is given to Head Start related studies, model programs such as the Perry school project, the Abecedarian project, and the Chicago Child Parent Center project are also included in the review because they are similar to the Head Start program.

Short-term Effects: Findings of Landmark Studies

For the last several decades, many studies have examined the effects of Head Start and similar programs on the participants' educational outcomes, and several landmark studies have synthesized the findings of individual studies. Since a brief review of these studies will be beneficial to understand historical trends, findings, and limitations of Head Start related studies, their findings are summarized below instead of exploring each individual study.

Westinghouse Study. The early research findings were not as optimistic as what Head Start supporters might have expected. According to the Westinghouse study (Cicirelli, 1969), which was one of the first national studies on the effect of Head Start programs, summer programs produced no significant gains in children's cognitive development. Even full-year programs resulted in marginal gains at the time of first grade and the gains disappeared by third grade. The study also reported that Head Start children were significantly below national standards on language development and scholastic

achievement, while they met the norm on school readiness at the beginning of the first grade. However, the findings of the Westinghouse study fell into question due to the faulty research designs it had applied (General Accounting Office, 1997; McGroder, 1990).

The most common critic was the non-comparability of comparison groups and the absence of pre-tests. Since the comparison group of the study may have been selected from less disadvantaged families than Head Start participants and no pre-test had been applied, the little difference in the outcomes between the two groups may have resulted from the higher initial status of the comparison group. Another critical defect was that the study did not apply statistical controls to adjust the influence of non-Head Start factors, such as other preschool program participation and the difference in the quality of schools they attended afterward.

Considering the numerous critiques of the Westinghouse study, Bronfenbrenner (1974) reviewed various studies using experimental designs, but the findings were similar to the Westinghouse study. While intellectual gains were detected from the children with early childhood education (ECE)[10], the effect sizes were small and the gains faded out in a few years. Jensen (1969) regarded the early findings as the failure of compensatory education and used the results to justify race-based differences in intelligence. His work contributed to the revitalization of the traditional controversy, whether IQ could be boosted by environmental manipulation like early education. Under the influence of the disappointing findings of the Westinghouse study and the nature-nurture debates on IQ improvement, more attention to the non-cognitive outcomes has been paid since then.

[10]. In this study, the term *Early Childhood Education (ECE)* is used to refer to Head Start and other early childhood intervention programs altogether.

Consortium for Longitudinal Studies (CLS). Lazar and Darlington (1982) assessed the long-term effects of ECE programs, which were mostly non-Head Start programs, but focused on children from low-income families. The study was a multi-sample secondary analysis in that it utilized data from 12 independently designed projects. In 1976, 12 investigators who had conducted their own preschool research in the 1960s formed the *Consortium for Longitudinal Studies* to do a collaborative follow up study to address 1) whether there were long-term effects of ECE programs, and 2) whether the programs were more effective for some subgroups.

The follow up study was conducted between 1976 and 1977. A total of 3,700 children from low income families participated in the study. Their ages ranged from 9 to 19 years at the time of the follow up study, and more than 90 percent of them were African-American. Outcomes were measured in school competence, developed abilities, children's attitudes and values, and the impact on the family[11].

According to the study, ECE had long-lasting effects in all four areas it investigated. Children who had participated in ECE programs were less likely to have grade repetition and special education placement, where family background factors and initial ability were constant. Although initial gains in intelligence tests faded three years after the program, lasting gains were detected in academic achievement tests. Further, program participation produced positive impacts on children's attitude and values and maternal attitudes toward the child's school performance. No significant difference was noticed between subgroups such as boys and girls, children from one parent and two parent families, children with different numbers of siblings, etc.

[11]. For detailed information on each measure, see chapter II (p.10~18) of Lazar and Darlington (1982).

Although this study employed a strong research design with random assignment and small attrition rates, its limitation was that most of the participants were African-American. In addition, most of the programs the study investigated were non-Head Start programs, which had more resources and experienced staff, thus the long-lasting effects detected in this study should not be regarded as the success of Head Start (McGroder, 1990).

CSR report (Head Start Synthesis Project). In 1985, McKey et al. (1985) published another landmark study, commonly known as the CSR report. As the title "Head Start Synthesis Project" indicates, the CSR report scientifically reviewed over 210 reports on the effects of Head Start programs by using a meta-analysis method. Unlike the Westinghouse study, the CSR report explored diverse outcomes such as children's cognitive test scores, socio-emotional test scores, health status, and the effect on communities. Its findings on immediate effects on cognitive development seemed to be more optimistic than the findings of the Westinghouse study. No matter what research designs and outcome measures were applied, almost all studies reported significant immediate effects on cognitive development and the average effect size was about .52 for the studies with the treatment and control groups and .48 for the studies with pre-and post-tests (figure 3-1); that is, Head Start participation elevated cognitive test scores by about a half standard deviation point.

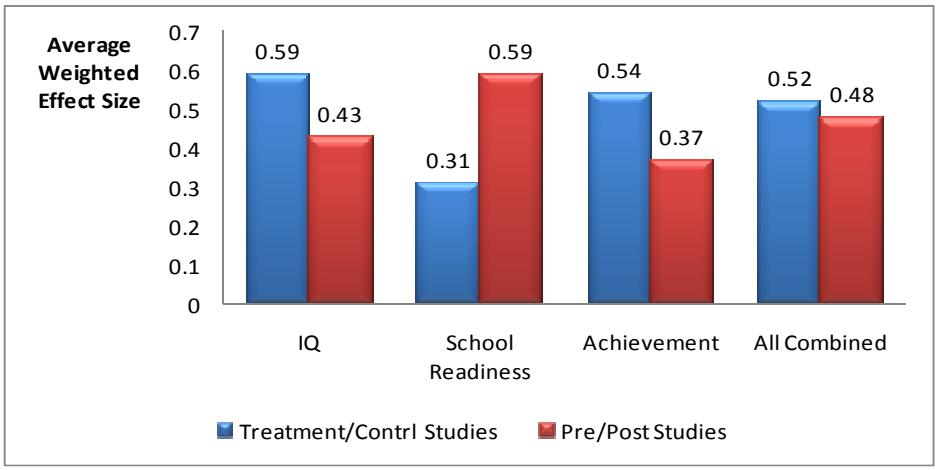

Figure 3-1. Immediate Effects of Head Start on Cognitive Development

Source: McKey et al. (1985)

Besides positive effects on cognitive development, the synthesis study found that Head Start had contributed to the improvement of participants' health status and the provision of health services to its participants. Immediate effects on socio-emotional development were also detected. Although the effect size was smaller than the cases of cognitive development, Head Start participants received preferable scores on all of the self-esteem, achievement motivation, and social behavior tests compared to the comparison groups: effect sizes were .17, .22, and .35, respectively.

The CSR report, however, found that most of the immediate gains were not maintained for a long time (McKey et al., 1985). One year after Head Start, no significant difference on intelligence test scores was observed between Head Start participants and non-participants. Although Head Start participants kept higher scores on achievement and school readiness tests than non-participants for one year after the program, the difference disappeared by the end of the second year. Even negative effects were found on

intelligence test scores after three or more years; Head Start participants recorded .2 standard deviation points below the non-participants.

In sum, the CSR report presented similar results to the Westinghouse study. While the study found sanguine immediate effects in various dimensions, most of the effects disappeared in the long run. However, Head Start supporters questioned the accuracy of the study (W S. Barnett, 2004). They mainly criticized the use of meta-analysis across many studies of different designs. Since meta-analysis tends to underestimate the effects found in specific studies, they insisted that reality might be better than the results of the CSR report.

GAO: Head Start (GAO, 1997). Before Head Start was reauthorized in 1998, the House Committee on the Budget asked Carlotta C. Joyner, who was the director of Education and Employment Issues of the U.S. General Accounting Office, to examine research on the impact of Head Start programs (General Accounting Office, 1997). Although many studies had examined the impact of Head Start (e.g., the Westinghouse study and the studies reviewed in the CSR report), newer research was needed as most of their subjects were children who participated in the program between the 60s and early 70s, which were the early years of the program. Considerable changes had occurred during this period. Head Start had become a full-year program by the early 1970s in most cases, and the performance standard and teacher credentialing were promulgated between the early to mid-1970s. As the findings from Head Start's first decade might not reflect these changes, the House Committee on the Budget wanted to have updated information on the impact of Head Start before reauthorization.

According to the report (General Accounting Office, 1997), only 22 studies out of more than 200 manuscripts examined met the following conditions: 1) it had examined the impact of Head Start, 2) Head Start participation had occurred in 1976 or later, 3) outcomes had been compared with children not attending any preschool or compared to normed standards, and 4) no follow-through programs had been provided to the participants.

After reviewing the 22 studies, the report (General Accounting Office, 1997) concluded that it was not clear whether Head Start was making positive differences in the lives of children it had served for the following reasons. First, most studies focused on educational and/or cognitive outcomes and left aside outcomes such as health and nutrition, despite the fact that Head Start had provided health related services as well as early education. Second, serious methodological problems, specifically non-comparability of a comparison group, were found. In many cases, studies constructed comparison groups by selecting children who had similar characteristics with Head Start participants in a few selected areas. Some other studies statistically adjusted the outcomes without matching comparison groups. Only one out of 22 studies had applied random assignment. Finally, the study pointed out the lack of a large-scale evaluation that used a nationally representative sample. Since most studies examined the impact from a small sample in a certain region, GAO (1997) terminated the study with conclusions that the findings were hard to generalize,[12] and little information on the impact of Head Start was available.

12. Because of the diversity in Head Start program characteristics, it is not easy to design research at the national level, and the generalization of the findings may be limited.

Head Start Family and Child Experiences Survey.[13] In 1997, a series of longitudinal studies, the Family and Child Experiences Survey (FACES), was first launched. The study, funded by the U.S. Department of Health and Human Services, was designed to obtain periodic data from recent participants and to provide an updated evaluation of Head Start's performance. Outcomes in various domains were explored including school readiness, social skills, health status, influence on parents, and the quality of the program.

To meet the purpose of the study, four independent cohorts were constructed and the survey for each cohort was initiated in 1997, 2000, 2003, and 2006, respectively, with nationally representative samples of Head Start families. Sample sizes varied from 2,400 to 3,500, and the samples were collected from more than 40 Head Start sites. Although there were minor differences in research design among the four cohort studies, study samples commonly consisted of families of children aged 3 or 4 years at the beginning of the study. In addition, they had been followed up at some or all of the following time points: at the beginning and the completion of the Head Start program, and in the spring of their kindergarten and first grade years.

The study found that Head Start narrowed the gap in academic skills between program participants and all children over the program year. Although Head Start participants enrolled in the program with below average skills in early literacy and math, they showed statistically significant progress in the same area by the end of the program. For example, children in the 2003 cohort began the program with average standard scores of 85.6 in vocabulary, 95.0 in early reading, 86.5 in early writing, and 88.4 in early math.

[13]. Findings presented in this section were summarized from a U.S. Department of Health and Human Services report (2001).

By the end of the first program year, their average gains were 2.9 in vocabulary, 1.5 in early math, and .7 in early writing; however, the gains were less than the amount needed to catch up to national norms, which were 100 points in all areas. Similar results were obtained from the 1997 and 2000 cohorts.

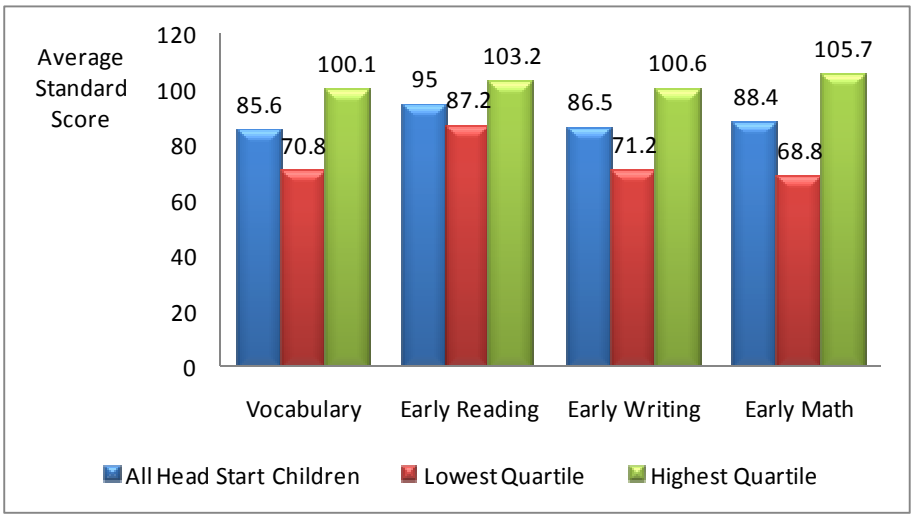

Figure 3-2. Effects on Academic Skills

Source: U.S. Department of Health and Human Services (2001)

Note: National average is 100 in all domains

According to the FACES study, Head Start also helped its participants develop social skills. During the program year, it was found that participants became more cooperative, less withdrawn, and less hyperactive in the classroom. Other positive outcomes were detected as well. The program had a positive effect on children's health: 81 percent of Head Start parents reported that their child health status was either excellent or very good. Parental involvement in child education and the program activities increased, and the involvement was significantly associated with most positive outcomes listed above.

Regarding the quality of the Head Start program, it was found to be higher than those of other preschools. Where the program quality was measured by the Early Childhood Environment Rating Scale-Revised version (ECERS-R), the mean score was 4.81 on a scale of 1 (inadequate) to 7 (excellent).

Although the FACES studies seem to report positive findings, it should be noticed that most findings reflected immediate to short-term outcomes, which is typically less debatable than long-term outcomes. Even the immediate and short-term gains should not be understood as a success of the program due to critical shortcomings of the study. The FACES study did not apply random assignment, and further, there was no matched comparison group. All the program effects were identified from pre and post comparisons without comparison groups. Thus, the study provided no trustworthy information on the key question, whether Head Start participants gained more than non-participants.

Head Start Impact Study.[14] Recently, the national *Head Start Impact Study* (HSIS) was initiated by Congressional mandate in order to examine the program effects on participating children and their parents (U.S. Department of Health and Human Services, 2005). Although the purpose of the study was almost the same as that of previous studies, the impact study employed rigorous and scientific research methods considering the methodological shortcomings[15] of preceding research.

To conduct the study, the HSIS randomly assigned the sample into a program group and a control group, which was remarkable progress in Head Start research. The absence of random assignment has been a continuous problem in Head Start studies. Although random assignment is regarded as the best way to prevent selection bias, it is,

[14]. Findings presented in this section were summarized from the U.S. Department of Health and Human Services report (2005).
[15]. Discussion on the methodological shortcomings of previous studies is presented in the following section.

in fact, difficult to apply the method in Head Start research because Head Start is a federal program which should be available to anyone who meets the eligibility criteria. Thus, previous studies seldom had randomly assigned control groups, and most of these few studies with random assignment were model program studies. However, the HSIS found a way to apply random assignment by gathering samples from agencies that had enough extra applicants that exceeded their funding capacities. As the number of applicants went beyond the agency's capacity, and some portion of the applicants had to be excluded from the service regardless of the study, random assignment was possible without suffering from ethical issues.[16]

In addition to random assignment, the impact study significantly progressed from the previous studies in that it had a nationally representative study sample. The sample size and the number of agencies from which the sample was collected were larger than previous studies. In 2002, a total of 4,667 children (2,783 Head Start group and 1,884 control group) ages 3 and 4 were chosen from 383 randomly selected Head Start centers, and they have been followed up until now.

Finally, the HSIS expanded its outcome measures into comprehensive domains including cognitive, social-emotional, health, and parenting practice outcomes. Subgroup comparisons on these outcomes were also outlined in order to understand the variations in program impacts among participants with different characteristics. For the subgroup comparison, a number of characteristics were considered including the child's gender, race, presence of special needs, and home language, parent's marital status, primary caregiver's depressive symptoms, mother's age at first birth, etc.

[16]. Applicants were notified that the decision of Head Start enrollment would be made using a lottery- like process.

According to the first year findings (U.S. Department of Health and Human Services, 2005), which are the most recent findings at this time, a statistically significant difference was found at least in some outcome measures throughout all outcome domains between Head Start participants and non-participants. Although cognitive development remained below the national norm, Head Start children reduced the gap in reading, writing, and vocabulary compared to non-participants (effect sizes varied from .1 and .24). Children who enrolled in the program at age 3 showed fewer behavioral problems and hyperactive behavior than their controls (effect size -.13 and -.18 respectively). Access to dental care was also an exceptional gain for Head Start children. About 70 percent of the participating children had received dental care, which was more than 15 percent higher than non-participants. Head Start participation also led to increased parental involvement in education and to reduced use of negative discipline strategies such as the use of physical punishment. Regarding the subgroup differences, greater impact was found among children who 1) began the program at age 3, 2) were African-American or Hispanic, or 3) spoke English at home. However, all of the findings were immediate gains of Head Start participation, and long-term impacts have not been shown yet due to the recent nature of the study.

Long-term Effects on Education

Despite the high volume of research on the short-term effects of Head Start programs, its long-term effects have not been examined actively.[17] While studies on model programs[18] tend to find promising effects on educational outcomes in the long-

[17]. There is no absolute definition of long-term effects. In this study, long-term effects mean the effects that last until at least high school years.

[18]. During the 1960s and 1970s, several non-Head Start preschool programs were initiated and provided high quality services for at-risk children and their parents. Since they were similar to Head Start except

term, studies on Head Start program provide mixed results and the quantity is limited (Barnett, 1998; Devaney, Ellwood, & Love, 1997).

From a study on Perry School participants, Schweinhart et al. (1993) found that program participants were more likely to graduate from high school (including GED) than their control peers who received no preschool intervention. The high school graduation rate was 71 percent for the program participants, which was 17 percent points higher than the control group. Time spent in special education through age 19 was shorter among the program participants: they spent, on average, 16 percent of the time in special education while the comparison group spent 28 percent of the time in special education (Schweinhart et al., 1993).

While the difference between the two groups was smaller than the findings of the Perry School program, Reynolds et al. (2007) found similar results from the Child Parent Center (CPC) program. 71.4 percent of the program children graduated from high school while only 63.7 percent of the comparison group children did (p=.01). A consistent finding was also detected when 4-year college entrance was examined (14.7 percent vs. 10.0 percent; p=.02). Using the same data but slightly different research methods, Ou (2003) found similar results. When the influence of background factors was adjusted, the CPC participants showed higher performance than non-participants in years of education (11.33 vs. 10.93, p = .001), high school completion (66.9 percent vs. 55.3 percent, p = .001), and college attendance (23.0 percent vs. 17.9 percent, p = .055).

---

higher quality, these programs have been frequently called model programs (Barnett & Hustedt, 2005). They were characterized as high-quality, local-based preschool programs with smaller participants, compared to Head Start. Some of the well-known model programs include the Perry School Project, the Chicago Child-Parent Center (CPC), and the Carolina Abecedarian project. Although these programs began several decades ago, follow up studies have been conducted up to recently (Belfield, Nores, Barnett, & Schweinhart, 2006; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Niles, 2004; Ou, 2005; Schweinhart et al., 2005).

Although Head Start supporters tend to claim that the promising outcomes of model programs support the expansion of Head Start, some researchers criticize this notion, stating that those programs were not Head Start and that they were more intensive and expensive preschool programs (Haskins, 1989; Herrnstein & Murray, 1994; Locurto, 1991).

Unlike the findings from model programs, studies on Head Start programs have found less promising results. Using the National Longitudinal Survey of Youth 1997 (NLSY97), Aughinbaugh (2001) examined the effects of Head Start enrollment on school suspension, grade retention, and test scores in mathematics (using the Peabody Individual Achievement Test in mathematics) when children were between the ages of 12 and 17. When background characteristics were controlled, there was no difference between Head Start participants and non-participants in regard to grade retention and math test scores. Head Start children even showed worse outcomes on school suspension. Consequently, she concluded that Head Start provided no long-term benefits to its participants (Aughinbaugh, 2001).

Joo (2006) presented similar findings. Using the Child Development Supplements (CDS) of the PSID data, he examined the long-term impact of Head Start participation on academic, behavior, and school outcomes. While some positive effects were found among non-Head Start preschoolers, no difference was found between Head Start and no preschool children, when background characteristics were controlled. The study suggested that background factors such as home environment, parental education, and neighborhood quality are more powerful determinants of children's long-term outcomes than Head Start or other preschool participation.

Some studies found positive program effects on long-term educational outcomes when samples were examined in sub-groups. From an analysis of the Panel Study of Income Dynamics (PSID) data, Garces et al. (2002) found no significant relationship between Head Start participation and educational outcomes, when Caucasian and African-American respondents were examined together. However, program effects were detected when the analysis was performed separately for Caucasians. Among Caucasian children, Head Start children performed better than their siblings with no Head Start experience on high school completion and college entrance. According to their findings, controlling for background characteristics was critical for the program evaluation. Without statistical adjustment for background characteristics, children with no or other preschool experience had better outcomes than Head Start children. However, once they were controlled, Head Start children were 28 percent or 20 percent more likely to attend college than no or other preschool children, respectively (Garces et al., 2002). Garces-Tolon (2001) also found similar results. Head Start was beneficial for Caucasians, but not for African-Americans in regard to educational outcomes.

In sum, the effects of Head Start participation on educational attainment are still under question, and more studies are needed.

Long-term Effects on Economic Status

As presented in the section of the historical background of Head Start, the program began as part of the War on Poverty with the hope of breaking the poverty cycle through early childhood intervention (Beatty, 1995; Cravens, 1993; Rank, 1994; Zigler & Muenchow, 1992) However, research on the long-term effects of the program on

adulthood economic success is scarce and the few existing research reports show mixed results.

Caputo (2003b) assessed the effects of preschool participation on adulthood economic success using data from the National Longitudinal Survey of Youth (NLSY79). Preschool participation was categorized into three groups (Head Start participants, other preschool participants, and no preschool participants), and economical success among the three groups was compared on five indices: average annual income to poverty ratios, economic mobility,[19] number of years in poverty, number of years in receiving Food Stamps and number of years in receiving TANF/AFDC. Significant differences between the groups were found in all areas, but four of them were non-favorable to Head Starters. While Head Starters showed the highest upward economic mobility, they had a lower income-to-poverty ratio, spent longer years in poverty, and received Food Stamps and TANF/AFDC longer than other preschoolers and non-preschoolers (Caputo, 2003b). However, most of these differences became negligible when statistical adjustments were made. Controlling for various factors including demographic and socio-economic backgrounds, results showed only one significant difference out of the five outcome measures: while other preschoolers had a higher income-to-poverty ratio as compared to non-preschoolers, no other significant difference was observed, meaning Head Start participation had no impact on adulthood economic success (Caputo, 2003b).

Findings of this study need to be understood with caution, however. Since the study collected samples whose ages ranged from 14 to 21 in 1978, subjects who belonged to the Head Start group in this study must have entered the program before 1970 when

[19]. Economic mobility was measured in the study as the difference in the income-to-poverty ratio between 1985 and 1998. Instead of using the raw income-to-need ratio, the study used the rank ordered by deciles.

many of the Head Start programs had been only summer programs. Considering that most of Head Start programs became year-round programs after the early 1970s and the program quality significantly improved throughout the first decade, there might be stronger program effects than uncovered by this study among children who attended the program after 1970. In addition, Caputo (2003b) did not confine the sample to children from low income families. Because most of the subjects who belonged to no preschool or the other preschool group were from better-off families as compared to Head Starters, the study might have underestimated the program effects. Although he statistically adjusted the economic background of the participant, stronger program effects might have been detected if the participants had been limited to low income children.

Garces, Thomas and Currie (2002) also examined the impact of preschool experience on adulthood earnings using Panel Survey of Income Dynamics (PSID) data and found some positive evidence. Preschool experience was classified into three categories as the case of Caputo (2003b). For people born between 1965 and 1977, they compared the logarithm of their average earnings between age 23 and 25. Although little difference was observed among the three groups, a subgroup difference was found in the case of whites who dropped out of high school. In this group, children who had participated in Head Start Programs earned significantly more than their siblings with no preschool experience (Garces et al., 2002).

Research on the Perry School Project provides more promising results (Schweinhart, 2002; Schweinhart et al., 1993; Schweinhart et al., 2005). Between 1962 and 1967, Schweinhart and his colleagues examined the life-long impact of early childhood education from 123 African-Americans randomly assigned to a program group

and a control group at ages 3 and 4. Their employment status and earned income were compared at the ages of 27 and 40. At both ages, subjects in the program group had higher employment rates (69 percent vs. 56 percent) and earnings ($12,000 vs. $10,000) at age 27 than their controls (Schweinhart et al., 1993), and the gaps between the two groups became even larger at age 40. Employment rates of the program group and the control group were 76 percent and 62 percent, and their average earnings were $20,800 and $15,300, respectively (Schweinhart et al., 2005). In addition, the program group was almost three times more likely to own their homes than the control group and 25 percent less likely to have received public assistance at some time by 27 years old, but no significant difference was found at age 40 (Schweinhart et al., 2005).

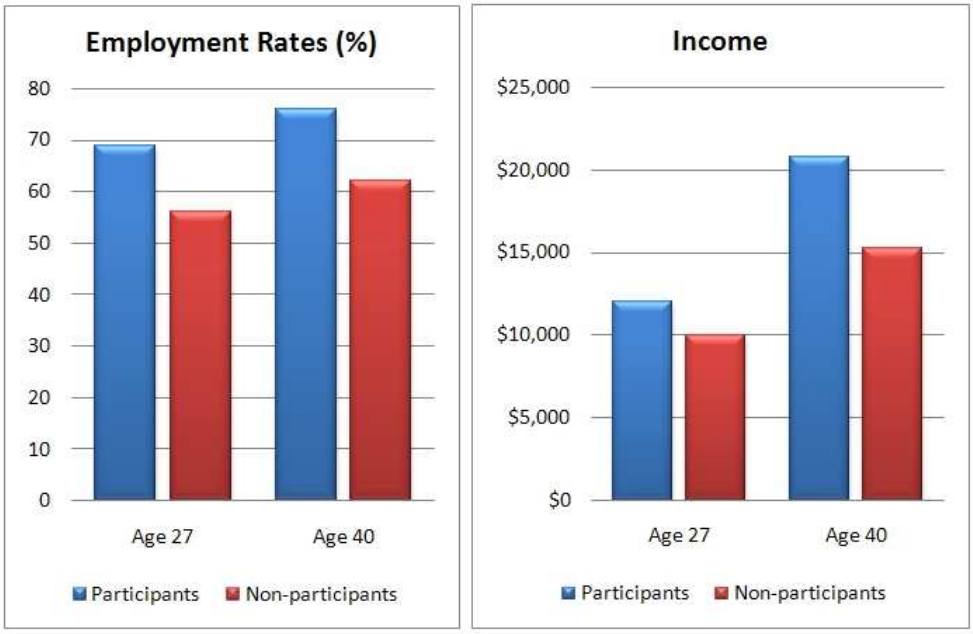

Figure 3-3. Longitudinal Outcomes of Perry School Participation

Source: Schweinhart et al. (2005)

As reviewed above, little is known about the impact of early childhood education on adulthood economic success. Although it appears that the model programs, especially

the Perry School Project, reflect better outcomes than Head Start on this domain, findings cannot be generalized due to small sample sizes. In addition, Schweinhart et al. (1993; 2005) only compared averages between program and control groups in selected outcomes without controlling other variables such as socio-economic status. Since they employed an experimental design with random assignment, statistical control for other factors might not have been necessary. However, as Chapin (1950) indicates, it is hardly possible to keep pure laboratory conditions in social science research despite random assignment, and statistical control is needed for more accurate analysis. Although Caputo (2003b) and Garces et al. (2002) tried to analyze Head Start's long-term effects at the national level, their findings were diluted by including Head Start participants at its early stage. In sum, both quantity and quality of research is limited in determining Head Start's impact on adulthood economic status. More research is needed, specifically for the people who have participated in the program after 1970.

Limitations of previous research

As reviewed above, there have been several studies on the impacts of Head Start programs; however, most of them suffered from methodological shortcomings and limitations including 1) simple comparison between groups without statistical adjustment, 2) non-representative samples, 3) cross-sectional approaches on economic background, and 4) lack of long-term evaluation, mainly on economic status in adulthood.

One of the more serious problems is a tendency to simply compare means (e.g., IQ, reading, and math scores) and ratios (e.g. high school completion, grade retention, and special education placement) between program and control groups without statistical adjustments among studies with an experimental design (Aughinbaugh, 2001). For

example, Weikart, Bond, and McNeil (1978) and Sweinhart and Weikart (1980) examined mean differences between Perry School attendants and non-attendants on cognitive development and educational achievement, and concluded that the program group surpassed their counter peers. No statistical control was made to generate their findings. This analytical pattern is predominant in model-program studies.[20] It could be acceptable to compare groups without statistical adjustment, if the study applied random assignment and examined short-term effects, because random assignment is generally regarded as the best way to control pre-existing differences. However, for studies on long-term effects, where the outcomes are examined more than ten years after the treatment, statistical control seems to be necessary as it is almost impossible to keep the study setting away from personal and social influences (Aughinbaugh, 2001; Chapin, 1950).

Another problem is that many studies have non-representative samples. Most studies on model projects focus on small local based programs: e.g., Perry school project in Michigan (Mahoney, Robinson, & Powell, 1992; Nores, Belfield, Barnett, & Schweinhart, 2005; Schweinhart et al., 1985), the Abecedarian project in North Carolina (Campbell et al., 2001; Clarke & Campbell, 1998; Ramey, 1992), and the Child Parent Center (CPC) project in Chicago (Conyers, Reynolds, & Ou, 2003; Niles, 2004; Ou, 2003, 2005; Reynolds, Mehana, & Temple, 1995; Reynolds, Temple, Robertson, & Mann, 2001, 2002). Furthermore, African-American children frequently dominated the study samples of these studies. In cases of the above three projects, for example, African-American children comprised 90 percent of their samples. Compared to model-program

[20]. See the following studies for more examples: Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey (2001), Campbell & Ramey (1995), Reynolds (1997), Reynolds & Bezruczko (1993), Schweinhart et al. (1993), and Schweinhart et al. (2005)

studies, the samples of Head Start studies include more diverse racial groups, but a significant portion of them examine local or state programs as well.

