

Journal of Rural and Community Development

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Citation:

Clarke, W., Jones, A. T., Lacy, B. (2015). Education spending and workforce quality as determinants of economic growth. *The Journal of Rural and Community Development*, 10(4), 24-35.

Publisher: Rural Development Institute, Brandon University.



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Education Spending and Workforce Quality as Determinants of Economic Growth

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Abstract

Several studies suggest that there is a statistically significant, positive relationship between education expenditures and economic growth in the U.S. states and among developed countries. Conversely, some literature suggests that there is no link between education spending and economic growth. There are several explanations given for the lack of a link between spending and growth including higher levels of taxation dampening growth, spending on administration instead of teaching, and poor student-teacher ratios. Our analysis of county level expenditures and demographics finds that it is not the expenditures that matter but the educational attainment level of the workforce. While a locally provided high school degree is still important, it is no longer an end but a means toward attaining a college degree, potentially obtained outside the jurisdiction. These results imply that local development officials must do more than spend on primary and secondary education; they must attract and/or retain college educated individuals as well.

Keywords: education, regional economics, economic development, growth, public finance, workforce

1.0 Introduction

In little more than a generation, the value of a high school education in terms of earning power has declined significantly. A report from the Center on Education and the Workforce at Georgetown University (Carnevale, Smith, & Strohl, 2010) reports that the proportion of high school graduates achieving middle class economic status dropped from 60 percent in 1970 to 45 percent in 2007. President Obama stated in his 2010 State of the Union Address (Obama, 2010) that “in this economy, a high school diploma no longer guarantees a good job.” Furthermore, a high school

educated workforce is no longer an attractive quality in economic development. The research presented in this paper finds that local governments must now do more than spend on primary and secondary education; they must also attract and/or retain college educated workers.

As evidence of the universal opinion that education is important, former U.S. House Speaker Newt Gingrich and the Reverend Al Sharpton teamed up with U.S. Secretary of Education Arne Duncan for a tour of U.S. cities in 2009 to promote education reform (Associated Press, 2009); and Bill Gates (2009, "U.S. Education", para. 16) wrote "our foundation has learned that graduating from high school is not enough anymore. To earn enough to raise a family, you need some kind of college degree, whether it's a certificate or an associate's degree or a bachelor's degree."

Education spending is one of the largest expenditures of state governments. Murray, Rueben, and Rosenberg (2007) note that it has remained a stable percentage of state budgets for the last 25 years, even as total state budgets have grown considerably. Their study also suggests that the number of school-aged children in the U.S. is expected to grow over the next several years, leading to greater demands for spending based on quantity of students as well as quality of the product with advocates making the connection between an educated workforce and economic development.

This study seeks to determine empirically the relationship between education levels, expenditure, and job growth in Georgia counties over the period 2006 to 2008. Education spending per pupil is one measure of the amount of education produced by society but has been found to be a weak determinant of educational achievement beginning with the so-called 'Coleman Report' (Coleman, 1966). Coleman, as well as Chubb & Moe (1990, p. 126), conclude that after controlling for relevant socio-economic factors, school resources had no statistically significant impact on student achievement.

As a measure of workforce quality, the proportion of a county's residents holding a particular level of education may likely be more determinative of economic development than education spending. The proportion of a population that has achieved a specific level of education also gets around the problem that some counties may not have produced the level of education held by its residents. This is more likely for levels of higher education than for K-12 levels. Georgia has traditionally been an importer of educated persons both in terms of beginning college students¹ and persons who have completed at least a four-year college degree. The National Center for Higher Education Management Systems estimates that for the three years 2005 through 2007 Georgia had a net in migration of 25,478 persons of working age (22 to 64) with at least a bachelor's degree while the University System of Georgia awarded about 77,000 four-year degrees over the same period (Board of Regents of the University System of Georgia, 2005, 2006, 2007). Businesses looking for places to locate or to expand often cite workforce quality as a major factor in their decisions. This suggests that temporally, the workforce will exist ahead of development in locales that experience strong economic growth.

