Do Educational Investments Affect Aggregate Earnings and Employment?

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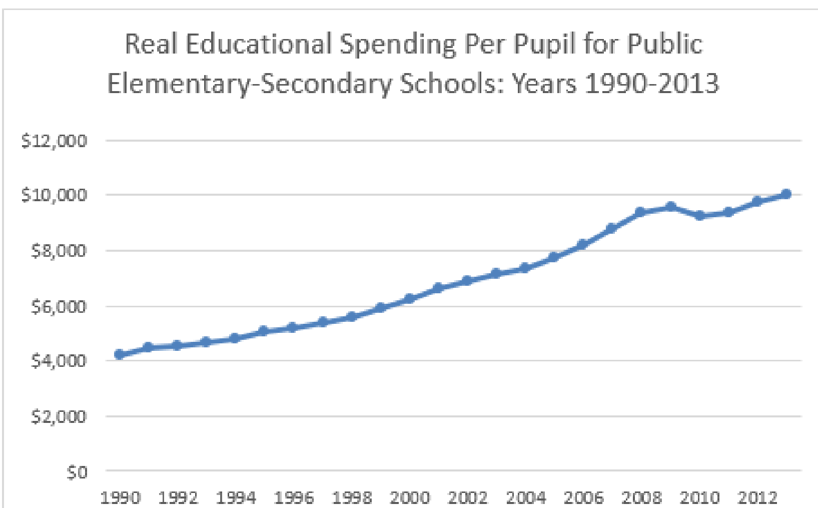
This paper examines the impact of state-level educational investments in public education on aggregate state labor markets, specifically earnings and employment. Using data on K-12 educational spending, 8th grade cognitive test scores, and educational demographics of a state's labor force, I observe whether these state-level investments are set so that the lifetime benefits of these investments are greater than the cost. Taking interstate migration into account, I separate the benefits from educational investment into benefits due to own-state investment and benefits due to other-state investment. By doing so I am able to identify whether or not educational investment spillovers exist between states. The preliminary results indicate that the earnings benefits associated with test scores and K-12 educational spending spill over into other states. Results also show that 8th grade NAEP test scores do not spillover onto other state's earnings.

1 Introduction

Historically, K-12 educational spending was largely funded by local governments.[1] However, in the 1970's state government contributions for education started to meet and some years even surpass contributions of local governments for educational spending. In fact, in 2014, state governments funded approximately 46% of total educational spending, while local governments funded approximately 45%.[2] At the same time, state-level earnings have also increased overtime. States having more control over policies affecting education naturally offer motivation to examine educational investments and their effects at the state level.

In Figure 1 below, the trend in K-12 educational spending per pupil in 2015 dollars shows it is obvious that educational spending has increased overtime since 1990. Although spending has persistently increased, spending across states varies dramatically. In 2014, current educational spending per pupil in the U.S. averaged $11,009, but that averaged covered a wide variation across states, ranging from $6,500 in Utah to $20,610 in New York.[3]

Figure 1: Real Educational Spending



Part of this variation in spending across states is obviously due to differences in costs of living as well as how state economies responded to the recession–many states are still spending less on

[1]Source: Federal Education Budget Project (2014).
[2]Source: U.S. Census Bureau, 2014 Annual Survey of School System Finances.
[3]Source: U.S. Census Bureau, 2014 Annual Survey of School System Finances.

education than before the recession.[4] The variation in educational spending across states can also be attributed to political differences. Some states invest more in education and some states invest less. At the same time, states also choose if and how they target funds to districts with low-income families who have a lower ability to raise funds through property taxes compared to their wealthier counterparts. Naturally, these differences across states lead to questions of how returns to education vary across states. States having more control over policies affecting education offer motivation to examine educational investments and their effects at the state level.

As educational funding budgets and reform continue to cause controversial debates within the U.S., determining the presence and impact of educational spending spillovers as well as the potential benefits of educational spending, in terms of future earnings and employment growth, is an important task. Although the amount of funds the government allocates to education does not necessarily measure the quality of that education or determine student performance[5], knowing the relationship between the amount of funds allocated to education and the resulting labor market outcomes could be useful when making future policy decisions.

It has been shown that better educated individuals have greater earnings and employment potential (Becker 1964). From 2002 Household Income and Expenditure Survey data, Figure 2 and Figure 3 below show employment rates and mean wages by educational attainment. It is easy to see that higher wages and employment result from increased education.

A primary outcome of education for the individual receiving the education is their increased productivity. Workers with advanced knowledge and skills who are able to work more efficiently benefit by receiving a higher salary. These skilled workers also tend to cause worker-to-worker spillovers that result in increases in other employees' productivity as well.[6] In addition, the state in which these skilled employees live, also benefits by being more attractive for firms to locate in.

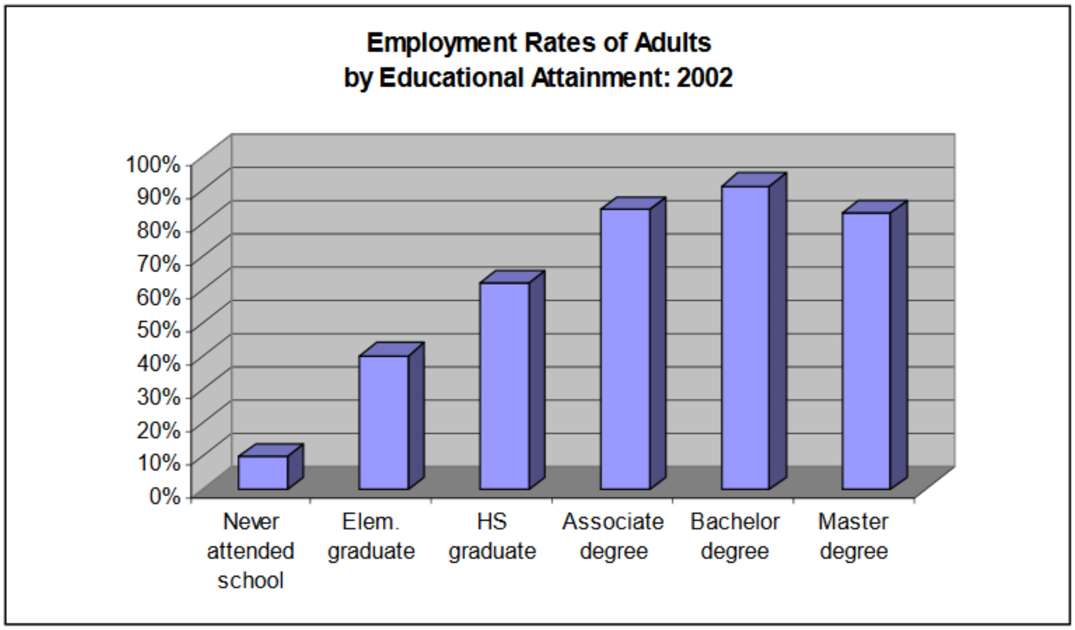
While education is provided and primarily funded at the state and local level, extensive migration makes it likely that states that benefit from the education of their workforce are not the same that fund this education. Better schools and better education not only lead to a stronger more skilled labor force, but can also attract skilled laborers from other areas who are looking for a sound education for their children. Through labor migration, skills and knowledge acquired in one state

[4] As of December 2015, The Center on Budget and Policy Priorities reported 25 states were currently funding K-12 education as levels lower than in 2008.

[5] Hanushek(1981)

[6] Gruber(2011), Mashall(1890), Lucas(1988), and Moretti(2004) all contribute to these findings.

Figure 2: Employment Rates by Educational Attainment

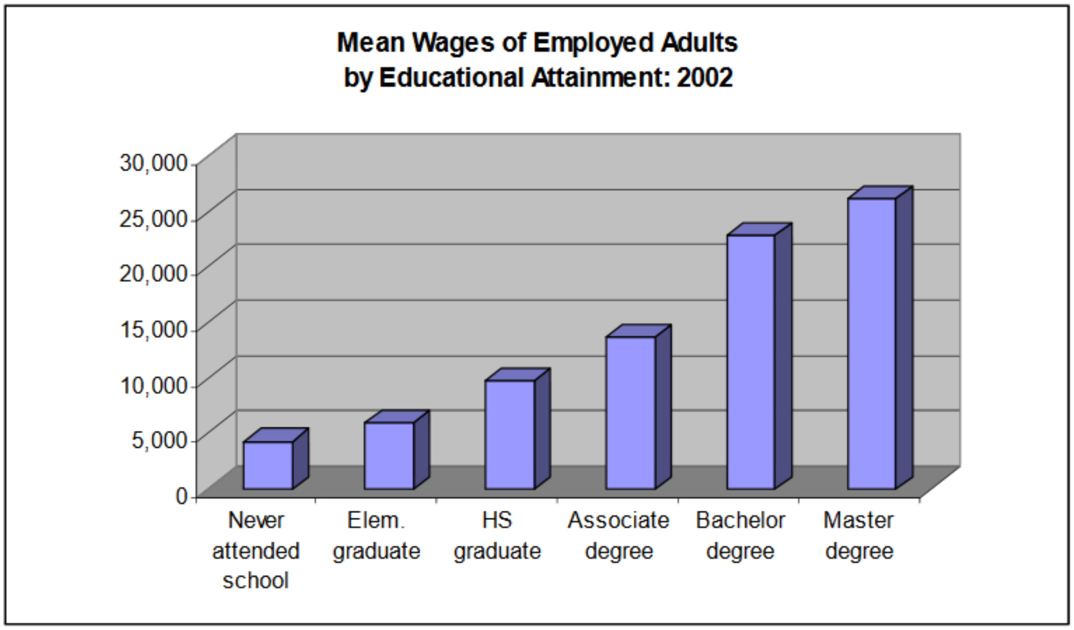


cross state borders and are used in another state. When this occurs, an educational investment spillover has taken place. The first state bears the cost of education, while the second state receives the future benefits.