Only a few exceptional studies employ nationally representative samples: recent government mandated Head Start studies, such as FACES study and Head Start impact study, and some other studies analyzing NLSY (Aughinbaugh, 2001; Caputo, 2003a; Currie & Thomas, 1995) and PSID (Garces et al., 2002; Joo, 2006) data. In addition, the subjects of many studies were enrolled in Head Start during the 1960s, when the program quality was not as good as the recent ones. As a result, the GAO (1997) concludes that research provides little information on the impact of current programs.

Research has also employed cross-sectional approaches in considering the economic background of study samples. As Danziger, Sandefur, and Weinberg (1994) point out that the income of a person or a family is a variable that changes dynamically. Even families living in poverty are not poor at all times, and non-poor families at some time could be poor at another time. Using PSID data, Rank and Hirschl (2001) found that more than half of all Americans and more than 90 percent of African-Americans experience at least one year of poverty during their lifetimes. This means that when a study examines the effectiveness of programs like Head Start by comparing the difference between program participants and non-participants, income dynamics should be considered in the analysis; however, almost all Head Start related studies have examined the family economic background only when the sample child was 3 or 4 years old. That is, once the subjects were categorized as low income children, they were all treated as having a similar economic background even though some of their families could be better-off and others could be worse-off within a year or two.

Caputo (2003b) exceptionally considered income dynamics. He included the years participants lived in poverty and the average income to poverty ratio as control variables in examining the impact of Head Start participation on life success. However, the two variables were derived from the data between 1978 and 1984. In 1978, the age of the subjects ranged from 14 and 21; that is, economic background during early childhood was totally ignored in the study.

Given the fact that the level of family income is not fixed at a certain level for a long time, specifically for low income families, and that economic background has a great influence on a child's development and later life, findings from the research that did not reflect the changes in economic status might be incorrect. The difference in outcome measures between program and control groups might result from different income dynamics rather than program participation.

In sum, the research on the long-term impact of Head Start on the later life of its participants is very limited, particularly on adulthood economic success. Although the program originated in hopes that it would be an antidote to intergenerational poverty, confirmation of the idea has been almost ignored from the research for the last 40 years plus. As reviewed in the previous section, the few studies that have attempted to examine the long-term economic effects have suffered from methodological limitations and the results have not been constant.

The current study attempts to examine Head Start's long-term effects by employing research methods that could minimize the shortcomings of previous research. Details of the research method are presented in the following chapter.

Factors Related to Children's Developmental Outcomes

There are some variations among researchers and theories in explaining the determinants of developmental outcomes. Based on Leibowitz's (1974) framework that highlights parental investment on children, Haveman and Wolfe (1994, 1995) suggest that children's outcomes are determined by three primary factors: social investment, parental investment, and the choices of the children themselves. Bronfenbrenner's (1989) system theory explains that human development is influenced by several environmental systems which include the microsystem, mesosystem, exosystem, and macrosystem.[21] While the focus of each perspective and the use of terms may differ from one another, actual factors examined as the determinants of children's education and economic status are similar and they can be categorized into three groups: community factors, family factors and child factors. In this section, findings of previous research are reviewed according to each category.

Community Factors

While social and neighborhood factors are rarely examined in the studies of early childhood education (Barnett, 1995), studies on the determinants of child outcomes have found that various social factors are significantly associated with child outcomes (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; Clark, 1992; Corcoran & Adams, 1997; Ginther, Haveman, & Wolfe, 2000; Turley, 2003).

Using 1980 census data, Clark (1992) found a positive association between neighborhood unemployment rates and the probability of the children's high school drop-out rate, when personal and family background characteristics were controlled. Corcoran and Adams (1997) found a negative relationship between average earnings in adulthood

[21]. Chronosystem was added later as a fifth system.

(age 25-35) and the male unemployment rate in neighborhoods during childhood. However, the finding was significant for the non-black population only. Other researchers have reported that children's educational attainment, as measured by high school graduation or the years of completed schooling, is affected by neighborhood characteristics such as the percent of poor households, average family income in the neighborhood, and the percent of families with high socio-economic status (Aaronson, 1997; Brooksgunn, Duncan, Klebanov, & Sealand, 1993; Duncan, Connell, & Klebanov., 1997; Plotnick & Hoffman, 1999; Turley, 2003).

Previous research, however, also presents conflicting findings (Ginther et al., 2000; Solon, Page, & Duncan, 2000). Corcoran, Gordon, Laren and Solon (1992) suggested that neighborhood influence on earnings is negligible. After the review of 17 studies which examine the relationship between child outcomes and neighborhood characteristics, Ginther et al. (2000) concluded that neighborhood influence tends to be significant by itself, but this significance disappears when a variety of personal and family variables are included.

Findings about the influence of racial composition in the community are also mixed. Some studies support that educational outcomes and/or earned incomes are significantly associated with the racial composition in ZIP codes (Datcher, 1982; Duncan, 1994). However, others have reported non-significant results (Brooks-Gunn et al., 1993; Corcoran & Adams, 1997; Duncan et al., 1997; Plotnick & Hoffman, 1999).

A few studies have examined other social factors such as the state's maximum AFDC and the food stamp benefits, education expenditures, the percentage of female headed families in a neighborhood, and the crime rate; however, they also provide mixed

results (Behrman, Rosenzweig, & Taubman, 1994; Clark, 1992; Duncan, 1994; Ribar, 1993).

Family Factors

Most studies examining the determinants of child outcomes include a number of variables describing parental characteristics (e.g., income, welfare recipient, education, family structure, employment status, and the number of children) and suggest significant relationships between them.

Family income during childhood is usually accepted as a key factor as well (Brooks-Gunn et al., 1993; Corcoran et al., 1992; Currie & Thomas, 1995). However, a few researchers argue that the effects of family income on child outcomes become negligible when the effects of other family characteristics and mediating factors such as parenting and home environment are adjusted (Blau, 1999; Yeung, Linver, & Brooks-Gunn, 2002). Corcoran et al. (1992) have found that parental income maintains a positive relationship with the children's earnings and wages even though children's education is controlled. Currie and Thomas (1995) and Brooks-Gunn et al. (1993) have also found similar results on children's cognitive and behavior outcomes. The influence of parental economic status is measured in various ways. Average income has been examined in some studies while other studies have examined the income to needs ratio, years in poverty, proportion of years in poverty, or whether parents receive public assistance (see Ginther et al., 2000; Haveman & Wolfe, 1995). However, the findings are similar in most studies regardless of the measure.

Regarding the effects of parents' education, the mother's education is more frequently suggested and considered as a determinant of the children's educational

outcomes than the father's (Aughinbaugh, 2001; Duncan, 1994; Haveman & Wolfe, 1995; Marks, 2008). However, some studies report that the father's education is also a strong predictor of the children's outcomes (Ferjan, Jereb, & Sustersic, 2008; Kaplan et al., 2001).

Haveman, Wolfe, and Spaulding (1991), using data from Panel Study of Income Dynamics (PSID), found that family structure is a significant predictor of the children's education. According to their findings, children growing up in a one-parent family were less likely to graduate from high school by about five percent than the children in two-parent families. Sandefur, McLanahan, and Wojtkiewicz (1992) found a similar but larger gap (16 percent) between these two groups.

The mother's employment during childhood was also found to be linked to the children's lower educational attainment and behavioral problems (Behrman et al., 1994; Morris, Duncan, & Clark-Kauffman, 2006). Researchers have suggested that the mother's employment results in undesirable adolescent outcomes, especially among low-income families, because the mother's supervision decreases due to the employment (Sampson & Laub, 1994; Duncan & Clark-Kauffman, 2003). However, its influence on children's adulthood income has seldom been reported to be significant.

A few studies have examined the effects of the number of children in a household. From the analysis of the National Longitudinal Study (NLS) of 1972, Behrman et al. (1994) found that children's years of schooling decrease as the number of children increases. Hill and Duncan (1987) also found similar results using the Panel Study of Income Dynamics (PSID).

Child Factors

Compared to parental factors, child factors are frequently overlooked, except demographic characters, in examining adulthood educational attainment and economic status. Although various theories suggest that children's outcomes depend on their own decisions and how they interact with their parents, friends, school and other institutions, these factors are seldom included in the empirical studies because it is hard to measure them (Haveman & Wolfe, 1995). As a result, most studies tend to consider only background characteristics such as age, gender, race/ethnicity, teenage pregnancy, birth order, and private school enrollment.

Researchers have also examined the consequences of teenage pregnancy on educational attainment and adulthood economic status (Brooks-Gunn & Chase-Lansdale, 1995; Butler, 1992; Coley & Chase-Lansdale, 1998; Hoffman, Foster, & Furstenberg Jr., 1993). Comparing teenage mothers and their sisters with no childbearing during teenage years, Hoffman et al. (1993) found that teenage mothers tend to show lower educational achievement and economic well-being than their sisters, even after the effects of other background factors are statistically adjusted. Other studies provide similar results on this issue.

Regarding the influence of birth order on child outcomes, previous research generally suggests that later birth order is related to lower performance on education and economic achievement (Booth & Kee, 2009; D. M. Fergusson, Horwood, & Boden, 2006; Herrera, Zajonc, Wieczorkowska, & Cichomski, 2003; Kantarevic & Mechoulan, 2006). For example, using the PSID data, Kantarevic and Mechoulan (2006) found that being a first-born child was significantly associated with longer years of education and higher adulthood income. Researchers often explain the linkage between birth order and

child outcome from a family resources perspective (Booth & Kee, 2009; Hertwig, Davis, & Sulloway, 2002; Marjoribanks, 2001). According to this perspective, siblings do not always receive equal shares of parental resources. Under a given set of resources, later born children tend to receive fewer resources because families have diminishing resources as the family size increases.

For the last few decades, it has been generally accepted that private school enrollment has a significant and positive influence on students' achievement even after controlling for socio-demographic differences (Bryk, Lee, & Holland, 1993; Coleman & Hoffer, 1987; Coleman, Hoffer, & Kilgore, 1982). Studies on the effects of private school vouchers[22] also support this assumption. Students who could attend private schools with a voucher had greater academic gains than their peers who attended public schools (Greene, 2001; Greene, Howell, & Peterson, 1997; D. P. Mayer, Peterson, Myers, Tuttle, & Howell, 2002). Some researchers explain that the achievement gap results from superior organizational attributes, community, and social capital in private schools. However, recently Lubienski, Crane and Lubienski (2008) found that private school effects were ignorable when Hierarchical Linear Modeling (HLM) was employed with background variables (student and family characteristics, and school type).

Research on the consequences of teenage childbearing has several decades of history. Moore and Waite (1977), one of the first generation studies, found that young women who gave birth during their teenage years had one to four fewer years of education than others by age 24. Recent studies on this issue tend to employ more advanced statistical analysis to obtain more accurate measures; they have consistently

[22]. Private school vouchers are a kind of benefit provided by the federal government. By using a voucher, poor students at public schools can attend private and religious schools.

suggested that teenage childbearing is associated with lower educational attainment and economic status (Ashcraft & Lang, 2006; David M. Fergusson & Woodward, 2000; Hotz, McElroy, & Sanders, 2005). For example, by considering community-level fixed effects, Fletcher and Wolfe (2009) found that teenage childbearing reduces the chance of finishing high school by 5 to 10 percent and decreases the mothers' annual incomes by $1,000 to $2,400.

In regard to the effects of religion on education and earnings, previous research has found that greater religiosity is positively related to various educational outcomes including years of education, educational attainment, and college readiness (Loury, 2004; Muller & Ellison, 2001; Regnerus & Elder, 2003; Stokes, 2008). Having a religion is also beneficial for the educational outcomes of disadvantaged groups such as minorities and students in high-risk communities (Brown & Gary, 1991; Regnerus & Elder, 2003). Some researchers suggest that the linkage between religiosity and educational and economic outcomes can be explained by social capital available in religious organizations or communities (Coleman, 1988; Muller & Ellison, 2001). Recently, Muller and Ellison (2001) found by using National Education Longitudinal Study (NELS) data that social capital explains most of the religious effects on education and economic outcomes.

Chapter 4

Research Method

Research Questions

The main purpose of this study is to examine whether the rationale for Head Start is supported by real data. Although the rationale varies among scholars and policy makers, most of them agree that one of the key motivations that brought about Head Start was to break intergenerational poverty by means of education, specifically early childhood education. It was generally expected that educational intervention for low income children in their early stage of life would lead to increased educational achievement and the achievement would result in higher income in the long run. As reviewed in the previous chapter, research has found short-term positive effects on educational achievement.

Despite the presence of over 40 years of research, it is still unclear 1) whether Head Start has met the expectation, 2) whether there is a significant difference between Head Start participants and other preschool participants, or between Head Start participants and non-preschool participants, and 3) whether the effects differ if background characteristics during early childhood are considered. The present study will cover these questions focusing on long-term educational and economic outcomes. Specific research questions are listed below.

1. Are there any differences in educational attainment among young adults with different early childhood education experiences[23]?
2. Are there any differences in economic achievement among young adults with different early childhood education experiences?
    2.1. Are there any differences in personal earned income among young adults with different early childhood education experiences?
    2.2. Are there any differences in the total family income to needs ratio among young adults with different early childhood education experiences?
    2.3. Are there any differences in welfare dependency among young adults with different early childhood education experiences?

Conceptual Framework

Figure 4-1 shows the conceptual framework of this study. The focus of this study will be given to the effects of early childhood education on educational attainment and economic success as an adult. However, various background factors at the community level, family level and, child level are also included in the analysis to minimize non-program effects. In addition, special attention will be given to the educational attainment which may mediate the effects of Head Start participation on economic status.

[23]. Early childhood education experiences are classified into four categories: 1) Head Start for less than a year, 2) Head Start for a year or more, 3) preschool programs other than Head Start, and 4) no preschool enrollment (See the section on independent variables for details.)

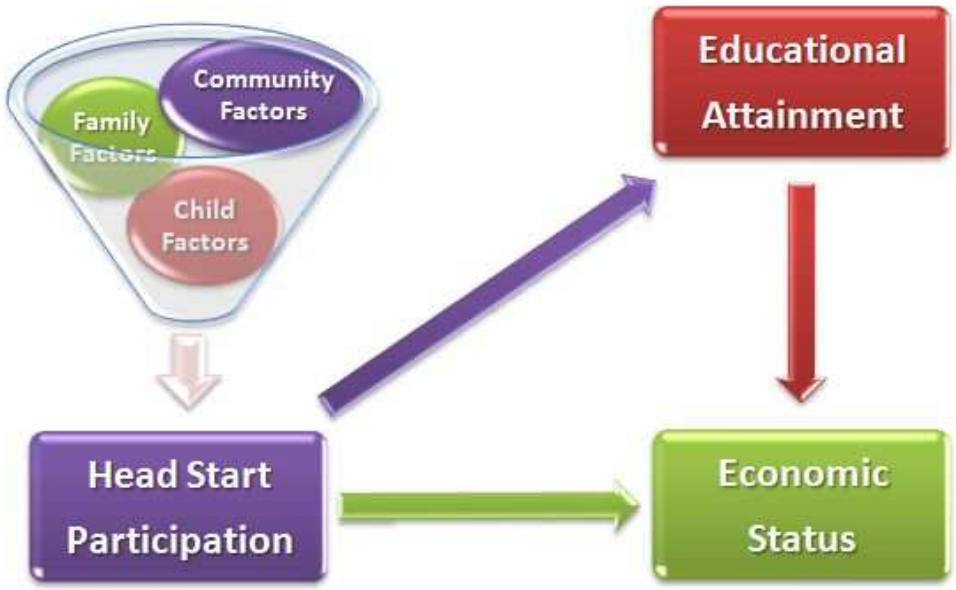

Figure 4-1. Conceptual Framework

Variables in each domain were selected based on the findings of previous research. Even variables with mixed results were also included in the analysis to control for their influence and to obtain better estimates of Head Start effects on the outcomes. Educational outcome was examined using the highest level of education: lower than high school, high school, and higher than high school (i.e., some college or higher). Adulthood economic status was examined using 1) personal income, 2) family income to poverty ratio, and 3) welfare (AFDC/TANF) dependency.

Detailed variables included in the analysis are listed below.

1. Community Factors: City size, region, unemployment rate, poverty rates, and per pupil education expenditure

2. Family Factors: Mother's marital status at child's birth[24], parental education, income to poverty ratio, welfare dependency, and mother's age at child's birth
3. Child Factors: Gender, birth order, religion, race, age, private school enrollment, teenage pregnancy, and religion

Data: Panel Study of Income Dynamics (PSID)

This study utilized the data from the Panel Study of Income Dynamics (PSID), which is one of the longest national panel studies in the U.S.[25] The first wave of the study began in 1968, with a representative sample of 18,000 individuals (men, women, and children) from 4800 households, and the original sample (including their newborn children, and other members who moved into the household, e.g., people who were married to the person in the original sample) has been followed. By the end of 2005 study, the sample size had grown to over 8,000 families.

The original sample (called the "core sample") was a combination of two independent samples: about 3,000 families were collected from the Survey Research Center (SRC) sample, and the other 2,000 came from the Survey of Economic Opportunity (SEO) sample. The SRC sample was a nationwide probability sample of households from the 48 contiguous states, and the SEO sample was oversampled to meet the needs of researchers who were interested in low-income families. Because the SEO sample was collected through oversampling and the PSID combined two independent

[24]. This means the marital status of study subjects' mother, when the subjects were born.
[25]. Some other secondary longitudinal data sets include variables of early childhood education and family backgrounds. The National Longitudinal Survey (NLS), the Survey of Income and Program Participation (SIPP), Head Start Family and Child Experiences Survey, and National Head Start/Public School Early Childhood Transition Demonstration Study are just a few examples. However, considering the length of the study and the sample size, the PSID is the best available data set for the research questions of this study.

samples, statistical weights have been provided to compensate for the unequal probability of sampling for each wave at personal and family levels.

The need for adjustments through the weights also occurs from different attrition rates. Since the PSID is a longitudinal study that has been ongoing for several decades, attrition of the original sample is unavoidable, and the sample loss has taken place at various rates among the different groups. Hence, the PSID provides weights acquired from the calculations, which compensate for unequal selection probabilities in the original sample and for the varying attrition rates.

In 1997, some considerable changes were made to the PSID. First, the core sample (specifically in the SEO section) was reduced from about 8,500 families to 6,168 between years 1996 and 1997, and a sample of 441 post-1968 immigrant families was added instead[26]. Another change was in the duration between waves. The interview had been done every year since the beginning of the study. However, it was changed to a biannual interview starting in 1997, due to insufficient funding. Although the interval was prolonged to every two years, some important variables (such as family income and labor market participation) were also available for every year because respondents were now being asked for information from the previous two years.

As the title "PSID (the Panel Study of Income Dynamics)" indicates, the main focus of the study is to collect economic and demographic information, such as the sources of income and the amounts, poverty status, the use of public assistance, labor market participation, and family structure. This type of information (called "core contents") is asked for at almost every survey. Besides the core contents, the PSID

[26]. Prior to the year 1997, a larger immigrant sample had been put into the PSID in 1990, where 2,000 Latino families were added to reflect the changing nature of immigration. However, the Latino sample was dropped after 1995 due to a lack of funding and the drawback of excluding Asians as immigrant samples.

provides a variety of information through supplements; a few examples of the information available through the supplements include housing and neighborhood characteristics, wealth, philanthropic giving, health, education, and child care[27].

Among several available supplemental data, this present study uses the education supplement along with the data from core contents, since one of the main foci of the study is to examine the long-term effects of early childhood education on a child's educational achievement. In 1995, a series of retrospective questions were asked about one's educational experience including grade failure, private/public school enrollments, school detention, special class placement, and Head Start and other preschool participations, which are all essential to the present study[28].

Sample

The study sample of this research was taken from the PSID sample by applying the following conditions: adults who 1) were born in 1970 or later, 2) were 19 years old or older as of the year 2005 interview, and 3) made up a separate household.

---

[27]. Supplemental data were gathered either for one wave or a few waves when needed; however, the use of the information is not necessarily limited to certain years. Since the PSID is a longitudinal panel study, even a single year data can be used for a longitudinal analysis depending on the research question.

[28]. In fact, the PSID has another supplement, the Child Development Supplement (CDS), which focused on education supplement, but provided far more comprehensive information on human capital development. The data were gathered three times—in 1997, 2002, and 2005—and included general measures of the child's home environment, family processes, child's time in home and at school, school and day care environment, and measures of their cognitive, emotional and physical functioning. Consequently, the CDS provides newer and richer information than the education supplement. However, there are critical shortcomings within the CDS study that make it preferable to use the education supplement in the present study, rather than using the CDS.

The first shortcoming is that the CDS gathered data from the sub-sample which had been reselected from the PSID sample, and the sample size was approximately 2,400 families which was less than half of the PSID sample. Second, the CDS is not practically appropriate for the present study, which explores the effects of early childhood education on the child's economic achievement when they were grown up. In 1997, the CDS gathered data from children ages 0-12, and the most recent PSID data are from the 2005 interviews. Therefore, even the oldest sample's ages are only 20 or 21 years old at the most, which is not old enough to examine adulthood income. For these reasons, the present study uses the education supplement from 1995 rather than the CDS.

Since the main concern of the present study is to compare the outcomes between Head Start participants and other children, Head Start related factors were considered for the selection of the study sample. As shown in figure 1 (see page 10), per capita expenditure of Head Start became relatively stabilized after 1971. It ranged between $2,100 and $2,450 and this trend continued up until 1990. Head Start began as a summer program in 1965, and a mixture of summer and year-round programs existed for the next few years. Most Head Start programs transformed to year-round programs after 1970. To ensure that Head Start enrollment did not equate with participation in a limited summer program in most cases, the sample was restricted to persons who were born in 1970 or later.

The second condition listed above (of being age 19 or older) was given so that the sample participants would be old enough to enroll in at least the first year of a post-secondary education program by 2005. Since the concern of this research is whether a person has achieved at least some level of higher education, the lowest age boundary is set at 19 instead of 18 years of age.

The last condition restricts sample participants to those who were heads of households and/or wives of a household and this is given due to the limitation of the PSID data. The data does not provide individual-specific information on earned income other than heads of households and wives. Therefore, adults whose status was neither a head nor a wife (e.g., adults headed by parents or grandparents) were excluded from the analyses.

Dependent Variables

The effect of early childhood education was examined in two dimensions in this study: adulthood educational attainment and economic status. Educational attainment was evaluated by the highest level of education and three factors (personal earned income, family income to needs ratio, and welfare dependency) were explored for adulthood economic status. Educational attainment can be considered as a mediating variable, because its mediating effects were also explored when the program effects on economic status were examined. Details for each factor are discussed in the next section.

Educational attainment. The respondents of the PSID study were asked about their highest grade or year of school completed in 2005.[29] The values for this variable represent the actual grade of school completed; for example, a value of 10 indicates that this individual completed the tenth grade by the time of the 2005 interview. A person who passed the General Educational Development (GED) test was coded as 12, and the highest coded value was 17, which indicated the completion of at least some post-secondary work. The present study re-coded this variable into three categories: 1) less than high school graduate, 2) high school graduate, and 3) at least some college or higher. The variable was re-coded because the present study is interested more in estimating the educational achievement in the form of the above three categories rather than the year itself.

Personal earned income. Although the PSID does not provide the amount of personal labor income as a separate variable, the present study generated it by using three variables: Head's labor income, wife's labor income, and relationship to head. To a

[29]. The same question has been asked throughout all the surveys, but the present study used the year 2005 survey data to obtain the most recent information on the participants' highest level of education.

person who is the head of a family, the value of head's labor income was assigned for the personal income variable, and the value of the wife's labor income was assigned to a person whose relationship to head is wife. The PSID constructed both the head's and wife's labor income variables by summing up the following labor income components from the raw data: wages and salaries, income from bonuses, overtime, commissions, professional practice or trade, market gardening, additional job income, and miscellaneous labor income[30]. All the income was collected in 2005 about the tax year 2004 and self-reported amounts.

Total family income to poverty ratio. Both the total family income and needs standard variables are available in the PSID 2005 data set. The needs standard values are identical to the official poverty thresholds.[31] Total family income to poverty ratio is simply produced from the value of total family income divided by the poverty thresholds.[32] The total family income includes taxable incomes, transfer incomes, and social security incomes of all family members.[33] The present study examined the family

[30]. Farm income and the labor portion of business income were excluded from the labor income calculation in the PSID. Contrary to other sources of labor incomes whose minimum values are zero, farm and business income can contain negative values if the total costs exceed total gains. Due to the different nature of the incomes and the coding schemes, the PSID provides them as separate variables. In the present study, people who had income from farm or businesses were excluded from the analyses because the number of the sample who had income from farm or businesses was small and the coding scheme was different.

[31]. Two types of needs standard are available in the PSID 2005 data: USDA needs standard and Census needs standard. The former is calculated using the Orshansky-type poverty threshold based on an annual food needs standard which is derived from weekly food costs, while the latter uses the official U.S. poverty threshold. The present study uses the Census needs standard, which provides a more generous poverty line, and the needs standard in this paper refers to it if otherwise mentioned.

[32]. Since the PSID provides the variable for only a few years, this study calculated additional years by means of the information available in the PSID—such as family demographic information and total family income, and the poverty thresholds issued by the Census Bureau.

[33]. Total family income is the sum of seven separate variables: 1) taxable income of head and wife, 2) transfer income of head and wife, 3) taxable income of other family members, 4) transfer income of other family members, 5) head's social security income, 6) wife's social security income, and 7) other family member's social security income.

income to poverty ratio due to its better comparability among families with different sizes than the use of total family income. Although the number of family members and children are not reflected in the total family income, the income to needs ratio provides an adjustment through poverty thresholds, which takes family size and the number of children into account.

Welfare dependency. Welfare dependency was examined by whether a respondent received TANF benefits in 2005. Recipients were coded as 1 and non-recipients were coded as 0. Other benefits such as Food Stamps and WIC vouchers were not taken into consideration.

Independent Variable: Head Start Participation

The main interest of the present study is to compare the effectiveness between Head Start and other preschool participation. The PSID provides two separate variables for Head Start and other program participation. A new variable, participation on early childhood education, is generated from the combination of the three variables including the above two and the length of Head Start participation (table 4-1).

Participation in early childhood education was classified into four categories: 1) long-term Head Start, 2) short-term Head Start, 3) other preschool,[34] and 4) no preschool. People who participated in both Head Start and other programs were excluded from the analysis because of the small sample size. In addition, it is not clear which experience would have caused the outcomes.

[34]. In the PSID data, programs other than Head Start include nursery schools, preschool programs, and day care centers. The length of other program participation was not considered due to the unavailability of this information in the data set.

Table 4-1

Classification of participation in early childhood education

		Head Start		
		1 year or more	Less than 1 year	No
Other Programs	No	Long-term Head Start	Short-term Head Start	No Preschool
	Yes	(Excluded)		Other Preschool

Control Variables

To control the influence of different background characteristics, community factors, family factors, and child factors were considered in the analysis. When variables have dynamic values which change over time, their average values or the modes are used for quantitative or qualitative variables, respectively.[35] One thing that should be noticed is that there are two sets of control variables in this study. Despite their identical names, each control variable has two final values: one reflects the background characteristics of a sample from birth to age 5, and the other from age 6 to age 17.[36] For example, two variables are used for poverty rates: one for preschool years (birth to age 5) and the other for after preschool years (age 6 to 17). This approach is needed for Propensity Score Matching (PSM) analysis. PSM analysis is a way to statistically control pre-existing differences and it needs background characteristics that may influence the choice of preschool type. Since background characteristics after age 5 cannot affect the choice of

[35]. Since this study includes background variables for the entire childhood years, from birth to age17, some categorical variables can change over time. For example, it could happen that the person's city size was smaller than 100,000 for two years and 500,000 or larger for three years from birth to age five. In this case, 500,000 or larger was considered the city size of the person during the preschool years. For continuous variables, average values were used.

[36]. Some variables have a constant value if they are a static variable such as gender and race.

preschool, background characteristics were measured for each time frame. Details about PSM analysis are discussed later.

Community factors. Community factors include city size, region, unemployment rates, poverty rates, and per pupil education expenditure. City size was categorized into three groups by the number of resident population: 1) under 100,000, 2) between 100,000 and 499,999, and 3) 500,000 or larger. Originally, the PSID data provided detailed categories for the cities under 100,000. However, they were put together to create a sufficient sample size for each cell. The PSID classifies all the states into four regions: Northeast, North-central, West, and South. This variable is dichotomized into Southern and Non-southern states to make the sample size balanced. Unemployment rates were examined at a county level. This variable is available in the PSID for every year from 1970 to 1993, but its coding scheme is not constant. From 1970 to 1981, it had been examined as a bracket variable, but since 1982 real numbers have been reported. To make each year's value compatible one another, the real numbers from 1982 to 1993 were re-coded to a bracket variable using the following categories, which are the same as the earlier data: 1) under 2 percent; 2) 2 to 3.9 percent; 3) 4 to 5.9 percent; 4) 6 to 10 percent; and 5) over 10 percent. Since the value varies by year, the average value of available years was calculated and used for the analyses. Poverty rates and per pupil education expenditure variables were created at the state level using the data from the U.S. Census Bureau and National Center for Education Statistics (NCES), respectively. Since the Census Bureau and NCES provide the data every year by state and the PSID provides the information about each sample's residential state every year, the two variables could be generated by matching values for a specific state and a year. Once poverty rates and per

pupil education expenditure variables were created for every year, the average of multiple years was used for the analyses.

Family factors. Family factors include mother's marital status at child's birth, highest level of parental education, total family income to poverty ratio, welfare dependency, and mother's age at birth. Mother's marital status was categorized into three groups: 1) married, 2) never married, and 3) other, which includes divorced, separated, widowed, etc. Highest level of parental education was assessed at three levels: 1) less than high school, 2) high school or GED, and 3) at least some college. When both the mother and father were living together, a higher level was considered.[37] The total family income to poverty ratio was measured in the same way as the one mentioned in the dependent variable section. The only difference is that the variable was a control variable this time and it reflected the values during childhood while the other indicated the value in 2005 which described adulthood economic status. Welfare dependency was examined by whether a respondent received AFDC or TANF benefits. One was given for recipients and zero for non-recipients. Since this variable is available for multiple years, the average value was used for analyses. The mother's age at birth was measured in actual number of years.