¹ The National Center for Higher Education Management Systems reports that Georgia was a net importer of beginning college freshmen from 1994 until 2006. In 2006, the most recent data available, Georgia became a net exporter of beginning college freshman. (see the NCHEMS website for detailed data:

<http://www.higheredinfo.org/dbrowser/?year=2004&level=nation&mode=data&state=0&submeasure=61>.

To test these propositions, we use data on Georgia counties from the period 2006 through 2008 to determine the impacts of education spending (K-12) and education level within a population on economic development. Using data from this time period during a severe economic downturn may produce a very demanding test for economic development, but greater growth during boom times and relatively lower economic loss during a downturn are two sides of the same coin. Regions that are well positioned for growth are also well positioned to maintain their economic vitality relative to those not as well positioned.

We define economic growth two ways. First, we consider the change in the number of jobs as reported by the U.S. Department of Commerce through the North American Industrial Classification System (NAICS). The second measure is the change in economic output over the same period both in total and for one specific industry sector, the bio-life science industry. Georgia, like several other states, has identified this sector as a growth industry that it wants to develop. Moreover, this is an industry that requires a highly educated workforce and is appropriate for testing the hypotheses that education levels, not expenditures, are positively related to economic growth. Data on these economic measures are obtained from the Georgia Economic Modeling System (GEMS) utilizing the Regional Dynamics input-output model.

2.0 Education and Economic Growth

Several studies suggest that there is a statistically significant positive relationship between education expenditures and economic development in the U.S. states and among developed countries. Quan & Beck (1987) found that spending on education had a significant impact on wages and employment in the Northeast, but not in the Sun Belt. They cited migration as a potential reason, noting that parents may migrate to where money is being spent in order to give their children a competitive advantage. Fischer (1997) cites several studies that showed a positive correlation between education spending and growth including those by Dalenberg & Partridge (1995) and Evans & Karras (1994). The Dalenberg and Partridge study looked at 28 metropolitan areas in 19 states, while Evans and Karras used data from the 48 contiguous states. Dalenberg and Partridge suggest that using data for metropolitan areas may capture some of the microeconomic interactions that are lost when data are aggregated to the state level. This may be the case and their findings are consistent with previous research, but rural areas of the states that may be in greater need of development are ignored. Hungerford & Wassner (2004), Harden & Hoyt (2003), and Bensi, Black, & Dowd (2004) all reached similar conclusions: education expenditures exert a positive influence on state economic development.

Conversely, some literature suggests that there is no link between education spending and economic development. Gabe (2003) using data on more than 17,000 firms in Maine found that spending for education had no effect on business expansion while higher levels of taxation tended to dampen growth. Blankenau & Simpson (2004) suggest that a crowding out effect may occur. By financing education through higher taxes, the total impact on economic development may be nullified. Similarly, Deskins, Hill, & Ullrich (2010) conclude that there is no significant relationship between spending on K-12 education and economic growth and failed to identify any statistically significant effect of spending in neighboring states as they had hypothesized.

Some of the literature suggests that education expenditures can exert a positive influence on economic development so long as certain conditions are met.

Blankenau, Simpson, & Tamljanovich (2007) test the notion that a crowding out effect exists in the presence of a budget constraint. They argue that the method of finance (higher taxes versus budget choice under a constraint) affects growth. Using data from 23 developed countries over the period 1960 to 2000, the authors found that education spending is related to growth after controlling for a budget constraint. They conclude that lower distortionary taxes coupled with relatively higher education spending produce greater levels of growth. Mofidi & Stone (1990) obtain a similar result using data on the fifty U.S. states.

Gabe & Bell (2004), using data for nearly 3,800 new businesses in Maine from 1993 to 1995, reported that the purpose of spending had an impact on location decisions. They found higher levels of government spending had a positive effect on the decision to locate. However, for education spending, the data revealed that spending on instruction and teaching had a positive effect while spending on administration had a negative association. Baldwin & Borrelli (2008) note that the way money is spent is more important than how much is spent. Their research shows reducing the student-teacher ratio has a positive impact on economic development.