In this investigation, the benefits associated with educational investments are examined through aggregate future earnings[7] and employment growth. More specifically, this paper evaluates the existence of educational investment spillovers on labor market outcomes across state borders. While there is an extensive literature examining the relationship between educational attainment for individuals and their labor market outcomes, there is much less evidence on how educational investment within a state affects future aggregate employment and earnings within that state, presumably a motivation for state-support of both K-12 and higher education. Examination at the aggregate state level allows for the inclusion of educational externalities affecting overall productivity (Moretti (2004)) and offers evidence about whether states appear to be providing education at levels consistent with maximizing future employment and earnings. My strategy involves disaggregating educational investments into four different measures weighted by migration, to more accurately measure the educational investments of each state. Doing this allows the benefits from educational investments

[7]In this paper, earnings refer to earnings per employed persons.

Figure 3: Mean Wages by Educational Attainment



to be identified as a result from one's own state investment or from another state. Results suggest that educational investment spillovers do exist between states. Educational spending increases of $1,000 in one state imply a 0.45% increase in earnings growth in any other state. Breaking down the results for each individual state, Alaska and Utah appear to gain the most benefit from other state's educational investment, while Florida, New York, Pennsylvania, and Rhode Island appear to gain the least. Overall, the results also indicate that the total lifetime benefits associated with educational spending are less than the total cost.

Past research including Berger and Fisher (2013), Fisher and French (2009), and Bauer et al. (2006) measure the private returns to education and have shown that higher educational attainment leads to higher median wages. By examining state-level data, Berger and Fisher report that by investing in education and therefore increasing the number of well-educated workers in a state, states can increase the strength of their economies. Fisher and French also find that more educated individuals are more likely to participate and to succeed in the job market. Using state-level data for 1939-2004, Bauer at al. conclude that the main factors contributing to per capita income growth are a states high school and college attainment rates as well as its stock of patents. In addition, Moretti (2004) provides evidence to support the claim that more educated individuals increase the wages of less-educated individuals, proposing that educational externalities exist. Moretti concludes that a one percentage point increase in the supply of college graduates raises college graduates wages by 0.4%, wages of high school graduates by 1.6%, and wages of high school drop-outs by 1.9%. It is important to investigate the returns to schooling at a broader, overall state level because the social returns to education are more than just the sum of the individual returns; because there are external returns playing a part as well (Moretti 2004).

In contrast to previous studies that use the level of educational attainment to measure the impacts of educational resources on individuals, I examine the impacts of both educational spending and educational achievement on state-level earnings and employment growth. In addition to examining the effects of different educational investments, I develop a simple theoretical model that allows me to estimate the relationship between state-level investments and future earnings. Determining the potential effect of educational investments on lifetime benefits can provide important policy implications as well as provide insights as to what factors impact future earnings and employment. For example, if educational funding is provided at an insufficient level, human capital is underinvested and as a result, economic growth and improvements in social welfare would be slower than they otherwise could be (McMahon 1997).

I estimate this model using a 43-year panel from 1972-2014 using state-level data including measures of education achievement (lagged 8th grade NAEP math test scores) and (lagged) educational spending to investigate the impact of education on growth of earnings and employment in states. My empirical approach follows a first differenced dynamic panel data model and the results of this estimation provide a clearer view of the impact of education provided within a state on that state's economic performance as well as the economic performance across state borders. The high degree of interstate mobility of U.S. residents necessitates a measure to account for those in the state workforce who did not receive their education there. Using state of birth as a proxy for where K-12 education was received, I implement a birthplace-weighted matrix that allows educational investments to be more accurately measured. However, the estimates for earnings and employment that I find may in fact be under- or overestimating the actual benefits of this state's level of educational support.

It is important to determine whether the relationship found between education and economic outcomes is a causal one that can support future policy decisions. For educational investment and returns to earnings, reverse causality is a possibility – as incomes increase people may be willing to invest more on their children's education. To avoid incorrectly identifying the relationship between education and economic outcomes, I use a ten-year lag on all education variables. Reverse causality issues are reduced as the income earned from this investment in education occurs ten years later. The remainder of this paper is organized as follows. Section II provides a literature review and discusses the most relevant papers supporting my investigation. Section III presents the model and its theoretical background. Section IV includes a description of the data and empirical methodology, while Section V discusses my results. Finally, Section VI addresses caveats, discusses contributions, offers extensions for future work, and concludes the paper.

2 Literature Review

While there exists a vast literature on the economics of education related to this study, I focus on two areas of particular relevance: the literatures on educational spillovers and returns to education.

2.1 Evidence of Spillovers from Education

Weisbrod (1964, 1965) examine how local school expenditures benefit other communities through the migration of educated people and find some evidence that communities with high rates of out-migration have lower school expenditures. Case et al. (1993) further expose channels in which educational expenditures can affect those across state borders using state-level data spanning 1970-1985. Although Case et al. mainly focus on expenditure reaction functions, the authors offer reasoning behind the existence of spillovers. Obviously those who receive education in one state and then move to another state to work, create one route for investments in education to cross state borders. In addition, well-educated workers in one state who received education there increase competition with workers in other states through firm outputs. The authors also suggest that educational expenditures of one state may have the most effect on labor markets of states with similar economic or demographic characteristics. This paper proposes that expenditures of neighboring governments are an important determinant of state and local government expenditures.

Moretti (2004) investigates the social returns to higher education at the city level by comparing wages of similar individuals living in areas with different shares of college educated workers in the labor force. OLS estimates show a positive relationship between a citys share of college graduates and wages, but testing potential biases due to omitted variables is needed. Using data from the National Longitudinal Survey of Youths (NLSY) for 1979-1994 and the 1980, 1990 Census, Moretti shows that omitted individual and city-specific characteristics are not a major source of bias. Moretti concludes that as the supply of college graduates increases in a city, wages for high school dropouts, high school graduates, and college graduates increase. This finding indicates that there is a spillover of benefits occurring between more educated people and others around them. Morettis work advances past research such as Lucas (1988) and Marshall (1890), which argue that positive externalities from education may be generated across workers through the sharing of knowledge and skills. In addition, Romer (1986, 1992) also acknowledge that externalities from education may exist when outputs from that education become public goods that spill over into the economy.

2.2 Returns to Education

There is an extensive literature that focuses on the returns to education at the individual level using micro-data. For example, Ashenfelter and Rouse (1998) and Arias and McMahon (2001) are two studies that offer estimates for the educational returns to the individual. Ashenfelter and Rouse (1998) use identical twins surveyed between 1991 and 1993 to measure the returns to schooling for the individual. They find that for the wage rates of twins, each additional year of schooling leads to an average return of 9% for genetically identical individuals. Using micro-data from 1967-1995, Arias and McMahon (2001) find slightly higher average dynamic rates of return to total financial assets for college educated males and females of 11.7%.

While there is an extensive literature examining the relationship between educational attainment for individuals and their private labor market outcomes, there is much less evidence on how educational spending within a state affects aggregate economic factors. After all, the estimates for private returns to education may in fact be underestimating the full returns to education if education exhibits characteristics of a public good or generates positive externalities. For this investigation, I focus on educational returns based on aggregate state measures.

Curs et. al (2011) investigates funding for higher education and how the level of privatization in this education system affects U.S. state economic growth. Using state-level data spanning from 1975-2005, the authors employ Arellano-Bond estimation techniques that offer empirical guidance. To account for the fact that education is an investment over many years, in their model, the authors use five year averages of past education expenditures to measure the effect of this spending on per-capita income growth. They find that states with large public shares of higher education experience a positive relationship between funding and per-capita income growth. In contrast, states with large shares of private higher education have a negative relationship between funding and economic growth. Although their work is mainly focused on higher education, the authors also find positive returns to K-12 education expenditures on per-capita income growth.