Child factors. In regard to child related factors, gender, birth order, religion, race, age, private school enrollment, and teenage pregnancy were considered. Male was coded as 0, and female as 1. The actual number was used for birth order, but a value greater than 4 was top-coded at 4. Religion was categorized into yes or no. Racial groups other than Caucasian and African-American were excluded because their sample size was

[37]. Since the father's and mother's education is not available in the PSID as a separate variable, it was retrieved from a person's level of education by matching the mother's and father's ID numbers.

negligible. The real value was used for age without recoding. Individuals who had ever enrolled in a private school were coded as 1 regardless of the length, and the others were coded as 0.[38] If a person became a father or a mother before age 20, 1 was given for his/her value for teenage pregnancy. Otherwise, 0 was given.[39]

Data Analyses

Analysis of the present study consists of two parts, propensity score matching (PSM) and other traditional analyses with matched sample.

In the first step, PSM was conducted to control pre-existing differences between the treatments and the controls. One of the major limitations of previous research is the absence of control groups or to having a control group with different characteristics. This creates severe problems in terms of comparability between groups. Hence, it is crucial to compare groups which are as close to each other as possible so that identified differences after Head Start enrollment can be regarded as treatment effects rather than the extension of the pre-existing conditions. A randomized trial is generally considered the best strategy to control for the pre-experimental differences; however, it is not always possible to use in social science research due to ethical dilemmas, costs, etc. (Nathan, 2008). A PSM strategy was developed as an alternative to random assignment, and it can minimize

[38]. The education supplement, included in the PSID 1995 data, has two variables asking whether a person had ever enrolled in private schools. Although the two variables are identical in content, the character of the respondents is slightly different from each other: one was asked to high school graduates and the other to students up to 12th grade. Since students up to 12th grade still had a chance to enroll in private schools, their answers were coded into the separate variable from the answers from high school graduates. However, these two variables were combined into one variable in the present study, i.e., respondents who answered "yes" to either question were coded as private-school-enrollees, and respondents who answered "no" to either question were coded as non-private-school-enrollees.

[39]. The teenage pregnancy variable was originally not available in the PSID data. It was generated by using an individual's age and the oldest child's age.

the influence of non-experimental factors on the outcomes, when random assignment is not applicable (Guo & Gibbons, 2004; Rosenbaum & Rubin, 1983; Rubin, 1980).

This method was developed by Rosenbaum and Rubin (1983) and generally conducted in two steps. In the first step, a group of matched samples was selected from the original sample using a propensity score to be the treatment group. To obtain the propensity score, logistic regression was executed with a variety of background factors that might be associated with the treatment. Once the logistic model was established, the predicted score of each subject could be calculated, and it was called the propensity score (PS). Since the likelihood of receiving the treatment is theoretically the same if the PS is equal, a group of comparison peers, which had the same or closest PS to each of treatment samples, could be selected to a matched control group.

While there are several ways to match, the simplest way is to match one control group sample to one treatment sample. This can be done either without replacement or with replacement. An extension of this method is to match two or more control groups to one treatment group sample. This method is called *k*-nearest matching and it is a good approach when a larger sample size or smaller variance is needed. To avoid the matching samples being far from each other, caliper can be used. Caliper indicates the maximum distance between two propensity scores where matching is allowed. This approach can be applied to any matching method when a researcher wants to set a boundary. Rosenbaum and Rubin (1983) recommend using the caliper size as a quarter of the standard deviation of the PS. Several control group samples can also be matched to one treatment group sample if the distance of the PS is smaller than the caliper. This method is called radius matching. PSM literature recommends using multiple matching methods and checking if

the findings are constant regardless of which matching methods are used (Guo & Gibbons, 2004). Thus, this study utilized the four matching methods presented above: 1) one-to-one matching without replacement, 2) one-to-one matching with replacement, 3) two-to-one matching with caliper, and 4) radius matching.

In the second step, a series of multivariate analyses were conducted using the samples constructed by the PSM analysis, which included an ordered logistic regression of educational attainment, Tobit regression of personal earned income, OLS regression of family income to poverty ratio, and logistic regression of welfare dependency.[40]

Since PSM can only be done with two groups, the same sets of analyses were conducted for the following pairs of groups: 1) long-term Head Start vs. no preschool, 2) long-term Head Start vs. other preschool, 3) short-term Head Start vs. no preschool, 4) short-term Head Start vs. other preschool, and 5) long-term Head Start vs. short-term preschool.

Stata 10.0 was used for all analyses. For the propensity score matching analysis, a PSMATCH2 module which was developed by Leuven and Sianesi (2003) was used.

[40]. For the analyses of economic outcomes, educational attainment was also entered as an independent variable. Since the level of education might be influenced by preschool experience, it could be an endogeneous variable. In that case, the effects of preschool experience on the outcome could be underestimated. However, it was entered into the analyses because the focus of this study is to examine the direct and indirect influences of preschool experience on adulthood economic status. If a linear relationship could be assumed, the analysis would be a path model, where endogeneous variables are not problematic since the model assumes that they exist. Path analyses were not employed in this study because educational attainment is a categorical variable, which violates the basic assumption of path analysis. However, the level of education was entered into the analyses because the logic was similar to path models. To make sure whether it causes any severe problems, a parallel set of regressions without the level of education were run and the outputs were compared to the ones with it. The coefficients of preschool experience were a little bit higher for the analysis of personal and family incomes and lower for the welfare dependency when the variable was not included in the model. However, they were not significantly different, which tells it is fine to enter the variable to the analyses.

Chapter 5

Results

Background Characteristics

The original sample, before propensity score matching, consisted of 1,765 young adults, ages 19 to 35 in 2005. Table 5-1 presents background characteristics of the sample. The first two columns show the values from birth to age 5 (common preschool years), and the other two columns reflect the background characteristics for the rest of childhood, from ages 6 to 17 (after preschool years).

Community factors. During preschool years, about half of the sample lived in a city with populations under 100,000. About 30 percent and 20 percent were raised in a city between 100,000 and 499,999 and 500,000 or larger, respectively. After preschool years, the samples were more likely to live in smaller cities: under 100,000 (56.4 percent), between 100,000 and 499,999 (26.1 percent), and 500,000 or larger (17.5 percent). About six out of ten respondents lived in non-southern states and the rest were in southern states.[41] Changes between preschool and after preschool years are negligible. Average unemployment rates of the residential county were 3.6 percent for both periods and state-level poverty rates slightly decreased from 14.7 percent during preschool years to 14.4 percent after preschool years. Per pupil education expenditure increased approximately $700, from $5,284 to $6,583.[42]

[41]. Southern states include the following states: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Mississippi, Alabama, Oklahoma, Texas, Arkansas, and Louisiana.

[42]. Each year's education expenditures were adjusted to 2005 dollars using the consumer price index.

Table 5-1. Background Characteristics (*N*= 1,765)

		Birth - Age 5		Age 6 - Age 17	
		Freq. or Mean	(%) or (SD)	Freq. or Mean	(%) or (SD)
Community Factors	Size of City				
	Under 100,000	865	(49.01)	996	(56.43)
	100,000-499,999	534	(30.25)	460	(26.06)
	500,000+	366	(20.74)	309	(17.51)
	Region				
	Non-Southern States	1,029	(58.30)	1,025	(58.07)
	Southern States	736	(41.70)	740	(41.93)
	Unemployment Rate	3.59	(0.67)	3.63	(0.54)
	Poverty Rate	14.65	(4.26)	14.39	(3.69)
	Per Pupil Education Expenditure	5283.73	(1435.86)	6583.04	(1487.52)
Family Factors	Mother's Marital Status at Birth				
	Married		1,218	(69.01)	
	Never married		344	(19.49)	
	Other		203	(11.50)	
	Parents' Education				
	Less than High School	276	(15.64)	216	(12.24)
	High School	753	(42.66)	663	(37.56)
	College +	736	(41.70)	886	(50.20)
	Income to Poverty Ratio	211.27	(95.17)	245.96	(146.35)
	Welfare Dependency	0.13	(0.26)	0.09	(0.21)
	Mother's Age at Birth		25.34	(5.52)	
Child Factors	Sex				
	Male		882	(49.97)	
	Female		883	(50.03)	
	Birth Order				
	1st		665	(37.68)	
	2nd		680	(38.53)	
	3rd		248	(14.05)	
	4th or younger		172	(9.75)	
	Religion				
	No		419	(23.74)	
	Yes		1,346	(76.26)	
	Race				
	White		1,149	(65.10)	
	Black		616	(34.90)	
	Ever Enrolled in Private School				
	No		1,541	(87.31)	
	Yes		224	(12.69)	
	Teenage Childbearing				
	No		1,350	(76.49)	
	Yes		415	(23.51)	
	Age		27.65	(4.34)	
Preschool Factor	Preschool Enrollment				
	Head Start (1yr +)		161	(9.12)	
	Head Start (1yr -)		171	(9.69)	
	Other Preschool		611	(34.62)	
	No Preschool		822	(46.57)	

Family factors. About seven out of ten children were born to married couples, two were born to a non-married couple, and one was attributed to others, such as widowed and separated. The mother's age at birth was about 25 on average. The highest level of parental education increased as the children grew older; 41.7 percent of the children lived with parent(s) who had at least some college education during preschool years, and the number rose to 50.2 percent by age 17. The percent of parents with less than high school decreased from 15.6 to 12.2 percent. The overall economic status of the family improved as the children grew older. The family income to need ratio elevated by 35 percent, from 211 to 246 percent, and welfare dependency fell from .13 to .09.

Child factors. Samples are evenly distributed in regard to gender: 882 are male and 883 are female. The majority of the participants were born as the first born (37.7 percent) or the second born (38.5 percent) child to their parents, and about 9.8 percent were born as the 4^{th} child or younger. Persons who reported having a religious affiliation made up 76.3 percent of the sample, and the sample size was bigger in Caucasians (65.1 percent) than African-Americans (34.9 percent). About 12.7 percent of the entire sample had attended private school at least some time during their school years. Persons who had their first child before they became 20 were about a quarter of the sample. The average age of the entire sample was 27.7.

Preschool enrollment. Preschool experience is categorized into four groups: 1) long-term Head Start (at least 1 year), 2) short-term Head Start (less than 1 year), 3) other preschool, and 4) no preschool. Participants who had ever enrolled in a Head Start program was 332 (18.8 percent), and 161 (9.12 percent) of them had enrolled in a Head Start program at least a year, and 171 attended less than a year. 611 children (34.6

percent) attended other preschools, and 822 children (46.6 percent) had no preschool experience at all.

Background Characteristics by Preschool Experience (before matching)

To compare the background characteristics of the four groups categorized by preschool experience, each group's characteristics are summarized in table 5-2. As presented in the table, background characteristics are significantly different among groups. Two Head Start groups are generally similar in their characteristics, but they are evidently different from other preschool or no preschool groups. This finding is not surprising because of the similarities of two Head Start groups in that the program was designed for low income children and enrollees must share similar characteristics to be accepted into the program. In some cases, however, similarities are found between long-term Head Starters and other preschoolers and between short-term Head Starters and no preschool children. These differences might be because the latter two share similar barriers to preschool programs, either Head Start or other preschools.

Community factors. Compared to the children with long-term Head Start or other preschool enrollment, individuals with limited preschool experience (i.e., short-term Head Start or no preschool) were raised in smaller cities. Almost 60 percent of the latter two groups lived in cities with populations under 100,000, while the numbers for the former two were only 41.0 percent and 36.5 percent, respectively. About six out of ten Head Start children, regardless of the length of enrollment, lived in southern states, which is considerably higher than the ratios of other preschool and no preschool children. Another characteristic is that county unemployment rates are higher among long-term

Head Starters (3.7 percent) and other preschooler (3.5 percent). The differences between the higher and lower groups are statistically significant at the level of $p<.05$. Both Head Start groups lived in states with higher poverty rates than other children. State poverty rates between ages 0 to 5 are also higher in long-term Head Starters (17.2 percent) and short-term Head Starters (16.6 percent).

Family factors. Head Start children were more likely to be born to non-married women compared to their peers, and 54 percent of the mothers of the long-term Head Start children were not married at the time of the delivery. The number is lower, about 22 percent, for short-term Head Start group; however, they are all considerably higher than other preschool (8.7 percent) and no preschool (18.1 percent) groups. The parents' level of education tells a similar story; 68.9 percent of other preschool children have parents with college educations. The percentage of parents who failed to finish high school is only 3.9 percent for this group. Although about half of the parents are high school graduates among the remaining three groups, parents of no preschool group are more likely to have college education and less likely to fail to graduate from high school than those of Head Start groups. One noticeable finding is that the level of parental education is higher in the long-term Head Start group than the short-term group, while the former have more vulnerable characteristics than the latter in most cases. Family income to poverty ratio increases in the following order: long-term Head Start (127.3 percent), short-term Head Start (155.5 percent), no preschool (203.9 percent), and other preschool (259.0 percent). In contrast, welfare dependency decreases in the same order. The mother's age is younger in long-term Head Starters and older in other preschoolers compared to short-term Head Start and no preschool groups.

Child factors. The average age of the sample ranges between 26.5 and 28.5, and persons with limited preschool experience are somewhat older than their counterparts. Regarding gender, the majority of the long-term Head Start group are female (70.2 percent), and the majority of the other preschool group are male (59.6 percent). The gender distribution is more balanced in the short-term Head Start and no preschool groups. The average birth order is slightly lower than 2 for all groups except the short-term Head Starters whose value is 2.3.

Over 80 percent of the sample has a religion affiliation regardless of the preschool experience. However, other preschoolers are less likely to have a religion than other groups. Only 65.1 percent of them have a religion and it is significantly lower than the others. Most of the Head Starters are African-American, but most of their control peers are Caucasian.

Table 5-2 presents supporting evidence that there are considerable pre-existing differences in background characteristics among the four groups. Consequently, it was necessary to adjust the differences before examining the effects of Head Start programs on educational and economic outcomes, so that all of the samples in the analysis could be considered under similar conditions except for preschool experience. As presented in the previous chapter, this adjustment was performed by employing Propensity Score Matching (PSM) analysis. The results of the PSM are presented in the following section. Once the issues of pre-existing differences were resolved by the PSM, the effects of Head Start participation on the outcome measures were examined.

Table 5-2.

Background Characteristics during Preschool Years by Preschool Experience

	Long-term Head Start (*N*= 161)	**Short-term Head Start (*N*= 171)**	**Other Preschool (N= 611)**	**No Preschool (N= 822)**
	% or mean	% or mean	% or mean	% or mean
Community Factors				
Size of City				
Under 100,000	40.99	57.31	36.5	58.15
100,000-499,999	33.54	18.71	42.88	22.63
500,000+	25.47	23.98	20.62	19.22
Region				
Non-Southern States	36.65	41.52	68.74	58.27
Southern States	63.35	58.48	31.26	41.73
Unemployment Rate	3.68	3.56	3.66	3.53
Poverty Rate	17.2	16.60	13.88	14.32
Family Factors				
Mother's Marital Status at Birth				
Married	39.75	54.39	70.87	76.4
Never married	54.04	32.16	8.67	18.13
Other	6.21	13.45	20.46	5.47
Parents' Education				
Less than High School	24.84	31.58	3.93	19.22
High School	52.17	52.05	27.17	50.36
College +	22.98	16.37	68.9	30.41
Income to Poverty Ratio	127.28	155.54	258.98	203.85
Welfare Dependency	0.31	.24	0.07	0.11
Mother's Age at Birth	22.82	24.35	27.61	24.36
Child Factors				
Age	26.45	28.22	26.69	28.49
Sex				
Male	29.81	47.95	59.57	47.2
Female	70.19	52.05	40.43	52.8
Birth Order	1.94	2.32	1.88	1.95
Religion				
No	16.77	17.54	34.86	18.13
Yes	83.23	82.46	65.14	81.87
Race				
Caucasian	6.21	35.09	82.82	69.71
African-American	93.79	64.91	17.18	30.29

Effects of Head Start Participation

In this study, the PSM analysis was conducted to examine the effects of Head Start participation on educational attainment and economic status as measured by personal earned income, family income to poverty ratio, and welfare dependency. This analysis was done in three steps: 1) ran logistic regression to obtain propensity scores, 2) matched the samples with similar characteristics using the propensity scores, and 3) performed appropriate analyses with the matched samples.

Since the first step was to run a logistic regression analysis, comparisons among the four groups were made on a one-to-one basis. Hence, the effects of Head Start participation were examined using the following five paired-group comparisons: 1) long-term Head Start vs. no preschool, 2) long-term Head Start vs. other preschool, 3) short-term Head Start vs. no preschool, 4) short-term Head Start vs. other preschool, and 5) long-term Head Start vs. short-term Head Start. For each comparison, four types of matching models were applied to check if the results were consistent regardless of how the control groups were matched. The four models included one-to-one matching without replacement (model 1), one-to-one matching with replacement (model 2), two nearest matching with caliper (model 3), and radius matching (model 4).

Long-term Head Start vs. No preschool

Logistic regression of preschool experience. Table 5-3 shows the results of the logistic regression of preschool experience: long-term Head Start or no preschool. Although bivariate analyses in table 5-2 reveal that there are significant differences in the characteristics between Head Start and no preschool children, some variables entered in the logistic regression are not significant. Among community factors, region and poverty

rate are statistically significant. Children who lived in southern states were less likely to participate in Head Start at least one year than their peers in non-southern states when other conditions were equal.[43]

Children in the state of higher poverty rate were more likely to have participated in Head Start, but the unemployment rate is not significantly associated with Head Start enrollment. An interesting finding is that none of the family related factors was influential on Head Start enrollment because the influence of family factors on Head Start enrollment was explained by community and child factors considered in the analysis. Concerning child factors, age and race are significant. As a respondent's age increased, the likelihood of Head Start enrollment decreased, and African-Americans were more likely to participate in Head Start program.

After the logistic regression, each sample's propensity score was computed. Figure 5-1 shows the density of the propensity scores. The upper part is for the treated (Head Start) group and the lower part is for the untreated (no preschool) group. Overall, the mean of the propensity score is .16 and its standard deviation is .20. Two samples in the treated group are outside of the common support area. They are excluded from matching due to the higher propensity score that cannot be matched with the control group.

[43]. This is a contrary finding to the bivariate analysis, which shows that children in southern states were more likely to participate in the Head Start program, where no other factors were considered. This inconsistency occurred because southern states generally had more disadvantaged characteristics than other states. For example, poverty rate was about 18.2 percent in southern states while it was only 12.0 percent in other states. In other words, higher enrollment rates in Head Start among children in southern states resulted not from a regional effect but from other effects such as higher poverty rates and a higher ratio of African-Americans in the South.

Table 5-3.

Logistic Regression of Long-term Head Start Enrollment (vs. No preschool)

	Coef.	S.E.	z	P>z
Community Factors				
Size of City				
(ref. = Under 100,000)				
100,000-499,999	.279	.147	1.890	.058
500,000+	-.162	.173	-.940	.347
Region (ref.=non-Southern States)				
Southern States	-.490	.183	-2.680	**.007**
Unemployment Rate	-.096	.106	-.910	.364
Poverty Rate	.039	.017	2.320	**.020**
Family Factors				
Mother's Marital Status at Birth				
(ref. = Married)				
Never married	.027	.158	.170	.866
Other	-.074	.253	-.290	.769
Parents' Education (ref.= less than HS)				
High School	.090	.157	.570	.565
College +	.108	.204	.530	.594
Income to Poverty Ratio	-.002	.001	-1.600	.111
Welfare Dependency	.025	.228	.110	.913
Mother's Age at Birth	-.003	.017	-.200	.845
Child Factors				
Age	-.047	.016	-3.020	**.003**
Sex (ref. = Male)				
Female	.148	.124	1.190	.232
Birth Order	-.020	.079	-.260	.797
Religion (ref. = No religion)				
Yes	.079	.164	.480	.628
Race (ref. = Caucasian)				
African-American	1.759	.196	8.980	**.000**

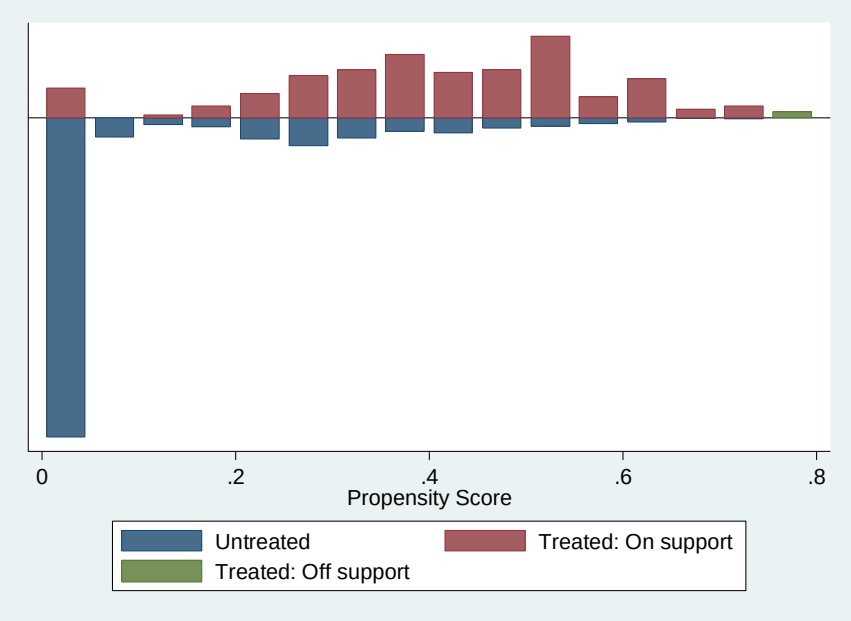

Figure 5-1. Density of Propensity Score (Long-term Head Start vs. No Preschool)

Based on the propensity score, four types of matched samples were selected: one-to-one matching without replacement (*N*=159), one-to-one matching with replacement (*N*=103), two nearest matching with caliper (*N*=169), and radius matching (*N*=822). Except the first matching where the treatment and control groups have the same sample size, weights are also generated and used for the final analysis. For the third and the fourth matching, caliper and radius sizes are set as .05, which is a quarter of standard deviation of the propensity score.[44]

Background characteristics of the matched sample. After the matching, most of the significant differences between two groups are disappeared. As presented in table 5-4, before the matched controls are constructed, the characteristics of the treatment and control groups are significantly different on almost every aspect considered in the

[44]. Rosenbaum and Rubin (1983) recommended to use the caliper size as the quarter of standard deviation of the propensity score.

analysis. However, the differences are sufficiently adjusted by the PSM. Although the average unemployment rates still remain significant in model 2 and 3, other than that, no significant differences are found between two groups. The balance between the treatment and control groups are generally fine in all matching methods; however, control groups constructed by model 1 and 4 are closer to the treatment group because no significant factors remained after matching. Also, the gaps between the treatment and control groups are generally smaller in model 1 and 4 than in model 2 and 3.

Table 5-4. Background Characteristics (Long-term Head Start vs. No preschool)

	Long-term Head Start (*N*= 159)	**No Preschool (*N*= 822)**		**Model 1 (*N*= 159)**		**Model 2 (*N*= 103)**		**Model 3 (*N*= 169)**		**Model 4 (*N*= 822)**	
	% or mean	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	χ2 or t
Community Factors											
Size of City			**16.32*** **		2.31		.44		.04		.31
Under 100,000	41.51	58.15		49.06		42.77		42.45		41.3	
100,000-499,999	32.7	22.63		25.79		34.59		31.76		34.15	
500,000+	25.79	19.22		25.16		22.64		25.79		24.54	
Region			**25.41*** **		.05		2.92		.42		.00
Non-Southern States	36.48	58.27		35.22		45.91		39.94		36.46	
Southern States	63.52	41.73		64.78		54.09		60.06		63.54	
Unemployment Rate	3.68	3.53	**2.56***	3.77	-1.5	3.82	**-2.35***	3.82	**-2.39***	3.73	-.85
Poverty Rate	17.17	14.32	**7.61*** **	17.04	.25	16.72	.81	17.2	-.04	17.11	.12
Family Factors											
Mother's Marital Status at Birth			**98.13*** **		1.1		2.35		.58		1.17
Married	40.25	76.4		39.62		41.51		39.31		39.04	
Never married	53.46	18.13		50.94		47.8		52.2		52.9	
Other	6.29	5.47		9.43		10.69		8.49		8.06	
Parents' Education			**4.75†**		.35		.45		.38		2.51
Less than High School	25.16	19.22		27.04		28.3		27.67		28.37	
High School	52.2	50.36		52.83		49.06		51.89		52.62	
College +	22.64	30.41		20.13		22.64		20.44		19.01	
Income to Poverty Ratio	128.56	203.85	**-9.80*** **	133.69	-.56	133.95	-.60	127.68	.1	128.72	-.02
Welfare Dependency	.3	.11	**8.28*** **	.32	-.54	.34	-.78	.37	-1.61	.33	-.75
Mother's Age at Birth	22.73	24.36	**-3.55*** **	23.02	-.53	23.18	-.86	22.943	-.40	22.59	.27

	Long-term Head Start (*N*= 159)	**No Preschool (*N*= 822)**		**Model 1 (*N*= 159)**		**Model 2 (*N*= 103)**		**Model 3 (*N*= 169)**		**Model 4 (*N*= 822)**	
	% or mean	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	χ2 or t
Child Factors											
Age	26.45	28.49	**-5.52*** **	26.51	.07	26.56	-.10	26.406	.3	26.45	.19
Sex			**16.50*** **		1.15		.10		.06		2.59
Male	30.19	47.2		35.85		32.04		31.45		35.01	
Female	69.81	52.8		64.15		67.96		68.55		65	
Birth Order	1.92	1.95	-.01	1.93	.11	1.98	-.52	1.9497	-.27	1.94	-.22
Religion			.17		.34		1.96		2.21		.44
No	16.98	18.13		19.5		23.27		23.58		.19	
Yes	83.02	81.87		80.5		76.73		76.42		.81	
Race			**222.24*** **		.00		.00		.00		.04
White	6.29	69.71		6.29		6.29		6.29		6.61	
Black	93.71	30.29		93.71		93.71		93.71		93.39	

Note: a. 2 samples in Head start (1 year +) group were excluded because they are out of common support area.

b. χ2 or t tests were conducted between long-term Head Start (1year+) group and the selected control group.

c. Model 1 (1-to-1 matching without replacement); Model 2 (1-to-1 matching with replacement); Model 3 (k-nearest matching with caliper, k=2); Model 4 (radius matching with caliper)

†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Effects of Head Start participation

Educational attainment. The results of ordered logistic regressions of educational attainment are summarized in Table 5-5. When background factors are controlled, long-term Head Start participants are more likely to have higher levels of education than no preschool children. This result is consistently found except the analysis model 2, in which the balances between the treatment and control groups are not as good as in model 1 and 4. Effect sizes are similar in model 1, 3, and 4. The coefficient of Head Start enrollment in each matching model is .632, .607, and .521, respectively. This corresponds to a proportional odds ratio of 1.88 ($e^{.632}$), 1.84 ($e^{.607}$), and 1.69 ($e^{.521}$), which means that compared to no preschool children, long-term Head Starters are at least 1.69 times more likely to have higher educational attainment if other conditions are equal. Although the effects of Head Start participation in the long-term is not significant at the level of $p < .05$ in model 2, its p-value is still low (.099) with a positive coefficient. This indicates some chance of positive program effects. Considering that the model 2 has a smaller sample size and less balanced control group and that all other models generate significant program effects, Head Start program produces sizable benefits to its participants in terms of educational attainment if they attend the program at least one year.

In addition to the Head Start enrollment, several family and child related factors are found to be associated with children's educational attainment. Community factors are not significantly associated with the outcome if the pre-existing differences are adjusted in advance by the PSM. Family income to poverty ratio and mother's age at birth are positively associated with higher education in all models.

Table 5-5.
Ordered Logistic Regression of Educational Attainment (long-term Head Start vs. No Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	.632	.236	**.008**	.387	.235	.099	.607	.267	**.023**	.521	.224	**.020**
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	.143	.288	.621	.160	.297	.590	.476	.301	.114	.164	.268	.541
500,000 or larger	-.207	.355	.560	-.621	.368	.092	-.421	.371	.256	-.428	.344	.213
Region (ref.=non-Southern States)												
Southern States	-.046	.358	.898	-.441	.366	.228	-.065	.443	.883	-.112	.338	.739
Unemployment rates	-.127	.255	.617	.075	.279	.787	-.125	.275	.648	-.233	.242	.336
Poverty rates	.063	.038	.101	.017	.040	.669	.019	.041	.639	.037	.034	.275
Per pupil education expenditure	.000	.000	.307	.000	.000	.987	.000	.000	.730	.000	.000	.446
Family factors												
Marital status (ref.=married)												
never married	-.316	.291	.277	-.368	.291	.205	-.303	.335	.366	-.322	.273	.239
other	.185	.493	.708	.443	.509	.384	.688	.863	.425	.124	.574	.829
Parents education (ref.=under HS graduate)												
High school graduate	.596	.313	.057	.404	.320	.207	.501	.363	.168	.473	.300	.115
College	.746	.394	.058	.658	.392	.093	.652	.416	.117	.564	.365	.123
Income to poverty ratio	.006	.002	**.001**	.004	.002	**.014**	.005	.002	**.019**	.004	.002	**.028**
Welfare dependency	.391	.504	.439	-.064	.498	.898	.515	.615	.403	.232	.487	.633
Mother's age at birth	.104	.035	**.003**	.094	.036	**.009**	.106	.045	**.020**	.099	.035	**.004**

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Child Factors												
Gender (ref.=Male)												
Female	.590	.263	**.025**	.818	.276	**.003**	.681	.297	**.022**	.557	.249	**.025**
Birth order	-.600	.159	**.000**	-.491	.157	**.002**	-.528	.232	**.023**	-.500	.192	**.009**
Religion (ref.=No)												
Yes	.428	.308	.165	-.059	.311	.849	.145	.380	.702	.554	.301	.065
Race (ref.=Caucasian)												
African-American	.811	.604	.179	1.170	.611	.055	1.051	.555	.058	1.099	.442	**.013**
Age	.073	.034	**.031**	.075	.035	**.031**	.087	.037	**.018**	.070	.034	**.039**
Teenage Pregnancy (ref.=No)												
Yes	-.834	.264	**.002**	-.773	.273	**.005**	-.900	.327	**.006**	-.819	.248	**.001**
Private school enrollment (ref.=No)												
Yes	1.134	.571	**.047**	1.211	.601	**.044**	1.327	.600	**.027**	.962	.557	.084
Constant (cut1)	5.269	1.977		3.795	2.047		4.719	2.269		4.114	1.976	
Constant (cut2)	7.639	2.007		5.977	2.063		6.989	2.302		6.358	2.010	
Number of Observation	318			318			328			981		
LR chi-square(21)	113.990			80.690			72.030			80.950		
Pr > chi-square	**.000**			**.000**			**.000**			**.000**		
Pseudo R-square	.172			.124			.150			.143		
Log Likelihood	-274.082			-284.779			-290.867			-878.557		

Among child factors, gender, birth order, age, teenage pregnancy, and private school enrollment are identified as significant factors in all models except model 4 for private school enrollment. Compared to male, female's educational attainment is higher and the coefficient ranged from .557 to .818 depending on the matching models. Later birth order (i.e., being a younger child within a family) is negatively related to the level of education, and age is positively related to it. The biggest barrier to education is teenage pregnancy, whose coefficient ranges from -.773 to -.900. Private school enrollment is identified as a strong promoter. According to the result, children who have ever enrolled in private school are about three times more likely to have higher educational attainment. In the model 4, race difference is found: African-American children perform better than Caucasian when other conditions are equal. However, the result is not significant in other models.