Denaux (2007) found that local fiscal policy and state fiscal policy differ in their effects on per capita personal income in North Carolina counties. While levels of local property and sales taxes had no impact on growth, statewide fiscal policy — personal and corporate marginal income taxes, and effective motor use fuel tax rates — had a negative effect. It is not surprising that marginal income tax rates and effective motor use fuel tax rates are negatively associated with per capita income at the county level. In rural counties with low incomes, a given level of taxation will produce higher marginal or effective rates than in counties with higher per capita income. The effective motor use fuel tax goes down as incomes increase and the greater use of tax deductions among those with higher incomes results in lower marginal income tax rates. In the study, Denaux found that spending for education and roads had a positive effect on economic development.

The relationship between spending for education and economic development seems intuitively plausible, yet the evidence is unclear. This may be partly due to the aggregated nature of data that have been used to investigate the linkage. With the exception of the Denaux (2007) study that focused on North Carolina counties, most studies have used data from the U.S. states or from developed nations around the world. Denaux's study used the increase in per capita income as the dependent variable and while most local governments strive to attract high-paying jobs, there are few economic development officials who would not want a new employer in their community simply because its presence would not increase average incomes. However, local and state job creation incentives are often tied to some requirement for wage levels. We believe the appropriate dependent variable is the percentage increase in jobs. Communities that attract new employers or create an environment that leads to business expansion benefit from that economic output even if average income remains unchanged. Building the economic base may be more important than trying to raise per capita income.

3.0 Data and Methods

Data for this analysis come from several sources and summary statistics are presented in Table 1. As noted above, the economic growth data come from the Georgia Economic Modeling System, GEMS (Georgia Economic Modeling System, 2011). A full description of GEMS can be found in the appendix. This model uses

data from the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, the U.S. Department of Energy, the U.S. Bureau of Census, and other public sources.

Local government spending data are from the Tax and Expenditure Database (Georgia DATA, 2011) which includes data from the Georgia Department of Community Affairs annual fiscal survey that collects revenue and expenditure data from county and municipal governments. In this analysis, local government spending is the sum of general fund spending by the county and those municipal governments located within the county. Where a municipal government's corporate limits encompasses parts of more than one county, we determined which county is its primary location based on the proportion within each one.

School district revenue and spending data are from the Georgia Department of Education and are audited data reported by the school districts. Happily, 159 of the 180 K-12 public school districts are county-based. The remaining 21 systems are operated by city school boards, including the Atlanta Public Schools. The measure of school spending in each county includes spending reported by the county-based district plus the city-based districts in the counties where those exist.

Table 1. *Summary Statistics*

Variable	Obs	Mean	Std.Dev.	Min	Max
Total job growth	118	1.770	2.453	-3.097	9.338
Biotech job growth	118	0.939	2.091	-0.476	9.766
Percentage increase in total output	118	4.797	2.932	-1.213	21.13
Percentage increase in biotech output	118	2.590	5.035	0	17.66
School spending per pupil (\$,000s)	118	8.952	1.660	4.945	14.76
Percentage with only high school degree	118	35.93	4.024	23.40	47.40
Percentage with bachelor degree	118	12.85	5.862	5.400	39.80
Percentage of land undeveloped	118	20.21	9.292	7.610	53.34
Local government spending per capita (\$,000s)	118	2.508	5.282	0.0298	41.60
Percent in poverty	118	19.67	6.361	4.700	35.20
Unemployment rate	118	4.993	0.956	3.200	7.700

Table 1 gives an overview of the data and some sample statistics. It is noteworthy that the means shown in the table are not weighted averages. In other words, more than fourteen percent (14%) of Georgians have a college degree. The low sample mean reflects the fact that our sample is of geographic areas – counties – and not population. If more populated urban counties have a higher education level than the more numerous rural counties the sample statistic will under represent the population with college degrees. In other words the average of the averages is not the average of the population. This fact does cause some concern about heteroskedasticity in the data and standard errors are corrected in all the analyses.