Most closely related to this study is Hanushek et al. (2015). This paper, examines how school quality is related to state income growth using newly-formed measures of human capital that focus on cognitive skills rather than years of schooling. Due to the high mobility of U.S. residents, migration rates are incorporated into their human capital measures that allow for more accurate measure of the effects of educational achievement on incomes. By analyzing a range of feasible educational quality reforms, they discover significant state-level economic returns.

In addition, Hanushek et al. (2015) describes how policies of one state could have major implications for other states due to outmigration. If only one state chooses to reform education, benefits to this state may be very low if the educated workers then move to another state and take their higher quality education with them. However, if all states reform in similar ways, then any educated worker who leaves the state in which they were educated, would potentially be replaced by another equally educated worker migrating from another state. The authors suggest that economic outcomes vary dramatically by state depending on that particular states rate of outmigration. In essence, the states with high rates of outmigration would suffer the most and could subsequently lose the desire to invest more in education if they are not receiving much benefit. Because of this finding, it is much more beneficial for all states to reform education policies instead of just a few. Many states pushing for reform could motivate federal policy in the future.

While there is a vast literature examining the relationship between educational attainment for individuals and their labor market outcomes, there is much less evidence on how educational investments within a state affect future aggregate employment and earnings within that state as well as outside of that state, presumably due to the existence of educational investment spillovers.

My research differs from previous studies in various ways. First, my data spans from 1972 to 2014, which is a longer timeframe and is more recent than other studies. Second, my data is aggregated to the state level for different reasons. Spillovers from investments in education are shown to exist and by using state-level data, I am able to account for school district spillovers as a whole. I am also able to capture and quantify the effect of spillovers across state lines. My research also differs from past studies in that not only am I examining the impact of educational investment on earnings and employment growth, but I am also using a balanced-budget framework which allows me to compare the total cost of education to the investments devoted to education and the resulting future lifetime earnings benefits.

As Hanushek et al. (2015) points out, much of the previous education literature does not provide a practical way of calculating the benefits from education and in fact can distort both calculations of cost and benefits. Following the authors' procedure, I implement a similar birthplace matrix to more accurately measure state education spending and student achievement. Through my investigation, I offer a more viable way to calculate these economic benefits by incorporating birthplace rates as well as present value discounting methods. By taking interstate migration into account, I separate and identify the educational investment benefits due to own-state investment and benefits due to other-state investment.

3 Structure and Model

To study the implications of education, analyzing its effect on earnings and employment through a theoretical model is necessary. To determine the relationship between education and labor market outcomes, I follow Harden and Hoyt (2003) examination of how balanced-budget changes in the tax structure affect labor markets allowing for firm and labor mobility.

Here I model the government's problem of maximizing future social welfare (total income), of its constituents by choosing current education and taxes. Consider a simple two-period model in which education in a state is chosen to maximize the net incomes of the current generation (t=0) and the discounted income of their children. Let there be two states, A and B. Then assume that the wages of the future generation (t=1) depend on the education they receive and the education received by co-workers in the other state. Children in period 0 may be employed in state A or B as adults. Then, the problem in state A at time 0 is:

$$\max_{E_0^A} -E_0^A + \beta \left(w_1^{AA} \left(E_0^A, E_0^B \times \frac{L_1^{BA}}{L_1^{AA}} \right) \right) + \beta \left(w_1^{BA} \left(E_0^B, E_0^A \times \frac{L_1^{AA}}{L_1^{BA}} \right) \right) \tag{1}$$

where E_t^i is the level of educational expenditures per pupil in state i in year t, L_t^{ij} is the number of workers educated in state i working in state j at time t, and w_t^{ij} is the wage of workers educated in state i working in state j at time t.[8]

[8]Additional information of the model setup can be found in Appendix A.

The first order condition is then:

$$-1 + \beta \left(\frac{\delta w_1^{AA}}{\delta E_0^A} + \frac{\delta w_1^{BA}}{\delta E_0^A} \times \frac{L_1^{AA}}{L_1^{BA}} \right) = 0 \tag{2}$$

And upon expanding the above equation to include those who were educated in state 2, the socially optimal investment in education satisfies the condition:

$$-1 + \beta \left(\frac{\delta w_1^{AA}}{\delta E_0^A} + \frac{\delta w_1^{BA}}{\delta E_0^A} \times \frac{L_1^{AA}}{L_1^{BA}} + \frac{\delta w_1^{BB}}{\delta E_0^B} + \frac{\delta w_1^{AB}}{\delta E_0^B} \times \frac{L_1^{BB}}{L_1^{AB}} \right) \tag{3}$$

where it is obvious that the residents in state A ignore any impact that education of their children have on the wages earned by those working in either state A or B who, as children, received their education in state B. This relationship can be seen through the fact that terms (a) and (b) of the above equation are independent of terms (c) and (d).

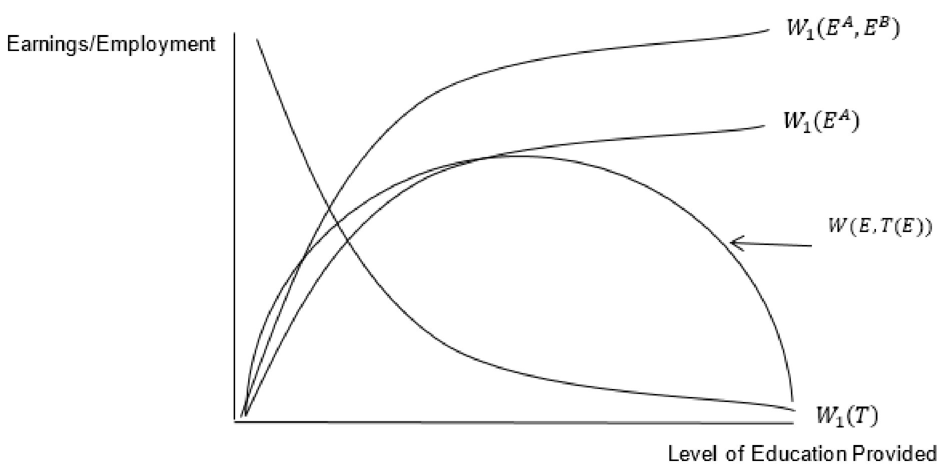
Finally, the impact of education in a state on labor earnings, β, is estimated by:

$$\frac{\delta w_1^{AA}}{\delta E_0^A} + \frac{\delta w_1^{BA}}{\delta E_0^A} \times \frac{L_1^{AA}}{L_1^{BA}} \tag{4}$$

where only earnings of those working in the state matter. Now, the equation for the relationship between wages, birthplace, and education has been derived. Below, I illustrate this theoretical model and explain how I will use this model in conjunction with my empirical model to estimate the returns to education in a state.

Using this framework, I employ empirical tests to determine whether these state-level investments are set so that the lifetime benefits of these investments are greater than the cost. Using Brueckner (1982) as a guide, if the effect from education on earnings and employment is positive, the government could be underproviding education. In figure **??**, I illustrate the relationship between educational spending and earnings, assuming diminishing returns to education. Also illustrated is when a positive coefficient is estimated, we think of the level of education provided by the government as being in the positively sloped area of the quadratic function. Adapting the work of Brueckner, being in this area would indicate that the level of education is below the maximizing level of education because this coefficient represents the partial derivative, or slope, of this relationship. Using the same logic, if the effect is a negative value, the government could be overproviding education. Lastly, if the coefficient is approximately zero, the government may be choosing a level of education in which benefits are equal to the cost. The first wage function, which is downward sloping, represents how wages decrease to offset an increase in taxes or how employment would decrease with an increase in taxes, as education is held constant. The next wage functions which are upward sloping show how education has diminishing marginal returns. The lower upward sloping curve represents how the wages of state A respond to the education of state A. The upper upward sloping curve illustrates state A's earnings or employment levels of the current labor force who were education in state A and educated in state B. Then, at the point where the quadratic function is maximized, the slopes of the two wage functions are opposite in sign, but equal in magnitude, as shown by Figure **??** below. The summation of these two slopes equal zero, as formulated by the theoretical modeling of equation (3).

Figure 4: Educational Returns



4 Data

To examine the effects of education on these aggregate factors, I employ a 43-year panel from 1972-2014 of state-level data for the 50 U.S. states.[9] This panel includes publicly available data from various sources measuring incomes, expenditures, and K-12 education characteristics. From the U.S. Bureau of Economic Analysis (BEA), I obtain my two primary variables of interest, annual earnings

[9]The District of Columbia is omitted due to missing data.

by place of work[10] and the annual employment level, as well as total annual state population.[11] Following Curs et al. (2011), I also collect other types of state and local government expenditures and industry shares of annual state GDP from the BEA. From the U.S. Census Bureau, I collect labor force demographics (gender, race, educational attainment). Public K-12 education data are obtained from the National Center for Education Statistics (NCES) and the Annual Digest of Education Statistics and include state and local current expenditures per pupil and total enrollment levels recorded at an annual frequency under the spring of the academic year.[12] Total current expenditures per pupil collected at the state level include all funds originating from the federal, state, and local governments. To accurately capture state-to-state spillovers in this analysis, I use only the state and local expenditures per student.[13] I collect total higher educational funding and enrollment levels for public institutions from the Annual Digest of Education Statistics and use this total to calculate higher public education spending per student.[14] I also calculate the college enrollment rate by dividing the enrollment level by the state population. All data are adjusted for inflation and expressed in 2015 dollars. Summary statistics of data values are shown below in Table 1.