Economic Status. Adulthood economic status is observed in three variables: 1) personal earned income, 2) family income to need ratio, and 3) welfare dependency. For the outcome of personal earned income, Tobit analysis is performed with the same set of variables as above, but educational attainment is additionally added to examine both direct and indirect effects of Head Start enrollment on earned income (see table 5-6). According to the results, direct effects of Head Start enrollment on earned income are not clear. Although model 2 shows negative association between them, no other models turn out significant results. However, indirect effects through educational attainment are detected. Earned income is considerably higher in the group of higher education. Compared to people who failed to finish high school, high school graduates earned more about $6,051 to $7,501 in 2004, depending on matching models. The income gap

becomes even greater ($7,815 to $10,489) if a person received at least some college education. Considering that Head Start enrollment tended to increase participants' education level, the results confirms that the program produces some indirect effects on personal income.

Secondly, Head Start's influence on family income is investigated. To get the better model, family income to poverty ratio is log-transformed, and Ordinary Least Square (OLS) regression is employed (table 5-7). The results are similar to the analysis of personal earned income. There are no direct effects on family income, but indirect effects through education are found.

At last, the impact on welfare dependency is checked by logistic regression (table 5-8). Like the results of personal and family income, no clear association between Head Start enrollment and welfare dependency is found. Although Head Starters are about three times more likely to receive AFDC or TANF benefits than no preschoolers in model 3, no significant difference between two groups is found in other models. However, indirect effects through educational attainment are found to be significant. The likelihood of being welfare recipients decreases in all models as the level of education increase.

Table 5-6.
Tobit Regression of Personal Earned Income (long-term Head Start vs. No Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	-1619	1600	.312	-3524	1714	**.041**	-1287	1732	.458	-842	1430	.556
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-1716	1988	.389	154	2188	.944	451	2277	.843	751	1763	.670
500,000 or larger	-339	2379	.887	-699	2679	.794	1162	2384	.626	-64	2168	.976
Region (ref.=non-Southern States)												
Southern States	-2246	2482	.366	-3890	2672	.147	-1987	3446	.565	-1661	2515	.509
Unemployment rates	-2762	1713	.108	-5570	2042	**.007**	-4880	1896	**.011**	-2974	1461	**.042**
Poverty rates	231	263	.380	214	291	.462	275	276	.320	231	251	.357
Per pupil education expenditure	0	1	.667	0	1	.611	0	1	.972	0	1	.984
Family factors												
Marital status (ref.=married)												
never married	-1020	1966	.604	-3476	2123	.103	-2294	2474	.355	-975	1842	.597
other	-4658	3176	.144	-5270	3419	.124	-5293	3716	.155	-4508	2649	.089
Parents education (ref.=under HS graduate)												
High school graduate	-843	2187	.700	-1173	2391	.624	-1640	2324	.481	1652	1851	.372
College	170	2648	.949	1768	2826	.532	474	2516	.851	2273	2155	.292
Income to poverty ratio	28	8	**.001**	25	9	**.004**	25	6	**.000**	26	5	**.000**
Welfare dependency	-4673	3360	.165	-3411	3645	.350	-3216	3263	.325	-2802	2903	.335
Mother's age at birth	565	227	**.013**	1015	249	**.000**	568	285	**.047**	416	207	**.044**
Child Factors												
Gender (ref.=Male)												
Female	-3827	1787	**.033**	-3147	2014	.119	-3200	1738	.067	-3697	1508	**.014**
Birth order	-1562	1055	.140	-3968	1110	**.000**	-2653	1434	.065	-1187	1046	.257

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	5347	2200	**.016**	6497	2362	**.006**	4840	2381	**.043**	5404	1893	**.004**
Race (ref.=Caucasian)												
African-American	11274	3953	**.005**	12911	4274	**.003**	6893	3895	.078	5093	2780	.067
Age	877	227	**.000**	761	245	**.002**	857	226	**.000**	912	192	**.000**
Teenage Pregnancy (ref.=No)												
Yes	-2272	1815	.212	2173	1978	.273	664	2058	.747	-1744	1562	.264
Private school enrollment (ref.=No)												
Yes	-54	3230	.987	-2246	3569	.530	-5229	4708	.268	-1091	3679	.767
Education (ref.=Less than HS)												
High school	7501	2401	**.002**	7230	2634	**.006**	6382	2293	**.006**	6051	1874	**.001**
College	7815	2586	**.003**	10489	2711	**.000**	10469	2413	**.000**	8158	1927	**.000**
Constant	-25346	13125	.054	-18897	14542	.195	-15453	16076	.337	-22623	12134	.063
Number of Observation	318			318			328			981		
Standard Error of estimate (sigma)	13657			14511			13615			13721		
LR chi-square(23)	124.680			136.590			8.540			10.250		
Pr > chi-square	**.000**			**.000**			**.000**			**.000**		
Pseudo R-square	.020			.021			.020			.019		
Log Likelihood	-3109.303			-3135.729			-3047.737			-3075.518		

Note: For coefficients and standard errors, the number of decimal places is set to zero due to limited space.

Table 5-7.
Regression of Family Income to Poverty Ratio (long-term Head Start vs. No preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	-.143	.093	.127	-.144	.099	.145	-.068	.116	.560	-.084	.088	.340
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.082	.116	.480	-.001	.126	.993	-.070	.155	.652	.007	.118	.952
500,000 or larger	.021	.139	.880	.119	.155	.443	.213	.166	.199	.108	.133	.415
Region (ref.=non-Southern States)												
Southern States	-.041	.144	.778	.033	.153	.827	.223	.252	.376	.110	.180	.543
Unemployment rates	.016	.099	.869	-.069	.116	.550	-.002	.112	.989	.022	.082	.793
Poverty rates	.000	.015	.986	.011	.017	.520	.005	.018	.774	.001	.016	.971
Per pupil education expenditure	.000	.000	.355	.000	.000	.796	.000	.000	.642	.000	.000	.714
Family factors												
Marital status (ref.=married)												
Never married	-.175	.115	.129	-.364	.122	**.003**	-.348	.138	**.012**	-.220	.114	.054
Other	-.338	.184	.067	-.517	.195	**.008**	-.439	.163	**.007**	-.361	.135	**.008**
Parents education (ref.=under HS graduate)												
High school graduate	.045	.127	.725	-.001	.138	.995	-.005	.175	.977	.133	.135	.327
College	.309	.155	**.047**	.329	.163	**.044**	.288	.163	.078	.353	.139	**.012**
Income to poverty ratio	.000	.000	.609	.000	.001	.913	.000	.001	.651	.000	.000	.376
Welfare dependency	-.557	.196	**.005**	-.584	.210	**.006**	-.447	.260	.087	-.384	.233	.099
Mother's age at birth	.017	.013	.205	.038	.014	**.009**	.030	.016	.061	.019	.012	.100

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Child Factors												
Gender (ref.=Male)												
Female	-.122	.105	.246	.080	.116	.492	.055	.137	.687	-.097	.101	.340
Birth order	-.143	.061	**.021**	-.278	.064	**.000**	-.300	.109	**.006**	-.181	.077	**.019**
Religion (ref.=No)												
Yes	.125	.126	.322	.363	.134	**.007**	.325	.179	.071	.245	.155	.114
Race (ref.=Caucasian)												
African-American	.009	.229	.968	-.104	.243	.668	-.249	.249	.319	-.083	.159	.601
Age	.058	.013	**.000**	.075	.014	**.000**	.070	.015	**.000**	.051	.012	**.000**
Teenage Pregnancy (ref.=No)												
Yes	-.215	.106	**.044**	-.059	.114	.604	-.068	.169	.688	-.122	.117	.296
Private school enrollment (ref.=No)												
Yes	-.375	.189	**.049**	-.359	.206	.083	-.422	.224	.060	-.315	.204	.123
Education (ref.=Less than HS)												
High school	.456	.138	**.001**	.506	.148	**.001**	.467	.251	.063	.428	.163	**.009**
College	.687	.149	**.000**	.708	.153	**.000**	.788	.248	**.002**	.705	.158	**.000**
Constant	3.308	.765	**.000**	2.193	.837	**.009**	2.155	1.462	.141	3.005	.965	**.002**
Number of Observation	318			318			328			981		
F value	7.750			10.150			7.560			8.960		
Pr > F	**.000**			**.000**			**.000**			**.000**		
R-square	.377			.443			.427			.357		
Adjusted R-square	.329			.399								

Table 5-8.
Logistic Regression of Welfare Dependency (long-term Head Start vs. No preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	1.705	.819	.266	1.732	.895	.288	2.736	1.278	**.031**	2.341	1.026	.052
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	3.973	2.641	**.038**	2.632	2.004	.204	3.608	2.809	.099	4.457	3.243	**.040**
500,000 or larger	12.800	9.886	**.001**	13.330	11.618	**.003**	16.047	13.314	**.001**	16.587	12.624	**.000**
Region (ref.=non-Southern States)												
Southern States	2.484	1.627	.165	1.622	1.238	.526	2.802	2.083	.166	2.556	1.599	.133
Unemployment rates	.677	.373	.479	.609	.403	.453	.517	.274	.213	.745	.441	.619
Poverty rates	.860	.071	.069	.790	.094	**.047**	.868	.094	.193	.881	.082	.176
Per pupil education expenditure	1.000	.000	.342	.999	.000	.057	1.000	.000	.099	1.000	.000	.195
Family factors												
Marital status (ref.=married)												
Never married	1.110	.724	.873	1.037	.732	.959	.858	.494	.791	.878	.464	.806
Other	4.338	3.681	.084	1.748	1.572	.535	1.870	1.710	.493	3.206	2.830	.187
Parents education (ref.=under HS graduate)												
High school graduate	2.405	1.448	.145	2.157	1.521	.276	2.506	1.538	.134	1.887	.949	.207
College	.543	.475	.485	.409	.402	.363	.782	.594	.746	.648	.432	.515
Income to poverty ratio	.994	.004	.173	.993	.004	.135	.993	.003	**.038**	.993	.003	**.024**
Welfare dependency	1.468	1.499	.707	2.318	2.645	.461	2.230	2.013	.374	1.797	1.623	.516
Mother's age at birth	1.037	.075	.613	1.058	.084	.481	1.041	.079	.599	1.056	.070	.407

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Child Factors												
Gender (ref.=Male)												
Female	3.424	2.309	.068	2.115	1.684	.347	4.390	2.963	**.028**	6.657	4.079	**.002**
Birth order	1.035	.304	.906	.927	.288	.807	.871	.243	.621	.772	.200	.316
Religion (ref.=No)												
Yes	.626	.340	.389	.782	.473	.684	.499	.288	.228	.494	.234	.137
Race (ref.=Caucasian)												
African-American	.102	.133	.080	.139	.194	.157	.104	.129	.069	.095	.096	**.019**
Age	.959	.063	.527	.878	.064	.076	.919	.059	.187	.925	.052	.164
Teenage Pregnancy (ref.=No)												
Yes	5.690	3.263	**.002**	7.799	5.236	**.002**	4.599	3.130	**.025**	5.333	3.368	**.008**
Private school enrollment (ref.=No)												
Yes	12.298	11.775	**.009**	29.202	32.014	**.002**	20.713	20.340	**.002**	10.384	8.610	**.005**
Education (ref.=Less than HS)												
High school	.307	.178	**.042**	.219	.140	**.018**	.228	.126	**.007**	.276	.146	**.015**
College	.248	.164	**.035**	.179	.119	**.009**	.210	.151	**.030**	.276	.176	**.044**
Number of Observation	318			318			328			981		
LR chi-square(23)	74.330			82.400			52.030			59.940		
Pr > chi-square	**.000**			**.000**			**.001**			**.000**		
Pseudo R-square	.344			.397			.370			.367		
Log Likelihood	-70.962			-62.614			-64.580			-206.955		

Long-term Head Start vs. other preschool

Logistic regression of preschool experience. Table 5-9 shows logistic regression of preschool enrollment: long-term Head Start versus other preschool. Similar to the logistic analysis with long-term Head Start and no preschool children, not all factors are significant. However, there are some differences from the previous one. The significance of region disappears but size of city becomes significant. Compared to children in smaller cities, children in larger cities are more likely to attend other preschools. It might be because there are more other preschools in larger cities. Although no family factors are significantly associated with the decision of preschool enrollment between Head Start and no preschool, some of them are significant between Head Start and other preschools. When other conditions are constant, children tend to attend other preschools if their mother's marital status at birth was *other* (compared to married), parents had at least some college education, and family income to poverty ratio was higher. Among child factors, race is significant. Compared to Caucasian children, African-Americans are about 6.5 times ($e^{1.866}$) more likely to attend Head Start program than other preschools. Age becomes insignificant while it is significant in the previous analysis (long-term Head Start vs. no preschool).

The density of propensity scores computed by the logistic regression is presented in figure 5-2. The upper part is for the treatment group (Head Start for 1 year or longer) and the lower part is for the control group (other preschools). The majority of treatment group are located in higher propensity score area, and the most control group sample are aggregated in near zero area. Although 27 treated cases are outside of common support area and dropped out from matching, there is sufficient overlap between two groups, and

no considerable problem is found to conduct the PSM analysis. The average of the propensity scores is .21 and the standard deviation is .31.

Table 5-9.

Logistic Regression of Long-term Head Start Enrollment (vs. Other preschool)

	Coef.	Std. Err.	z	P>z
Community Factors				
Size of City				
(ref. = Under 100,000)				
100,000-499,999	-.462	.204	-2.270	**.023**
500,000+	-.672	.237	-2.840	**.005**
Region (ref.=non-Southern States)				
Southern States	-.276	.226	-1.220	.221
Unemployment Rate	.111	.142	.780	.433
Poverty Rate	.051	.022	2.310	**.021**
Family Factors				
Mother's Marital Status at Birth				
(ref. = Married)				
Never married	-.030	.210	-.140	.885
Other	-.574	.275	-2.090	**.037**
Parents' Education (ref.= less than HS)				
High School	-.066	.242	-.270	.785
College +	-.581	.271	-2.140	**.032**
Income to Poverty Ratio	-.005	.001	-3.790	**.000**
Welfare Dependency	.314	.321	.980	.328
Mother's Age at Birth	-.005	.022	-.210	.832
Child Factors				
Age	-.001	.021	-.060	.952
Sex (ref. = Male)				
Female	.073	.161	.450	.651
Birth Order	-.027	.100	-.270	.789
Religion (ref. = No religion)				
Yes	-.047	.213	-.220	.827
Race (ref. = Caucasian)				
African American	1.866	.229	8.160	**.000**
Constant	-1.127	1.066	-1.060	.290

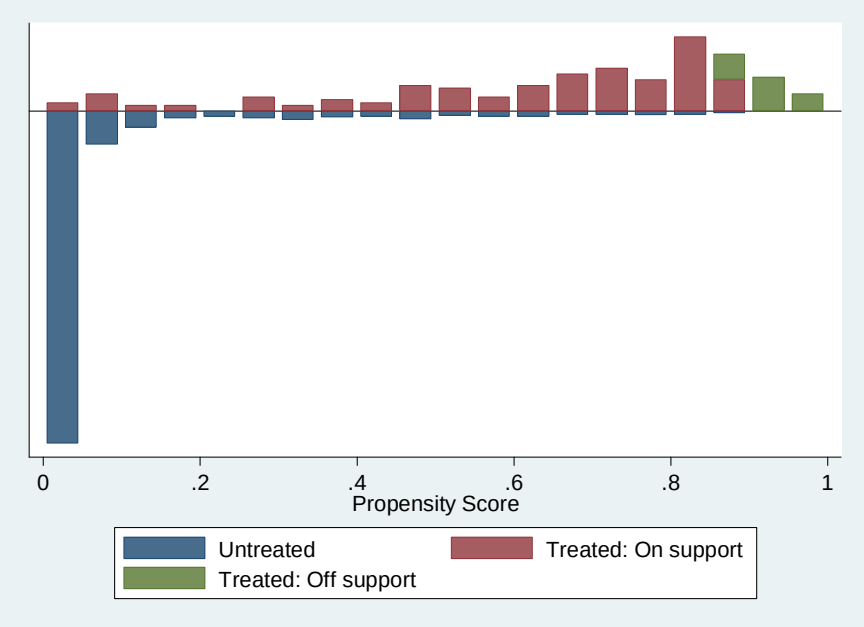

Figure 5-2. Density of Propensity Score (Long-term Head Start vs. Other Preschool)

Based on the propensity scores, four matched control groups are constructed as the previous analysis. Sample sizes of the control groups are 134 for one-to-one matching without replacement (model 1), 60 for one-to-one matching with replacement (model 2), 84 for two nearest matching with caliper (model 3), and 611 for radius matching (model 4). For model 2, 3 and 4, weights are generated and used for later analyses. Caliper size of.078, which is a quarter of standard deviation of the propensity scores, was applied for model 3 and 4.

Background characteristics of the matched sample. As described in table 5-10, most of the significant differences between Head Start and other preschool groups are disappeared after the matching. Originally, the characteristics of two groups are significantly different on most domains, but the difference is sufficiently adjusted by the PSM. One exception is the matching model 1.

Table 5-10.
Background Characteristics (Long-term Head Start vs. Other Preschool)

	Long-term Head Start (*N*= 134)	**Other Preschool (*N*= 611)**		**Model 1 (*N*= 134)**		**Model 2 (*N*= 60)**		**Model 3 (*N*= 84)**		**Model 4 (*N*= 611)**	
	% or mean	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t
Community Factors											
Size of City			5.66^{+}		1.47		4.02		2.01		7.05
Under 100,000	34.33	36.5		39.55		41.04		33.96		26.64	
100,000-499,999	35.82	42.88		29.1		39.55		43.66		44.38	
500,000+	29.85	20.62		31.34		19.4		22.39		28.98	
Region			**40.39*****		.98		.00		.03		.4
Non-South	39.55	68.74		45.52		39.55		40.67		41.83	
South	60.45	31.26		54.48		60.45		59.33		58.17	
Unemployment Rate	3.6515	3.66	-.16	3.6093	.62	3.55	1.56	3.643	.14	3.68	-.48
Poverty Rate	16.75	13.88	**7.84*****	15.479	2.08	16.72	.04	16.67	.13	16.26	.78
Family Factors											
Mother's Marital Status at Birth			**148.20*****		**8.85***		1.31		.01		1.25
Married	41.04	70.87		55.22		47.76		41.04		41.94	
Never married	51.49	8.67		33.58		44.78		51.87		48.58	
Other	7.46	20.46		11.19		7.46		7.09		9.49	
Parents' Education			**98.79*****		4.34		2.63		.71		1.81
Less than High School	20.9	3.93		11.94		19.4		21.64		20.44	
High School	52.24	27.17		54.48		61.19		56.34		56.6	
College +	26.87	68.9		33.58		19.4		22.01		22.96	
Income to Poverty Ratio	140.14	258.98	**-15.90*****	185.56	-4.78	136.45	.45	134.81	.63	138.67	.16
Welfare Dependency	.26	.07	**9.49*****	.16	**2.49***	.26	.00	.28	-.29	.30	-.87
Mother's Age at Birth	22.918	27.61	**-9.16*****	23.85	-1.58	22.59	.55	22	1.56	22.59	.55

	Long-term Head Start (*N*= 134)	**Other Preschool (*N*= 611)**		**Model 1 (*N*= 134)**		**Model 2 (*N*= 60)**		**Model 3 (*N*= 84)**		**Model 4 (*N*= 611)**	
	% or mean	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t
Child Factors											
Age	26.51	26.69	-.48	26.78	-.53	26.25	.49	26.05	.89	26.39	.23
Sex			**37.20*****		**3.18**†		1.12		7.31		21.50
Male	30.6	59.57		41.04		38.33		48.51		47.16	
Female	69.4	40.43		58.96		61.67		51.49		52.84	
Birth Order	1.92	1.88	.47	1.96	-.35	2.04	-.91	1.84	.58	1.82	.77
Religion			**18.78*****		.24		1.15		.01		.72
No	15.67	34.86		17.91		11.19		16.04		13.47	
Yes	84.33	65.14		82.09		88.81		83.96		86.53	
Race			**293.10*****		**15.66*****		1.53		.74		1.33
White	7.46	82.82		25.37		11.94		10.82		9.84	
Black	92.54	17.18		74.63		88.06		89.18		90.16	

Note: a. 27 samples in Head start (1 year +) group were excluded because they are out of common support area.

b. $\chi 2$ or t tests were conducted between Head Start (1year+) group and the selected control group.
c. Model 1 (1-to-1 matching without replacement); Model 2 (1-to-1 matching with replacement); Model 3 (k-nearest matching with caliper, k=2); Model 4 (radius matching with caliper)

$\dagger p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Despite the matching reduces biases in a great deal, two groups are still considerably different from each other in mother's marital status at birth, welfare dependency, sex and race in model 1. In other matching models, no significant difference is found at all, which means the treatment and control groups are well balanced, and the pre-existing differences are effectively controlled.

Effects of Head Start participation

Educational attainment. The effects of Head Start participation on educational attainment is evaluated by ordered logistic regressions (table 5-11). Compared to other preschoolers, children who attended Head Start at least one year are more likely to have higher levels of education, when other community, family, and child factors are controlled. This result is constantly found in all matching models. Effect sizes are larger in model 2, 3, and 4 than in model 1, which indicates the benefit of Head Start becomes more obvious where pre-existing differences are better-adjusted. According to the results, the coefficient of Head Start enrollment for each model was .902, 1.238, .986, and 1.228 (from 1 to 4), which is equivalent to a proportional odds ratio of 2.46 ($e^{.902}$), 3.45 ($e^{1.238}$), 2.68 ($e^{.986}$), 3.41 ($e^{1.228}$), respectively. It points out that Head Starters are about two to three times more likely to have higher education than other preschoolers. This finding should be highlighted because few studies have reported that Head Starters do better than other preschoolers, and some studies even suggest that other preschoolers outperform Head Starters when traditional multivariate analyses are used instead of the PSM approach (Bulgakov, 2003; Caputo, 2003b).

Table 5-11.
Ordered Logistic Regression of Educational Attainment (long-term Head Start vs. Other Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Other Preschool)												
Long-term Head Start	.902	.313	**.004**	1.238	.329	**.000**	.986	.393	**.012**	1.228	.368	**.001**
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	.108	.394	.784	-.326	.435	.454	-.459	.515	.372	-.276	.458	.547
500,000 or larger	-.015	.446	.974	-.740	.540	.171	-1.151	.716	.108	-.691	.621	.266
Region (ref.=non-Southern States)												
Southern States	.396	.373	.289	-.026	.441	.952	.388	.473	.412	.911	.422	**.031**
Unemployment rates	-.217	.306	.479	-.704	.357	**.048**	-.176	.411	.668	-.072	.389	.852
Poverty rates	.045	.043	.295	.111	.048	**.022**	.096	.053	.073	.055	.051	.279
Per pupil education expenditure	.000	.000	**.034**	.000	.000	**.011**	.000	.000	**.013**	.000	.000	**.019**
Family factors												
Marital status (ref.=married)												
Never married	.142	.345	.679	.518	.382	.175	.285	.397	.473	.025	.399	.950
Other	-.894	.515	.083	-1.452	.637	**.023**	-1.280	.807	.113	-1.535	.690	**.026**
Parents education (ref.=under HS graduate)												
High school graduate	.548	.421	.192	1.247	.439	**.005**	1.107	.526	**.035**	.968	.483	**.045**
College	1.154	.456	**.011**	1.955	.474	**.000**	1.635	.584	**.005**	1.502	.532	**.005**
Income to poverty ratio	.006	.002	**.001**	.004	.002	**.044**	.006	.004	.089	.006	.003	**.036**
Welfare dependency	.517	.673	.443	.019	.720	.979	.964	.825	.243	.937	.755	.214
Mother's age at birth	.111	.040	**.005**	.161	.043	**.000**	.182	.046	**.000**	.179	.041	**.000**

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Child Factors												
Gender (ref.=Male)												
Female	.642	.291	**.027**	.785	.324	**.015**	.770	.386	**.046**	.788	.343	**.021**
Birth order	-.351	.172	**.042**	-.458	.186	**.014**	-.481	.218	**.028**	-.510	.196	**.009**
Religion (ref.=No)												
Yes	.700	.349	**.045**	.359	.439	.413	.679	.433	.117	.764	.442	.084
Race (ref.=Caucasian)												
African-American	-.210	.474	.658	.066	.641	.918	.447	.806	.580	.580	.628	.355
Age	.131	.038	**.001**	.217	.042	**.000**	.215	.048	**.000**	.192	.042	**.000**
Teenage Pregnancy (ref.=No)												
Yes	-1.413	.299	**.000**	-1.696	.335	**.000**	-1.459	.367	**.000**	-1.196	.338	**.000**
Private school enrollment (ref.=No)												
Yes	.677	.466	.146	.401	.459	.383	.981	.661	.138	1.383	.573	**.016**
Constant (cut1)	7.320	2.352		10.207	2.714		13.467	3.278		13.129	2.964	
Constant (cut2)	10.107	2.401		13.473	2.782		16.566	3.347		16.087	2.972	
Number of Observation	268			268			218			745		
LR chi-square (21)	119.480			184.870			89.090			125.690		
Pr > chi-square	**.000**			**.000**			**.000**			**.000**		
Pseudo R-square	.227			.333			.326			.319		
Log Likelihood	-204.052			-185.181			-153.125			-535.948		

Besides the Head Start enrollment, several factors are significantly associated with educational attainment. Among community factors, per pupil education expenditure is an important factor. Regardless of matching models, children raised in a state with higher education expenditure are more likely to achieve higher educational attainment. Unemployment rates in residential county are negatively associated with the outcome in model 2, and children raised in Southern states perform better than others in model 4.

Children tend to enjoy higher educational attainment, irrespective of matching models, as parents' level of education gets higher and mother's age at birth becomes older. Mother's marital status at birth is significant in model 2 and 4. In both models, married women's children surpass their peers whose mothers were separated, widowed, etc. Family income level is positively related to children's educational attainment except in model 4, and welfare dependency is not important at all.

Regarding child related factors, results are similar to the previous analysis which compares long-term Head Starters and no preschoolers. Factors such as female, earlier birth order, older age, and no teenage pregnancy are associated with higher educational attainment. The effects of private school enrollment are weaker in this analysis. Only model 4 generates significant results. Although religion affiliation is found to be significant in model 1, where pre-existing differences are not successfully controlled, no significant results are found in other models.

Economic Status. Same as the comparison between long-term Head Start and no preschool children, adulthood economic status is measured by 1) personal earned income, 2) family income to need ratio, and 3) welfare dependency.

After controlling for other background variables, negative effects of Head Start on personal earned income are detected by Tobit analysis (table 5-12). No matter which method is applied, Head Starters' annual income is generally lower than other preschoolers' by at least $4,618 and up to $5,499, depending on matching models. That is, direct program effects on personal income are disappointing. However, indirect effects are promising. Higher educational attainment, influenced partly by Head Start program, is associated with higher income. Compared to individuals who failed to finish high school, people who received at least some higher education earned at least $6,373 more yearly. However, the differences between persons with less than high school and high school graduates are not statistically meaningful.

Community factors during childhood generate no sizeable influence on personal income when family and child factors are also included in the model. Among family factors, variables reflecting childhood economic status are related to adulthood earnings. As the family income to poverty ratio during childhood increases by 1 percent, the adulthood annual income increases about $17 to $22. In addition, children whose families received welfare[45] all years from age 6 through 17 make about $7,751 to $9,656 less income annually, compared to their peers whose families never received welfare during the same period. Although its influence was not significant in model 1 and 2, the balance of welfare dependency between the treated and matched controls is not satisfactory in model 1 and the p-value in model 2 is .50 which is the border of rejecting the null hypothesis. In model 2 and 4, the mother's age at birth is significantly associated with the outcome. Among child factors, race and age are influential. Except for model 1, African-

[45] Welfare means ADC, AFDC, or TANF benefits.

American's earned income is greater than Caucasian's by at least $5,360 if other conditions are equal.

The same result patterns are found in the OLS regression of family income to poverty ratio, as shown in table 5-13. There are unfavorable direct effects of Head Start enrollment on family income, but indirect effects via education are favorable in all models. Some differences are found in other factors. Childhood family income and race become a non-significant factor when the dependent variable is switched from personal income to family income. Instead, the mother's marital status at birth becomes a significant factor. Children born to married women have higher family income to poverty ratios compared to their peers born to separated, widowed, or divorced women.

