THE RETURNS TO EDUCATIONAL ATTAINMENT, LOCAL SUPPORT, AND STUDENT PERFORMANCE IN CENTRAL INDIANA COUNTIES

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ABSTRACT

Central Indiana, a region of 44 counties, has enjoyed economic prosperity throughout most of the 1990s but when it comes to education the region has, like the rest of Indiana, lagged behind most of the United States. An empirical model, using a 1998 cross section of data, is developed to measure the effects of county wide educational attainment, financial support and student performance on a county's per capita income. Simultaneity between per-capita income and educational performance is estimated with two stage least squares and preliminary findings indicate that higher levels of income, a more educated household and smaller classes promote higher levels of student performance. Higher levels of funding per student are found to hinder student performance and thus an argument could be made for finding ways to spend less money but to spend it more wisely.

BACKGROUND

A substantial body of research supports the assertion that, for an individual worker, there is a positive return to increased amounts of education.[1] These returns are potentially justified by two hypotheses. The first is that schooling fundamentally changes the person, making them a more productive unit of labor and thus able to command a higher wage. The second is that the student, without improving their inherent productivity, endures education. Completion of the education sends a signal to employers that the student is productive.

While it is widely assumed that more and better education improves the earnings of an individual, studies at the county and/or metropolitan statistical area (MSA) level are becoming more prevalent. Madden (1996) provides a useful review of the literature surrounding changes in urban and suburban poverty rates and finds that the median level of education in the population (over age 25) has no significant effect on the rate of growth in poverty rates, but that variables designed to capture economic growth and local labor market conditions do influence the growth of poverty in MSAs. Levernier, *et al* (2000) examine differences in 1990 family poverty rates for all U.S. counties and independent cities in the lower 48 states. With regard to education they find that greater educational attainment reduces poverty, but that these effects are stronger with high school attainment, and are about twice as effective as college attainment in lifting a family out of poverty. This makes sense in that college attainment "more likely lifts families into the middle and upper classes" (p. 487). Domazlicky, et al (1996) estimates that a one-percentage point increase in a county's high school noncompletion rate is associated with a drop in per capita personal income by over $50. Every one-percentage point increase in a county's college degree rate increases per capita personal income by over $200.

While stronger educational attainment is likely to increase an individual's income and many studies have found the same effect for decreasing poverty and/or increasing per capita income at the county level, there are likely simultaneity issues. Strong education variables may be included as independent variables with per capita income as the dependent variable, but education may simultaneously be dependent upon local economic conditions. For example a poor school system may be a function of a poor county, and this poor school system fails to produce strong students who fail to attain high-income jobs. A model that incorporates simultaneous effects is desirable. Borland and Howsen (1996) construct a model of educational performance (mathematics scores) and educational support (average teacher salaries), each as a function of one another and other explanatory variables. They find, with 2SLS estimation, that in the teacher salary equation, student performance in mathematics significantly increases teacher salaries. They also find that higher teacher salaries decrease math performance, a seemingly puzzling result. However Hanushek's (1986) survey of the literature finds that only nine of sixty studies find a positive and significant impact between these two variables. Of the fifty studies for which there is no significant impact, eleven report a negative sign.

[1] See Hanushek (1986) and Filer, Hammermesh, and Rees (1996) for a review of this literature.

MODEL

In this study I incorporate many of the above techniques and models to estimate a two-equation system of county per-capita income and student academic performance (as measured by total battery ISTEP scores) in that county. The specific model to be estimated is:

Realy = f(ISTEP, urate, msa, manuf_ratio, BA_90) and

ISTEP = f(Realy, spend_adm , teach_exp, pupil_ratio, BA_90) where

Realy represents the inflation adjusted[2] per capita income in the county, *ISTEP* is the total battery score for the county, *urate* is the 1998 average monthly unemployment rate, *msa* is a dummy variable equal to one for a county located in a MSA area, *manuf_ratio* is the 1998 ratio of manufacturing jobs in the county, and *BA_90* is the percentage of county residents who indicated on the 1990 census that they had attained at least a Bachelor's degree.[3] In other words, per-capita income is a function of the strength of local economic activity, the countywide level of educational attainment (or inventory of human capital), the manufacturing base, an urban/rural dummy variable and a measure of the output quality of the school system.

