Theory and Evidence…

Understanding the effect of federal and state early childhood policy on state outcomes

by

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Abstract

Discussion of the efficacy of early childhood programs fits into the policy discourse over poverty and welfare in the United States. This thesis explores the relationship between three federal early childhood programs and educational attainment and poverty rates through linear regressions. The three programs that I address are Head Start, Temporary Assistance for Needy Families, and the Child Care and Development Block Grant. I find that there is a strong correlation between Head Start federal funding and the rate of adults that have completed at least four years of high school. I also incorporate some observations on the difference between observing state and federal outcomes and the implications of state discretion in early childhood program policy on observing outcomes. In my review of the background of early childhood policy, I note that research in early childhood policy must be extended to address empirical outcomes on larger economic levels beyond the individual beneficiary and his or her family.

I. Introduction

My thesis intends to explore the relationship between federal and state early childhood education policy and economic outcomes in those regions. This report will provide a brief policy and funding background for early childhood in the United States, a literature review for existing economics-oriented research in the field of early childhood education, an overview of the data that I intend to use, and a discussion of the results that I find. I will focus on studying the main federal programs dedicated to funding early childhood education and childcare: Head Start, the Child Care and Development Fund (CCDF), and Temporary Assistance for Needy Families (TANF).

An early childhood program is a loose term to describe care that is provided for children and infants and their families before the kindergarten age. Generally, some early childhood education strategies include quality daycare, pre-Kindergarten, nurse-home visitation programs, and a number of others. The Perry Preschool Program and North Carolina Abecedarian are two examples of the most well-known programs in the history of early childhood and spurred the uptake of early childhood programs and policies as cost-effective methods to improve the lifetime outcomes of individuals (Karoly et al. 1998). Early childhood programs have been hailed in recent years as a way to boost long-run outcomes for society's most vulnerable children while allowing the government to incur savings in the long term in the form of reduced unemployment, welfare dependency, incarceration, and a variety of other outcomes (Karoly et al. 1998, Reynolds et al. 2008). High quality programs have been estimated to procure an economic return through government savings of up to ten times the original investment (Reynolds et al. 2008). Others measure that additional tax revenue from higher-income earners as a result of participation in a successful program can yield up to $24,000 per family (Karoly et al. 1998).

In addition to citing the potential for government savings, researchers and advocates also note that other intangible benefits of early childhood programs exist. The Perry Preschool Program, which ran as a longitudinal experiment in the 1960s with a 40-year follow-up evaluation period, was crucial to revealing the true magnitude of the benefits that quality early childhood program yield. The treatment group in Perry Preschool reported fewer years in special education, higher graduation rates, lower rates of criminal activity, higher earnings, and better health outcomes (Barnett 2011).

Yet despite a wealth of evidence heralding the effectiveness of early childhood programs, the secret to success behind early childhood programs remains to be completely understood. The relationship between short-term cognitive outcomes and long-term success in non-cognitive and lifestyle-related outcomes is particularly unclear. Despite observing large advances in long-term outcomes, even researchers in the Perry Preschool Program found that early advancements in a child participant's IQ faded before adolescence (Barnett 2011). While a common presumption is that positive cognitive outcomes early on lead to success later on in life, the indistinguishable advancement in short-term academic achievement and IQ levels amongst early childhood beneficiaries and their counterparts dispels that notion (Heckman et al. 2013). Some researchers hypothesize that the short-term fadeout of cognitive outcomes is a result of the low-quality public education that early childhood program beneficiaries encounter after they have grown out of early childhood care, but that early childhood programs endow its beneficiaries with non-cognitive skills and enhanced home environments that contribute to the participant's long-term success (Duncan 2013).

Nevertheless, this hazy area poses a political problem for early childhood programs, which frequently encounter skepticism as critics press the point that early childhood programs have no short-term effects and should therefore be deemed a failure (Ryan 2014). Interestingly, while Head Start is no different from the most successful early childhood programs in that research has demonstrated short-term fadeout of cognitive outcomes but long-term success later on, it seems to be a popular subject for criticism (Duncan 2013, Deming 2009). In a 2014 Budget Committee Report, Speaker of the House Paul Ryan detracts from Head Start's credibility by citing lack of short-term academic outcomes and enrollment fraud. Given that Head Start and other early childhood programs have been shown to advance individual-level outcomes in the long term, the viability of Ryan's arguments against Head Start should be readily diminished (Currie 2005). However, Head Start's continued unpopularity might indicate that the discourse around its effectiveness should be reoriented to center on benefit on a large scale and in the long term. In describing the need for an up-to-date benefit-cost analysis of Head Start, Jens Ludwig (2014) notes that research on Head Start that centers on short-term effects "are not directly informative" about the comprehensive benefits and costs to government and society.

Therefore, the goal for conducting macro level research on the effects of early childhood programs is twofold and complementary. Initially, such a perspective serves to fill a gap in early childhood research that focuses heavily on benefits to the individual but which often neglects to address the benefit to larger economic systems such as cities, states, and the country as a whole. A long-term view might also incorporate into observation the idea that the benefits of early childhood programs compound over generations because the wellbeing of a beneficiary as an adult might be passed on to his own children through better income and stability. Subsequently, macro-level observations of early childhood programs can play a role in reorienting the dialogue in favor of early childhood programs towards a discussion of benefits to the greater community with a longer time horizon.