Although Head Start enrollment produces noticeable direct and indirect effects on personal and family income, its influence on welfare dependency is negligible. No model verifies remarkable effects (either direct or indirect) caused by Head Start participation (table 5-14). Poverty rates of residential state, gender, and private school enrollment are closely related to children's welfare dependency when they are grown up. Teenage pregnancy is found to be influential on the outcome in model 1 and 2 only.

Table 5-12.

Tobit Regression of Personal Earned Income (long-term Head Start vs. Other Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment												
(ref.=Other Preschool)												
Long-term Head Start	-4618	1866	**.014**	-5499	1476	**.000**	-5371	1853	**.004**	-4884	1687	**.004**
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-2817	2501	.261	-1613	2050	.432	-3817	2503	.129	-1059	2065	.608
500,000 or larger	313	2707	.908	2422	2497	.333	816	3231	.801	1383	2647	.601
Region (ref.=non-Southern States)												
Southern States	2263	2439	.354	3481	2171	.110	1420	2641	.591	3062	2261	.176
Unemployment rates	-781	1933	.686	-1122	1702	.511	-927	1876	.622	-2042	1736	.240
Poverty rates	66	279	.813	-215	229	.348	-121	297	.686	129	282	.648
Per pupil education expenditure	0	1	.606	0	1	.901	0	1	.834	1	1	.367
Family factors												
Marital status (ref.=married)												
Never married	108	2228	.961	-834	1812	.646	-496	2515	.844	-1208	2263	.593
Other	-4236	3238	.192	-5306	2888	.067	-5229	2736	.057	-4356	2534	.086
Parents education (ref.=under HS graduate)												
High school graduate	3227	2789	.248	-335	2142	.876	-1942	2425	.424	-1502	2381	.528
College	1983	3014	.511	18	2324	.994	-2858	2703	.292	-1365	2725	.617
Income to poverty ratio	17	8	**.032**	22	6	**.001**	22	6	**.000**	20	6	**.002**
Welfare dependency	-6540	4299	.130	-6789	3442	.050	-9656	3913	**.014**	-7751	3306	**.019**
Mother's age at birth	319	237	.180	487	193	**.012**	442	250	.078	563	224	**.012**
Child Factors												
Gender (ref.=Male)												
Female	-1362	1840	.460	-2591	1493	.084	-1322	1831	.471	-275	1737	.874
Birth order	266	1087	.807	-1255	886	.158	-868	1219	.477	-408	1175	.728

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	2478	2414	.306	3600	2149	.095	1712	2863	.550	1098	2503	.661
Race (ref.=Caucasian)												
African-American	1705	2945	.563	6674	3031	**.029**	8693	3315	**.009**	5360	2386	**.025**
Age	959	238	**.000**	746	193	**.000**	816	248	**.001**	794	230	**.001**
Teenage Pregnancy (ref.=No)												
Yes	-1971	1995	.324	-1436	1657	.387	-1673	2071	.420	-1355	1885	.473
Private school enrollment (ref.=No)												
Yes	1499	2685	.577	-199	2160	.927	-792	3589	.826	-223	2906	.939
Education (ref.=Less than HS)												
High school	4596	2904	.115	3738	2387	.119	1784	2564	.487	201	2399	.933
College	10619	3195	**.001**	8159	2709	**.003**	7328	3188	**.023**	6373	2863	**.026**
Constant	-26381	14518	.070	-14569	12565	.247	-16037	17030	.348	-22432	14733	.128
Number of Observation	268			268			218			745		
Standard Error of Estimate (Sigma)	13521			10641			11682			12058		
LR chi-square(23)	111.980			135.800			6.660			8.410		
Pr > chi-square	**.000**			**.000**			**.000**			**.000**		
Pseudo R-square	.020			.025			.020			.019		
Log Likelihood	-2731.624			-2701.358			-2689.956			-2707.435		

Note: For coefficients and standard errors, the number of decimal places is set to zero due to limited space.

Table 5-13.

Regression of Family Income to Poverty Ratio (long-term Head Start vs. Other preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Other Preschool)												
Long-term Head Start	-.291	.098	**.003**	-.391	.088	**.000**	-.380	.100	**.000**	-.364	.092	**.000**
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.054	.131	.683	-.082	.122	.503	-.088	.133	.511	-.029	.116	.801
500,000 or larger	-.025	.143	.863	.214	.148	.150	.175	.153	.254	.082	.137	.549
Region (ref.=non-Southern States)												
Southern States	.086	.128	.505	.049	.129	.704	.030	.145	.836	.066	.124	.595
Unemployment rates	.071	.101	.485	.084	.100	.404	.059	.101	.555	.058	.097	.550
Poverty rates	.006	.015	.680	-.015	.014	.258	-.014	.019	.474	.002	.017	.891
Per pupil education expenditure	.000	.000	.609	.000	.000	.059	.000	.000	.487	.000	.000	.978
Family factors												
Marital status (ref.=married)												
Never married	-.085	.117	.467	-.069	.108	.524	-.030	.128	.814	-.057	.121	.635
Other	-.421	.170	**.014**	-.366	.172	**.034**	-.344	.154	**.027**	-.352	.145	**.015**
Parents education (ref.=under HS graduate)												
High school graduate	.169	.146	.248	-.160	.127	.207	-.225	.157	.154	-.145	.154	.346
College	.125	.157	.429	-.077	.137	.576	-.102	.173	.558	-.052	.172	.762
Income to poverty ratio	.000	.000	.436	.000	.000	.305	.000	.000	.454	.000	.000	.333
Welfare dependency	-.722	.225	**.002**	-.759	.205	**.000**	-.957	.215	**.000**	-.815	.188	**.000**
Mother's age at birth	.011	.013	.393	.032	.012	**.005**	.030	.013	**.024**	.028	.012	**.023**
Child Factors												
Gender (ref.=Male)												
Female	-.016	.097	.870	-.110	.089	.220	-.126	.104	.225	-.088	.095	.354

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Birth order	-.036	.057	.526	-.199	.052	**.000**	-.161	.063	**.011**	-.123	.061	**.044**
Religion (ref.=No)												
Yes	.040	.126	.753	.049	.126	.698	-.056	.148	.705	-.081	.126	.521
Race (ref.=Caucasian)												
African-American	-.198	.155	.203	.099	.180	.584	.066	.174	.707	.006	.132	.964
Age	.062	.012	**.000**	.043	.011	**.000**	.052	.015	**.001**	.051	.014	**.000**
Teenage Pregnancy (ref.=No)												
Yes	-.077	.105	.461	-.023	.098	.813	-.016	.130	.902	-.025	.123	.839
Private school enrollment (ref.=No)												
Yes	-.045	.141	.748	.051	.128	.689	-.061	.180	.735	-.101	.152	.505
Education (ref.=Less than HS)												
High school	.286	.151	.060	.069	.141	.623	.079	.159	.620	-.002	.148	.989
College	.703	.166	**.000**	.539	.160	**.001**	.574	.189	**.003**	.507	.175	**.004**
Constant	2.663	.764	**.001**	4.074	.747	**.000**	3.892	1.026	**.000**	3.364	.928	**.000**
Number of Observation	268			268			218			745		
F value	7.840			7.970			7.910			9.110		
Pr > F	**.000**			**.000**			**.000**			**.000**		
R-square	.425			.429			.417			.391		
Adjusted R-square	.371			.375								

Table 5-14.

Logistic Regression of Welfare Dependency (long-term Head Start vs. Other preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Other Preschool)												
Long-term Head Start	1.185	.811	.804	1.578	1.157	.534	1.713	1.100	.402	.968	.629	.960
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	4.820	4.981	.128	16.832	21.466	**.027**	5.761	6.152	.101	4.646	3.899	.067
500,000 or larger	4.469	4.865	.169	14.506	19.608	.048	3.635	4.324	.278	4.339	4.296	.138
Region (ref.=non-Southern States)												
Southern States	2.211	1.661	.291	1.266	1.081	.782	.943	.855	.948	1.029	.840	.972
Unemployment rates	.627	.485	.546	.331	.320	.252	.493	.404	.388	.418	.328	.267
Poverty rates	.643	.099	**.004**	.599	.113	**.007**	.687	.097	**.008**	.598	.102	**.002**
Per pupil education expenditure	1.000	.000	.357	1.000	.000	.612	1.000	.000	.521	.999	.000	.170
Family factors												
Marital status (ref.=married)												
Never married	.530	.475	.479	.096	.101	**.027**	.278	.336	.289	.459	.448	.425
Other	.809	1.062	.871	7.055	11.022	.211	.511	1.330	.797	.618	1.480	.841
Parents education (ref.=under HS graduate)												
High school graduate	.995	.813	.995	.942	.786	.943	1.223	.901	.785	1.188	.916	.823
College	.301	.345	.295	.103	.132	.075	.288	.306	.241	.328	.327	.264
Income to poverty ratio	.995	.004	.272	.997	.005	.595	.999	.004	.704	.999	.003	.653
Welfare dependency	4.766	5.841	.203	3.395	4.577	.364	5.302	7.450	.235	1.609	1.657	.644
Mother's age at birth	.952	.090	.600	.856	.089	.136	.930	.094	.476	.906	.092	.332

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Child Factors												
Gender (ref.=Male)												
Female	13.221	14.891	**.022**	44.051	62.403	**.008**	34.958	36.639	**.001**	30.370	29.432	**.000**
Birth order	1.128	.458	.767	1.166	.429	.676	1.153	.498	.742	1.331	.564	.500
Religion (ref.=No)												
Yes	.426	.296	.219	.445	.355	.310	.312	.224	.104	.293	.182	**.048**
Race (ref.=Caucasian)												
African-American	.586	.770	.684	.164	.257	.248	.354	.411	.372	.424	.431	.399
Age	.891	.075	.166	.920	.087	.374	.925	.079	.361	.932	.070	.353
Teenage Pregnancy (ref.=No)												
Yes	5.706	3.945	**.012**	6.894	5.125	**.009**	3.362	2.214	.066	3.158	2.028	.073
Private school enrollment (ref.=No)												
Yes	16.457	14.499	**.001**	20.015	20.462	**.003**	14.747	12.512	**.002**	7.932	6.193	**.008**
Education (ref.=Less than HS)												
High school	.373	.290	.205	.281	.246	.147	.244	.216	.112	.469	.350	.310
College	.588	.527	.554	.217	.240	.167	.247	.286	.226	.362	.352	.296
Number of Observation	268			268			218			745		
LR chi-square(23)	72.020			100.210			64.090			62.560		
Pr > chi-square	**.000**			**.000**			**.000**			**.000**		
Pseudo R-square	.433			.533			.463			.439		
Log Likelihood	-47.088			-43.842			-39.194			-151.927		

Short-term Head Start vs. No Preschool

Logistic regression on preschool experience. For the comparison between short-term Head Start participation and no preschool enrollment, the logistic regression of those preschool experiences is performed first (table 5-15). Similar to the logistic analysis of long-term Head Start and no preschool experience, just a few variables are found to be significant. Short-term Head Start experience is related to higher poverty rate, later birth order, and being an African-American. Family related factors are not significantly associated with the decision of Head Start enrollment. Living in southern states and older age are not significant this time, while they play an important role in choosing preschool programs between Head Start at least one year and no preschool.

Figure 5-3 shows the density of the propensity scores computed by the above logistic regression. The upper bars present the density for the treated (Head Start for less than 1 year) and the lower bars reflect the density for the control (no preschool).

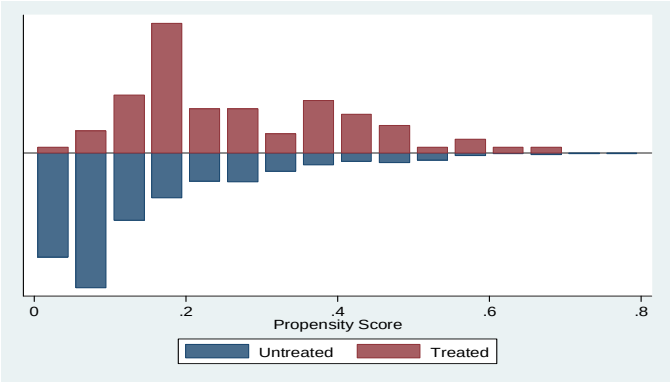

Figure 5-3. Density of Propensity Score (Short-term Head Start vs. No Preschool)

While the control group tends to have lower propensity scores, compared to the treatment group, both groups' scores are widely spread out and no case is found at the outside of common support area. As a result, no Head Start sample is dropped out from matching

and entire samples are used for later analyses. The average of propensity scores is .17 with the standard deviation of .14.

Table 5-15.

Logistic Regression of Short-term Head Start Enrollment (vs. No preschool)

	Coef.	Std. Err.	z	P>z
Community Factors				
Size of City				
(ref. = Under 100,000)				
100,000-499,999	-.228	.141	-1.620	.106
500,000+	-.030	.151	-.200	.842
Region (ref.=non-South)				
South	-.257	.158	-1.620	.105
Unemployment Rate	-.113	.083	-1.360	.173
Poverty Rate	.060	.016	3.660	.000
Family Factors				
Mother's Marital Status at Birth				
(ref. = Married)				
Never married	.106	.155	.680	.496
Other	.365	.192	1.900	.057
Parents' Education (ref.= less than HS)				
High School	.023	.133	.180	.860
College +	-.172	.175	-.980	.326
Income to Poverty Ratio	.000	.001	-.430	.665
Welfare Dependency	.201	.211	.950	.341
Mother's Age at Birth	-.013	.014	-.940	.349
Child Factors				
Age	-.005	.013	-.350	.726
Sex (ref. = Male)				
Female	-.137	.106	-1.300	.193
Birth Order	.224	.065	3.430	.001
Religion (ref. = No religion)				
Yes	.015	.139	.110	.915
Race (ref. = Caucasian)				
African American	.671	.146	4.600	.000
Constant	-1.572	.644	-2.440	.015

Based on the propensity scores, four matched control groups are constructed as earlier analyses. Post-matching sample sizes are 171 for one-to-one matching without replacement (model 1), 108 for one-to-one matching with replacement (model 2), 183 for two nearest matching with caliper (model 3), and 821 for radius matching (model 4). Weights are generated and used except the model 1 where the treatment and the control samples are uniquely matched. For the last two models, a quarter of standard deviation of the propensity scores (.035) was used for the caliper.

Background characteristics of the matched sample. After control groups are matched to the treatment group, differences in their background characteristics are examined. As presented in table 5-16, all the significant differences between two groups are disappeared after the PSM is applied. Before the matching, Head Start children tend to have undesirable characteristics than no preschool children, but both groups' characteristics become virtually same in all models after the matching. In other words, pre-existing differences between two groups are sufficiently controlled.

Table 5-16. Background Characteristics (Short-term Head Start vs. No Preschool)

	Short-term Head Start (*N*= 171)	**No Preschool (*N*= 822)**		**Model 1 (*N*= 171)**		**Model 2 (*N*= 108)**		**Model 3 (*N*= 183)**		**Model 4 (*N*= 821)**	
	% or mean	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t
Community Factors											
Size of City			2.60		.34		.08		2.17		1.3
Under 100,000	57.31	58.15		56.73		57.89		64.91		60.01	
100,000-499,999	18.71	22.63		16.96		17.54		15.79		16.08	
500,000+	23.98	19.22		26.32		24.56		19.3		23.91	
Region			**16.08*** **		.19		.60		.62		.34
Non-Southern states	41.52	58.27		39.18		37.43		37.43		39.70	
Southern states	58.48	41.73		60.82		62.57		62.57		60.30	
Unemployment Rate	3.56	3.53	.49	3.55	.16	3.63	-1.09	3.49	1.00	3.52	.48
Poverty Rate	16.60	14.32	**6.36*** **	16.3	.62	16.72	-.24	16.60	.00	16.38	.45
Family Factors											
Mother's Marital Status at Birth			**36.17*** **		.21		.34		2.19		.55
Married	54.39	76.40		56.73		56.73		61.11		54.17	
Never married	32.16	18.13		30.99		29.24		29.53		33.75	
Other	13.45	5.47		12.28		14.04		9.36		12.09	
Parents' Education			**20.17*** **		.66		428		1.61		2.91
Less than high school	31.58	19.22		29.82		22.22		33.63		28.75	
High school	52.05	50.36		56.14		61.99		54.68		57.33	
College or higher	16.37	30.41		14.04		15.79		11.70		13.92	
Income to Poverty Ratio	155.54	203.85	**-6.34*** **	148.09	.80	150.24	.59	145.52	1.11	154.09	.15
Welfare Dependency	.24	.11	**5.56*** **	.24	-.10	.23	.38	.21	.71	.22	.66
Mother's Age at Birth	24.35	24.36	-.01	24.78	-.69	24.91	-.93	24.06	.50	24.27	.13

	Short-term Head Start (*N*= 171)	**No Preschool (*N*= 822)**		**Model 1 (*N*= 171)**		**Model 2 (*N*= 108)**		**Model 3 (*N*= 183)**		**Model 4 (*N*= 821)**	
	% or mean	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t
Child Factors											
Age	28.22	28.49	-.73	28.13	.18	28.09	.27	28.67	-.94	28.17	.09
Sex			.03		.29		.33		.11		.25
Male	47.95	47.2		45.03		44.44		49.71		46.37	
Female	52.05	52.8		54.97		55.56		50.29		53.63	
Birth Order	2.32	1.95	**4.35*** **	2.38	-.52	2.48	-1.39	2.34	-.17	2.28	.33
Religion			.033		.19		2.34		2.70		.06
No	17.54	18.13		15.79		11.7		11.4		16.96	
Yes	82.46	81.87		84.21		88.3		88.6		83.04	
Race			**73.41*** **		.65		1.01		.01		.10
White	35.09	69.71		30.99		40.35		35.67		34.11	
Black	64.91	30.29		69.01		59.65		64.33		65.89	

Note: a. $\chi 2$ or t tests were conducted between Head Start (less than 1year) group and the selected control group.

b. Model 1 (1-to-1 matching without replacement); Model 2 (1-to-1 matching with replacement); Model 3 (k-nearest matching with caliper, k=2); Model 4 (radius matching with caliper)

*$p < .05$, **$p < .01$, ***$p < .001$

Effects of Head Start participation. When background characteristics are controlled, Head Start participation for less than a year produces no significant gains in all outcomes considered in this study. As presented in table 5-17 through table 5-20, no meaningful difference is detected between Head Start and no preschool group in educational attainment (table 5-17), personal earned income (table 5-18), family income to poverty ratio (table 5-19) and welfare dependency (table 5-20). The results are consistent regardless of matching models. Although higher education, specifically college or higher, is associated with higher personal and family income and lower likelihood of receiving public assistance, it cannot be regarded as the indirect effects of Head Start because no significant relationship is found between Head Start participation and educational attainment. In a word, if children participated in Head Start programs for less than a year, they gain nothing, either directly or indirectly, from the program in terms of educational attainment and adulthood economic status.

Table 5-17.

Ordered Logistic Regression of Educational Attainment (Short-term Head Start vs. No Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Short-term Head Start	-.054	.229	.813	-.170	.248	.492	-.044	.255	.863	-.119	.199	.550
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.060	.323	.853	.281	.334	.399	.141	.384	.713	-.083	.309	.787
500,000 or larger	-.997	.343	**.004**	-1.003	.381	**.009**	-.695	.426	.103	-1.035	.315	**.001**
Region (ref.=non-Southern states)												
Southern states	-.986	.341	**.004**	-1.609	.368	**.000**	-1.004	.400	**.012**	-.586	.281	**.037**
Unemployment rates	-.482	.243	**.047**	-.704	.261	**.007**	-.420	.305	.168	-.403	.212	.057
Poverty rates	.021	.045	.640	.034	.048	.485	.018	.052	.733	.015	.040	.708
Per pupil education expenditure	.000	.000	.227	.000	.000	**.004**	.000	.000	.115	.000	.000	.409
Family factors												
Marital status (ref.=married)												
Never married	-.319	.309	.302	-.247	.342	.469	-.374	.396	.345	-.509	.284	.073
Other	-.357	.349	.306	-.257	.365	.482	-.397	.381	.298	-.372	.323	.249
Parents education (ref.=under HS graduate)												
High school graduate	.625	.308	**.042**	.222	.342	.517	.246	.401	.539	.302	.291	.299
College	.564	.361	.119	.251	.393	.522	.398	.467	.393	.478	.362	.187
Income to poverty ratio	.004	.002	**.006**	.006	.002	**.000**	.006	.002	**.003**	.005	.001	**.000**
Welfare dependency	-.680	.543	.210	-.079	.576	.891	.199	.688	.772	.199	.542	.714
Mother's age at birth	-.018	.030	.534	-.040	.032	.220	-.019	.039	.620	-.005	.029	.854

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Child Factors												
Gender (ref.=Male)												
Female	.763	.247	**.002**	.707	.267	**.008**	.727	.293	**.013**	.752	.207	**.000**
Birth order	-.064	.141	.653	-.087	.157	.579	-.109	.173	.530	-.167	.126	.188
Religion (ref.=No)												
Yes	.118	.321	.713	-.382	.358	.285	-.108	.402	.788	.367	.292	.209
Race (ref.=Caucasian)												
African-American	1.070	.313	**.001**	1.134	.340	**.001**	1.090	.359	**.002**	.878	.291	**.003**
Age	.052	.029	.075	.017	.032	.603	-.010	.034	.760	.023	.026	.381
Private school enrollment (ref.=No)												
Yes	.903	.528	.087	.620	.364	.089	.652	.345	.059	.712	.376	.058
Teenage Pregnancy (ref.=No)												
Yes	-.528	.257	**.040**	-.398	.281	.156	-.837	.331	**.011**	-.684	.228	**.003**
Constant (cut1)	-2.081	1.897		-6.418	1.997		-4.189	2.281		-1.990	1.717	
Constant (cut2)	.629	1.893		-3.340	1.971		-1.378	2.278		.718	1.716	
Number of Observation	342			342			354			992		
chi-square(21)	89.61			84.12			47.91			87.74		
Pr > chi-square	.0000			.000			.001			.000		
Pseudo R-square	.127			.125			.096			.118		
Log Likelihood	-307.71			-293.59			-320.87			-897.92		

Table 5-18.

Tobit Regression of Personal Earned Income (Short-term Head Start vs. No Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Short-term Head Start	-538	1661	.746	1489	1594	.351	1822	1752	.299	201	1597	.900
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-629	2273	.782	-2119	2111	.316	349	2300	.880	-1277	2122	.547
500,000 or larger	-817	2463	.740	-3074	2420	.205	-844	2355	.720	-1581	2053	.441
Region (ref.=non-Southern states)												
Southern states	-4097	2460	.097	-4668	2399	.053	-841	2627	.749	-1307	2140	.541
Unemployment rates	-716	1688	.672	-590	1615	.715	58	1748	.973	-851	1494	.569
Poverty rates	241	311	.439	184	298	.538	12	322	.971	-75	269	.779
Per pupil education expenditure	1	1	.370	1	1	.122	1	1	.280	0	1	.978
Parents Factors												
Marital status (ref.=married)												
Never married	-141	2201	.949	-772	2161	.721	948	2209	.668	-315	1963	.873
Other	-1104	2540	.664	-2796	2379	.241	-1430	3011	.635	-1283	2698	.634
Parents education (ref.=under HS graduate)												
High school graduate	757	2163	.727	-935	2153	.665	1488	2181	.496	-543	2213	.806
College	-601	2543	.813	-221	2454	.928	2151	2407	.372	-1400	2407	.561
Income to poverty ratio	42	11	.000	35	11	.002	49	11	.000	51	9	.000
Welfare dependency	-3477	3839	.366	-2612	3636	.473	1996	3783	.598	1837	3384	.587
Mother's age at birth	-317	209	.130	-54	202	.789	-232	229	.312	-140	232	.548
Child Factors												
Gender (ref.=Male)												
Female	-10244	1768	.000	-8378	1698	.000	-8173	1736	.000	-10105	1528	.000
Birth order	1162	1016	.253	59	1005	.953	1406	1110	.206	701	1095	.522

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	692	2290	.763	4009	2276	.079	28	2779	.992	531	2229	.812
Race (ref.=Caucasian)												
African-American	1153	2253	.609	2468	2177	.258	-1610	2679	.548	300	2329	.898
Age	1172	209	.000	1316	208	.000	1054	209	.000	1123	185	.000
Private school enrollment (ref.=No)												
Yes	4095	3569	.252	-4253	2388	.076	-1563	3947	.692	3997	2532	.115
Teenage Pregnancy (ref.=No)												
Yes	-377	1845	.838	-745	1801	.679	-19	1881	.992	-490	1612	.761
Education (ref.=Less than HS)												
High school	4651	2249	.039	4499	2192	.041	1480	2441	.545	4351	2380	.068
College	8992	2517	.000	9289	2448	.000	9068	2423	.000	9568	2351	.000
Constant	-18937	13155	.151	-32055	12461	.011	-24249	13196	.067	-13675	11190	.222
Number of Observation	342			342			354			992		
Standard Error of Estimate (Sigma)	14068.81			12925.65			13366.27			15465.38		
LR chi-square(23) / F value	143.64			139.19			9.48			13.78		
Pr > chi-square	.000			.000			.000			.000		
Pseudo R-square	.021			.020			.021			.020		
Log Likelihood	-3365.45			-3349.89			-3369.62			-3339.16		

Table 5-19.

Regression of Family Income to Poverty Ratio (Short-term Head Start vs. No Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Short-term Head Start	-.268	.142	.061	-.204	.146	.163	-.115	.150	.443	-.165	.131	.209
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.132	.195	.501	-.168	.194	.387	-.027	.226	.905	-.131	.197	.506
500,000 or larger	-.335	.211	.114	-.358	.222	.108	-.165	.237	.488	-.234	.199	.240
Region (ref.=non-Southern states)												
Southern states	-.277	.212	.193	-.418	.221	.059	-.219	.228	.337	-.142	.187	.448
Unemployment rates	-.009	.145	.951	-.049	.149	.744	.022	.126	.863	-.063	.116	.584
Poverty rates	.053	.027	**.048**	.066	.027	**.017**	.048	.030	.106	.040	.026	.123
Per pupil education expenditure	.000	.000	**.043**	.000	.000	**.018**	.000	.000	.100	.000	.000	.060
Family factors												
Marital status (ref.=married)												
Never married	.123	.188	.515	.144	.198	.467	.133	.234	.569	.094	.218	.666
Other	.098	.217	.651	.001	.217	.997	.043	.295	.885	.126	.220	.568
Parents education (ref.=under HS graduate)												
High school graduate	.137	.185	.460	.115	.196	.559	.259	.211	.220	.231	.207	.263
College	.087	.218	.690	.126	.224	.573	.238	.274	.385	.179	.244	.463
Income to poverty ratio	.002	.001	**.034**	.002	.001	.062	.002	.001	**.000**	.002	.000	**.000**
Welfare dependency	-.221	.328	.501	-.246	.332	.460	.026	.460	.955	.063	.408	.877
Mother's age at birth	-.008	.018	.643	-.002	.018	.921	-.012	.031	.698	-.005	.029	.872
Child Factors												
Gender (ref.=Male)												
Female	-.184	.152	.226	-.146	.156	.351	-.086	.175	.625	-.122	.146	.403
Birth order	-.036	.086	.678	-.072	.092	.436	.010	.097	.916	-.033	.089	.708

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	.326	.195	.096	.374	.207	.071	.311	.286	.278	.270	.238	.257
Race (ref.=Caucasian)												
African-American	-.290	.194	.136	-.252	.201	.210	-.378	.230	.102	-.393	.207	.058
Age	.060	.018	**.001**	.069	.019	**.000**	.055	.020	**.007**	.057	.018	**.001**
Private school enrollment (ref.=No)												
Yes	.026	.309	.934	-.476	.221	.032	-.297	.232	.201	-.055	.191	.774
Teenage Pregnancy (ref.=No)												
Yes	-.191	.158	.228	-.201	.164	.222	-.240	.222	.281	-.187	.182	.305
Education (ref.=Less than HS)												
High school	.273	.191	.153	.297	.198	.136	.203	.228	.375	.281	.231	.224
College	.693	.215	**.001**	.811	.224	**.000**	.839	.203	**.000**	.736	.200	**.000**
Constant	1.623	1.121	.149	1.088	1.140	.341	1.443	1.432	.314	2.012	1.182	.089
Number of Observation	342			342			354			992		
F value	4.22			4.28			6.85			10.84		
Pro. > F	.000			.000			.000			.000		
R-square	.234			.236			.231			.219		
Adjusted R-square	.178			.181			-			-		

Table 5-20.