3.1 Dependent Variables

One conceptualization of economic growth is an increase in the number of jobs within the jurisdiction. Annual data for the number of jobs within each county are produced by GEMS using data from the Bureau of Labor Statistics. We use totals aggregated for all industries and those for the biotechnology sciences industry (NAICS code 541711) to calculate the percentage growth in jobs from 2006 to 2008. A second conceptualization of economic growth is the percent increase in total economic output. GEMS produces historical totals based on reporting by businesses to the U.S. Department of Commerce.

3.2 Independent Variables

The independent variables of interest in this research are the level of expenditure for education and the proportion of the county population that has achieved specified levels of education, specifically high school or college. Spending for education is operationalized as spending per person of school age within the county. That is, total expenditures in the county (including spending by municipal districts in the county, if any) are divided by the number of persons between ages 5 and 19 as estimated by the U.S. Census Bureau in 2006 to yield our measure of education spending. The research presented below examines contemporaneous educational spending but examination using medium-term lagged spending, 5 years, yielded the same results.

To examine the relationship between education expenditure and employment growth we collected two variables from the 2000 U.S. Census that measure the proportion of the county population that had attained some level of education: the proportion with only a high school education, and the proportion with at least a four-year college or university degree. Using data from the 2000 census gives us confidence that temporally the quality of the workforce as indicated by these two measures preceded any change (increase or decrease) in the number of jobs or the value of economic output observed from 2006 to 2008.

We anticipate that the proportion with only a high school education will be an important determinant for overall growth in jobs, but possibly not for job growth in the biotechnology sector. In that industry sector we expect the proportion holding the post-secondary degree will be a significant determinant of growth. Other control variables used in the analysis include a number of socio-economic variables and will be discussed in the analysis section.

4.0 Analysis

Table 2 presents four OLS models analyzing the impact of the education spending and educational achievement variables on job growth overall and within the biotechnology industry sector. Not surprisingly, we find that the proportion of the population holding a bachelor's degree has a positive and statistically significant association with job growth both overall and within the biotechnology sector. We anticipated that the proportion holding a high school education would be associated with overall growth but not employment growth in the biotechnology sector. This, however, is not the case. In both models the variable for the proportion achieving only a high school education was non positive and higher levels of high school degree holders were negatively related to bio-tech employment growth. These results suggest that a high school education is no longer adequate for the jobs being created today.

The difference between the insignificant result for total employment growth and the negative result for bio-tech growth is potentially due to the fact that for many occupations, residents with a high school degree are more attractive to employers than residents without any degree; but for the more politically-attractive jobs, such as biotech, a high school degree is still below the minimum requirement. In fact, increasing the percentage of the population with a bachelor's degree or better, as shown in the second and fourth columns of Table 2, by 10% is estimated to add almost a full percent (.95%) to the two-year growth rate for all employment and well over one percent (1.7%) for biotech jobs. These increases in the growth rate are economically significant in that they translate to a nearly fifty-four percent (54%) increase in the growth rate for total employment and more than doubling the growth rate of biotech jobs.