My intention is to take on this macro-level perspective on the effects of large-scale early childhood policy spending and outcomes as broad as poverty and educational attainment across states. This very broad scope admittedly introduces considerable noise into observing any effects that early childhood programs might have. For example, while poverty can provide some insight into the economic wellbeing of the country as a whole and over time, poverty is also influenced by economic shocks and policies that are outside the scope of early childhood programs. Given the potential for observations of Head Start and other early childhood program's effects to be biased by the noise in poverty and educational attainment measures, I will also reflect on why an effect may or may not exist. In my thesis to follow, I will use publicly available state and federal spending data and poverty and educational attainment data.

II. An Overview of Federal Early Childhood Programs

According to the National Association for Education of Young Children (NAEYC), about three quarters of public dollars spent on early childhood education are federal funds. On the federal level, there are three main programs that fund early childhood programs: Temporary Assistance for Needy Families (TANF), the Child Care and Development Block Grant (CCDBG), and Head Start. Federal spending in these three early childhood programs and state matching policies to these programs comprise the bulk of early childhood spending in the United States, and thus will provide the focus for understanding government spending on early childhood in the United States in this thesis. This section will review the policy background, funding allocation characteristics, and eligibility requirements for each of the three programs.

TANF was formed in 1996 as a successor and transformed version of Aid to Families with Dependent Children (AFDC) and was a result of the United States' biggest milestones in welfare reform. AFDC was largely criticized as ineffective in reducing poverty in the United States and was the founding policy setting for the notion that welfare serves only to make its recipients more dependent and less able. In short, the conversion to TANF emphasized work requirements that welfare in America had not yet witnessed on a federal level. Interestingly, while the new legislation slashed funding for many programs and made obtaining benefits arguably more difficult, it increased funding for childcare and established what would become CCDF (Congressional Research Service 2003). States are able to spend TANF dollars in a variety of categories, ranging from cash assistance such as food stamps to childcare, and are allowed to spend up to 30% of the grant on childcare by moving the funds to their CCDBG allocations (Congressional Research Service 2003). States are also able to spend some TANF dollars directly on childcare, a category of funding that I will use in my analysis (Administration for Children and Families 2005).

CCDBG was established in 1990 and allocates money to states to subsidize childcare for families below 85% of the state median income level (NAEYC 2014). For example, in Kentucky, the state with the highest poverty rate in 2013, a family would qualify for CCDBG vouchers with a household income of around $36,889 by these guidelines (American Community Survey - ACS). In New Hampshire, the state with the lowest poverty rate in 2013, a family would qualify for CCDBG vouchers with a household income of $54,595. Families are allowed to use these subsidies at any qualifying childcare center certified by the state for minimum safety and quality standards (NAEYC 2014).

CCDBG and TANF funds combine to form the Child Care and Development Fund, an umbrella that was established after the conversion from AFDC to TANF. CCDF funds have several components: discretionary funds, mandatory funds, federal match, and state match. Discretionary funding is determined annually through the budget appropriations process (Congressional Research Service 2003). The federal mandatory portion is required through legislation in the Social Security Act. The federal match is the gap between discretionary funding and mandatory funding, which is then allocated to various states depending on the size of the population of children under 13 years old. According to data provided by Center for Law and Social Policy (CLASP) the median spending on CCDBG including federal and state dollars was approximately $99 million. In total, with federal and state spending combined, the country spent $8.5 billion on CCDBG in 2013 (CLASP 2013).

Head Start, which is considerably older than both CCDBG and TANF, was established in 1965 as part of President Lyndon B. Johnson's War on Poverty legislation (Sabol & Chase-Landsale 2014). It was designed to provide disadvantaged children with a boost before entering kindergarten by offering child care alongside an array of education and support services to children and their families, including health care, nutrition counseling, and informational workshops on parenting (Currie 2005, Sabol & Chase-Landsale 2014). States allocate Head Start funds to agencies that operate Head Start centers on the local level (Office of Head Start). Local agencies are also required to contribute 20% in a funding match, raising the program cost in 2009 to an estimated $9,000 per child (Duncan et al. 2013). In 2014, total federal spending on Head Start was just over $8.5 billion (CLASP 2013).

It is important to note that Head Start and CCDBG fall on opposite ends of the political ideology spectrum and are different approaches to early childhood policy. Head Start is largely dictated by federal guidelines and the format of Head Start is administered and determined by the Office of Head Start. On the other hand, CCDBG is a subsidy program for low-income parents to place their children in child care, and also gives states considerable discretion in using CCDBG funds. For example, states determine their own guidelines on the requirements for qualifying childcare centers (CLASP 2010). In this respect, Head Start and CCDBG provide interesting perspectives and grounds for research: the difference between federal mandates for early childhood policy and state-enforced guidelines and eligibility requirements may provide a difference in the effectiveness of early childhood.

Other programs on the federal level for early childhood include portions of the Individuals with Disabilities Education Act, the Early Learning Challenge Fund, and Promise Neighborhoods (Zero to Three 2014). These programs operate at much smaller funding levels than the aforementioned CCDBG, Head Start, and TANF so will not be included in the scope of my research. Some states also support early childhood programs independently from federal policy directive, such as the Positive Parenting Program (also known as Triple P) in some California counties or funding for the Nurse Family Partnership in South Carolina (First 5 Santa Cruz County, South Carolina Department of Health and Human Services). States will often fund these programs through a variety of means, such as through Medicaid or specific health programs. Because of the disparity in ways that a state might implement an early childhood program, it is difficult to gather funding and program data for any given state. Ultimately, observing the effects of the largest early childhood programs seems to be the best starting point for understand early childhood programs on a larger level.