The second equation in the simultaneous model is a model for ISTEP performance as a function of *Realy*, *BA_90*, *spend_adm* is a measure of total spending per student[4], *teach_exp* is the average number of years of experience for teachers in the county schools, and *pupil_ratio* is the average pupil to teacher ratio in the county. The performance of the school system in a county is thus modeled as a function of that county's economic prosperity, local educational attainment (or household factors contributing to student success), spending per student, the pupil to teacher ratio, and average experience of the teachers in the county. The latter two measures can be viewed as measures of the quality of the instructional inputs. A cross-section of data has been collected for 1998 for the 44 counties that fall within the BEA's definition of Central Indiana.

It is expected that ISTEP, *manuf_ratio*, *msa*, *BA_90* will have positive effects on the per-capita income of the county and that *urate* will have a negative effect. ISTEP is included as a reflection of school and student quality and *BA_90* is a measure of the quality of the labor force in the county. Of course this specification cannot account for inter-county migration or for people who live in one county and work in another. It is also noteworthy that such a cross-sectional model does not incorporate a lag structure between the educational performance (or attainment) and per-capita income. Therefore the empirical estimates should not be interpreted as directly causal from year t to year t or (t+1), but rather an overall reflection of the current aggregate influence of the independent variable on per capita income.

It is expected that *Realy*, *BA_90*, *spend_adm*, and *teach_exp* should have positive effects on countywide ISTEP battery scores. With more experienced teachers who are working with more financial support per student, teaching students who are more likely to come from households with highly educated members in prosperous counties, students should perform better on the standardized exam. However, the literature has not universally supported assertions that better quality inputs have produced higher quality output in the production of education. Hanushek (1986) states that one of the most important puzzles in the economics of education is "that the constantly rising costs and "quality" of the inputs of schools appear to be unmatched by the improvement in the performance of students." The pupil to teacher ratio has an ambiguous theoretical influence on test scores. Smaller classes may allow the teacher to provide more one on one contact with the student, thus quickly identifying weaknesses in testable subject matter and helping to remedy those weaknesses. It could also be argued that larger classrooms provide a situation where a teacher can specialize instruction on testable subjects, benefit from economies of scale in the classroom, and thus produce well-drilled students who perform well on the ISTEP. Summary statistics for these nine variables can be found in Table 1 below.

EMPIRICAL RESULTS

The above model was estimated with two stage least squares[5] and the results are reported in Table 2 below. All results are corrected for heteroskedasticity using

[2] Nominal incomes were deflated by the annual average of the Midwest urban CPI (1982-84 = 100).

[3] One potential difficulty in using both education data and economic data is the time span in which data is collected. Unemployment and per capita income are published for a calendar year while education data are published for the academic year that includes parts of both 1998 and 1999 calendar years. Although I could have used data for the 1997-1998 academic year, I chose 1998-99 because it included the end of calendar year 1998, which was more consistent with BEA and BLS data.

[4] The Indiana Department of Education reports the total 1998-99 current cost spent in a district divided by the average daily membership over the year.

[5] The software used for all estimations is Limdep 7.0.

White's (1978) consistent estimator and t-statistics are reported in parentheses.

Within the first equation, the coefficients on unemployment rate, the percentage of residents who have at least a Bachelor's degree, and the MSA dummy are all statistically significant. The coefficients on the total battery score on the ISTEP and the percentage of jobs in manufacturing are insignificant. This implies that metropolitan counties with a well-educated labor force and plentiful job opportunities experience greater economic prosperity. High performing schools do not appear to significantly impact the current level of economic activity, but of course studies over time may shed more light on these functions. Somewhat surprisingly, per capita incomes are stronger in counties that are moving away from a weakening manufacturing sector. Perhaps this reflects changing industrial structure in the region toward Central Indiana's growing high-tech and service sectors.