Because of the high mobility of U.S residents among states, migration rates must be accounted for when measuring educational investments. For example, the workforce in the state of Kentucky is not only made up of individuals educated there, but also those educated in any other state who then migrated to Kentucky. For this reason, I use place of birth as a proxy to most accurately measure where a state resident received their elementary and secondary education.[15] Following the Hanushek et al. (2015) weighted average migration matrix, I use a weighted average birthplace matrix to measure the appropriate amount of education invested in each state's current workforce. Using 1970 Census IPUMS, this state-by-state migration matrix contains birthplace totals for 1% of the 1970 population for each state. I then calculate the percentage born in each state and in every other state for those not born in their current state of residence. Doing this for the entire U.S. gives me a 50x50 matrix that I then use to more accurately weight the educational investment and educational achievement of each state. Figure **??** below depicts the percentage of the 1970 population who were born in their current state of residence. A full list of state percentages in 1970

[10]Earnings are the sum of wages and salaries, supplements to wages and salaries, and proprietors' income.

[11]I then calculate growth rates for earnings and employment using: $(Y_t - Y_{t-1}/Y_{t-1})$

[12]For example, academic year 1980-1981 is recorded under the year 1981.

[13]Federal revenues are subtracted from the total current expenditures per pupil, so expenditures per pupil are only from state and local sources. Federal revenues are also collected from the NCES and Annual Digest of Education Statistics.

[14]Total higher education funding includes funding from Federal, State, and Local governments.

[15]Follows Card and Krueger (1992). In the United States, 86% of children aged 0-14 live in their state of birth.

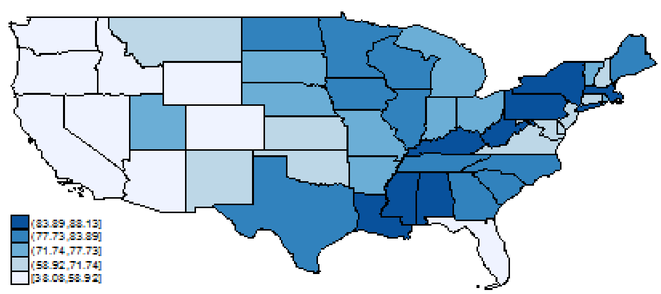
Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Earnings Growth	0.01	0.02	−0.14	0.14
Employment Growth	0.01	0.02	−0.06	0.10
Non-weighted Educ Spending L10	3.68	2.25	0.43	12.67
K-12 Enrollment Rate L10	0.18	0.03	0.13	0.27
College Enrollment Rate L10	0.05	0.01	0.03	0.08
College Exp. L10	12.53	3.34	3.45	26.12
% of population born in current state of residence	0.72	0.13	0.38	0.88
Tax per capita L2	1.63	0.89	0.29	12.70
Non-weighted NAEP test score L10	270.00	12.00	219.00	291.00
State Own revenue as a percentage of GSP Lag10	0.12	0.03	0.00	0.47
Other government expenditure as a % of GSP Lag10	0.12	0.03	0.00	0.57
Agriculture as a % of GSP (contemporaneous)	0.02	0.02	0.00	0.15
Manufacturing as a % of GSP (contemporaneous)	0.15	0.07	0.02	0.34
% of Adults (25+ years) with a highschool diploma	0.32	0.04	0.20	0.43
% of Adults (25+ years) with some college (1-3 years)	0.22	0.07	0.08	0.37
% of Adults (25+ years) with college (4+ years)	0.32	0.05	0.08	0.36

Note: N=1,650. Statistics are for 50 states from 1982-2014 and are in 2015 dollars. Earnings, Education Exp, College Exp, and Taxes are measured in per capita/per pupil terms. Earnings are measured in dollars. Education Exp, College Exp, and Taxes are measured in 1000s of dollars. Educational attainment values are measured as highest attainment achieved.

as well as in 2010 can be found in the Appendix.

Figure 5: Educational Returns



Using this birthplace rate matrix in different weighting calculations gives me with four different measures of educational investment to be used in estimation. These different measurements are weighted for interstate migration in the following ways: unweighted for migration, weighted-average based on migration, own-state weighted by only those who were educated and now work in the same state, and other-state weighted by migration of those who were educated in a state other than where they now work. Shown below are the calculations for these educational investment measures where f_{ji} is the fraction of the population who were born in state j and now live and work in state i and

E_j is the educational investment of state j.

Weighted Average Education (AE):

$$AE_i = \Sigma_{j=1}^{50} f_{ji} E_j \tag{5}$$

Own-State Education (OE):

$$OE_i = f_i E_i \tag{6}$$

Other-State Education (RE):

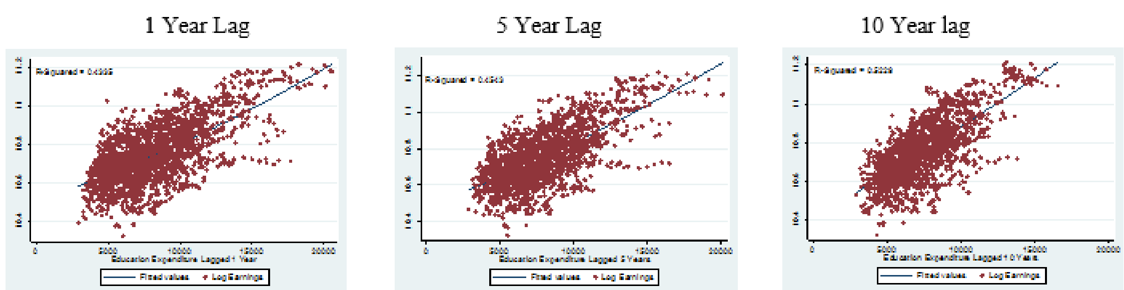
$$RE_i = \frac{\Sigma_{i=1}^{49} f_i E_i}{(1 - f_{j \neq i})} \tag{7}$$

By applying the four different variations of educational investments in estimation, I am able to identify the separate labor market benefits due to own-state educational investment and the investments of other states.

4.1 Trends in Data

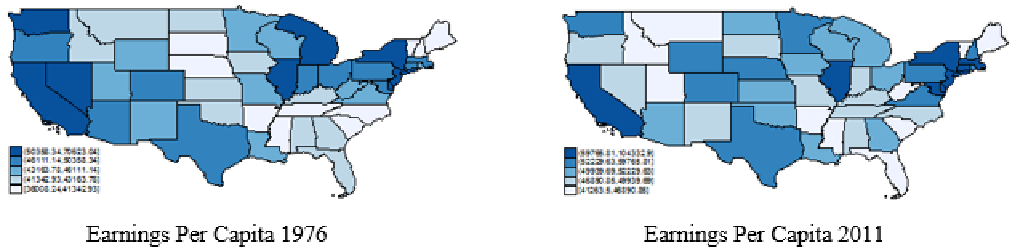
To evaluate the impacts of educational investment on future earnings, it is important to note the trends in educational spending as well as earnings. Figure **??** below illustrates the relationship between the log of earnings and different lags of educational spending for years of data. Across all lag options the relationship between earnings and education expenditures appears to be positive.

Figure 6: Earnings and Lagged Education Expenditures



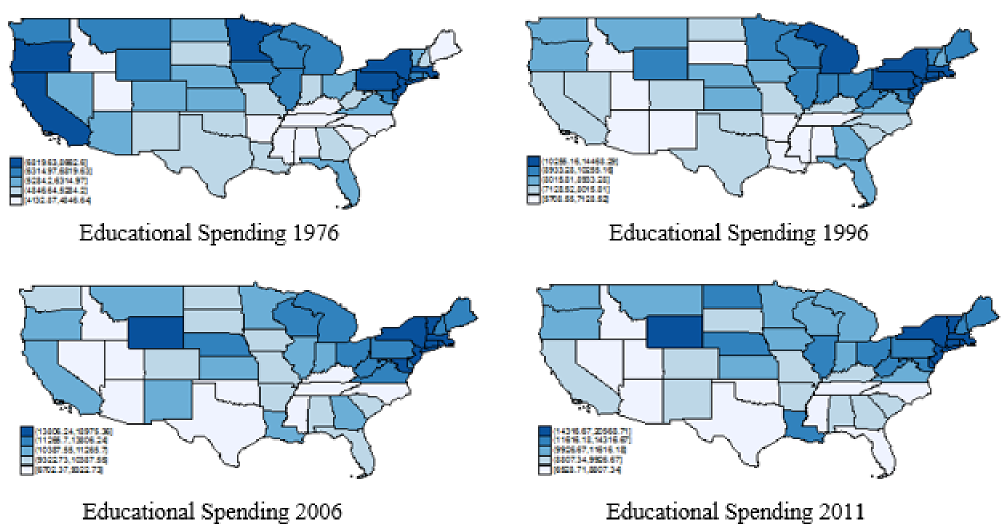
To give some perspective of the differences in K-12 educational spending and earnings across states, Figure **??** and Figure **??** below map earnings and spending patterns across states. All values are shown in 2015 dollars. Earnings for years 1969 and 2014 are shown below in Figure **??**. Although many states' earnings level change, some states are consistently at the higher end of the earnings spectrum, such as California and New York, while other states are consistently at the lower end, such as Mississippi and Alabama.