III. An Overview of Poverty and Educational Attainment in the United States

This section will review poverty and educational attainment trends in the United States, which provide somewhat conflicting pictures of the past few decades in the United States. On one hand, while educational attainment has improved dramatically since the middle of the 20th century, poverty seems to have remained almost constant in the past four decades.

Figure 1: Poverty and Federal Head Start Spending in the US, 1959-2013 (Source: United States Census Bureau 2014).

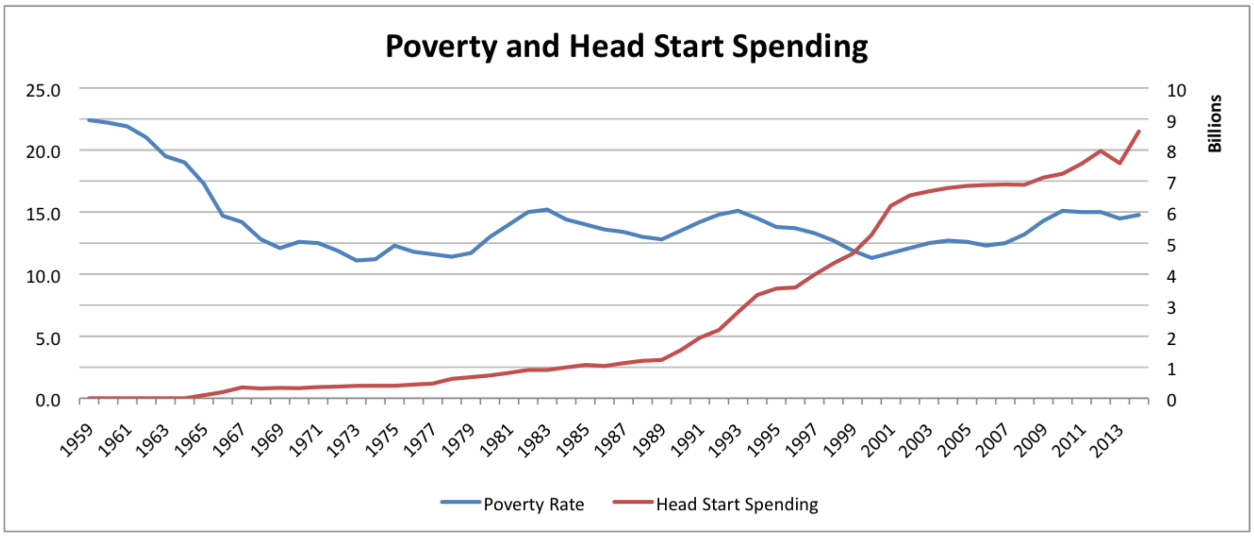


Figure 1 describes the trends in Head Start federal spending and the national poverty level. From this perspective, the only notable drop in poverty takes place before Head Start has even been conceived in 1965. Even after Head Start's inception, poverty remains relatively steady and never rose above 16%—not a promising first case in favor of Head Start.

However, the lack of an observable relationship between Head Start and poverty rates illuminates the challenges of observing the effects of a government program at this scale. Numerous confounding factors might contribute to noisy data that will make it difficult to distinguish the effect of Head Start from other events that affect poverty. First, poverty is cyclical and is subject to a variety of external shocks. For example, poverty rose to a 15-year high in 2010 conceivably as a result of the 2008-2009 financial crisis. Furthermore, poverty is often a temporary transition for much of the affected population, making it an imperfect measure to understand long-term outcomes of welfare programs. In addition, other existing social programs that were also created during President Lyndon B. Johnson's War On Poverty 1960s may influence poverty, affecting the observation of the relationship between Head Start and poverty. Another caveat to using poverty as a measure is that Census Bureau historical poverty data extends only as far back as 1959, giving researchers few, if any, windows of time with which to compare programs initiated in that same time period. Other hypotheses that explain a lack of a notable decline in poverty abound, such as those that speak to the changing family demographics and culture in the US: for example, one hypothesis for an increase in poverty rates proposes that an increase in mobility in the past half century allows families to create smaller, more independent family units that elect to not be dependent upon already economically stable families and communities (Sawhill 2008). Thus, the challenge of observing the effect of early childhood programs from a macro perspective can be attributed to a whole array of external cultural and economic influences, related policies, and data restrictions. A more explicit description of potential sources of noise appears in the Data section.

Figure 2: Educational attainment for population over 25 years old, 1940-2015 (Source: United States Census Bureau 2014).