Logistic Regression of Welfare Dependency (Short-term Head Start vs. No Preschool)

	Model 1			Model 2			Model 3			Model 4		
	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	.905	.638	.887	2.150	1.648	.318	1.096	.826	.903	.808	.399	.666
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	.102	.153	.128	-	-	-	.040	.077	.095	.231	.261	.194
500,000 or larger	19.637	19.615	**.003**	-	-	-	8.312	8.162	**.031**	13.861	11.673	**.002**
Region (ref.=non-South)												
South	.379	.444	.407	.085	.146	.151	.010	.016	.005	.984	.647	.981
Unemployment rates	1.015	.902	.986	1.789	1.820	.567	1.262	1.117	.793	1.015	.565	.978
Poverty rates	1.347	.207	.052	1.431	.262	.050	2.166	.660	**.011**	1.159	.137	.212
Per pupil education expenditure	1.000	.000	.365	1.000	.000	.397	1.000	.000	.963	1.000	.000	.396
Family factors												
Marital status (ref.=married)												
never married	3.447	3.417	.212	3.032	3.051	.270	10.701	12.203	**.038**	1.964	1.517	.382
other	9.141	10.177	**.047**	3.870	4.496	.244	6.078	7.005	.117	3.514	2.786	.113
Parents education (ref.=under HS graduate)												
High school graduate	3.166	2.788	.191	3.440	3.243	.190	2.742	2.414	.252	1.701	.940	.336
College	5.583	6.164	.119	9.516	12.066	.076	12.489	18.916	.096	2.392	1.672	.212
Income to poverty ratio	.987	.008	.120	.990	.009	.246	.995	.005	.281	.991	.004	**.034**
Welfare dependency	.296	.461	.435	6.459	10.751	.262	3.012	4.975	.504	1.107	1.213	.926
Mother's age at birth	1.142	.099	.124	1.033	.097	.729	1.217	.132	.070	1.113	.049	**.015**
Child Factors												
Gender (ref.=Male)												
Female	4.573	4.146	.094	9.925	11.879	.055	15.145	20.135	**.041**	5.076	4.044	**.041**
Birth order	.562	.217	.135	.915	.335	.809	.739	.210	.286	.685	.188	.169

	Model 1			Model 2			Model 3			Model 4		
	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z
Religion (ref.=No)												
Yes	.534	.474	.480	1.441	1.624	.746	.627	.542	.589	.893	.432	.816
Race (ref.=Caucasian)												
African-American	1.490	1.946	.760	-	-	-	3.758	5.962	.404	.905	.827	.913
Age	.823	.078	**.040**	.906	.088	.314	.733	.111	**.040**	.848	.055	**.011**
Private school enrollment (ref.=No)												
Yes	25.431	35.730	**.021**	10.541	13.117	.058	53.707	77.954	**.006**	4.232	4.540	.179
Teenage Pregnancy (ref.=No)												
Yes	3.007	2.266	.144	2.025	1.641	.384	.669	.404	.506	2.088	1.064	.149
Education (ref.=Less than HS)												
High school	1.021	.791	.979	2.020	1.877	.449	.868	.631	.846	.669	.338	.427
College	.060	.102	.098	.293	.444	.418	.010	.015	**.002**	.252	.149	**.020**
Number of Observation	342			342			354			992		
LR chi-square(23) / Wald chi-square(23)	73.41			49.40			26.95			66.44		
Pr > chi-square	.000			.000			.258			.000		
Pseudo R-square	.482			.423			.502			.385		
Log Likelihood	-39.48			-33.75			-32.56			-137.95		

Short-term Head Start vs. Other preschool

Logistic regression on preschool experience. To examine whether there are significant differences between short-term Head Start children and other preschool children, the control group was switched from no preschool children to other preschool children. First, a logistic regression was performed to obtain propensity scores (table 5-21).

The results are similar to the analysis of long-term Head Starters and other preschoolers. Children who lived in larger cities or states with lower poverty rates were more likely to attend other preschools than their counterparts. In addition, children whose parents had college educations or who were in higher income families are more likely to attend other preschools than Head Start. In regard to child related factors, older age, later birth order, and race (being an African-American) are significantly related to an increased likelihood of Head Start enrollment.

Figure 5-4 illustrates the density of the propensity scores for both groups. The upper part is for the treatment group (Head Start for less than 1 year) and the lower part is for the control group (other preschool). The distribution of the Head Start group spreads out with a higher density around .5. Although the distribution of other preschool group is peaked at the bottom score, there is sufficient overlap between two groups, which is required to conduct the PSM analysis. Head Starters in outside of common support area (14 cases) are excluded from the following analyses because their propensity score is too high to be matched to other preschoolers. Overall, the average propensity score is .22 and its standard deviation is .28.

Table 5-21.

Logistic Regression of Short-term Head Start Enrollment (vs. Other preschool)

	Coef.	Std. Err.	z	P>z
Community Factors				
Size of City				
(ref. = Under 100,000)				
100,000-499,999	-.972	.198	-4.900	**.000**
500,000+	-.728	.219	-3.320	**.001**
Region (ref.=non-Southern States)				
Southern States	-.214	.212	-1.010	.313
Unemployment Rate	.051	.119	.430	.668
Poverty Rate	.078	.024	3.300	**.001**
Family Factors				
Mother's Marital Status at Birth				
(ref. = Married)				
Never married	.082	.208	.390	.694
Other	-.122	.242	-.500	.614
Parents' Education (ref.= less than HS)				
High School	-.257	.213	-1.210	.227
College +	-.975	.235	-4.140	**.000**
Income to Poverty Ratio	-.004	.001	-4.130	**.000**
Welfare Dependency	.351	.309	1.140	.256
Mother's Age at Birth	-.005	.018	-.260	.794
Child Factors				
Age	.040	.017	2.330	**.020**
Sex (ref. = Male)				
Female	-.177	.141	-1.260	.208
Birth Order	.241	.085	2.830	**.005**
Religion (ref. = No religion)				
Yes	.050	.186	.270	.788
Race (ref. = Caucasian)				
African American	1.009	.189	5.330	**.000**
Constant	-2.033	.893	-2.280	**.023**

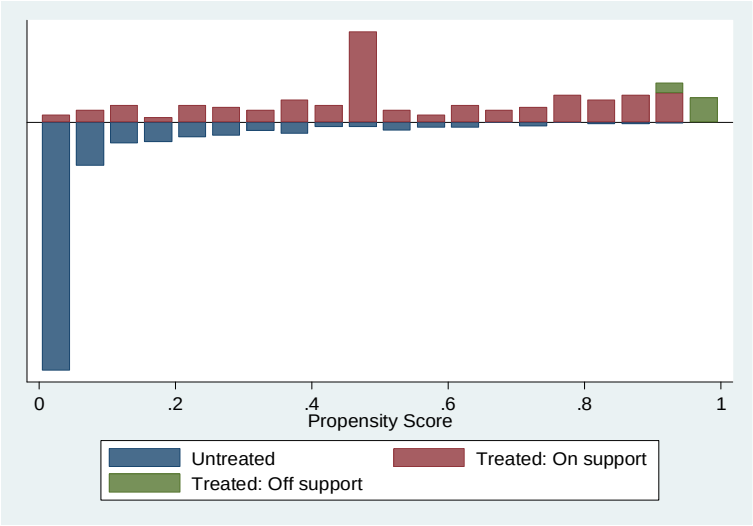

Figure 5-4. Density of Propensity Score (Short-term Head Start vs. Other Preschool)

By using four types of propensity score matching, four matched control groups were constructed. 151 samples were selected by one-to-one matching without replacement (model 1), 63 samples by one-to-one matching with replacement (model 2), 108 samples by two nearest matching with caliper (model 3), and 611 samples by radius matching (model 4). Because control group samples can be matched more than once in models 2, 3, and 4, weights were generated and used for the analyses in those models. For models 3 and 4, the caliper size of .07 was applied.

Background characteristics of the matched sample. Table 5-22 shows the background characteristics of other preschool groups before and after matching. Unlike the earlier analyses, the matching does not sufficiently reduce the bias for all variables. Although matching helps to construct control groups with similar background characteristics, short-term Head Starters and other preschoolers are still significantly different in some characteristics after the matching except model 4: model 1 (parental education, income to poverty ratio, and welfare dependency), model 2 (age, religion, and

race), and model 3 (welfare dependency). Only model 4 generated a balanced control group in all characteristics.

Table 5-22.

Background Characteristics (Short-term Head Start vs. Other preschool)

	Short-term Head Start (*N*= 157)	**Other Preschool (*N*= 611)**		**Model 1 (*N*= 157)**		**Model 2 (*N*= 63)**		**Model 3 (*N*= 108)**		**Model 4 (*N*= 611)**	
	% or mean	% or mean	χ^2 or t	% or mean	χ^2 or t	% or mean	χ^2 or t	% or mean	χ^2 or t	% or mean	χ^2 or t
Community Factors											
Size of City			**27.28*****		.18		3.33		2.00		3.96
Under 100,000	53.5	36.50		54.14		57.96		51.91		48.68	
100,000-499,999	20.38	42.88		21.66		12.74		15.29		18.66	
500,000+	26.11	20.62		24.20		29.30		32.8		32.65	
Region			**33.19*****		2.16		.47		.04		.30
Non-South	43.95	68.74		52.23		40.13		45.22		41.99	
South	56.05	31.26		47.77		59.87		54.78		58.01	
Unemployment Rate	3.56	3.66	**-1.82**†	3.57	-.23	3.435	**1.82**†	3.48	1.13	3.55	.08
Poverty Rate	16.28	13.88	**7.28*****	15.27	**1.96**†	16.02	.51	16.31	-.05	16.27	.03
Family Factors											
Mother's Marital Status at Birth			**55.46*****		1.71		.24		2.26		.35
Married	55.41	70.87		61.78		57.32		64.33		53.51	
Never married	31.21	8.67		28.66		28.66		25.8		33.13	
Other	13.38	20.46		9.55		14.01		9.87		13.36	
Parents' Education			**163.54*****		**9.37****		1.44		4.17		3.86
Less than High School	27.39	3.93		14.65		22.29		17.2		22.9	
HS	54.78	27.17		57.96		61.15		64.65		54.32	
College +	17.83	68.9		27.39		16.56		18.15		22.78	
Income to Poverty Ratio	161.53	258.98	**-13.38*****	189.86	**-3.03****	175.71	-1.56	172.99	-1.29	162.92	-.15
Welfare Dependency	.24	.07	**8.60*****	.15	**2.4***	.20	.87	.16	**2.19***	.23	.10

	Short-term Head Start (*N*= 157)	**Other Preschool (*N*= 611)**		**Model 1 (*N*= 157)**		**Model 2 (*N*= 63)**		**Model 3 (*N*= 108)**		**Model 4 (*N*= 611)**	
	% or mean	% or mean	χ^2 or t	% or mean	χ^2 or t	% or mean	χ^2 or t	% or mean	χ^2 or t	% or mean	χ^2 or t
Mother's Age at Birth	24.38	27.61	**-6.57*****	24.58	-.34	25.43	**-1.79**†	25.42	**-1.71**†	24.29	.15
Child Factors											
Age	27.99	26.69	**3.42****	27.19	1.53	26.64	**2.45***	27.28	1.36	27.53	.86
Sex			**6.37***		.01		.10		.01		.07
Male	48.41	59.57		47.77		50.79		49.04		49.4	
Female	51.59	40.43		52.23		49.21		50.96		50.6	
Birth Order	2.31	1.88	**5.47*****	2.13	1.40	2.32	-.15	2.37	-.53	2.3	.07
Religion			**15.55*****		.02		**4.38***		.07		.87
No	18.47	34.86		17.83		10.19		17.2		12.27	
Yes	81.53	65.14		82.17		89.81		82.8		87.73	
Race			**128.17*****		1.58		**5.86***		3.97		4.37
White	38.22	82.82		45.22		25.48		26.75		31.04	
Black	61.78	17.18		54.78		74.52		73.25		68.96	

Note: a. 14 samples in Head start (less than 1 year) group were excluded because they are out of common support area.

b. χ^2 or t tests were conducted between Head Start (1year+) group and the selected control group.

c. Matched sample 1 (1-to-1 matching without replacement); Matched sample 2 (1-to-1 matching with replacement); Matched sample 3 (k-nearest matching with caliper, k=2); Matched sample 4 (radius matching with caliper)

$\dagger p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Effects of Head Start participation. Similar to the comparison between short-term Head Start and no preschool, no direct or indirect effects were found between the former and other preschool children. As explained earlier, the PSM fails to adjust all the pre-existing differences between treatment and control groups except for model 4, but the results are consistent regardless of the matching models. In regard to the outcomes considered in this study, Head Start participation produced no gains as compared to other preschools. Analysis results for each outcome variable are presented in the following tables: educational attainment (table 5-23), personal earned income (table 5-24), family income to poverty ratio (table 5-25) and welfare dependency (table 5-26).

Table 5-23.
Ordered Logistic Regression of Educational Attainment (Short-term Head Start vs. Other Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	-.333	.261	.202	-.235	.287	.413	-.353	.315	.262	-.155	.271	.568
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.198	.369	.593	-.663	.390	.090	-.461	.488	.345	-.141	.409	.731
500,000 or larger	-.133	.397	.738	-1.426	.466	**.002**	-.806	.547	.141	-.306	.464	.509
Region (ref.=non-South)												
South	-.123	.357	.731	.274	.429	.523	-.163	.517	.753	-.077	.381	.840
Unemployment rates	-.565	.263	**.032**	-.937	.304	**.002**	-.957	.360	**.008**	-.800	.292	**.006**
Poverty rates	.064	.050	.206	.109	.064	.086	.085	.065	.192	.072	.048	.131
Per pupil education expenditure	.000	.000	.375	.000	.000	**.010**	.000	.000	.220	.000	.000	.188
Family factors												
Marital status (ref.=married)												
never married	-.563	.349	.107	-.816	.373	**.029**	-.777	.446	.082	-.544	.388	.161
other	-.636	.419	.129	-1.023	.401	**.011**	-1.230	.580	**.034**	-1.134	.543	**.037**
Parents education (ref.=under HS graduate)												
High school graduate	.326	.392	.406	-.290	.432	.502	-.184	.612	.764	.023	.487	.962
College	1.023	.415	**.014**	1.127	.455	**.013**	.989	.646	.125	.970	.520	.062
Income to poverty ratio	.006	.002	**.000**	.008	.002	**.000**	.006	.003	**.011**	.005	.002	**.010**
Welfare dependency	1.298	.644	**.044**	1.696	.661	**.010**	1.587	.866	.067	1.000	.789	.205
Mother's age at birth	.050	.032	.119	.040	.034	.241	.051	.044	.253	.022	.037	.548
Child Factors												
Gender (ref.=Male)												
Female	1.136	.257	**.000**	1.463	.287	**.000**	.957	.359	**.008**	1.147	.286	**.000**
Birth order	-.357	.154	**.021**	-.267	.171	.117	-.320	.215	.136	-.210	.187	.262

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	.724	.322	**.025**	1.300	.383	**.001**	.466	.487	.339	.447	.349	.201
Race (ref.=Caucasian)												
African-American	.162	.347	.641	.658	.388	.089	.742	.503	.140	.330	.434	.447
Age	.029	.033	.378	.010	.037	.795	.000	.042	.996	.044	.036	.219
Private school enrollment (ref.=No)												
Yes	.697	.405	.085	-.244	.423	.564	.829	.676	.220	.825	.617	.181
Teenage Pregnancy (ref.=No)												
Yes	-1.168	.298	**.000**	-.694	.334	**.038**	-1.065	.412	**.010**	-1.077	.358	**.003**
Constant (cut1)	1.100	2.041		3.040	2.620		-.600	2.801		.290	1.965	
Constant (cut2)	4.033	2.052		6.293	2.645		2.399	2.830		3.251	1.981	
Number of Observation	314			314			265			768		
LR chi-square(21) / Wald chi-square(21)	128.22			173.93			65.00			98.98		
Probability > chi-square	.000			.000			.000			.000		
Pseudo R-square	.200			.268			.237			.202		
Log Likelihood	-256.93			-237.58			-207.94			-636.01		

Table 5-24.

Tobit Regression of Personal Earned Income (Short-term Head Start vs. Other Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	-626	1938	.747	-405	1665	.808	-983	2158	.649	-680	2076	.743
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-47	2633	.986	3962	2233	.077	1444	2659	.588	365	2549	.886
500,000 or larger	1469	2880	.610	3598	2695	.183	3697	3492	.291	3248	4042	.422
Region (ref.=non-South)												
South	6312	2611	**.016**	3675	2478	.139	2448	3286	.457	5668	3066	.065
Unemployment rates	-733	1862	.694	-2555	1739	.143	-2344	1992	.240	-532	1893	.779
Poverty rates	-389	370	.293	66	363	.855	168	353	.634	-4	317	.989
Per pupil education expenditure	2	1	.075	2	1	.121	1	1	.237	2	1	.075
Family factors												
Marital status (ref.=married)												
never married	-665	2522	.792	-964	2112	.648	-2996	2581	.247	-1451	2774	.601
other	-5110	3049	.095	-7844	2410	**.001**	-7453	3777	.050	-5985	3192	.061
Parents education (ref.=under HS graduate)												
High school graduate	2713	2871	.345	-31	2507	.990	1077	3316	.746	3249	3338	.331
College	4486	3018	.138	4911	2614	.061	5630	3477	.107	5295	3441	.124
Income to poverty ratio	19	11	.103	25	11	**.027**	18	12	.146	24	10	**.014**
Welfare dependency	-3070	4518	.497	-2153	3729	.564	-443	4781	.926	-1779	5074	.726
Mother's age at birth	-436	232	.062	-362	202	.073	-200	257	.437	-315	258	.221
Child Factors												
Gender (ref.=Male)												
Female	-7994	1873	**.000**	-7020	1674	**.000**	-7656	2397	**.002**	-7383	2200	**.001**

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Birth order	2468	1118	**.028**	2254	999	**.025**	1279	1369	.351	2037	1329	.126
Religion (ref.=No)												
Yes	1031	2372	.664	2480	2230	.267	-2205	2901	.448	-2217	2581	.391
Race (ref.=Caucasian)												
African-American	-1652	2461	.502	-4442	2227	**.047**	-2575	2906	.377	-4145	3246	.202
Age	1050	235	**.000**	559	221	**.012**	938	264	**.000**	774	260	**.003**
Private school enrollment (ref.=No)												
Yes	5469	2694	**.043**	-2075	2445	.397	7019	4120	.090	2585	3814	.498
Teenage Pregnancy (ref.=No)												
Yes	370	2194	.866	-826	1972	.676	-1162	2500	.642	1595	2704	.555
Education (ref.=Less than HS)												
High school	436	2678	.871	3029	2228	.175	2752	3445	.425	-228	3253	.944
College	9800	3000	**.001**	7861	2563	**.002**	10375	3709	**.006**	11247	3816	**.003**
Constant	-14390	14839	.333	-2625	15543	.866	-10344	14521	.477	-12835	13796	.352
Number of Observation	314			314			265			768		
Standard Error of Estimate (Sigma)	14743.76			12022.11			12839.49			14673.35		
LR chi-square(23) or F value	121.75			129.65			8.16			8.05		
Probability > chi-square or F value	.000			.000			.000			.000		
Pseudo R-square	.019			.021			.027			.019		
Log Likelihood	-3151.14			-3091.49			-3146.29			-3143.40		

Table 5-25.

Regression of Family Income to Poverty Ratio (Short-term Head Start vs. Other Preschool)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=No Preschool)												
Long-term Head Start	-.219	.150	.146	-.194	.155	.214	-.261	.153	.089	-.236	.136	.083
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.145	.203	.476	-.147	.207	.479	-.245	.214	.254	-.183	.194	.345
500,000 or larger	-.222	.223	.319	-.019	.250	.938	-.088	.304	.773	-.153	.230	.506
Region (ref.=non-South)												
South	-.011	.202	.955	-.052	.231	.821	-.129	.275	.639	-.026	.255	.919
Unemployment rates	-.107	.144	.461	-.188	.162	.249	-.107	.135	.429	-.075	.116	.517
Poverty rates	.045	.029	.119	.067	.034	**.047**	.072	.035	**.044**	.052	.030	.076
Per pupil education expenditure	.000	.000	**.023**	.000	.000	.068	.000	.000	**.021**	.000	.000	**.009**
Family factors												
Marital status (ref.=married)												
never married	-.010	.195	.959	.024	.197	.902	-.095	.222	.668	-.021	.215	.923
other	-.113	.235	.629	-.185	.221	.405	-.211	.248	.394	-.142	.236	.548
Parents education (ref.=under HS graduate)												
High school graduate	.145	.219	.508	.135	.230	.558	.088	.393	.822	.065	.342	.850
College	.077	.231	.739	.019	.242	.936	.069	.354	.846	-.072	.309	.814
Income to poverty ratio	.001	.001	.231	.001	.001	.232	.001	.001	.363	.001	.001	**.038**
Welfare dependency	-.009	.348	.979	-.176	.346	.612	-.024	.433	.955	-.023	.401	.954
Mother's age at birth	-.028	.018	.119	-.018	.018	.327	-.007	.039	.858	-.023	.037	.530
Child Factors												
Gender (ref.=Male)												
Female	-.113	.145	.436	-.103	.155	.508	-.170	.180	.346	-.176	.183	.336
Birth order	.077	.085	.369	.066	.091	.471	.019	.111	.865	.096	.103	.351

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	.317	.183	.085	.481	.207	**.021**	.255	.325	.433	.248	.286	.387
Race (ref.=Caucasian)												
African-American	-.350	.190	.067	-.491	.208	**.019**	-.327	.229	.155	-.467	.203	**.022**
Age	.064	.018	**.001**	.050	.020	**.015**	.064	.026	**.014**	.049	.026	.064
Private school enrollment (ref.=No)												
Yes	.224	.210	.287	.155	.226	.494	.465	.196	**.019**	.293	.169	.084
Teenage Pregnancy (ref.=No)												
Yes	-.185	.169	.276	-.043	.183	.815	-.149	.295	.613	-.068	.236	.773
Education (ref.=Less than HS)												
High school	.235	.205	.253	.159	.205	.439	.289	.237	.223	.147	.217	.500
College	.719	.232	**.002**	.644	.237	**.007**	.796	.219	**.000**	.767	.201	**.000**
Constant	2.107	1.150	.068	2.017	1.444	.163	1.383	1.692	.415	2.476	1.542	.109
Number of Observation	314			314			265			768		
F value	4.54			3.36			4.93			7.28		
Probability > F	.000			.000			.000			.000		
R-square	.264			.210			.267			.250		
Adjusted R-square	.207			.148			-			-		

Table 5-26.

Logistic Regression of Welfare Dependency (Short-term Head Start vs. Other Preschool)

	Model 1			Model 2			Model 3			Model 4		
	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Other Preschool)												
Short-term Head Start	.862	.526	.808	.372	.299	.219	.538	.479	.486	1.456	1.180	.643
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	1.512	1.150	.587	1.158	1.379	.902	1.546	1.799	.708	.881	1.380	.935
500,000 or larger	2.913	2.219	.161	5.581	7.294	.188	3.985	3.256	.091	4.931	4.082	.054
Region (ref.=non-South states)												
Southern states	.504	.368	.348	.057	.076	.031	.080	.095	.034	.137	.125	.030
Unemployment rates	.655	.424	.514	.202	.208	.121	.246	.223	.123	.354	.275	.181
Poverty rates	1.020	.112	.858	1.257	.261	.270	1.275	.186	.096	1.205	.205	.273
Per pupil education expenditure	1.000	.000	.574	1.000	.001	.582	1.000	.000	.758	1.000	.000	.515
Family factors												
Marital status (ref.=married)												
Never married	2.752	1.958	.155	1.590	1.472	.616	2.204	1.797	.332	2.497	2.187	.296
Other	1.604	1.444	.599	3.788	4.429	.255	1.371	1.291	.737	1.378	1.070	.680
Parents education (ref.=under HS graduate)												
High school graduate	1.558	1.162	.553	1.124	1.058	.901	.835	.607	.804	.988	.703	.986
College	1.216	1.094	.828	.159	.224	.192	.183	.256	.225	.395	.362	.311
Income to poverty ratio	.998	.003	.558	.999	.007	.884	1.000	.004	.994	.999	.003	.771
Welfare dependency	4.347	4.973	.199	11.082	15.300	.081	6.127	9.403	.238	1.966	2.560	.603
Mother's age at birth	.982	.072	.803	.951	.096	.619	1.027	.096	.778	1.055	.073	.436
Child Factors												
Gender (ref.=Male)												
Female	22.598	24.810	.005	26.727	31.532	.005	21.930	31.146	.030	13.183	14.867	.022
Birth order	.805	.256	.495	.577	.247	.200	.619	.269	.270	.742	.247	.369

Religion (ref.=No)												
Yes	1.152	.873	.852	2.037	2.112	.492	2.289	1.990	.341	1.652	1.312	.527
Race (ref.=Caucasian)												
African-American												
Age	.950	.064	.440	.944	.103	.597	.984	.076	.832	.995	.064	.940
Private school enrollment (ref.=No)												
Yes	4.464	3.155	.034	9.776	10.819	.039	11.188	13.335	.043	8.999	9.340	.034
Teenage Pregnancy (ref.=No)												
Yes	1.858	1.061	.278	1.048	.808	.952	.851	.684	.841	.934	.722	.930
Education (ref.=Less than HS)												
High school	1.057	.760	.939	.766	.687	.766	1.026	.987	.979	.592	.441	.481
College	.260	.245	.152	.127	.168	.118	.098	.107	.033	.087	.093	.022
Constant												
Number of Observation	314			314			265			768		
LR chi-square(22) or Wald chi-square(22)	46.62			106.69			58.64			65.91		
Probability > chi-square	.002			.000			.000			.000		
Pseudo R-square	.353			.565			.475			.443		
Log Likelihood	-42.79			-41.05			-34.72			-93.80		

Long-term Head Start vs. Short-term Head Start

Logistic regression on preschool experience. In this section, it is examined whether the length of Head Start participation matters. To investigate whether longer participation brings more gains to its participants on educational attainment and economic status, the same PSM analysis was performed for the two groups.

According to the logistic regression (table 5-27), the mother's marital status at birth, parental education, and race are significantly associated with the decision of long-term or short-term participation. Children were more likely to attend the program at least one year if their mother's marital status at birth was married rather than other which includes separated, divorced, widowed, etc. If the parents graduated from high school, their children tended to stay in the program longer compared to children whose parents did not finish high school. In addition, African-American children were more likely to attend the program longer than Caucasian children. The remaining factors considered in the analysis are not related to the length of Head Start participation.

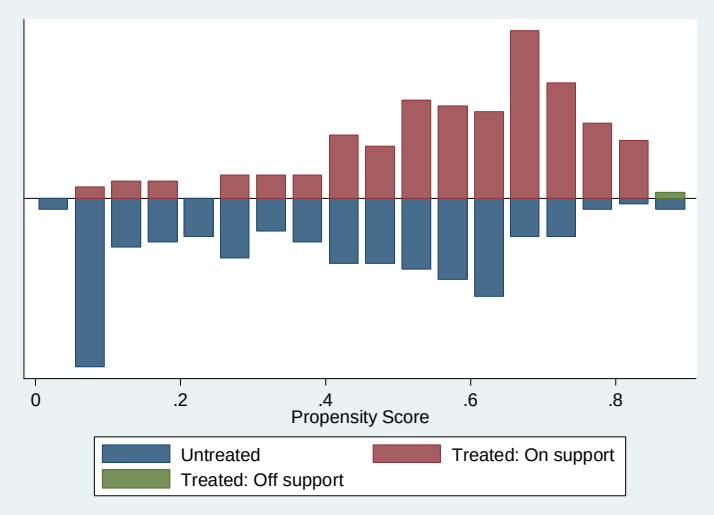

Figure 5-5. Density of Propensity Score (Long-term vs. Short-term Head Start)

Table 5-27.
Logistic Regression of Long-term Head Start Enrollment (vs. Short-term Head Start)

	Coef.	Std. Err.	z	P>z
Community Factors				
Size of City				
(ref. = Under 100,000)				
100,000-499,999	.323	.197	1.640	.102
500,000+	-.202	.236	-.860	.392
Region (ref.=non-Southern States)				
Southern States	.082	.237	.350	.729
Unemployment Rate	.122	.150	.810	.416
Poverty Rate	-.001	.021	-.030	.978
Family Factors				
Mother's Marital Status at Birth				
(ref. = Married)				
Never married	-.028	.193	-.140	.886
Other	-.594	.277	-2.140	**.032**
Parents' Education (ref.= less than HS)				
High School	.399	.191	2.090	**.036**
College +	.384	.243	1.580	.114
Income to Poverty Ratio	-.001	.001	-.710	.478
Welfare Dependency	.168	.280	.600	.548
Mother's Age at Birth	-.012	.019	-.620	.532
Child Factors				
Age	-.026	.019	-1.340	.181
Sex (ref. = Male)				
Female	.190	.165	1.150	.250
Birth Order	-.088	.095	-.920	.356
Religion (ref. = No religion)				
Yes	.022	.212	.110	.916
Race (ref. = Caucasian)				
African American	1.033	.262	3.940	**.000**
Constant	-.483	1.044	-.460	.643

The distribution of propensity scores retrieved from the logistic regression is similar in both groups while more short-term participants have lower scores. Due to the

higher propensity score, one sample from the long-term Head Start group was excluded from the subsequent analyses.

Background characteristics of the matched sample. Before propensity score matching, the two Head Start groups were considerably different in their characteristics (table 5-28). In general, long-term participants have more disadvantaged characteristics than short-term participants. The former were more likely to be a child of a never married woman and of a lower income family. In addition, they tended to be younger, a female, and African-American. One-to-one matching without replacement (model 1) was not effective to reduce the differences due to small sample size of the control group (short-term participants). Only 11 out of 176 control group samples were dropped and all other samples were matched to the treatment group (long term participants). As a result, all the significant differences remained the same even after the matching. Results of model 2 are better. Except for poverty rates, birth order and religion, all the significant differences were negligible. Model 3 and 4 resulted in even better outcomes. All the pre-existing differences were adjusted in these models.

Table 5-28.