Figure 7: Earnings (of labor force)



Educational spending per pupil in years 1970, 1985, 2000, and 2013 are shown in Figure **??** below. The maps show areas with consistently high educational spending in states such as Wyoming and multiple Northeastern states. The maps also show areas of consistently low educational spending in states such as Utah, Arkansas, Mississippi, and Tennessee. It is important to notice that just because a state has lower earnings than another state, does not mean that the state spends less on educational expenditures, and vice versa.

Figure 8: Educational Spending Per Pupil



5 Empirical Methodology

Rather than simply focus on quantifying the impact of education on earnings, I determine if, in fact, the level of educational investment chosen in a state is set so that the lifetime benefits of these investments are greater than the cost. I also evaluate whether educational investments extend passed state borders. To test these hypotheses, a dynamic panel data model is formulated as:

$$Y_{it} = \theta Y_{it-1} + \alpha E_{it-10} + \eta EK_{it-10} + \beta X_{it} + \gamma_i + \mu_t + \upsilon_{it} \tag{8}$$

where Y_{it} is earnings growth, Y_{it-1} is earnings growth lagged one year, E_{it-10} is a variety of educational investments lagged ten years, EK_{it-10} is an interaction term for educational spending and K-12 enrollment rates lagged ten years, X_{it} is a vector containing other state-level variables and controls such as other types of government expenditures and industry shares of annual state GDP, γ_i are state fixed effects, and μ_t are year fixed effects.[16] The educational investments used in the model above include cognitive measures of student achievement through 8th grade NAEP math test scores and the level of educational spending per pupil.

When estimating this baseline model, I instrument using Arellano Bond techniques as done by Curs et al. (2011):

$$\Delta(Y_{it}) = \theta\Delta(Y_{it-1}) + \alpha\Delta E_{it-10} + \eta\Delta EK_{it-10} + \beta\Delta X_{it} + \Delta\mu_t + \Delta\upsilon_{it} \tag{9}$$

I estimate this model with two-step system GMM. and by following this procedure, I obtain efficient estimates (Arellano and Bond (1991)). By implementing a dynamic panel data model in first differences, I mitigate issues of unobserved heterogeneity and autocorrelation while avoiding inconsistent estimates due to estimating a model with both a lagged dependent variable and fixed effects (Baum 2006). The use of the ten-year lag on educational investment was selected based on both theory and through inspection of the Bayesian information criterion (BIC) for multiple lag options. Theory suggests that because investments, such as those in education, can take many years to impact economic factors and because current educational investments might only affect those who are currently in school, values of educational investment should be lagged a significant number of

[16] The covariates were chosen because they are potential factors that affect the productivity of labor in addition to the level of education. Variables focusing on the determination of education spending were left out.

years in this model.[17] When examining multiple year lag options, the ten-year lag on educational investment minimized the value of the BIC compared to other lags between one year and fifteen years.[18] For this earnings regression, the difference in values of the BIC with the ten-year lag versus other year lags shows some evidence to use the ten-year lag for educational investment. However, theory and data concerns mostly drive the use of a ten-year lag for this investigation.

The baseline empirical model of Equation (5) is modified to capture the educational investment effects on state employment as:

$$M_{it} = \theta M_{it-1} + \alpha E_{it-10} + \eta EK_{it-10} + \beta X_{it} + \gamma_i + \mu_t + \upsilon_{it} \tag{10}$$

where M_{it} is total employment growth, $M_{it-1}$is total employment growth lagged one year, and all other variables are defined as above in Equation (5). When empirically solving this model, all variables are first differenced as shown by Equation (8) below. Again, for the choice of the value of the lagged educational investment, theory and comparison of the BIC values for multiple lag options shows the ten-year lag minimizes the BIC.

$$\Delta(M_{it}) = \theta\Delta(M_{it-1}) + \alpha\Delta E_{it-10} + \eta\Delta EK_{it-10} + \beta\Delta X_{it} + \Delta\mu_t + \Delta\upsilon_{it} \tag{11}$$

6 Results

Results from my preferred specification are reported in Table 2. The four different weighted measures of educational spending are included in this table and show similar relationships to earnings growth. Educational expenditures, unweighted, average-weighted, own-weighted, and other-weighted, lagged ten years are negative and statistically significant at the 1% level. This implies that as educational expenditures in a state increased, the additional funds caused a decrease in earnings growth ten years in the future. This appears to be the case regardless of whether or not this educational spending occurred in the same state of birth and state of current residence. The coefficient on other-weighted educational spending is -0.016 whereas the coefficient on own-weighted educational spending is only -0.015.

[17]In the Curs et al. (2011) income growth regression, the average of the previous five years of higher education expenditures is used to account for this investment over many years.

[18]Schwarz(1978) introduced the BIC to be used with descriptive models in comparison to the Akaike information criterion (AIC) which is used for predictive models.

In addition, the interaction term of educational spending and the K-12 enrollment rate is positive and statistically significant at the 1% level. This interaction term allows the effect of K-12 educational expenditure on earnings growth to vary based on K-12 enrollment rates. The positive coefficient indicates that as K-12 enrollment increases within a state the relationship between educational spending and earnings growth increases. For example, the coefficient on the interaction of K-12 enrollment rate and other-weighted educational spending is 0.108. This value indicates that as K-12 enrollment rates increase, educational spending increases of $1,000 imply a 10.8% increase in earnings growth ten years in the future. This impact is driven entirely by the K-12 enrollment rate.

From these results, I evaluate the impact of educational spending using the coefficients associated with education and evaluating at the mean. The values of the total differential evaluated at the mean are reported at the bottom of Table 2.

To calculate the present value of benefits for each specification and state, the total differential at the mean is then multiplied by the mean of earnings.[19] To determine the benefits of this educational spending in terms of future lifetime earnings, this value is then discounted for 40 years. Proper discounting is done using a 3% discount rate, as is standard.[20]

This final value gives the appropriately discounted present value of the benefits from educational spending. The discounted future earnings benefits of the weighted-average educational spending per additional $1,000 is $1,037. The future earnings benefits associated with other-weighted educational spending per additional $1,000 is $5,270.

Next, I determine if educational spending is set so that the future lifetime earnings benefits are greater than the cost. Applying a $1,000 increase per pupil per year for grades K-12 assumes that the total amount spent on education is $12,000 per pupil. Then, due to using a ten-year lag on the education variables, this $12,000 needs to be properly discounted for those 10 years. Again using a 3% discount rate, this $12,000 becomes $16,130 as the total education cost. Finally, to calculate the net benefit of education, this cost value is subtracted from the benefits previously found.

Figure **??** and Figure **??** show these results broken down by state. Figure **??** illustrates the net benefit for own-weighted educational spending. Although the net benefit values vary, all states have a negative net benefit. These negative net benefits indicate that the benefits from educational spending are smaller than the cost and that educational spending may be set at a level that is too

[19]Equations used are shown in the Appendix

[20]Hanushek et al.(2015)

high. Alaska and Utah gain the most benefit from educational spending in their state while Florida, New York, Pennsylvania, and Rhode Island gain the least.