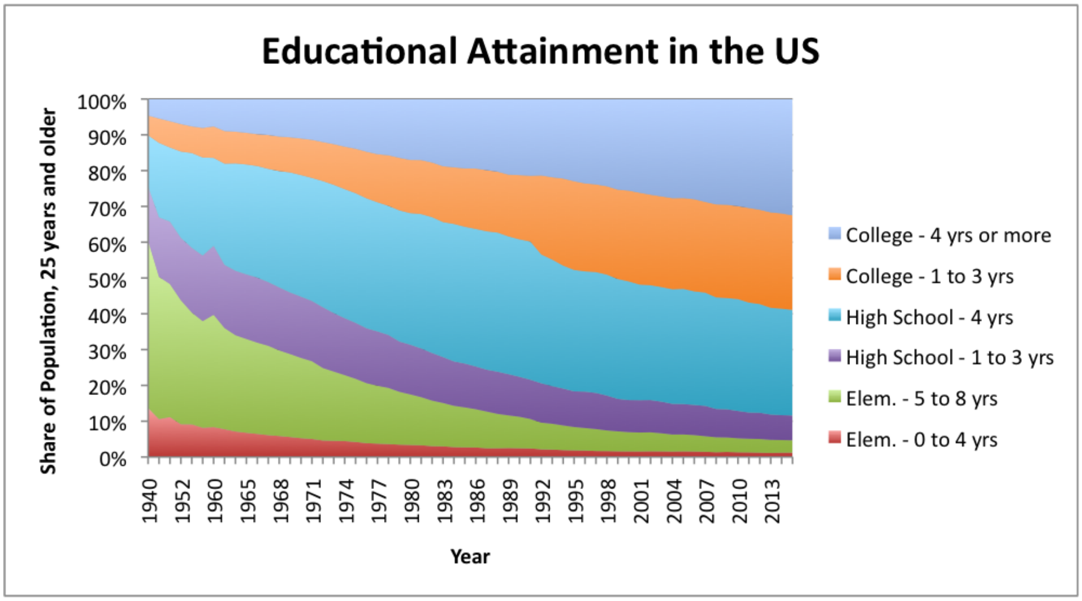


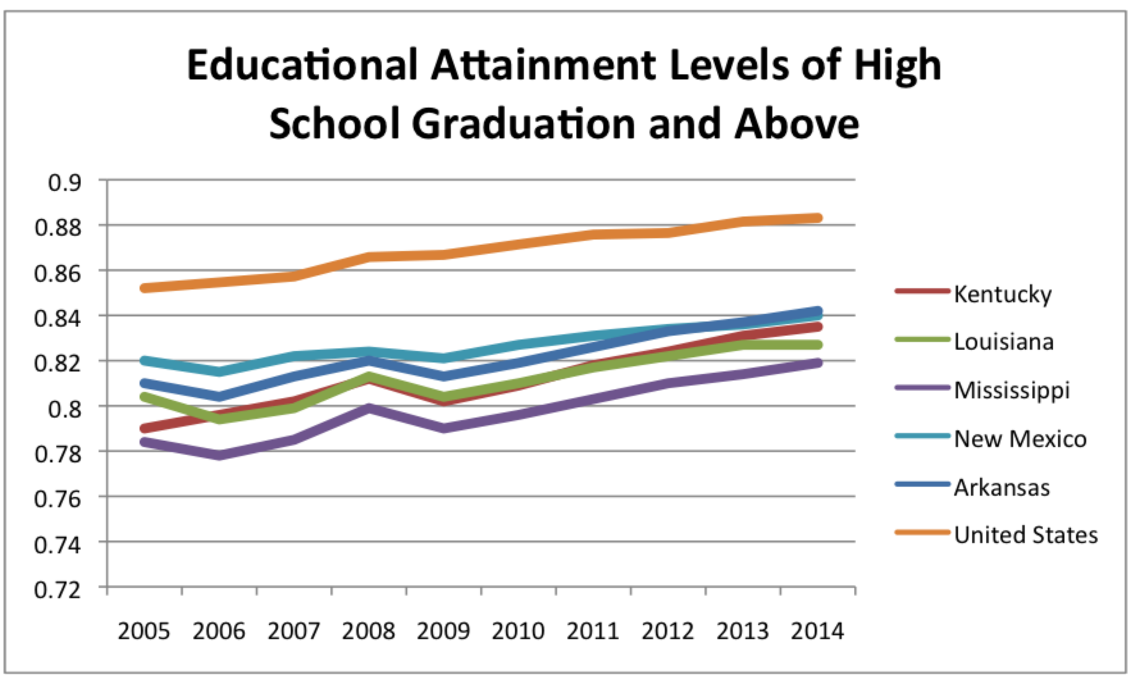
Figure 2 provides a more promising outlook on the change in the United States in the past century. The graph indicates that a growing share of the American population is obtaining higher levels of education, and the share of the population that has only attended up to four years of primary school has become almost nonexistent at a little more than one percent in 2015. The single most dominant share of educational attainment belongs to high school, but its size has remained relatively constant over time. Instead, it is notable that the share of the population that has attended at least one year of college has increased greatly, growing from around 10% in 1940 to 58.9% in 2015. From the perspective of Head Start and other early childhood programs, it is important to keep in mind that an expected increase in educational attainment for participants will not be realized until 1990, 25 years after the inception of Head Start.

But while educational attainment in the United States provides a very different image of improvement than the poverty measure, poorer states still experience lower than average rates of educational attainment. This is important because it shows that educational attainment, while perhaps more isolated from the shocks that affect the poverty measure, is still closely related to an individual's other outcomes, such as poverty and employment. The following table lists the top five states with the highest average poverty levels from 2007 to 2014 (calculated assuming constant population).

State	Average 2007-2014
MISSISSIPPI	0.223
KENTUCKY	0.206
NEW MEXICO	0.199
LOUISIANA	0.190
ARKANSAS	0.188

Meanwhile, the following figure compares the rate of the population that has obtained a high school degree or higher in these states with the national average.

Figure 3: High school graduates as percentage of population in five most impoverished states, 2003-2014 (Source: United States Census Bureau 2014).