Background Characteristics (Long-term Head Start vs. Short-term Head Start)

	Long-term Head Start (*N*= 160)	**Short-term Head Start (*N*= 171)**		**Model 1 (*N*= 160)**		**Model 2 (*N*= 69)**		**Model 3 (*N*= 98)**		**Model 4 (*N*= 171)**	
	% or mean	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	$\chi 2$ or t	% or mean	F or t	% or mean	F or t
Community Factors											
Size of City			11.08**		8.07*		1.64		.33		.07
Under 100,000	41.25	57.31		54.37		36.25		35.00		43.42	
100,000-499,999	33.13	18.71		20.00		31.87		36.56		32.76	
500,000+	25.62	23.98		25.62		31.87		28.44		23.82	
Region			.75		1.30		1.06		.06		.13
Non-Southern States	36.88	41.52		43.13		42.5		38.75		34.56	
Southern States	63.13	58.48		56.88		57.5		61.25		65.44	
Unemployment Rate	3.68	3.56	1.96	3.58	1.50	3.69	-.10	3.68	.02	3.70	-.35
Poverty Rate	17.15	16.6	.99	16.53	1.09	15.98	2.00*	16.06	1.85	16.65	.84
Family Factors											
Mother's Marital Status at Birth			16.95***		13.42**		1.66		.18		.05
Married	40.00	54.39		52.50		33.13		35.94		41.4	
Never married	53.75	32.16		34.38		59.38		57.50		51.92	
Other	6.25	13.45		13.13		7.50		6.56		6.68	
Parents' Education			3.18		2.60		2.62		.02		.01
Less than High School	25.00	31.58		31.87		23.13		25.94		25.69	
HS	51.88	52.05		50.63		60.00		52.19		51.05	
College +	23.13	16.37		17.50		16.88		21.88		23.27	
Income to Poverty Ratio	127.69	155.54	-3.14**	151.3	-2.65**	126.13	.18	125.33	.28	131.02	-.39
Welfare Dependency	.31	.24	1.62	.26	1.18	.23	1.94	.29	.37	.26	1.07
Mother's Age at Birth	22.84	24.35	-2.61*	24.34	-2.51*	22.3	.99	22.29	.97	22.82	.05

	Long-term Head Start (*N*= 160)	**Short-term Head Start (*N*= 171)**		**Model 1 (*N*= 160)**		**Model 2 (*N*= 69)**		**Model 3 (*N*= 98)**		**Model 4 (*N*= 171)**	
	% or mean	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	χ2 or t	% or mean	F or t	% or mean	F or t
Child Factors											
Age	26.48	28.22	-3.44**	27.92	-2.83**	26.6	-.25	26.94	-.93	26.42	.12
Sex			11.17**		7.08**		.00		.01		.32
Male	30.00	47.95		44.38		30.43		29.38		33.52	
Female	70.00	52.05		55.63		69.57		70.63		66.48	
Birth Order	1.95	2.32	-3.13**	2.27	-2.66**	1.71	2.14*	1.76	1.66	1.88	.64
Religion			.03		.02		7.64**		1.65		.27
No	16.88	17.54		17.50		6.88		10.94		.15	
Yes	83.13	82.46		82.50		93.13		89.06		.85	
Race			41.22***		31.61***		.05		.19		.12
White	6.25	35.09		30.63		6.88		7.5		7.07	
Black	93.75	64.91		69.38		93.13		92.5		92.93	

Note: a. 14 samples in Head start (less than 1 year) group were excluded because they are out of common support area.
b. χ2 or t tests were conducted between Head Start (1year+) group and the selected control group.
c. Matched sample 1 (1-to-1 matching without replacement); Matched sample 2 (1-to-1 matching with replacement); Matched sample 3 (k-nearest matching with caliper, k=2); Matched sample 4 (radius matching with caliper)
†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Effects of long-term participation in Head Start

Educational attainment. Ordered logistic regression shows that long-term participation in Head Start programs yielded beneficial effects on educational attainment (table 5-28). Compared to short-term participants, long-term participants were more likely to have higher levels of education, when other community, family, and child factors are constant. Although the balance of background characteristics between treatment and control groups is not satisfactory in model 1 and 2, program effects are also found in both models. The coefficient of long-term participation for each model is .661, .664, .732, and .660, from model 1 to 4, which is equivalent to a proportional odds ratio of 1.94 ($e^{.661}$), 1.94 ($e^{.664}$), 2.08 ($e^{.732}$), 1.93 ($e^{.660}$). That is, long-term participants were about two times more likely to have higher educational attainment than short-term participants.

Besides the Head Start enrollment, more variables were found to be important factors on educational attainment in model 3 and model 4, where pre-existing differences were successfully controlled. They include family income, mother's age at birth, race, age, and private school enrollment.

Table 5-29.

Ordered Logistic Regression of Educational Attainment (Long-term vs. Short-term Head Start)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Short-term Head Start)												
Long-term Head Start	.661	.250	**.008**	.664	.250	**.008**	.732	.308	**.017**	.660	.271	**.015**
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.310	.303	.306	-.355	.310	.252	-.405	.355	.253	-.266	.336	.428
500,000 or larger	-.766	.368	**.038**	-.453	.395	.251	-.726	.442	.100	-.947	.415	**.022**
Region (ref.=non-South states)												
Southern states	.043	.362	.905	.799	.350	**.022**	.579	.415	.163	.383	.382	.317
Unemployment rates	-.243	.261	.352	.281	.281	.318	.297	.362	.413	.277	.337	.412
Poverty rates	.069	.042	.100	.008	.043	.847	.011	.049	.821	.036	.046	.440
Per pupil education expenditure	.000	.000	**.044**	.000	.000	.759	.000	.000	.482	.000	.000	.195
Family factors												
Marital status (ref.=married)												
Never married	-.293	.296	.323	-.127	.301	.673	-.187	.352	.595	-.244	.324	.453
Other	-.629	.441	.154	-.315	.557	.572	.286	.832	.731	-.553	.599	.357
Parents education (ref.=under HS graduate)												
High school graduate	.218	.310	.483	.048	.341	.888	.016	.401	.969	-.068	.368	.854
College	.349	.355	.325	.733	.435	.092	.276	.453	.542	.040	.432	.926
Income to poverty ratio	.004	.002	**.024**	.008	.002	**.000**	.009	.004	**.017**	.009	.003	**.007**
Welfare dependency	-.394	.566	.486	-.191	.593	.747	.113	.815	.889	.179	.715	.803
Mother's age at birth	.078	.031	**.011**	.151	.040	**.000**	.165	.043	**.000**	.144	.035	**.000**
Child Factors												
Gender (ref.=Male)												
Female	.830	.261	**.001**	.092	.297	.756	.233	.339	.493	.577	.283	**.041**
Birth order	-.313	.149	**.036**	-.386	.172	**.025**	-.398	.211	.059	-.409	.183	**.026**

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	.452	.320	.157	.020	.387	.958	.513	.428	.231	.517	.339	.126
Race (ref.=Caucasian)												
African-American	.800	.395	**.043**	.903	.582	.121	1.699	.689	**.014**	1.693	.542	**.002**
Age	.099	.032	**.002**	.110	.035	**.002**	.112	.041	**.007**	.096	.037	**.009**
Private school enrollment (ref.=No)												
Yes	.663	.527	.208	.773	.603	.200	1.462	.696	**.036**	1.423	.591	**.016**
Teenage Pregnancy (ref.=No)												
Yes	-.516	.251	**.039**	-.354	.257	.169	-.476	.287	.097	-.639	.258	**.013**
Constant (cut1)	5.786	2.095		7.477	2.313		9.314	2.739		9.245	2.310	
Constant (cut2)	8.426	2.127		10.356	2.355		12.395	2.793		12.051	2.339	
Number of Observation	320			320			258			331		
LR chi-square(21) / Wald chi-square(21)	92.70			132.57			69.04			96.53		
Probability > chi-square	.000			.000			.000			.000		
Pseudo R-square	.142			.202			.208			.198		
Log Likelihood	-280.35			-262.07			-203.92			-269.89		

Economic Status. When other background variables were controlled, the length of Head Start involvement generated no direct influence on adulthood economic status as measured in personal earned income, family income to poverty ratio, and welfare dependency. Nevertheless, there are positive mediating effects through educational attainment. Individuals with college education tended to have a higher earned income, higher family income to poverty ratio, and lower welfare dependency.

Compared to individuals with less than high school education, people earned more income, about $6,837 (model 3) or $9,330 (model 4), if they attended at least some college. For the same group, the log-transformed family income to poverty ratio was greater in college attendants by about .71 (model 3) or .86 (model 4) points. High school graduates were less likely to be welfare recipients compared to people with lower educations. However, no difference was found between people with college or higher educations and less than high school educations when it comes to welfare dependency.

Community factors during childhood have no substantial influence on adulthood economic status when the influence of family and child factors was considered in the analyses. Higher family income during childhood was linked to higher earned income in later life. However, earned income depends mostly on child factors. Males, African-Americans, and persons with higher education earned more income than their counterparts. Regarding the family income to poverty ratio, the factors of parental education, age, and one's education were important. Welfare dependency among the two Head Start groups was affected by private school enrollment and education. Receiving welfare during childhood, gender, and race were also found to be significant factors, but they were only supported by either analysis in model 3 or model 4.

Table 5-30.

Tobit Regression of Personal Earned Income (Long-term vs. Short-term Head Start)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Short-term Head Start)												
Long-term Head Start	-1721	1586	.279	-1213	1503	.420	-988	1744	.572	-1238	1676	.461
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	670	1912	.726	504	1883	.789	900	2013	.655	1291	1796	.473
500,000 or larger	-27	2276	.990	-3673	2374	.123	-1592	2788	.568	-561	2079	.788
Region (ref.=non-South states)												
Southern states	1362	2363	.565	2004	2227	.369	2596	3060	.397	554	2246	.805
Unemployment rates	-1206	1584	.447	454	1642	.782	-623	2043	.761	-2300	1682	.173
Poverty rates	274	264	.300	375	259	.150	124	315	.694	284	280	.310
Per pupil education expenditure	1	1	.313	2	1	**.026**	1	1	.128	1	1	.163
Family factors												
Marital status (ref.=married)												
Never married	-259	1862	.889	-2408	1835	.191	-983	2176	.652	-1530	2121	.471
Other	-4135	2700	.127	-4763	3109	.127	-4918	3051	.108	-4128	2680	.125
Parents education (ref.=under HS graduate)												
High school graduate	1466	1994	.463	-3935	2122	.065	-1840	2499	.462	45	2024	.982
College	5134	2169	**.019**	2037	2549	.425	2769	2591	.286	4174	2119	.050
Income to poverty ratio	29	8	**.000**	37	8	**.000**	35	7	**.000**	34	7	**.000**
Welfare dependency	932	3390	.784	5539	3466	.111	1815	4575	.692	793	3701	.831
Mother's age at birth	-146	189	.442	233	219	.290	125	231	.589	37	208	.859
Child Factors												
Gender (ref.=Male)												
Female	-5433	1655	**.001**	-6117	1749	**.001**	-6021	1961	**.002**	-6003	2028	**.003**
Birth order	870	930	.350	213	1017	.835	470	1128	.677	468	964	.628

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	2204	2091	.293	3164	2374	.184	3408	2467	.168	1901	2307	.411
Race (ref.=Caucasian)												
African-American	2245	2526	.375	10199	3479	**.004**	6556	3950	.098	6621	2841	**.020**
Age	928	197	**.000**	626	209	**.003**	867	298	**.004**	957	249	**.000**
Private school enrollment (ref.=No)												
Yes	208	3166	.948	-1372	3197	.668	-572	2997	.849	-3345	2828	.238
Teenage Pregnancy (ref.=No)												
Yes	-546	1600	.733	2467	1584	.120	2233	1962	.256	532	1644	.746
Education (ref.=Less than HS)												
High school	5414	2243	**.016**	261	2207	.906	1938	2805	.490	4846	1947	**.013**
College	9861	2421	**.000**	5677	2470	**.022**	6837	3116	**.029**	9330	2507	**.000**
Constant	-25041	12996	.055	-40928	13508	**.003**	-35367	16053	**.029**	-30381	14180	**.033**
Number of Observation	320			320			258			331		
Standard Error of Estimate (Sigma)	12534.71			12375.18			12271.54			12001.48		
LR chi-square(23) or F value	134.52			123.43			8.07			7.90		
Probability > chi-square or F value	.000			.000			.000			.000		
Pseudo R-square	.022			.020			.020			.022		
Log Likelihood	-3062.05			-2986.99			-3055.84			-3067.06		

Table 5-31.

Regression of Family Income to Poverty Ratio (Long-term vs. Short-term Head Start)

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Short-term Head Start)												
Long-term Head Start	.084	.159	.600	-.172	.117	.142	-.179	.120	.135	-.024	.139	.863
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	-.003	.192	.986	-.145	.145	.320	-.110	.115	.340	.003	.130	.984
500,000 or larger	-.183	.229	.424	-.715	.183	**.000**	-.512	.211	**.016**	-.329	.186	.078
Region (ref.=non-South states)												
Southern states	-.082	.236	.727	.325	.170	.057	.219	.251	.383	.068	.184	.711
Unemployment rates	.079	.159	.617	.299	.126	**.018**	.201	.113	.078	.057	.116	.621
Poverty rates	.031	.026	.248	.019	.020	.351	-.005	.022	.830	.016	.024	.511
Per pupil education expenditure	.000	.000	.174	.000	.000	**.014**	.000	.000	.282	.000	.000	.112
Family factors												
Marital status (ref.=married)												
Never married	.081	.187	.664	-.032	.142	.819	.035	.162	.828	.052	.185	.780
Other	-.033	.270	.904	-.091	.240	.705	-.003	.201	.987	.052	.240	.830
Parents education (ref.=under HS graduate)												
High school graduate	.411	.198	**.039**	-.018	.163	.912	.103	.154	.503	.358	.175	**.041**
College	.479	.217	**.028**	.247	.197	.211	.255	.157	.104	.387	.191	**.044**
Income to poverty ratio	.001	.001	.441	.002	.001	**.013**	.001	.001	.107	.001	.001	.293
Welfare dependency	-.236	.338	.485	.077	.266	.773	-.174	.397	.661	-.310	.319	.332
Mother's age at birth	-.008	.019	.668	.031	.017	.068	.027	.016	.089	.008	.019	.688
Child Factors												
Gender (ref.=Male)												
Female	.002	.166	.991	-.108	.136	.426	-.240	.123	.052	.014	.188	.942
Birth order	-.050	.092	.584	-.105	.078	.181	-.083	.079	.297	-.092	.085	.282

	Model 1			Model 2			Model 3			Model 4		
	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z	Coef.	SE	P>z
Religion (ref.=No)												
Yes	.181	.208	.383	-.030	.183	.870	-.003	.153	.983	.290	.287	.313
Race (ref.=Caucasian)												
African-American	-.364	.253	.152	.192	.266	.470	.227	.234	.334	-.027	.258	.918
Age	.071	.020	**.000**	.029	.016	.071	.049	.021	**.020**	.074	.021	**.001**
Private school enrollment (ref.=No)												
Yes	-.242	.320	.451	-.231	.249	.356	-.168	.193	.384	-.367	.227	.107
Teenage Pregnancy (ref.=No)												
Yes	-.173	.161	.282	.155	.122	.205	.134	.146	.359	-.169	.185	.361
Education (ref.=Less than HS)												
High school	.435	.221	.050	.061	.170	.720	.194	.184	.292	.338	.211	.109
College	.944	.240	**.000**	.625	.190	**.001**	.710	.179	**.000**	.862	.198	**.000**
Constant	1.040	1.298	.423	.663	1.042	.525	1.325	1.171	.259	.674	1.493	.652
Number of Observation	320			320			258			331		
F value	3.86			4.96			7.25			6.06		
Probability > F	.000			.000			.000			.000		
R-square	.231			.278			.291			.254		
Adjusted R-square	.171			.222			-			-		

Table 5-32.

Logistic Regression of Welfare Dependency (Long-term Head Start vs. Short-term Head Start)

	Model 1			Model 2			Model 3			Model 4		
	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z
Preschool Factor												
Preschool Enrollment (ref.=Short-term Head Start)												
Long-term Head Start	1.881	1.031	.249	.807	.424	.683	1.244	.671	.686	1.692	.833	.286
Community Factors												
City Size (ref.=under 100,000)												
100,000-499,999	.505	.401	.389	.245	.205	.093	.330	.238	.124	.462	.304	.241
500,000 or larger	3.470	2.888	.135	4.186	3.994	.134	3.034	1.922	.080	3.750	2.190	**.024**
Region (ref.=non-South states)												
Southern states	1.827	1.387	.427	.993	.743	.993	1.225	.935	.790	1.776	1.342	.448
Unemployment rates	.965	.587	.954	.802	.490	.718	.903	.494	.852	.829	.421	.712
Poverty rates	1.041	.101	.683	1.039	.108	.711	1.061	.116	.589	1.096	.109	.354
Per pupil education expenditure	1.000	.000	.808	1.000	.000	.179	1.000	.000	.238	1.000	.000	.536
Family factors												
Marital status (ref.=married)												
Never married	1.399	.935	.616	1.569	1.071	.510	1.499	.908	.504	1.335	.818	.637
Other	.517	.585	.560	.504	.601	.566	.433	.669	.588	.420	.688	.596
Parents education (ref.=under HS graduate)												
High school graduate	1.848	1.163	.329	.611	.374	.421	.755	.613	.729	1.467	1.065	.598
College	.566	.481	.502	.208	.189	.084	.194	.214	.137	.481	.436	.420
Income to poverty ratio	.997	.005	.547	.994	.006	.318	.996	.003	.207	.997	.003	.361
Welfare dependency	4.823	5.519	.169	6.193	7.062	.110	5.928	6.645	.112	8.169	8.571	**.045**
Mother's age at birth	1.029	.071	.681	1.029	.075	.692	1.055	.077	.464	1.017	.062	.784
Child Factors												
Gender (ref.=Male)												
Female	5.219	4.077	**.034**	4.404	3.847	.090	4.109	3.730	.120	6.638	4.975	**.012**
Birth order	1.010	.307	.974	.868	.282	.663	.933	.316	.837	1.166	.380	.637

	Model 1			Model 2			Model 3			Model 4		
	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z	OR	SE	P>z
Religion (ref.=No)												
Yes	.409	.244	.134	.267	.180	.050	.393	.254	.149	.366	.222	.097
Race (ref.=Caucasian)												
African-American	.660	.830	.741	.534	.759	.659	.379	.440	.403	.209	.226	.148
Age	.908	.065	.176	.853	.063	**.030**	.841	.059	**.014**	.879	.060	.056
Private school enrollment (ref.=No)												
Yes	28.048	24.453	**.000**	37.793	35.386	**.000**	34.227	38.731	**.002**	61.152	59.863	**.000**
Teenage Pregnancy (ref.=No)												
Yes	2.471	1.320	**.090**	2.461	1.307	.090	2.557	1.452	.098	2.480	1.317	.087
Education (ref.=Less than HS)												
High school	.218	.136	**.015**	.181	.113	**.006**	.218	.154	**.032**	.191	.125	**.011**
College	.265	.210	.093	.435	.342	.290	.335	.277	.186	.264	.216	.104
Constant												
Number of Observation	320			320			258			331		
LR chi-square(22) or Wald chi-square(22)	61.43			84.90			70.74			72.28		
Probability > chi-square	.000			.000			.000			.000		
Pseudo R-square	.332			.392			.334			.356		
Log Likelihood	-61.87			-65.90			-51.62			-63.08		

Chapter 6

Conclusion and Discussion

The purpose of this study is to examine whether there are differences on adulthood educational attainment and economic status (measured in personal earned income, family income to poverty ratio, and welfare dependency) among children with different preschool experiences, when other background conditions are effectively controlled. To this end, Propensity Score Matching (PSM) analysis was performed focusing on Head Start enrollment.

Summary of the Findings

Effects on Educational Attainment

Findings of this study suggest that Head Start provides sizeable gains in terms of educational attainment to its participants if they attended the program at least one year. When pre-existing differences were controlled by PSM and remaining differences in background characteristics after preschool years were also controlled in the final multivariate analysis, long-term Head Starters performed better than children with all other types of preschool experiences. They tended to have higher levels of educational attainment by approximately 1.5 to 2 times than no preschool children, 2 to 3.2 times than other preschool children, and 1.9 to 2.1 times than short-term Head Start children. This suggests that Head Start participation in the long term is the most beneficial. In addition, while the effectiveness of no preschool, other preschool, and short-term Head Start cannot be compared directly by the above values, which designates the relative effects of

long-term Head Start to each preschool experience, it implies that attending non-Head Start preschool programs may be the worst among the four types of preschool involvements.[46]

The findings of this study need to be understood and interpreted with caution. In this study, other preschools includes all non-Head Start center-based preschools whose quality widely varies. Considering that the majority of the study participants are from low income families, the quality of other preschools may be inferior to that of Head Start. In most cases, low income children tend to attend cheaper, lower quality preschools. In contrast, Head Start has been generally acknowledged to have better quality than common preschools (Barnett, 2007).[47] Therefore, the results are reasonable, revealing that Head Start is better than other preschools.

While Head Start participation in the long term produces positive results, short-term participation is not very helpful. Compared to no preschool and other preschool children, children attending Head Start less than a year are not significantly different in their educational attainment where other conditions are held constant.

In sum, the findings of this study suggest that Head Start programs provide sizeable educational benefits to the participants in the long term only if they stay in the program at least one year. In addition, if they can stay in the program at least one year,

---

[46]. The results of these analyses are not presented in this study since they are not the main interest of this study. When other preschool children are compared to no preschool or short-term Head Start children, no statistical difference is found.

[47]. The most effective programs, they explain, are intensive interventions such as the model Abecedarian and Perry Preschool programs, which feature highly qualified teachers and small group sizes. State preschool programs with the highest standards rank next, followed by Head Start and the average state program, which produce effects ranging from one-tenth to one-quarter of those of the best programs. Typical child care and family support programs rank last. Barnett and Belfield point out that preschool programs raise academic skills on average, but do not appear to have notably different effects for different groups of children, and so do not strongly enhance social mobility (Barnett & Belfield, 2006).

Head Start is the best choice for low income children in terms of its effects on educational attainment.

Effects on Economic Status

Although this study identifies clear gains of long-term Head Start participation on educational attainment, its influence on economic status is not obvious. No direct effects are found on all kinds of economic outcomes except the comparison between long-term Head Start participation and other preschool participation. Interestingly, long-term Head Start participants earn about $4,720 to $5,701 less than other preschool participants when other background conditions including educational attainment are constant. The log-transformed family income to poverty ratio is also higher in other preschool children than long-term Head Start children. However, these results should not be simply interpreted as other preschool enrollment is more favorable than Head Start concerning adulthood earnings and family incomes. Although Head Start participation is negatively related to economic outcomes, it has a positive indirect influence on the outcome through increased educational attainment. Compared to persons whose educations are less than high school, people with college educations earned at least $6,070 and at most $10,214 more per year. It is not easy to tell how much of this gap is caused by Head Start participation because the indirect effect is not linear. However, once Head Start children had college or higher educations, most of the negative effects seem to be cancelled out or turned over to positive by indirect effects.

Indirect effects of long-term Head Start participation are also detected when it is compared to no preschool or short-term Head Start participation. For the comparison between long-term Head Start and no preschool, the effects of education on personal

income and family income are greater than the comparison between long-term Head Start and other preschools. Persons with college educations have earnings at least $9,386 more than the ones with less than high school. The gap between graduate school and less than high school is a minimum of $20,916. Since there are no negative direct effects, it is clear that Head Start results in more favorable outcomes than no preschool when it comes to adulthood economic status. The length of Head Start enrollment plays an important role indirectly for earned income and the family income to poverty ratio. Similar to the outcomes of educational attainment, long-term Head Start participants perform better in two adulthood income measures.

Regarding welfare dependency, the effects of Head Start enrollment are weaker than other outcomes. No statistical difference is found in either direct or indirect effects in all paired group comparisons. One exception is the comparison between long-term Head Starters and short-term Head Starters, in which indirect effects through education are found. Children who stayed in Head Start at least one year are more likely to have higher education attainment than their peers who enrolled in the program less than a year. Subsequently, higher educational attainment results in a lower likelihood of receiving TANF. While other factors play more important roles on the decision of receiving TANF and Head Start's effects are negligible in general, no undesirable effects are found. Although the results are not statistically significant, some signs of positive effects are found.

In sum, even though there are some exceptions, long-term Head Start generally has a strong positive influence on personal earnings and family income to poverty ratio

through higher educational attainment; however, the effects on welfare dependency are weaker.

Limitations

Although this study attempts to investigate the effects of Head Start enrollment among low income children by employing more rigorous research designs and analyses, there are some limitations. Since this study uses secondary data where a researcher's modification of the data or addition of new information is extremely limited, most of the following limitations are unavoidable.

First, this study used PSID data, where the information about the respondents' preschool experience is gathered by a few retrospective questions. Since the respondents are asked about their experiences during their early childhood years, some of their answers might be wrong. Furthermore, even though it can be assumed that no respondents intentionally gave any wrong information, they might not have a good distinction between Head Start and other preschool programs. Since they generally attended a program when they were 5 years of age or younger, the accuracy of their answers is questionable if they had not been told about it later from their parents. For example, they could answer that they had attended Head Start when they actually attended other preschools. In addition, they could say that the length of the program involvement was less than a year when they stayed in the program longer than a year. However, it is impossible to control the response errors. This could be a critical limitation depending on situations, but it is a common limitation that a self-reported survey data holds. Hence, the findings of this study should be understood with this limitation.

Second, the length of other preschool enrollment is not considered. Since the information is not available in the PSID data, the length of program enrollment is considered only for Head Start participants. While it does not affect the comparison between Head Start children and no preschool children, the effects of other preschool enrollment might be devaluated if most of the other preschoolers attended a program for just a few months.

Third, two community related variables (poverty rates and per pupil education expenditures) are imported from other data sources to control for the influence of neighborhood conditions. While they might not reflect the actual neighborhood conditions, state level conditions are considered instead of county or smaller levels of data due to the unavailability of the data. The PSID does not provide information about the residential locations to the public except by residential state. Although the residential ZIP codes can be identified with approval from both IRB and the PSID committee, it is also difficult to obtain information about poverty rates and per pupil expenditures that can be matched to the ZIP codes in the PSID. Further, the information would be needed for all years since 1970 because this study employs a longitudinal approach. Therefore, the two factors are considered only by state level.

Fourth, there are too many African-American samples in the final study. The original data includes sufficient numbers of Caucasians in the sample, but most of them were dropped because of the propensity score matching. The sample of the PSID is not problematic, but in reality, African-American children have been more likely to attend Head Start programs than Caucasian children. Other minority samples such as Hispanics and Asian Americans are also not included in the analysis, because the PSID does not

have a large sample size for those populations. Although a number of Hispanics were added to the dataset, they were not added until around 1990, so they could not be included in this study, because the time frame of this study begins in 1970.

Fifth, there are some unobserved factors which might have an important influence on Head Start enrollment or the outcome measures (educational attainment, personal earned income, family income, and welfare dependency) considered in this study. Recent studies have increasingly reported that family environment including parental involvement in children's education has a strong influence on children's educational outcomes (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; Ginther, Haveman, & Wolfe, 2000; Joo, 2006; Ou, 2005). School quality and participation in other programs such as job training and nutrition programs may have significant effects on the outcomes (Currie & Thomas, 2000). Although previous studies suggest social and cultural capitals as determinants of educational attainment and economic achievement (Coleman, 1988; Farrell, Tayler, & Tennent, 2004; Vimpani, 2000), they are not considered in the analysis due to the absence of appropriate measures in the data set.

Sixth, the outputs of this study have potential problems of unreliable standard errors. The standard error of coefficient was considerably high for some variables, which made the test results inaccurate. This problem was frequently observed where the balance of the sample was not good, which means most sample belonged to one category and only a few samples belonged to another category. For example, among the matched samples, most people had no private school experience and just a few people had ever enrolled in a private school. Also, Caucasian cases accounted for only 10%, while African American cases accounted for over 90%. The problem of unreliable standard

errors could be minimized by using bootstrapping (Ogden & Tarpey, 2006). However, this has not been done in this study to avoid too complicate analysis models. In the future research, this problem needs to be addressed and adjusted by an alternative analysis model or by employing statistical adjustment methods like bootstrapping.

Finally, this study provides little information about recent Head Start programs. Since the main focus of this study is long-term outcomes of Head Start enrollment, the outcome is measured at least 15 years after the preschool enrollment. That is, the youngest sample of this study participated in the program in 1991. It is the best and the most recent data available for this study, however, it is an evaluation of the program which was provided at least 15 years ago. As mentioned earlier, per capita expenditure in Head Start increased a great deal during the 1990s and there has been increasing concerns about the quality of the program since then. As a result, the program effects might be greater among recent participants.

Implications

While there are several limitations listed above, this study makes an important contribution to Head Start related research, policy, and practice.

Implications for Research

The major contribution of this study to the existing literature is that this study showed an alternative way to conduct more accurate analysis at national level without gathering an additional data. In the previous Head Start research, it has been frequently indicated that the research has been suffered from many methodological problems such as the use of local data, the non-comparability between treatment and control groups, and

the failure of controlling for various non-program effects (Aughinbaugh, 2001; General Accounting Office, 1997; McGroder, 1990; Nores et al., 2005; Schweinhart et al., 1985). In other words, previous research often failed to carefully check the difference in background characteristics between treatment and control groups. Some studies even examined the program effects without control groups (U.S. Department of Health and Human Services, 2001). When they constructed control groups, the influence of other factors on the outcome measures were not efficiently controlled. As a result, the credibility of the findings of those studies is under question.

Responding to these problems, studies with experimental design are generally suggested as the best solution (Hollister, 2008; Nathan, 2008). The Head Start Impact Study (2005), recently conducted under the Congressional mandate, is a good example of studies with random assignment. However, strategies other than experimental design have seldom been suggested or attempted in the literature. Although random assignment is a good way to control the influence of both observed and non-observed factors, researchers need to wait for at least10 years plus to see the longitudinal outcomes of the study as it recently began to collect the data. Consequently, it may be the best strategy at this time to estimate the program effects by using the information currently available and by employing the best possible scientific analyses. This approach is exactly what the present study attempted to do. Utilizing the PSM analysis and the PSID data together, this study tried to provide more accurate estimates about the program effects at no extra cost. In short, this study opened the door to future research on examining the program effects by using existing data.

Implications for Policy

Regarding the implications for policy, this study answered the question of the policy makers who brought Head Start program into the world in 1965. When they introduced this program, their ultimate goal was to get poor children out of the poverty by enhancing their educational outcomes, assuming the increased educational achievement would eventually lead to higher incomes (Zigler & Muenchow, 1992; Zigler & Valentine, 1979). However, this simple and clear idea has seldom been answered for the last 40-plus years. Some studies on model programs like the Perry School Project have attempted to answer this question (Schweinhart et al., 1993; Schweinhart et al., 2005), but only a handful of studies have tried to answer this question with Head Start children. Therefore, this study itself is valuable in that it aimed to answer the seldom-examined question.

The findings of this study provide an important message to policy makers and politicians. While Head Start has enjoyed strong bipartisan support over the past several decades, the broad support has been weakened recently, and there has been growing skepticism regarding the effects of Head Start. Assuming that the program effects were not as strong as they should be, the Bush administration proposed a plan in 2003 to make the program stronger by putting more emphasis on education and school readiness and by changing its administrative body to the Department of Education, even though the plan was eventually discarded. In 2006, the program experienced the first budget cut in its history, which had never happened even during Reagan's administration. This situation has been changing since the President Obama was elected and pledged an increase of $10 billion for early childhood education (Dillian, 2008). Despite the economic recession, the new administration declared it will make strategic investments in early childhood

education to better prepare children for the future. The findings of this study, which confirmed the long-lasting effects of Head Start participation on adulthood educational attainment and economic status, provide a scientific rationale for this initiative.