Figure 9: Educational Spending Per Pupil

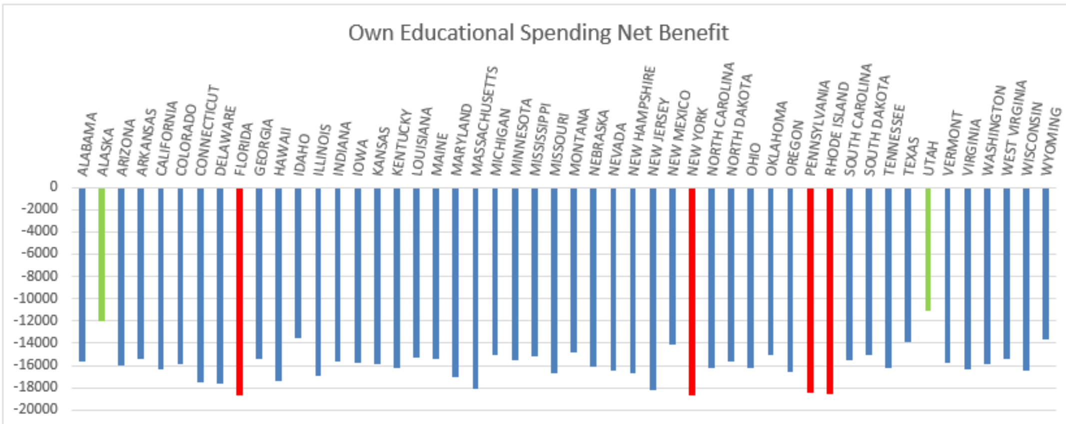
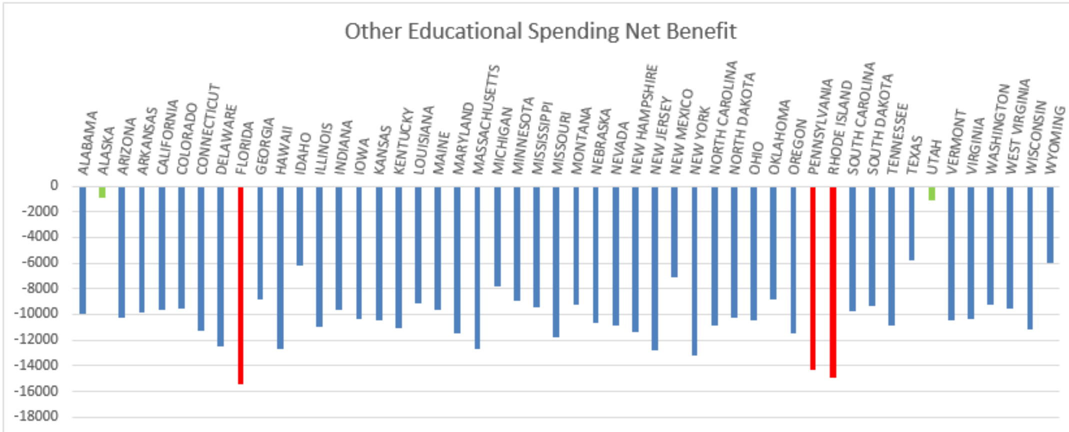


Figure ?? shows the net benefit from other-weighted educational spending. Again, every state has a negative net benefit, however the magnitudes are very different. Alaska and Utah are again lowest in magnitude while Florida, Pennsylvania, and Rhode Island have the highest. Although these net benefits are negative, the magnitudes indicate that states are receiving a benefit from other states. If the states were not receiving any benefit from other states, all net benefits here would be negative and at least equal in magnitude to the total cost of education, $16,130. Having the lowest magnitudes of -$2019 and -$2324, respectively, Utah and Alaska appear to be receiving large benefits from other states, showing that educational spending spillovers do exist.

From Table 2, we also observe that the coefficients for K-12 enrollment are negative and statistically significant at the 1% level, whereas the college enrollment coefficients are positive but statistically insignificant for all specifications. College expenditure per pupil is also negative and statistically significant at the 1% level. The percent of the population born in their current state of residence also has a positive and statistically significant effect on earnings growth at the 10% level for most specifications. Table 3 displays regression results for earnings growth and NAEP test scores. For the unweighted, average-weighted, and own-weighted NAEP test scores, the effect on earnings growth is negative and statistically significant, although the coefficients are very small. The coefficient on other-weighted NAEP test scores is also negative, but it is not statistically significant.

Figure 10: Educational Spending Per Pupil



These results are not all that surprising as many researchers have found that 8th grade test scores are not the best measure of learning abilities and may be unrelated to future earnings.[21] Again, we also see college expenditure lagged ten years is negative and statistically significant at the 1% level.

Table 4 shows the results for educational spending on employment growth while Table 5 shows the results for NAEP scores on employment growth. From Table 4, unweighted educational spending has a positive and significant coefficient at the 10% level, while the other three measures of educational spending are not statistically significant. Testing of the total differential for all four specifications shows that it is not statistically different from zero. From Table 5, all NAEP test coefficients are negative, but only unweighted and other-weighted are statistically significant at the 5% and 1% levels, respectively.

7 Caveats, Contributions, and Extensions

There are two main caveats that warrant mention at this point. First, different changes in state-level policies such as educational quality and achievement requirements could have various effects on state-level education. These policy changes will be accounted for and addressed in the empirical estimations in the future. In addition, following the work of Hanushek et al. (1996), an investigation at disaggregated levels of schooling data, for instance at the county or district level, would likely result in more reliable estimates of the true impact of education and the presence of educational investment

[21] Ludwig and Miller(2007), Deming (2009), Jackson(2012), Chetty et al.(2011), Heckman et al.(2014).

spillovers on future earnings and employment. Estimation using micro-data is forthcoming. Another extension to this paper includes measuring the exact size of the educational investment spillovers.

This paper adds to the literature because its main focus is educational investment spillovers rather than educational returns. Whereas existing literature focus on human capital formation as the mechanism through which education affects the individual, I turn my attention away from just the human capital or quality of education aspect and focus on a variety of educational investment types. This focus allows for investigation into whether these investments affect earnings and employment across state borders. My theoretical predictions also allow me to empirically test whether education investments are set so that the benefits from education are greater than the cost. The results of this paper indicate that some state level educational investments do spill over into other states' labor market outcomes. Results from this investigation are not only important to the literature but they are also important for those who are setting policies in regards to education. If in fact the results found in this study prove reliable, future policy setters will have other state's labor markets to consider. It is important to note that a true evaluation of the financial investments in education requires a "comprehensive assessment of all of the returns to schooling market, nonmarket, and external/public goods effects" (Wolfe and Haveman (2002)). This statement motivates future work involving all aspects of any returns to educational investments.

8 References

Arellano, Manuel, and Stephen Bond. 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. The Review of Economic Studies 58 (2): 277-297.

Arellano, Manuel, and Olympia Bover. 1995. Another Look at the Instrumental Variable Estimation of Error-Components Models. Journal of Econometrics 68 (1): 29-51. Arias, Omar and McMahon, Walter. 2001. Dynamic rates of return to education in the U.S. Economics of Education Review 20, 121-138.

Ashenfelter, Orley and Rouse, Cecilia. 1998. Income Schooling, and Ability: Evidence from a new sample of identical twins. Quarterly Journal of Economics 113, 253-284.

Bauer, Paul W., Schweitzer, Mark E., Shane, Scott. 2006. State growth empirics: the long-run determinants of state income growth. Working Paper 0606, Federal Reserve Bank of Cleveland.

Baum, Christopher F. 2006. An Introduction to Modern Econometrics Using Stata. College Station, TX: Stata Press.

Becker, Gary S. 1964. Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education Columbia University Press.

Berger, Noah and Fisher, Peter. 2013. A well-educated workforce is key to state prosperity. Economic Analysis and Research Network Report.

Blundell, Richard, and Stephen Bond. 1998. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. Journal of Econometrics 87 (1): 115-143.

Betts, Julian R. 1996. Is There a Link between School Inputs and Earnings? Fresh Scrutiny of an Old Literature. In G. Burtless, ed., Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success (Brookings, Washington, DC), 141-191.

Brueckner, J.K., 1979. Property values, local public expenditure, and economic efficiency. Journal of Public Economics 11 (2), 223-245.

Brueckner, J.K., 1982. A test for allocative efficiency in the local public sector. Journal of Public Economics 19, 311-331.

Brueckner, J.K. 1983. The Economics of Urban Sprawl: Theory and Evidence of the Spatial Sizes of Cities. The Review of Economics and Statistics, 479-482.

Card, David, and Alan B. Krueger. 1992. Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States. Journal of Political Economy 100 (1): 1-40.

Case, Anne, Rosen, Harvey, Hines, James. 1993. Budget Spillovers and Fiscal Policy Interdependence, Evidence from the states. Journal of Public Economics 52, 285-307.

Chetty, Raj, Friedman, John, Hilger, Nathanial, Saez, Emmanual, Schanzenbach, Diane, and Danny Yagan. 2011. How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project STAR. Quarterly Journal of Economics 126 (4): 1593-1660.

Curs, Bradley R., Bhandari, Bornali, Steiger, Christina. 2011. The Roles of Public Higher Education Expenditure and the Privatization of the Higher Education on U.S. States Economic Growth. Journal of Education Finance 36 (4), 424-441.

Deming, David. 2009. Early Childhood Intervention and Life-Cycle Skill Development: Evidence from Head Start. American Economic Journal: Applied Economics, 1, 111-134.

Fisher, Peter S. and French, Lily. 2009. Education pays in Iowa: the states return on investment in workforce education. The Iowa Policy Project.

Gruber, Jonathan. 2011. Public Finance and Public Policy. New York, NY: Worth Publishers.