This graph makes evident that the five states with the highest percentage of the population in poverty also has notably lower rates of high school graduates. Thus, while educational attainment may be a better indicator than the official poverty rate is of the performance of certain welfare program or of early childhood policies because it appears to be less susceptible to macroeconomic activity, it is still a useful metric to understand the wellbeing and achievement of individuals and states, especially when compared to the national average.

IV. Existing Research on Public Spending in Early Childhood

There appears to be little empirical research on the effects of American public spending on early childhood programs and macro-level outcomes. However, two theoretical analyses point out that increased spending and investment in early childhood can yield improved outcomes for low-income families, a third paper on Head Start provides the foundation for understanding the role of such a program for the public benefit, and a final piece of literature discusses the effect of Head Start on the parents of beneficiaries.

Casey Abington and William Blankenau create a model to test the effect of government spending in early versus late childhood education in "Government education expenditures in early and late childhood". The authors first employ the notion that total spending on a child's education—that is, government spending and family spending combined—remains relatively constant and that government spending "crowds out" what would be spent by families with means to do so. As a result, wealthy families expend far less on late childhood (K-12) education, but do spend on early childhood. For low-income families, the means to fund early education is unavailable, making it effective (by outcomes for children) for the government to fund early childhood for low-income families.

Blankenau and Xiaoyuan Youderian adopt a similar approach in “Early childhood education expenditures and the intergenerational persistence of income.” The authors develop a model to represent the effect of government spending on early childhood on intergenerational poverty—in other words, its effectiveness in breaking the parent-to-child cycle of poverty. They conclude that if the US matched the spending levels of Norway and Denmark for early childhood, “the gap in intergenerational income persistence” decreases by less than 8.5%, which is substantially more than if a similar increase was allocated to later childhood education.

Janet Currie provides a comprehensive overview of Head Start and its outcomes for disadvantaged children in “Economic Impact of Head Start.” She asserts that although Head Start has been criticized for doing little to advance academic achievement for disadvantaged children, the program does appear to produce positive long-term outcomes for beneficiaries. This is a familiar theme in the literature surrounding the effectiveness of early childhood programs, both publicly and privately funded: while researchers are unable to explain why the academic effects of early childhood programs often fade out initially (and faster for some populations than others), the programs provide benefits in the long run with increased graduation rates and lower crime rates, among other outcomes (Deming 2009). Some authors suggest that early childhood programs instead strengthen non-cognitive outcomes, such as social skills and judgment, but the success of these claims is varied across programs (Duncan 2013). Criticisms of early childhood programs as ineffective for short-term outcomes miss the point of the original purpose of such programs: long-term outcomes are of ultimate concern to stakeholders, who often find that short-term outcomes are not indicative of the program’s success (Reynolds et al. 2008).

Terri Sabol and Lindsay Chase-Lansdale take a more uncommon approach to early childhood programs by analyzing the effect of Head Start on the parents of participants. Although they found that Head Start does not noticeably increase employment among participant's parents, they did find that parents that were randomly assigned to admit their children to Head Start attained greater increases in educational attainment when the child reached six years old than the parents in the control group (Sabol & Chase-Landsale 2014). They also offer three key hypotheses to explain why Head Start benefits parents, which may readily be generalized to other similar early childhood programs. First, parents may benefit from Head Start simply by having more time and resources to allocate attention elsewhere, such as to leisure, study or an occupation. Second, early childhood settings provide parents with a network of support. Head Start incorporates several different opportunities for parents, including leadership positions, workshops and activities for parents to meet and network, and informational resources for postsecondary educational activities (Sabol & Chase-Landsale 2014). By taking advantage of these opportunities, parents might feel more motivated or more supported in pursuing a higher degree. Lastly, the authors posit that parents may feel motivated by their child’s achievement in Head start or wish to set an example for their children participating in the program, and thus strive to achieve a higher level of educational attainment for themselves. They note further that subsidized childcare and the presence of a public school system are correlated with increases in employment for the mother. In sum, early childhood programs should not observe the performance of the child in isolation to the parent; as parent’s educational attainment is an indicator for the child’s future wellbeing, so is a child’s participation in a program such as Head Start on the parent’s behavior (Sabol & Chase-Landsale 2014).

While the above literature provides insight on the role of government spending in achievement and the benefits of Head Start for both parent and child, none directly links outcomes to government spending as it has occurred in the United States. Other widely cited pieces of literature from a range of authors in this field also typically focus on individual and family level benefits. Raj Chetty et al. find that Project STAR, a high-quality kindergarten experiment in Tennessee, resulted in higher earnings for its beneficiaries using longitudinal data from the program. Literature that details government savings is frequently demonstrated through cost-benefit analyses, such as those provided by Arthur Reynolds and Lynn Karoly, who each use such an analysis to support the conclusion that the potential in government savings through early childhood programs outweigh the cost on several different outcomes of early childhood programs.

My thesis intends to diverge from what has already been achieved to provide an empirical grounding of early childhood outcomes as they relate to historical government spending.

V. Data Description

To analyze the trends in national outcomes and early childhood data, I have procured several pieces of data, organized by inputs—what the government puts into early childhood programs—and outputs—the outcomes that I will observe. This section will review the data I will use in my analysis as well as a list of foreseeable sources of noise that will make it difficult to understand the effect of early childhood program funding on outcomes.