Implications for Practice

The focus of this study is to examine the overall program effects without considering the detailed characteristics of each program. Consequently, the findings of this study may not be beneficial to the practitioners searching for a strategy to make the program more effective. In other words, this study tells nothing about which class module works better or how effective the quality of a program is. However, this study suggests that it is important for Head Start professionals to help low income children keep attending the program. According to the findings of this study, long-term Head Start participation is generally the most beneficial to its participants among the four types of preschool experiences (long-term Head Start, short-term Head Start, other preschool and no preschool). Therefore, more efforts should be made to minimize the barriers that prevent low income children from attending the program. The programs' coverage should be expanded further as along with increasing the quality of the program.

References

Abbott-Shim, M., Lambert, R., & McCarty, F. (2003). A Comparison of School Readiness Outcomes for Children Randomly Assigned to a Head Start Program and the Program's Wait List. *Journal of Education for Students Placed at Risk, 8*(2), 191-214.

ACYF. (1995). Celebration of Head Start's 30th Anniversary. Nov. 30th, 2007, from http://eclkc.ohs.acf.hhs.gov/hslc/Program%20Design%20and%20Management/Head%20Start%20Requirements/IMs/1995/resour_ime_01017_022206.html

Adair, V. C. (2001). Poverty and the (broken) promise of higher education. *Harvard Educational Review, 71*(2), 217-239.

Ashcraft, A., & Lang, K. (2006). *The consequences of teenage childbearing*. Cambridge, MA: National Bureau of Economic Research.

Ashenfelter, O., & Krueger, A. (1994). Estimates of the economic return to schooling from a new sample of twins. *American Economic Review, 84*(5), 1157-1173.

Aughinbaugh, A. (2001). Does head start yield long-term benefits? *Journal of Human Resources, 36*(4), 641-665.

Ausubel, D. P. (1964). How reversible are the cognitive and motivational effects of cultural deprivation? Implications for teaching the culturally deprived child. *Urban Education, 1*, 16-38.

Barnett, W. S. (1998). Long-term cognitive and academic effects of early childhood education on children in poverty. *Preventive Medicine, 27*(2), 204-207.

Barnett, W. S. (2004). Does Head Start have lasting cognitive effects?: The myth of fade-out. In E. Zigler & S. Styfco (Eds.), *The Head Start debates* (pp. 221-249). Baltimore: Paul H. Brookes Publishing Co.

Barnett, W. S. (2004). Does Head Start have lasting cognitive effects?: The myth of fade-out. In E. Zigler & S. J. Styfco (Eds.), *The Head Start debates* (pp. 221-249). Baltimore, MD.: Paul H. Brookes Publishing Co.

Barnett, W. S. (2007). Revving up Head Start: Lessons from recent research. *Journal of Policy Analysis and Management, 26*(3), 674-677.

Barnett, W. S., & Belfield, C. R. (2006). Early childhood development and social mobility. *Future of Children, 16*(2), 73-98.

Barnett, W. S., & Hustedt, J. T. (2005). Head start's lasting benefits. *Infants and Young Children, 18*(1), 16-24.

Beatty, B. (1995). *Preschool education in America: The culture of young children from the colonial era to the present.* New Haven, CT: Yale University Press.

Becker, G. S. (1964). *Human capital; a theoretical and empirical analysis, with special reference to education*. New York,: National Bureau of Economic Research. distributed by Columbia University Press.

Becker, G. S. (1976). *The economic approach to human behavior*. Chicago: University of Chicago Press.

Belfield, C. R., Nores, M., Barnett, S., & Schweinhart, L. J. (2006). The High/Scope Perry Preschool program - Cost-benefit analysis using data from the age-40 Followup. *Journal of Human Resources, 41*(1), 162-190.

Bhattacharya, J., Currie, J., & Haider, S. (2004). Poverty, food insecurity, and nutritional outcomes in children and adults. *Journal Of Health Economics, 23*(4), 839-862.

Blau. (1999). The impact of income on child development. *Review of economics and statistics, 81*, 261-276.

Bolger, K. E., Patterson, C. J., Thompson, W. W., & Kupersmidt, J. B. (1995). Psychosocial Adjustment among Children Experiencing Persistent and Intermittent Family Economic Hardship *Child Development, 66*(4), 1107-1129.

Booth, A., & Kee, H. (2009). Birth order matters: the effect of family size and birth order on educational attainment. *Journal of Population Economics, 22*(2), 367-397.

Bronfenbrenner, U. (1974). *A report on longitudinal evaluations of preschool programs. Vol 2: Is early intervention effective?* (No. OHD 74-24). Washington, D.C.: Office of Child Development.

Brooks-Gunn, J., Duncan, G. J., Klebanov, P. K., & Sealand, N. (1993). Do neighborhoods influence child and adolescent development? *American Journal Of Sociology, 99*(2), 353-395.

Brown, D. R., & Gary, L. E. (1991). Religious socialization and educational-attainment among african-americans - an empirical-assessment. *Journal of Negro Education, 60*(3), 411-426.

Bryant, D. M., & Maxwell, K. (1997). The effectiveness of early intervention for disadvantaged children. In M. J. Guralnick (Ed.), *The effectiveness of early intervention* (pp. 23-46). Baltimore: P.H. Brookes.

Bryk, A. S., Lee, V. E., & Holland, P. B. (1993). *Catholic schools and the common good.* Cambridge, Mass.: Harvard University Press.

Bulgakov, D. M. (2003). *Head Start attendance as a predictor of elementary school outcomes.* Unpublished Ph.D., The University of Toledo, United States -- Ohio.

Butler, A., Gish, M., & Shaul, M. (2004). *Head Start : background, issues, and bibliography*. New York: Novinka Books.

Campbell, F. A., Pungello, E., Miller-Johnson, S., Burchinal, M., & Ramey, C. T. (2001). The development of cognitive and academic abilities: Growth curves from an early childhood educational experiment. *Developmental Psychology, 37*(2), 231-242.

Campbell, F. A., & Ramey, C. T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: Positive effects of early intervention. *American Educational Research Journal, 32*(4), 743-772.

Caputo, R. K. (2003a). Early Education Experiences & School-to-Work Program Participation. *Journal of Sociology & Social Welfare, 30*(4), 141-156.

Caputo, R. K. (2003b). Head Start, Other Preschool Programs, & Life Success in a Youth Cohort. *Journal of Sociology & Social Welfare, 30*(2), 105-126.

Chapin, F. S. (1950). Experimental Design in Sociology: Limitations and Abuses. *Social Forces, 29*(1), 25-28.

Cicirelli, V. (1969). *The impact of Head Start: An evaluation of Head Start on children's cognitive and affective development* (No. PB 184-328). Washington, DC: U.S. Department of Commerce, National Bureau of Standards.

Clarke, S. H., & Campbell, F. A. (1998). Can intervention early prevent crime later? The Abecedarian Project compared with other programs. *Early Childhood Research Quarterly, 13*(2), 319-343.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*(94), S95-120.

Coleman, J. S., & Hoffer, T. (1987). *Public and private high schools: the impact of communities*. New York: Basic Books.

Coleman, J. S., Hoffer, T., & Kilgore, S. (1982). *High school achievement: Public, Catholic, and private schools compared*. New York: Basic Books.

Conyers, L. M., Reynolds, A. J., & Ou, S. R. (2003). The effect of early childhood intervention and subsequent special education services: Findings from the Chicago Child-Parent Centers. *Educational Evaluation and Policy Analysis, 25*(1), 75-95.

Corcoran, M. (1995). Rags to rags: Poverty and mobility in the United States. *Annual Review Of Sociology, 21,* 237-267.

Costello, E. J., Compton, S. N., Keeler, G., & Angold, A. (2003). Relationships between poverty and psychopathology: a natural experiment. *The Journal of the American Medical Association, 290,* 2023-2029.

Council of Economic Advisors. (1964). *Economic report to the president, 1964.* Washington, D.C.: U.S. Government Printing Office.

Cravens, H. (1993). *Before Head Start: The Iowa station and America's children.* Chapel Hill, NC: University of North Carolina Press.

Cunningham, P. J., & Hahn, B. A. (1994). The changing American family: implications for children's health insurance coverage and the use of ambulatory care services. *Future Child, 4*(3), 24-42.

Currie, J. (2007). How should we interpret the evidence about Head Start? *Journal of Policy Analysis and Management, 26*(3), 681-684.

Currie, J., & Thomas, D. (1995). Does Head-Start make a difference? *American Economic Review, 85*(3), 341-364.

Currie, J., & Thomas, D. (2000). School quality and the longer-term effects of Head Start. *Journal of Human Resources, 35*(4), 755-774.

Danziger, S., Sandefur, G. D., & Weinberg, D. H. (1994). *Confronting poverty: prescriptions for change*. New York: Harvard University Press.

Deutsch, M. (1968). Early social environment: Its influence on school adaptation. In D. L. Schreiber (Ed.), *Profile of the High School Dropout: a Reader on America's Major Educational Problem* (pp. 203-214). New York: Random House.

Devaney, B. L., Ellwood, M. R., & Love, J. M. (1997). Programs that mitigate the effects of poverty on children. *Future of Children, 7*(2), 88-112.

DHHS. (2003). President bush's plan to prepare children for kindergarten. Retrieved Dec. 1, 2007, from http://www.dhhs.gov/news/press/2003pres/20030203.html

Dubow, E. F., & Ippolito, M. F. (1994). Effects of poverty and quality of the home-environment on changes in the academic and behavioral-adjustment of elementary school-age-children. *Journal of Clinical Child Psychology, 23*(4), 401-412.

Duncan, G. J. (1994). Families and neighbors as sources of disadvantage in the schooling decisions of white and black-adolescents. *American Journal of Education, 103*(1), 20-53.

Duncan, G. J., & Brooks-Gunn, J. (1997). *Consequences of growing up poor*. New York: Russell Sage Foundation.

Duncan, G. J., Yeung, W. J., Brooks-Gunn, J., & Smith, J. R. (1998). How much does childhood poverty affect the life chances of children? *American Sociological Review, 63*(3), 406-423.

Eamon, M. K. (2002). Effects of poverty on mathematics and reading achievement of young adolescents. *Journal of early adolescence, 22*(1), 49-74.

Farrell, A., Tayler, C., & Tennent, L. (2004). Building social capital in early childhood education and care: an Australian study. *British Educational Research Journal, 30*(5), 623-632.

Fergusson, D. M., Horwood, L. J., & Boden, J. M. (2006). Birth order and educational achievement in adolescence and young adulthood. *Australian Journal of Education, 50*(2), 122-139.

Fergusson, D. M., & Woodward, L. J. (2000). Teenage pregnancy and female educational underachievement: a prospective study of a New Zealand Birth Cohort. *Journal of Marriage and the Family, 62*(1), 147-161.

Ferjan, M., Jereb, E., & Sustersic, O. (2008). Social class position as a determinant of educational achievement. *Drustvena Istrazivanja, 17*(4-5), 869-886.

Fletcher, J. M., & Wolfe, B. L. (2009). Education and labor market consequences of teenage childbearing evidence using the timing of pregnancy outcomes and community fixed effects. *Journal of Human Resources, 44*(2), 303-325.

Fosburg, L., & Brown, B. (1984). *The effects of Head Start health services: Executive summary of the Head Start health evaluation*. Cambridge, MA: Abt Associates.

Fukahori, S. (2000). *The long term effects of Project Head Start: A national-scale longitudinal study.* Unpublished Ph.D., Columbia University, United States -- New York.

Garces-Tolon, E. (2001). *The effects of social programs on education and employment outcomes.* Unpublished Ph.D., University of California, Los Angeles, United States -- California.

Garces, E., Thomas, D., & Currie, J. (2002). Longer-term effects of head start. *American Economic Review, 92*(4), 999-1012.

General Accounting Office. (1997). *Head Start: Research provides little information on impact of current program*. Washington D.C.: Author.

General Accounting Office (GAO). (1997). *Head Start: Research provides little information on impact of current program*. Washington D.C.: Author.

Ghase-Lansdale, P. L., Mott, F. L., Brooks-Gunn, J., & Phillips, D. A. (1991). Children of the National Longitudinal Survey of Youth: A unique research opportunity. *Developmental Psychology, 23*, 918-931.

Ginther, D., Haveman, R., & Wolfe, B. (2000). Neighborhood attributes as determinants of children's outcomes - How robust are the relationships? *Journal of Human Resources, 35*(4), 603-642.

Gottschalk, P. (1992). The Intergenerational Transmission of Welfare Participation - Facts And Possible Causes. *Journal Of Policy Analysis And Management, 11*(2), 254-272.

Gray, S. W. (1987). The early training project through time - the natural-history of an intervention study. *Peabody Journal of Education, 65*(1), 5-14.

Greene, J. P. (2001). Vouchers in Charlotte. *Education Next, 1*.

Greene, J. P., Howell, W. G., & Peterson, P. E. (1997). *An evaluation of the Cleveland scholarship program*: Program on Education Policy and Governance, Harvard University.

Guo, S., & Gibbons, C. (2004). *Introduction to propensity score matching: a new device for program evaluation.* Paper presented at the Society for Social Work Research, New Orleans.

Hale, B., Seitz, V., & Zigler, E. (1990). Health services and Head Start: a forgotten formula. *Journal of Applied Developmental Psychology, 11*(447-458).

Harrington, M. (1962). *The other America; poverty in the United States*. New York,: Macmillan.

Haskins, R. (1989). Beyond metaphor: the efficacy of early childhood education. *American Psychologist, 44*(2), 274-282.

Haveman, R., & Wolfe, B. (1995). The determinants of children's attainments: a review of methods and findings. *Journal of Economic Literature, 33*(4), 1829-1878.

Hebb, D. O. (1949). *The organization of behavior; a neuropsychological theory*. New York,: Wiley.

Herrera, N. C., Zajonc, R. B., Wieczorkowska, G., & Cichomski, B. (2003). Beliefs about birth rank and their reflection in reality. *Journal of Personality and Social Psychology, 85*(1), 142-150.

Herrnstein, R. J., & Murray, C. A. (1994). *The bell curve : intelligence and class structure in American life*. New York: Free Press.

Hertwig, R., Davis, J. N., & Sulloway, F. J. (2002). Parental investment: How an equity motive can produce inequality. *Psychological Bulletin, 128*(5), 728-745.

Hill, M. S., & Sandfort, J. R. (1995). Effect of childhood poverty on productivity later in life: implications for public policy. *Children and Youth Services Review, 17*(1/2), 91-126.

Hohmann, M., & Weikart, D. P. (1995). *Educating young children: active learning practices for preschool and child care programs*. Ypsilanti, Mich.: High/Scope Press.

Hollister, R. (2008). The role of random assignment in social policy research. *Journal of Policy Analysis and Management, 27*(2), 402-409.

Hotz, V. J., McElroy, S. W., & Sanders, S. G. (2005). Teenage childbearing and its life cycle consequences - Exploiting a natural experiment. *Journal of Human Resources, 40*(3), 683-715.

Hunt, J. M. (1961). *Intelligence and experience*. New York,: Ronald Press Co.

Hunt, J. M. (1969). *The challenge of incompetence and poverty; papers on the role of early education*. Urbana,: University of Illinois Press.

Jensen, A. R. (1969). How much can we boost IQ and scholastic achievement? *Harvard Educational Review 39*(1), 1-123.

Joo, M. (2006). *Long-term impacts of early childhood care and education on children's academic, behavior, and school outcomes: Is Head Start more effective than private preschools and no preschools for poor children?* Unpublished Dissertation, Washington University, St. Louis: Missouri.

Kantarevic, J., & Mechoulan, S. (2006). Birth order, educational attainment, and earnings - An investigation using the PSID. *Journal of Human Resources, 41*(4), 755-777.

Kaplan, G. A., Turrell, G., Lynch, J. W., Everson, S. A., Helkala, E. L., & Salonen, J. T. (2001). Childhood socioeconomic position and cognitive function in adulthood. *International Journal of Epidemiology, 30*(2), 256-263.

Krueger, A. B., & Bowen, W. G. (1993). Policy watch: Income-contingent college loans. *Journal of Economic Perspectives, 7*(3), 193-201.

Laird, J., Lew, S., DeBell, M., & Chapman, C. (2006). *Dropout Rates in the United States: 2002 and 2003* (No. NCES 2006-062). Washington, DC: National Center for Education Statistics.

Lazar, I., & Darlington, R. (1982). Lasting effects of early education - a report from the consortium for longitudinal-studies. *Monographs of the Society for Research in Child Development, 47*(2-3), R9-151.

Leuven, E., & Sianesi, B. (2003). PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing" [Electronic Version], from http://ideas.repec.org/c/boc/bocode/s432001.html

Lewis, O. (1959). *Five families; Mexican case studies in the culture of poverty*. New York,: Basic Books.

Lewis, O. (1966). Culture of poverty. *Scientific American, 215*(4), 19-25.

Locurto, C. (1991). Beyond IQ in preschool programs. *Intelligence, 15*(3), 295-312.

Loury, L. D. (2004). Does church attendance really increase schooling? *Journal for the Scientific Study of Religion, 43*(1), 119-127.

Lubienski, C., Crane, C., & Lubienski, S. T. (2008). What do we know about school effectiveness? Academic gains in public and private schools. *Phi Delta Kappan, 89*(9), 689-695.

Mahoney, G., Robinson, C., & Powell, A. (1992). Focusing on parent child interaction - the bridge to developmentally appropriate practices. *Topics in Early Childhood Special Education, 12*(1), 105-120.

Marjoribanks, K. (2001). Sibling dilution hypothesis: A regression surface analysis. *Psychological Reports, 89*(1), 33-40.

Marks, G. N. (2008). Are father's or mother's socioeconomic characteristics more important influences on student performance? Recent international evidence. *Social Indicators Research, 85*(2), 293-309.

Mayer, D. P., Peterson, P. E., Myers, D. E., Tuttle, C. C., & Howell, W. G. (2002). *School choice in New York city after three years: An evaluation of the school choice scholarships program*. Princeton, N.J.: Mathematica Policy Research, Inc

Mayer, S. E. (1997). *What money can't buy: family income and children's life chances*. Cambridge, Mass.: Harvard University Press.

McGroder, S. M. (1990). Head Start: What do we know about what works? Washington D.C.: Office of the Assistnat Secretary for Planning and Evaluation. U.S. Department of Health and Human Services.

McKey, R. H., Condelli, L., Ganson, H., Barrett, B. J., McConkey, C., & Plantz, M. C. (1985). *The impact of head start on children, families and communities. Final report of the head start evaluation, synthesis and utilization project.* Washington, D.C.: CSR, Inc.o. Document Number)

McLoyd. (1998). Socioeconomic disadvantage and child development. *Ameican Psychologist, 53*, 185-204.

Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy, 66*(4), 281.

Monheit, A. C., & Cunningham, P. J. (1992). Children without health insurance. *Future of Children, 2*(2), 154-170.

Moore, K. A., & Waite, L. J. (1977). Early childbearing and educational attainment. *Family Planning Perspectives, 9*(5), 220-225.

Moynihan, D. P. (1965). *The Negro family: the case for national action*. Washington, D.C.: Office of Policy Planning and Research, Department of Labor. .

Muller, C., & Ellison, C. G. (2001). Religious involvement, social capital and adolescents' academic progress: Evidence from the National Education Longitudinal Study of 1988. *Sociological Focus, 34*(2), 261-289.

Nathan, R. P. (2008). The role of random assignment in social policy research. *Journal of Policy Analysis and Management, 27*(2), 410-415.

National Center for Education Statistics. (2006). *The Condition of Education 2006* (No. NCES 2006-071). Washington, DC: U.S. Department of Education.

National Head Start Association. (2005, May 24-27). *Head Start History 1965 to the Present.* Paper presented at the 32nd Annual Training Conference "Head Start: The Nation's Pride...Celebrating 40 Years of Success", Orlando, Florida.

Niles, M. D. (2004). *Does early childhood intervention affect children's social and emotional development?* Unpublished Dissertation/Thesis, The University of Wisconsin - Madison, United States -- Wisconsin.

Nores, M., Belfield, C. R., Barnett, W. S., & Schweinhart, L. J. (2005). Updating the economic impacts of the High/Scope Perry Preschool Program. *Educational Evaluation and Policy Analysis, 27*(3), 245-261.

O'Keefe, A. (1980). *What Head Start means to families*. Washington: Dept. of Health, Education, and Welfare, Office of Human Development Services, Administration for Children, Youth and Families.

Office of Head Start. (2008). Head Start program fact sheet. Retrieved Sep. 11, 2008, from http://eclkc.ohs.acf.hhs.gov/hslc/About%20Head%20Start/dHeadStartProgr.htm

Ou, S. R. (2003). *Mechanisms of effects of an early childhood intervention on educational attainment.* Unpublished Dissertation/Thesis, The University of Wisconsin - Madison, United States -- Wisconsin.

Ou, S. R. (2005). Pathways of long-term effects of an early intervention program on educational attainment: Findings from the Chicago longitudinal study. *Journal of Applied Developmental Psychology, 26*(5), 578-611.

President's Task Force on Manpower Conservation. (1964). *One-third of a nation: a report of young men found unqualified for military service*. Washington, DC.

Ramey, C. T. (1992). High-risk children and IQ - altering intergenerational patterns. *Intelligence, 16*(2), 239-256.

Rank, M. R. (1994). *Living on the edge: the realities of welfare in America*. New York: Columbia University Press.

Rank, M. R., & Hirschl, T. A. (2001). The occurrence of poverty across the life cycle: Evidence from the PSID. *Journal of Policy Analysis and Management, 20*(4), 737-755.

Regnerus, M. D., & Elder, G. H. (2003). Staying on track in school: Religious influences in high- and low-risk settings. *Journal for the Scientific Study of Religion, 42*(4), 633-649.

Reynolds, A. J. (1994). EFFECTS OF A PRESCHOOL PLUS FOLLOW-ON INTERVENTION FOR CHILDREN AT RISK. *Developmental Psychology, 30*(6), 787-804.

Reynolds, A. J. (1997). The Chicago Child-Parent Centers: A Longitudinal Study of Extended Early Childhood Intervention. Madison, Wisc.: Institute for Research on Poverty.

Reynolds, A. J., & Bezruczko, N. (1993). School adjustment of children at risk through 4th grade. *Merrill-Palmer Quarterly-Journal of Developmental Psychology, 39*(4), 457-480.

Reynolds, A. J., Mehana, M., & Temple, J. A. (1995). Does preschool intervention affect children's perceived competence? *Journal of Applied Developmental Psychology, 16*(2), 211-230.

Reynolds, A. J., Temple, J. A., Robertson, D. L., & Mann, E. A. (2001). Long-term effects of an early childhood intervention on educational achievement and juvenile arrest: a 15-year follow-up of low-income children in public schools. *Jama-Journal of the American Medical Association, 285*(18), 2339-2346.

Reynolds, A. J., Temple, J. A., Robertson, D. L., & Mann, E. A. (2002). Age 21 cost-benefit analysis of the Title I Chicago Child-Parent Centers. *Educational Evaluation and Policy Analysis, 24*(4), 267-303.

Riessman, F. (1962). *The culturally deprived child* (1st ed.). New York,: Harper.

Robinson, J., & Choper, W. B. (1979). Another perspective on program evaluation: the parents speak. In E. Zigler & J. Valentine (Eds.), *Project Head Start: a legacy of the War on Poverty*. New York: Free Press.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1), 41-55.

Ryan, W. (1972). *Blaming the victim*. New York: Vintage Books.

Schultz, T. W. (1963). *The economic value of education*. New York,: Columbia University Press.

Schultz, T. W. (1970). *Investment in human capital; the role of education and of research*. New York,: Free Press.

Schultz, T. W. (1981). *Investing in people : the economics of population quality*. Berkeley, Calif.: University of California Press.

Schweinhart, L. J. (2002). How the High/Scope Perry Preschool Study Grew: A Researcher's Tale [Electronic Version]. *Research Bulletin, 32,* from http://www.pdkintl.org/research/rbulletins/resbul32.htm

Schweinhart, L. J., Barnes, H. V., & Weikart, D. P. (1993). *Significant benefits : the High-Scope Perry preschool study through age 27.* Ypsilanti, MI: High/Scope Press.

Schweinhart, L. J., Berruetaclement, J. R., Barnett, W. S., Epstein, A. S., & Weikart, D. P. (1985). The promise of early-childhood education. *Phi Delta Kappan, 66*(8), 548-553.

Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). *Lifetime effects: The High/Scope Perry Preschool study through age 40*. Ypsilanti, MI: High/Scope Press.

Schweinhart, L. J., & Weikart, D. P. (1980). *Young Children Grow Up: Effects of the Perry Preschool Program on Youths Through Age 15*. Ypsilanti, Mich.: High/Scope Press.

Sherman, A. (1994). *Wasting America's future: the Children's Defense Fund report on the costs of child poverty*. Boston: Beacon Press.

Shonkoff, J. P., & Meisels, S. J. (2000). *Handbook of early childhood intervention* (2nd ed.). Cambridge [England] ; New York: Cambridge University Press.

Slaughter, D. T., Lindsey, R. W., Nakagawa, K., & Kuehne, V. S. (1989). Who gets involved? Head-start mothers as persons. *Journal of Negro Education, 58*(1), 16-29.

Solon, G. (1992). Intergenerational income mobility in the United-States. *American Economic Review, 82*(3), 393-408.

Spitz, H. H. (1986). *The raising of intelligence : a selected history of attempts to raise retarded intelligence*. Hillsdale, N.J.: L. Erlbaum Associates.

Steiner, G. Y. (1976). *The children's cause*. Washington D.C.: Brookings Institution.

Stokes, C. E. (2008). The role of parental religiosity in high school completion. *Sociological Spectrum, 28*(5), 531-555.

Stone, J. G. (1979). General philosophy: preschool education within Head Start. In E. Zigler & J. Valentine (Eds.), *Project Head Start: a legacy of the War on Poverty* (pp. 163-174). New York: Free Press.

Stossel, S. (2004). *Sarge: the life and times of Sargent Shriver*. Washington [D.C.]: Smithsonian Books.

The White House. (2003). Head Start policy book: president Bush's plan to prepare all children for kindergarten. Retrieved Dec. 1., 2007, from http://www.whitehouse.gov/infocus/earlychildhood/hspolicybook/01.html

Thompson, J. J. (1993). Women, welfare, and college: The impact of higher education on economic well-being. *Afflia, 8*, 425-441.

U.S. Census Bureau. (2007). Historical poverty tables. Retrieved Aug. 11, 2008, from http://www.census.gov/hhes/www/poverty/histpov/hstpov2.html

U.S. Department of Health and Human Services. (2001). *Head start FACES: Longitudinal findings on program performance*. Washingtom, DC: Administration for Children and Families.

U.S. Department of Health and Human Services. (2005). *Head Start impact study: first year findings*. Washington, DC: Administration for Children and Families.

Vimpani, G. (2000). Child development and the civil society: Does social capital matter? *Journal of Developmental and Behavioral Pediatrics, 21*(1), 44-47.

Vinovskis, M. (2005). *The birth of Head Start: preschool education policies in the Kennedy and Johnson administrations*. Chicago: University of Chicago Press.

Weikart, D. P., Bond, J. T., & McNeil, J. T. (1978). *Ypsilanti Perry Preschool Project: preschool years and longitudinal results through fourth grade*. Ypsilanti, Mich: High/Scope Press.

Wilson, W. J. (2007). *The Moynihan Report and Research on the Black Community*. Paper presented at the Moynihan report revisited: lessons and reflections after four decades from http://conference.aapss.org/index.html

Yeung, W. J., Linver, M. R., & Brooks-Gunn, J. (2002). How money matters for young children's development: Parental investment and family processes. *Child Development, 73*(6), 1861-1879.

Zigler, E. (1994). Reshaping early-childhood intervention to be a more effective weapon against poverty. *American Journal of Community Psychology, 22*(1), 37-47.

Zigler, E., & Muenchow, S. (1992). *Head Start: the inside story of America's most successful educational experiment*. New York: BasicBooks.

Zigler, E., & Valentine, J. (1979). *Project Head Start: a legacy of the War on Poverty*. New York: Free Press.

Appendix A. Timeline of the Changes in the Head Start Program

Year	Description
1965	Head Start began as a summer program.
1966	Head Start became a primarily part day, 9 month program, which was administered by the federal Office of Economic Opportunity (OEO). Basic program requirements were outlined in program "guidance."
1969	Head Start was transferred from OEO to the Office of Child Development in the Department of Health, Education, and Welfare (renamed as Department of Health and Human Services in 1979).
1972	It was mandated that "at least 10%" of the national enrollment would be set aside for children with disabilities.
1973	The National Head Start Association was established. First Child Development Associate (CDA) program established.
1974	First Performance Standards were published and the review process began.
1986	Considerable federal pressure put on programs to limit service to children to one year in oder to serve more children for the same funding.
1990	Head Start Expansion and Quality Improvement Act passed. Head Start/State collaboration projects began.
1993	President's Commission on Head Start established.
1994	Head Start Reauthorization. Major change included … 1) increased concerns about program quality, 2) services for children birth to three (early Head Start), 3) revision of the Performance Standards, 4) increased focus on collaboration with child care, 5) Early Head Start grants would be completive with any qualified provider.
1995	On-site peer reviews were enforced every three years. Head Start programs were required to be shut-down if deficiencies are not corrected within one year.
1996	CDA requirement was established.
1997	Revised Head Start Performance Standards enforced.
1998	Head Start Reauthorization. Major changes included the followings. 1) increased emphasis on school readiness 2) for-profit organizations could be Head Start grantees 3) expansion of funding to Early Head Start 4) focus on full-day, full-year services for families 5) Associate degrees were required for at least one teacher in each classroom
2000	Biggest increase in Head Start funding ($933 million)
2003	President's Strengthening Head Start plan introduced, which proposed a change in administration from DHHS to the Department of Education and a state by state grant of the federal funding. Head Start was not reauthorized on schedule and went into "Continuing Resolution" funding.
2004	Head Start reauthorization bill passed in House, but failed to pass in Senate.
2006	First budget cut (by 1%) happened in Head Start history.
2007	Head Start Reauthorization bill enacted.