Table 2. *OLS Model of Job Growth 2006-2008*

Dependent Variable: Percent Increase in jobs 2006-2008	Total Jobs	Total Jobs	Biotech Jobs	Biotech Jobs
Variable	Coefficient (t)			
Undeveloped land proportion	.0098 (0.49)	.0139 (0.69)	-.0175 (-0.86)	-.0144 (-0.72)
School spending per pupil	.0059 (0.05)	.0181 (0.14)	.0251 (0.19)	.0531 (0.40)
Local government spending per capita	.0183 (0.34)	.012 (0.25)	.0522* (1.78)	.0385 (1.48)
Percent living in poverty	-.1643*** (-4.05)	-.12*** (-2.88)	-.0724 (-1.38)	-.0133 (-0.25)
Unemployment rate	-.7657*** (-3.15)	-.7479*** (-3.11)	-.1644 (-0.58)	-.1377 (-0.49)
Percent with only a high school education in 2000	-.0345 (-0.87)		-.1672*** (-3.37)	
Percent with a bachelor's or more in 2000		.095*** (3.51)		.1693*** (4.59)
Constant	9.767*** (5.68)	6.172*** (3.19)	9.187*** (4.07)	-.5672 (-0.27)
<i>N</i>	118	118	118	118
<i>R</i> ²	0.439	0.471	0.223	0.280

Marginal effects; *t* statistics in parentheses
(d) for discrete change of dummy variable from 0 to 1
* *p*<.1, ** *p*<.05, *** *p*<.01

In the models of total job growth from 2006 to 2008 (the first two columns in Table 2), the estimated effect of school district spending per child of school age is small and not statistically significant. This non-result is supported by the literature on school resources and student performance. The effect of local government spending is again miniscule and insignificant for total employment but marginally positive for biotech employment. Policy makers should be cautioned that even though the results are statistically significant, the effect is so small that it may not be economically significant. Increasing per-capita government expenditures by \$1,000, a quite sizable increase in expenditures, will on average increase the growth rate of biotech jobs by only 1/20th of a percent. Taken to their logical extreme, these results suggest that counties should eliminate education expenditures and spend that money elsewhere to attract biotech jobs; we believe this takes our findings out of context. The results instead suggest that counties must attract educated workers either by attracting new residents or retaining existing residents with degrees. It is reasonable to assume that location decisions depend on the mix of services offered, a Tiebout sorting assumption, where potential residents choose a jurisdiction based on the package of services provided and the tax cost of those services, and that eliminating education expenditures would greatly reduce the attractiveness of a community to high skill workers. Considering that additional expenditures must be funded from taxes, the insignificance of the estimated coefficients for education expenditure may reflect that local governments are within the margin of error for an optimal expenditure level.

Table 3. *OLS Model of Output Growth 2006-2008*

Dependent Variable:				
Percent Increase in Output 2006-2008	Total Output	Total Output	Biotech Output	Biotech Output
Variable	Coefficient (t)			
Undeveloped land proportion	.0174 (0.78)	.0224 (1.02)	-2.1e-04 (-0.43)	-1.4e-04 (-0.28)
School spending per pupil	.0827 (0.62)	.1033 (0.75)	-7.6e-04 (-0.24)	-1.4e-05 (-0.00)
Local government spending per capita	.0314 (0.68)	.0209 (0.56)	.0018** (2.06)	.0015 (1.39)
Percent living in poverty	-.1797*** (-3.80)	-.1177*** (-2.71)	-8.8e-04 (-0.75)	6.6e-04 (0.53)
Unemployment rate	-.7834*** (-2.91)	-.7575*** (-2.86)	-.0039 (-0.59)	-.0032 (-0.48)
Percent with only a high school education in 2000	-.0857 (-1.07)		-.0045*** (-3.84)	
Percent with a bachelor's or more in 2000		.1462** (2.31)		.0045*** (5.23)
Constant	14.15*** (3.96)	7.585*** (3.54)	.2324*** (4.23)	-.0299 (-0.62)
N	118	118	118	118
R ²	0.398	0.443	0.194	0.258

Marginal effects; *t* statistics in parentheses; (d) for discrete change of dummy variable from 0 to 1
 * p<.1, ** p<.05, *** p<.01

The models using the percentage change in economic output as the dependent variable produced similar results and are presented in Table 3. We also considered the possibility that the results obtained were in some way a product of the recessionary trends of the period 2007 to 2008. As a robustness check, models for an earlier period (2004 to 2007) yielded nearly identical results giving us some confidence that our findings are robust. In addition, the models were estimated for non-Atlanta area counties and the results were substantially the same. On a final note, not surprisingly, higher rates of poverty and unemployment reduce employment and output growth as regional economies fail to utilize resources available, in this case labor.