Input:

- CCDBG State Matches and TANF Child Care Direct Spending (2006-2013) (Source: CLASP)

- Head Start Funding and Funded Enrollment by State (2003-2013) (Source: Head Start Fact Sheet FY 2004-2014)
- Head Start Funding and Funded Enrollment by total United States (1965-2014) (Source: Head Start Fact Sheet FY 2014)

Output:

- State Poverty Rates (2007-2014) (Source: CLASP)
- National Poverty Levels and Family Poverty Rates (1959-2014) (Source: United States Census Bureau)
- Educational Attainment by State (2005-2014) (Source: United States Census Bureau)
- Educational Attainment by total United States (1940-2015) (Source: United States Census Bureau)

Two clear issues with the data I intend to use are the level of detail and the time span for state-oriented data sets. Early childhood development program spending and its related outcomes conceivably might experience a time lag. Given that existing research has emphasized that individual-level outcomes for early childhood programs often do not appear until after high school, policies put in place may take more than 18 years to show results. While federal poverty and Head Start spending data are available for a period of more than five decades, only utilizing data at a national level introduces even more noise to any effect that policy might have. Ideally, Head Start spending, CCDBG spending, and TANF spending broken down by state should extend to the inception of the programs, along with state-level poverty rates (currently available Census Data as of April 2014 does not have a time series available of state poverty levels).

Tracking data on a state level for a longer period of time would also allow a deeper analysis into why certain states do or do not respond to federal early childhood policy. Because CCDBG and TANF legislation give states relative autonomy to monitor standards for qualifying child care centers and what types of programs funds can be allocated to, detail by state could provide a more telling picture of why states and their populations might respond (or not respond) to a certain amount of funding.

The poverty rate and educational attainment rates as measures of early childhood program success have several foreseeable sources of noise. In the following table, I have divided them up into three categories based on the source of each: public or governmental factors, cultural or demographic factors, or macro-level factors that are not in either domain.

Public or government factors	Other anti-poverty programs are affecting the poverty rate
	Other education programs are affecting the educational attainment rate
	Public policy that affects local industry and residences (taxes, minimum wage, etc.)
	Availability of post-intervention resources for poor families (career centers, etc.)
Demographic or cultural factors	Immigration flow into and out of state and country affects both outcome measures
	Changing perception of education or welfare services affects welfare enrollment or educational attainment
	Changing population makeup by age affects poverty rate
Macro-level factors (Little in control of public and private spheres)	Little workforce mobility, limited local industry affects poverty rate
	Cost of education affects both outcome measures
	Economic shocks and crises affects poverty rate

Another caution when using poverty as a performance metric is that CCDBG, TANF, and Head Start are all means-tested programs, which means that participation in the program is contingent upon the participant's income or employment status. As a result, program outlays may increase as poverty increases, potentially creating a causal relationship that is difficult to extract from the effect of program spending on poverty.

VI. Data Processing

I will run linear regressions using the data described above using the statistics software R. Below are the linear models for the three sets of tests I will run: federal-level detail, long-term, with no time lag; federal-level detail, long-term, with an 18-year time lag; and a final one with state-level detail, short-term.

1. Federal, Long-Term, No Time Lag:

   Poverty Rate = $y_1 + a_1$ (HSFF) + b_1 (HSFE) + E_1

   Edu. Attainment* = $y_2 + a_2$ (HSFF) + b_2 (HSFE) + E_2

2. Federal, Long-Term, 18-Year Time Lag:

   Poverty Rate = $y_3 + a_3$ (HSFF) + b_3 (HSFE) + E_3

   Edu. Attainment* = $y_4 + a_4$ (HSFF) + b_4 (HSFE) + E_4

3. State, Short-Term:

   Poverty Rate = $y_5 + a_5$ (HSFF) + b_5 (HSFE) + c_5 (TANF) + d_5 (CCDBG) +E_5

   Edu. Attainment* = $y_6 + a_6$ (HSFF) + b_6 (HSFE) + c_6 (TANF) + d_6 (CCDBG) +E_6

Note that the first and second sets of linear regressions are essentially the same but the time lag regression will be conducted by matching input data from output data 18 years later. For example, 1965 Head Start funding data is matched with 1983 Poverty and Educational Attainment data, and the final data point will be 1996 Head Start data matched with 2014 Poverty and Educational Attainment data.

The constant terms here, y_i and E_i, delineate the y-intercept and noise component respectively. Furthermore, educational attainment here will be defined as the rate of the adult population over 25 years old that has completed at least four years of high school.

Using a linear regression will allow me to assess correlation between the inputs and outputs, but will not permit assessments about causality. Nonetheless, it will be valuable not only to see the correlations individually for the comparisons listed above, but also to compare the correlations against each other: for example, I will compare the results of linear regressions in the federal-level detail with and without a time lag against each other and compare the results against the state-level regression.

VII. Results and Analysis

Appendix A lists the regression results in detail. There are three prominent findings that I will discuss in this section:

1. A $200 million increase in federal Head Start funding is associated with a 1.08% increase in the rate of adults that have completed at least four years of high school;
2. With a time lag, a $200 million increase in Head Start funding is associated with a 1.1% increase in the rate of adults that have completed at least four years of high school;
3. With a $100 million increase in Head Start Federal Funding as allocated to states, there is an associated 2.7% decrease in the poverty rate.

The first point listed above is also associated with a remarkably low p-value that is substantially below 1%. It would be fanciful to conclude that the increase in Head Start federal funding has driven an increase in the educational attainment of the American adult population. For now, it is more worth noting that the correlation exists at all.