Hanushek, Eric A. 1981. Throwing Money at Schools. Journal of Policy Analysis and Management 1 (1), 19-41.

Hanushek, Eric A., Rivkin, Steven G., Taylor, Lori L. 1996. Aggregation and the Estimated Effects of School Resources. Review of Economics and Statistics 78 (4), 611-627.

Hanushek, Eric A., Ruhose, Jens, Woessmann, Ludger. 2015. Economic Gains for U.S. States From Educational Reform. NBER Working Paper Series.

Harden, William J. and Hoyt, William H. 2003. Do States Choose Their Mix of Taxes to Minimize Employment Losses? National Tax Journal 56 (1), 7-26.

Heckman, James, Rodrigo Pinto, and Peter Savelyev. 2014. Understanding the Mechanisms through which an Influential Early Childhood Program Boosted Adult Outcomes. American Economic Review 103, 2052-2086.

Jackson, C. Kirabo. 2012. Student Demographics, Teacher Sorting, and Teacher Quality: Evidence from the End of School Desegregation. Journal of Labor Economics 27, 213-256.

K-12 Education. (2015). Retrieved 2015, from The White House: https://www.whitehouse.gov/issues/education/k-12

Lucas, Robert. 1988. On the mechanics of economic development. Journal of Monetary Economics 22 (1): 3-42.

Ludwig, Jens and Douglas L. Miller. 2007. Does Head Start Improve Childrens Life Chances? Evidence from a Regression Discontinuity Design. Quarterly Journal of Economics 122, 159-208.

Mashall A. 1890. Principles of Economics. Macmillan, New York.

McMahon, W. W. 1997. Recent Advances in Measuring the Social and Individual Benefits of Education. International Journal of Educational Research 27 (6): 447-532.

Mincer, Jacob. 1974. Schooling, Experience and Earnings. New York: Columbia University Press.

Moretti, Enrico. 2004. Estimating the social return to higher education: evidence form longitudinal and repeated cross-sectional data. Journal of Econometrics 121, 175-212.

Psacharopoulos, G. 1994. Returns to Investment in Education: A Global Update. World Development 22(9):1325-43.

Psacharopoulos, G. 2004. Returns to Investment in Education: A Further Update. Education Economics 12 (2)

Psaharopoulos, G. 2006. The Value of Investment in Education: Theory, Evidence, and Policy. Journal of Education Finance, 32 (2), 113-136

Ribich, Thomas I. and Murphy, James L. 1975. The Economic Returns to Increased Educational Spending. Journal of Human Resources 10 (1), 56-77.

Romer, Paul M. 1986. Increasing Returns and Long-Run Growth. Journal of Political Economy 94 (5), 1002-1037.

Romer, Paul M. 1992. Two Strategies for Economic Development: Using Ideas and Producing Ideas.

In Proceedings of the World Bank Annual Conference on Development Economics. Washington, DC: Author, pp. 63-91.

Schwarz, G. (1978). Estimating the dimension of a model. Annals of Statistics 6, 461-464.

Steven Ruggles, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. Integrated Public Use Microdata Series: Version 6.0 [Machine-readable database]. Minneapolis: University of Minnesota, 2015.

T.D. Snyder, S.A. Dillow, and C.M. Hoffman, Digest of Education Statistics 2006 (NCES 2007-017), National Center for Education Statistics, Institute of Education Sciences (Washington, D.C.: US Department of Education, March 2007), Table 26, p. 44.

T.D. Snyder, S.A. Dillow, and C.M. Hoffman, Digest of Education Statistics 2007 (NCES 2008-022), National Center for Education Statistics, Institute of Education Sciences (Washington, D.C.: U.S. Department of Education, March 2008), Table 171, p. 253.

University of Kentucky Center for Poverty Research. 2015. "UKCPR National Welfare Data, 1980-2014." Gatton College of Business & Economics, University of Kentucky, Lexington, KY. http://www.ukcpr.org/data (accessed July 20, 2016)

Weisbrod, Burton A. 1964. Collective-Consumption Services of Individual-Consumption Goods. The Quarterly Journal of Economics, Vol. 78(3), 471-477.

Weisbrod, Burton A. 1965. Geographic spillover effects and the allocation of resources to education. The public economy of urban communities. 192-206.

9 Appendix

9.1 Appendix A: Theoretical Model

My theoretical model operates in a balanced-budget framework. For simplicity purposes, I set $E_0^A = T_0^A$ so that taxes are not shown in the equation. The model starts with $-E_0^A$. This term represents the loss in wages due to taxes. No wages are shown for time 0 because these wages are already determined and do not have an effect on this model. State A is only concerned about the wages of those working in state A: (w^A). Because of migration, the wages of state A include those educated in and now working in state A as well as those who were educated in state B and now work in State A: $w^A = w^{AA} + w^{BA}$. w^{AA} depends on the education of state A but also the education of state B as shown in the theoretical model: $w_1^{AA}(E_0^A, E_0^B \times \frac{L_1^{BA}}{L_1^{AA}})$ in which $\frac{L_1^{BA}}{L_1^{AA}}$ is weighting E_0^B for migration, and has a value less than 1. The second term of the w_1^{AA} function thus takes spillovers into account. The people educated in B who then move to A could influence those people educated in A, thus having an impact on the wages of those in state A.

9.2 Percent of Population born in current state of residence, 1970 & 2010.

9.3 Calculation of Benefits vs. Cost

Total Differential Calculation at the mean for each state:

$$\frac{dY}{dE_i} = \alpha_E + \eta * \overline{K_i} \tag{12}$$

Total Differential multiplied by mean of earnings of each state:

$$B = \frac{dY}{dE_i} \times \overline{Y_i} \tag{13}$$

Present Value Benefits Calculation using 3% discount rate:

$$1 + \left(\frac{1}{1+.03}\right) + \left(\frac{1}{1+.03}\right)^2 + ... + \left(\frac{1}{1+.03}\right)^{40} = 24.11477 \tag{14}$$

$$\text{Present Value of Benefits} = B \times 24.11477$$

Discount \$12,000 for 10 years for present value of total cost using 3% discount rate:

$$\text{Present Value of Total Cost} = 12,000 \times (1.03)^{10} = 16,130$$

$$\text{Net Benefit} = \text{Total Benefit - Total Cost}$$

9.4 Net Benefit of Educational Spending on Future Earnings

Table 2: Educational Spending on Earnings Growth

	(1)	(2)	(3)
Earnings Growth$_{t-1}$	-0.146^{***}	-0.146^{***}	-0.144^{***}
	(0.051)	(0.052)	(0.054)
(NE) Unweighted Educational Spending$_{t-10}$	-0.007		
	(0.004)		
Unweighted Education Spending$^2{}_{t-10}$	0.000^{*}		
	(0.000)		
Interaction: NE & HS Only	0.009		
	(0.007)		
Interaction: NE & Some College	0.023^{**}		
	(0.010)		
Interaction: NE & College	-0.037^{**}		
	(0.015)		
(AE) Average-weighted Educational Spending$_{t-10}$		-0.008^{*}	
		(0.004)	
Average-weighted Education Spending$^2{}_{t-10}$		0.000	
		(0.000)	
Interaction: AE & HS Only		0.013^{*}	
		(0.007)	
Interaction: AE & Some College		0.020^{*}	
		(0.011)	
Interaction: AE & College		-0.031^{*}	
		(0.016)	
(OE) Own-weighted Educational Spending$_{t-10}$			-0.005
			(0.006)
Own-weighted Education Spending$^2{}_{t-10}$			0.000
			(0.000)
Interaction: OE & HS Only			0.009
			(0.008)
Interaction: OE & Some College			0.020^{*}
			(0.012)
Interaction: OE & College			-0.032^{**}
			(0.016)
(RE) Other-weighted Educational Spending$_{t-10}$			0.004
			(0.005)
Other-weighted Education Spending$^2{}_{t-10}$			-0.002
			(0.001)
High school diploma only$_{t-10}$	-0.062^{**}	-0.073^{***}	-0.063^{**}
	(0.026)	(0.024)	(0.024)
Some College (1-3 years)$_{t-10}$	-0.160^{***}	-0.147^{**}	-0.131^{**}
	(0.057)	(0.065)	(0.052)
College (4+ years)$_{t-10}$	0.280^{***}	0.259^{***}	0.187^{***}
	(0.084)	(0.090)	(0.069)
K12 Enrollment Rate$_{t-10}$	-0.033	-0.033	-0.017
	(0.055)	(0.058)	(0.058)