If one of the contributing factors to a county's prosperity may not be the current quality of the students produced in the county school systems, the second equation attempts to identify the factors that produce higher ISTEP scores. The issue of simultaneity arises again because of the possibility that the citizens of counties of relative wealth will demand better schools and better teachers and will be willing to support those efforts. Thus it is argued that prosperous counties will produce better students, as measured by the ISTEP. The coefficient on per capita income is indeed positive and statistically significant, as is the variable for the level of education in the county. The variable measuring spending per student and the pupil to teacher ratio are both negative and both significant. The average years of teacher experience is insignificant. These results do support the assertion that high performing county schools may be the product of high performing county economies and that counties with households that have higher average levels of education have a positive affect on test scores. Counties in which spending per student is high actually pull down overall test scores, which may be seen as a sign that lower levels of spending, if wisely targeted, may be more effective. Smaller average class sizes also appear to improve test scores, testament

perhaps to the benefits of more one on one instruction and assistance. As mentioned earlier in this paper, the insignificant impact of teacher experience on student achievement and the negative impact of spending should not be surprising given the results of Hanushek's (1986) survey of the literature.

IMPLICATIONS

The subject of education is controversial in many sectors of society and the economics of education is no exception. Much is made of the mismeasurement of inputs and outputs, the inability to capture many factors that contribute to the success of a student, such as innate ability, and the "correct" way to assess the performance of the school or district. And while education is a cumulative process, researchers are usually limited to contemporaneous data. The result is that, in models such as the one presented here, there are likely specification errors and biases. Like most pieces of empirical work, compromises need to be made between what is ideally desirable and the availability of the data. Limitations of the results need to be acknowledged.[6]

With this in mind, results presented in this paper may be useful in beginning to look at the connections between economic growth and prosperity in Central Indiana counties and the relative strength of students, teachers and the educational system. If it is the case that more prosperous counties are producing better students, and if those better students eventually make up the labor force in that very same county, we could be facing even wider gaps between the economic "haves" and "have nots" in Central Indiana. The answer does not appear to be, in this piece of research or in many others, that we should respond by spending more per student. Perhaps parents, educators and voters can begin to demand that public funds are used more wisely rather than just used.

In the greater body of literature, there remain more questions than have been answered in this paper. A comprehensive panel study that I have already begun may be useful to track changes in counties over time. A longitudinal study following individuals and groups throughout their schooling could be even more desirable. Regardless of the direction that this research takes, better understanding of connections between economic and educational performance is a vital link to the growth of Central Indiana and other communities.

[6] Again Hanushek (1986) details the empirical issues and measurement constraints in this field of economics.

Table 1: Summary Statistics

Variable	Mean	Maximum	Minimum	Standard Deviation
Per capita Income[a]	$22,901	$39295	$17,146	$4134
Unemployment Rate[b]	3.51%	7.70%	1.20%	1.54%
Percentage with BA degree[c]	12.85%	36.20%	6.00%	6.78%
ISTEP Total Battery Score[d]	59.03	67.50	53.90	2.80
Pupil/Teacher Ratio[d]	25.18	28.45	21.98	1.49
Spending per ADM[d]	$4790	$5469	$4101	$318
Dummy for MSA counties on Interstate[a]	.34	1	0	.48
Average Years of Teacher Experience[d]	15.96	12.70	19.25	1.40
Percentage of Jobs in Manufacturing[a]	20.00%	34.62%	3.37%	8.82%

Data Sources: [a] U.S. Bureau of Economic Analysis. [b] U.S. Bureau of Labor Statistics. [c] U.S. Bureau of the Census.
[d] Indiana Department of Education, School Finance and Educational Information.

Table 2: Empirical Results (t-statistics in parentheses)

Variable	Real per-capita Income	Total Battery ISTEP score
Intercept	47478.258 (1.742)	75.196 (6.893)
Total Battery ISTEP score (ISTEP)	-481.709 (-1.015)	
Unemployment Rate (urate)	-1022.420 (-2.669)	
Ratio of Manufacturing jobs (manuf_ratio)	74.839 (1.622)	
Dummy variable for counties in MSA's (msa)	2177.799 (1.863)	
Percentage of Residents with Bachelor's or more (BA_90)	404.944 (2.167)	.179 (2.880)
Real per-capita Income (Realy)		.00025 (1.867)
Spending per Average Daily Membership (spend_adm)		-.363 (-2.462)
Average Teacher Experience (teach_exp)		.137 (.685)
Pupil to Teacher Ratio (pupil_ratio)		-.361 (-1.900)

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