Interpreted in conjunction, the first two points are of particular interest. By running a regression with an 18-year time lag, I hypothesized that Head Start funding would be better correlated with outcomes after the beneficiary class was of adult age than without a time lag, which regresses the population outcomes on that current year's Head Start policy. The result is only a marginal increase of .03% in educational attainment with the time lag as opposed to without it. That an increase exists provides some validation to the hypothesis, but its diminutive magnitude may also offer insight. One interpretation leaves the slight increase solely up to chance: there are only 13 data points in the time lag regression, which is a small sample size that might result in a greater correlation coefficient than the regression without a time lag simply by coincidence—after all, both Head Start funding and educational attainment increase steadily from 1960 onwards—and that the regression does not pick up on any positive outcomes from the graduating class of Head Start that are associated with Head Start spending. Another interpretation is that the slight increase indicates that there are only some outcomes that Head Start influences that this regression is able to capture.

With that second interpretation in mind, another conclusion might be drawn from the positive correlation in the federal-level regression without the time lag. Because the increase does exist, the results could also suggest that the base rate of the increase in educational attainment is simply what occurs before outcomes begin to show 18 years after Head Start's inception. Once the first few classes of Head Start have completed at least four years of high school, the results display the small increase in educational attainment. From this perspective, the regression of Head Start funding concurrently with the educational attainment of that same year offers a comparison group against which to contrast the years in which I am able to evaluate the outcomes 18 years after the funding has occurred.

The third point is interesting in light of the lack of a similarly strong correlation in the federal, long-term regression of Head Start funding on poverty. The state-level p-value for Head Start federal funding on poverty is 0.000572, whereas the corresponding p-value for federal-level no time lag regression is 0.257. This might suggest that state-level detail is a better perspective with which to evaluate outputs as they correspond to early childhood policy. Reflecting on my reservations on using poverty as a metric because of the innumerable external influences that might affect it, a more significant correlation with state-level detail is unsurprising. Regressing Head Start against federal poverty data might mute changes in outcomes that might occur in higher-poverty areas where there is more Head Start funding. State-level detail enables the regression to account for poorer states that might receive more funding or wealthier states that might receive less, and thus increases the likelihood of observing a change in outcomes that coincides with funding.

However, similar to the caution presented in interpreting the first point of results, the decrease in poverty as it corresponds with an increase in Head Start funding requires more research to be understood. Such a correlation might arise for a number of reasons. Head Start funding and participation is also tied to funding for other anti-poverty programs, which may play a more direct role in decreasing poverty; this is particularly salient given the financial crisis in 2008, ensuing fiscal and welfare expenditures, and subsequent economic recovery. The data here also excludes 2010 funding data because the data provided by the Office of Head Start neglect to include state-level funding detail for that year. Given that 2010 was only two years after the financial crisis, this could have considerable influence on the poverty rate and its correlation with Head Start spending.

There are several other observations that the linear regressions permit. First, the direction of correlation for Head Start funded enrollment slots and outcomes is opposite to the direction of correlation for Head Start federal funding and outcomes: Head Start Funded Enrollment is often negatively correlated with educational attainment, but positively correlated with poverty. This might be because as funding increases, oftentimes the number of enrollment slots decreases. The number of funded enrollment slots is the number of slots that the federal dollars will fund; oftentimes, the number of actual enrollments is lower because of local resource capacities or participant movement into and out of the program (Kids Count 2016). Further research might explore the relationship between the ratio of federal funding and enrollment slots and outcomes, and explore why funded enrollment slots sometimes decrease with the same amount of federal funding.

A second observation is that the p-value for state-level educational attainment regression against CCDBG state match spending is 0.614, substantially higher than the p-values in the rest of the regressions, and a $1 billion increase in CCDBG state match funding is associated with a 1.5% increase in the rate of adults that have completed at least four years of high school. As a result, CCDBG state match sticks out amongst the other inputs such as Head Start and TANF funding, which have stronger correlations with outputs. There are several reasons that attempt to resolve why CCDBG state match does not have a similar correlation with outputs. First, CCDBG state match may be an inappropriate measure with which to evaluate the priority that states place on early childhood. The state match can be viewed as a requirement to obtain federal CCDBG funds, so this figure may not change over time; the state match might only change at the directive of federal CCDBG policy. A more telling metric for state policies using CCDBG funds may be the percentage of TANF funds that states choose to transfer to CCDBG. Another explanation may be that early childhood policies that do not have strong federal mandates (such as CCDBG) are more difficult to use to assess the outcomes of early childhood programs and federal legislation. The discretion that states can exercise with CCDBG is quite broad, which makes it difficult to aggregate outcomes across all states. For example, federal policy requires that the parents of families that are CCDBG recipients must be "working or in education or training programs," but the requirements for programs that meet those restrictions are decided by the state. The state can also determine certain eligibility factors. Thus, future research might explore what qualities of CCDBG state policies are correlated with immediate outcomes more directly related to the parent and family, such as rate of children that are in day care, rate of parents that are in occupational training programs, and more.