Table 2(continued): Educational Spending on Earnings Growth

College Enrollment Rate$_{t-10}$	-0.024	-0.022	-0.021
	(0.065)	(0.065)	(0.066)
College Expenditure$_{t-10}$	-0.001^{***}	-0.001^{***}	-0.001^{***}
	(0.000)	(0.000)	(0.000)
Taxes Per Capita$_{t-2}$	0.001	0.001	0.002
	(0.001)	(0.001)	(0.001)
Other Gov't Expenditure as a % of GSP$_{t-10}$	0.074^{***}	0.078^{***}	0.084^{***}
	(0.027)	(0.026)	(0.025)
Agriculture as a % of GSP (contemp.)	0.229^{***}	0.226^{***}	0.218^{***}
	(0.068)	(0.068)	(0.071)
Manufacturing as a % of GSP (contemp.)	0.040^{***}	0.041^{***}	0.042^{***}
	(0.012)	(0.012)	(0.013)
Observations	1,650	1,650	1,650
Number of Groups (States)	50	50	50
Number of Instruments	47	47	49
F-Statistic	478.76	661.72	617.27
AR(1)	0.000	0.000	0.000
AR(2)	0.789	0.781	0.748
Hansen Test	0.538	0.544	0.554
Difference-in-Hansen Test	0.538	0.544	0.554

Note: Standard errors are shown in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3: NAEP Test Score on Earnings Growth

	(1)	(2)	(3)
Earnings Growth$_{t-1}$	-0.129^{***}	-0.128^{***}	-0.130^{***}
	(0.045)	(0.045)	(0.044)
Unweighted NAEP$_{t-10}$	-0.000^{**}		
	(0.000)		
Average-weighted NAEP$_{t-10}$		-0.000^{**}	
		(0.000)	
Own-weighted NAEP$_{t-10}$			
Other-weighted NAEP$_{t-10}$			-0.001
			(0.001)
K12 Enrollment Rate$_{t-10}$	-0.036	-0.037	-0.034
	(0.042)	(0.042)	(0.040)
% Born in current state of residence	0.003	0.002	-0.320
	(0.004)	(0.004)	(0.195)
College Enrollment Rate$_{t-10}$	0.085	0.091	0.080
	(0.054)	(0.055)	(0.056)
College Expenditure$_{t-10}$	-0.001^{***}	-0.001^{***}	-0.001^{***}
	(0.000)	(0.000)	(0.000)
Taxes Per Capita$_{t-2}$	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
State Own Revenue as a % of GSP$_{t-10}$	0.047	0.048	0.033
	(0.029)	(0.029)	(0.028)
Other Gov't Expenditure as a % of GSP$_{t-10}$	0.024	0.023	0.044
	(0.028)	(0.029)	(0.029)
Agriculture as a % of GSP (contemp.)	0.182^{***}	0.187^{***}	0.185^{***}
	(0.055)	(0.058)	(0.054)
Manufacturing as a % of GSP (contemp.)	0.040^{***}	0.040^{***}	0.038^{***}
	(0.013)	(0.012)	(0.012)
Observations	1,650	1,650	1,650
Number of Groups (States)	50	50	50
Number of Instruments	45	45	45
F-Statistic	869.55	780.19	4,879.47
AR(1)	0.001	0.001	0.001
AR(2)	0.633	0.635	0.637
Hansen Test	0.674	0.677	.657
Difference-in-Hansen Test	0.674	0.677	.657

Note: Standard errors are shown in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Educational Spending on Employment Growth

	(1)	(2)	(3)
Employment Growth$_{t-1}$	0.615***	0.615***	0.614***
	(0.063)	(0.063)	(0.062)
(NE) Unweighted Educational Spending$_{t-10}$	0.001		
	(0.002)		
Unweighted Education Spending$^2{}_{t-10}$	0.000		
	(0.000)		
Interaction: NE & HS Only	0.001		
	(0.005)		
Interaction: NE & Some College	−0.004		
	(0.003)		
Interaction: NE & College	0.004		
	(0.006)		
(AE) Average-weighted Educational Spending$_{t-10}$		0.001	
		(0.002)	
Average-weighted Education Spending$^2{}_{t-10}$		0.000	
		(0.000)	
Interaction: AE & HS Only		0.003	
		(0.005)	
Interaction: AE & Some College		−0.005	
		(0.004)	
Interaction: AE & College		0.004	
		(0.007)	
(OE) Own-weighted Educational Spending$_{t-10}$			0.000
			(0.002)
Own-weighted Education Spending$^2{}_{t-10}$			0.000
			(0.000)
Interaction: OE & HS Only			0.001
			(0.006)
Interaction: OE & Some College			0.000
			(0.004)
Interaction: OE & College			0.005
			(0.006)
(RE) Other-weighted Educational Spending$_{t-10}$			−0.003
			(0.003)
Other-weighted Education Spending$^2{}_{t-10}$			0.000
			(0.000)
High school diploma only$_{t-10}$	−0.020	−0.029	−0.017
	(0.021)	(0.022)	(0.019)
Some College (1-3 years)$_{t-10}$	0.045**	0.050*	0.019
	(0.022)	(0.025)	(0.020)
College (4+ years)$_{t-10}$	−0.025	−0.028	−0.016
	(0.034)	(0.038)	(0.023)

Table 4(continued): Educational Spending on Earnings Growth

Interaction: NE & Percent of Labor	-0.003^{**}		
	(0.001)		
Percent of Labor White" White	0.015^{***}	0.016^{***}	0.015^{***}
	(0.006)	(0.005)	(0.005)
K-12 Enrollment Rate$_{t-10}$	−0.005	0.000	−0.000
	(0.019)	(0.020)	(0.019)
% Born in current state of residence	−0.003	−0.004	−0.012
	(0.002)	(0.003)	(0.010)
College Enrollment Rate$_{t-10}$	−0.056	−0.057	−0.053
	(0.038)	(0.037)	(0.035)
College Expenditure$_{t-10}$	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)
Taxes Per Capita$_{t-2}$	-0.001^{**}	-0.001^{*}	-0.001^{*}
	(0.000)	(0.000)	(0.000)
State Own Revenue as a % of GSP$_{t-10}$	−0.000	−0.006	−0.004
	(0.017)	(0.017)	(0.017)
Other Gov't Expenditure as a % of GSP$_{t-10}$	−0.004	−0.003	−0.005
	(0.014)	(0.014)	(0.014)
Agriculture as a % of GSP (contemp.)	−0.002	0.001	0.002
	(0.018)	(0.017)	(0.018)
Manufacturing as a % of GSP (contemp.)	-0.007^{*}	−0.006	-0.008^{*}
	(0.004)	(0.004)	(0.004)
Interaction: AE & Percent of Labor White" White		-0.003^{***}	
		(0.001)	
Interaction: OE & Percent of Labor White" White			-0.003^{**}
			(0.001)
Observations	1,200	1,200	1,200
Number of Groups (States)	50	50	50
Number of Instruments	45	45	47
F-Statistic	3,286.86	2,534.33	7,821.68
AR(1)	0.000	0.000	0.000
AR(2)	0.219	0.218	0.219
Hansen Test	0.729	0.739	0.792
Difference-in-Hansen Test	0.729	0.739	0.792

Note: Standard errors are shown in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 5: NAEP Test Score on Employment Growth

	(1)	(2)	(3)
Employment Growth$_{t-1}$	0.620***	0.620***	0.620***
	(0.057)	(0.057)	(0.056)
Unweighted NAEP$_{t-10}$	−0.000**		
	(0.000)		
Average-weighted NAEP$_{t-10}$		−0.000	
		(0.000)	
Own-weighted NAEP$_{t-10}$			
Other-weighted NAEP$_{t-10}$			−0.001***
			(0.000)
K12 Enrollment Rate$_{t-10}$	0.037*	0.037*	0.041**
	(0.020)	(0.020)	(0.020)
% Born in current state of residence	−0.014***	−0.014***	−0.254***
	(0.002)	(0.002)	(0.066)
College Enrollment Rate$_{t-10}$	0.001	0.001	0.005
	(0.029)	(0.029)	(0.028)
College Expenditure$_{t-10}$	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)
Taxes Per Capita$_{t-2}$	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)
State Own Revenue as a % of GSP$_{t-10}$	−0.026	−0.029	−0.028*
	(0.017)	(0.018)	(0.015)
Other Gov't Expenditure as a % of GSP$_{t-10}$	0.023	0.026	0.031**
	(0.015)	(0.016)	(0.015)
Agriculture as a % of GSP (contemp.)	0.020	0.019	0.031*
	(0.017)	(0.017)	(0.017)
Manufacturing as a % of GSP (contemp.)	0.010*	0.010	0.010*
	(0.006)	(0.006)	(0.006)
Observations	1,650	1,650	1,650
Number of Groups (States)	50	50	50
Number of Instruments	45	45	45
F-Statistic	556.34	570.02	619.47
AR(1)	0.000	0.000	0.000
AR(2)	0.259	0.258	0.264
Hansen Test	0.269	0.272	0.367
Difference-in-Hansen Test	0.269	0.272	0.367

Note: Standard errors are shown in parentheses *** p<0.01, ** p<0.05, * p<0.1.