5.0 Conclusion

The analysis presented in this paper confirms that counties relying on a labor force with low levels of education, or only a high school degree, are bound to struggle. However, responding to the need for an educated workforce with increased education spending does not lead directly to economic growth. It is the product of that spending – educated persons, and particularly those with a college degree – that results in successful growth.

The effect of poverty and unemployment (and their correlation) suggest that these variables prevent economic growth. Coupled with the evidence that work force quality is the key to growth, it is not much of a stretch to argue that high levels of poverty and persistent unemployment prevent growth in areas where it might otherwise occur. Growth in a county is associated with a quality work force, not necessarily educated in the state or in that particular county. The role of K-12, from this perspective, is to prepare more students for post-secondary education, and local governments need to focus on retaining graduates and competing for educated workers willing to relocate. Recognizing that education expenditures by K-12 school districts are part of the package of services offered by a community in a Tiebout-type framework, policy makers must balance the benefits of additional expenditures and costs of higher taxes along with other services to attract educated workers.

Future research should extend the analysis presented here to other states to ensure there are no state specific policies which prevent the finding presented above from being generalized to a larger geographic area. Furthermore, if the data were available, analyses containing a longer time series may provide additional insights. In addition, the findings discussed above suggest that attracting and retaining educated workers is a critical component of the development process. Additional research should focus on how best to attract these workers and shed light on the age old question of whether workers flow to employment opportunities or whether employment follows the development of the labor force. This issue should be viewed with specific attention to the college educated workforce.

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Appendix

GEMS is structural in nature, meaning that it clearly includes cause-and-effect relationships. The model is based on two key underlying assumptions from mainstream economic theory: (1) households maximize utility and (2) producers maximize profits. Because these assumptions make sense to most people, lay people as well as trained economists can understand the model.

In the model, businesses produce goods and services to sell to other firms, consumers, investors, governments, and purchasers outside the region. Output is produced using labor, capital, fuel, and intermediate inputs. Demand for labor, capital, and fuel per unit of output depends on relative costs because an increase in the price of any one of these inputs leads to substitution away from that input to other inputs.

Supply and demand for labor are incorporated into the model to calculate wage rates. The wage rates, along with other prices and productivity, determine the cost of doing business for every industry in the model. An increase in the cost of doing business causes either an increase in prices or a decrease in profits, depending on the market for the product. In either case, an increase in costs would decrease the share of the

local and U.S. market supplied by local firms. This market share, combined with the demand previously described, determines the amount of local output. The model has many other feedbacks. For example, changes in wages and employment affect income and consumption, while economic expansion changes investment, and population growth influences government spending.

Within the model, firms produce goods and services that are purchased either by final consumers or by other firms as inputs to their own production processes. Firms also purchase labor, capital, and other inputs. Labor and capital requirements depend on both output and relative costs. Population and labor supply contribute to demand and to wage determination. Economic migrants, in turn, respond to wages and other labor market conditions. Supply and demand interact in the wages, prices, and profits block. Prices and profits determine market shares. Output depends on market shares and the components of demand.

GEMS brings together all of the elements to determine the value of each variable for each year in the baseline forecasts. Inter-industry interactions that are included in input-output models are used to estimate the values of other regional economic variables. In order to broaden the model in this way, it was necessary to estimate key relationships. Extensive data sets covering all areas in the country and two decades' worth of research were used to ensure that the model was theoretically sound and based on all of the relevant data available.

The model has strong dynamic properties; that is, it forecasts not only what will happen but also when it will happen. It enables long-term predictions that have general equilibrium properties, meaning that the long-term properties of general equilibrium models are preserved, accurate year-by-year predictions are maintained, and key equations can be estimated by using primary data sources.