VIII. Conclusion

The research in this thesis only scratches the surface of the relationship between early childhood policy and the outcomes they hope to affect. While some important observations arose—strong correlation between Head Start spending and educational attainment, negative correlation between Head Start spending and poverty on the state level, and some insight into the differences in outcomes between CCDBG and Head Start funding—further work on the causal relationships between these policies and a whole array of other possible outcomes must be done. Research and data on early childhood from a policy standpoint is rather incomplete: data is disparate and oftentimes unavailable for longer time series and existing research only approaches macro-level effects of early childhood policy from a theory level. Early childhood programs are an important focus of antipoverty and welfare policy: while they have immense potential to resolve key issues that welfare legislation hopes to combat, their effectiveness on a large scale is often contested and inconclusive.

Appendix A: Regression results

The following section show the results in R from linear regression conducted on federal funding for Head Start and the number of enrollment slots against the outcomes three outcomes for the US population: the rate of people in families in poverty and the rate of adults older than 25 years of age that have completed at least four years of high school.

1. Federal, long-term, no time lag

1A. Rate of population that has completed at least four years of high school as predicted by Head Start

```
Call:
lm(formula = FourYrsPlus ~ HSFF + HSFE, data = x)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.11303 -0.04456 -0.01711  0.06181  0.09511 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  7.475e-01  4.013e-02  18.626  < 2e-16 ***
HSFF         5.410e-11  6.916e-12   7.822  4.7e-10 ***
HSFE        -2.668e-07  8.864e-08  -3.010  0.00419 ** 
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.06037 on 47 degrees of freedom
Multiple R-squared:  0.7572,  Adjusted R-squared:  0.7469 
F-statistic:  73.3 on 2 and 47 DF,  p-value: 3.562e-15
```

1B. Poverty as predicted by Head Start

```
Call:
lm(formula = PovFam ~ HSFF + HSFE, data = x)

Residuals:
    Min      1Q  Median      3Q     Max 
-2.2538 -1.0790  0.0077  1.0402  3.7788 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  1.062e+01  8.947e-01  11.874 9.46e-16 ***
HSFF        -1.770e-10  1.542e-10  -1.148    0.257    
HSFE         2.521e-06  1.976e-06   1.276    0.208    
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Residual standard error: 1.346 on 47 degrees of freedom
Multiple R-squared:  0.03347, Adjusted R-squared:  -0.007659
F-statistic: 0.8138 on 2 and 47 DF,  p-value: 0.4493
```

2. Federal, long-term, 18 year time lag

<u>**2A. Rate of population that has completed at least four years of high school** as predicted by Head Start</u>

```
Call:
lm(formula = FourYrsPlus ~ HSFF + HSFE, data = lag1FED)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.031711 -0.018164  0.004202  0.014320  0.028430 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  8.621e-01  1.265e-02  68.123  < 2e-16 ***
HSFF         5.563e-11  4.105e-12  13.550 4.48e-14 ***
HSFE        -2.052e-07  2.842e-08  -7.222 5.95e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.0183 on 29 degrees of freedom
Multiple R-squared:  0.8641,  Adjusted R-squared:  0.8547 
F-statistic: 92.17 on 2 and 29 DF,  p-value: 2.71e-13
```

<u>**2B. Poverty** as predicted by Head Start</u>

```
Call:
lm(formula = PovFam ~ HSFF + HSFE, data = lag1FED)

Residuals:
     Min       1Q   Median       3Q      Max 
-1.95321 -0.80903 -0.07616  0.70556  2.12714 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  1.024e+01  7.493e-01  13.670 3.59e-14 ***
HSFF        -1.864e-10  2.431e-10  -0.767   0.4494    
HSFE         3.739e-06  1.683e-06   2.222   0.0342 *  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.084 on 29 degrees of freedom
Multiple R-squared:  0.1563,  Adjusted R-squared:  0.09807 
F-statistic: 2.685 on 2 and 29 DF,  p-value: 0.08512
```

3. State, short-term

3A. Rate of population of high school graduates as predicted by inputs

```
Call:
lm(formula = HighSchoola ~ HSFFa + HSFEa + CCDBGStatea + TANFa,
    data = states_x)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.062865 -0.025695  0.007128  0.022720  0.053789 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  8.839e-01  2.178e-03 405.823  < 2e-16 ***
HSFFa        2.777e-10  7.427e-11   3.739 0.000216 ***
HSFEa       -3.491e-06  5.961e-07  -5.856 1.09e-08 ***
CCDBGStatea  1.569e-11  3.113e-11   0.504 0.614539    
TANFa        1.405e-10  3.243e-11   4.333 1.92e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.02918 on 352 degrees of freedom
  (153 observations deleted due to missingness)
Multiple R-squared:  0.3144,  Adjusted R-squared:  0.3067 
F-statistic: 40.36 on 4 and 352 DF,  p-value: < 2.2e-16
```

3B. Poverty as predicted by inputs

```
Call:
lm(formula = Pova ~ HSFFa + HSFEa + CCDBGStatea + TANFa, data =
states_x)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.05780 -0.02246 -0.00448  0.01967  0.08464 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  1.276e-01  2.260e-03  56.465  < 2e-16 ***
HSFFa       -2.679e-10  7.705e-11  -3.476 0.000572 ***
HSFEa        3.159e-06  6.184e-07   5.107 5.36e-07 ***
CCDBGStatea -1.161e-10  3.230e-11  -3.596 0.000370 ***
TANFa       -9.651e-11  3.364e-11  -2.869 0.004369 ** 
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.03027 on 352 degrees of freedom
  (153 observations deleted due to missingness)
Multiple R-squared:  0.1915,  Adjusted R-squared:  0.1823 
F-statistic: 20.84 on 4 and 352 DF,  p-value: 1.979e-15
```

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