



POLICY BRIEF

Does Money Matter in Education?

Reconsidering an Old Question with Reference to Michigan

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For over half a century, researchers have attempted to measure the academic and economic returns to increased education funding. Using a range of methods of varying quality, this ever-growing body of research has yielded mixed results, although a clearer understanding is now available. Early research, done primarily before the turn of the century, often failed to find strong or systematic associations between school funding and student outcomes. The data and methods used in those studies, however, left much to be desired in terms of scientific precision. With the benefit of better data and more rigorous statistical methods, studies over the last 20 years have consistently shown that increases in school funding do, in fact, generate improved educational outcomes.

The purpose of this nontechnical brief is to describe the arc of research studying the relationship between educational funding and achievement, to highlight strengths and limitations of data and methods used in each wave of the literature, and to show how recent research has reversed early conclusions that ‘money doesn’t matter.’ Additionally, we pay special attention to Michigan as a uniquely advantageous context for researchers to establish causal links between the money schools receive and the benefits their students enjoy.

Beginnings: Education Production Function Studies

The debate over the effect of educational resources can be traced to the landmark 1964 Coleman report.¹ Contrary to prevailing assumptions, that report found little relationship between school financial resources and student outcomes, but instead highlighted the social and economic resources in children’s homes in accounting for the variance in educational outcomes.

For over two decades following the Coleman report, many studies employed similar research methods, which became known as education production function analyses, in an attempt to pinpoint key determinants of educational success. Education production function studies typically applied basic regression statistical models to cross-sectional data (i.e., all data coming from one point in time) to estimate the relationship between educational inputs (e.g., per-pupil expenditures) and outcomes (such as student

¹ Coleman, James S., Ernest Campbell, Carol Hobson, James McPartland, Alexander Mood, Frederick Weinfeld, and Robert York. “The Coleman report.” *Equality of Educational Opportunity* (1966).

achievement, educational attainment, or lifetime income), while holding other variables constant.

Despite the rapid expansion of the field, early production function research employed weak data and statistical methods when compared to modern research. Importantly, these analyses could at best only identify correlations between inputs and outcomes, but could not assess the existence of cause and effect relationships.

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In 1986, and again in 1997, Eric Hanushek published surveys of the education production function literature.² Hanushek counted the number of studies that found positive, negative, and no significant relationships between educational inputs and outcomes. Since substantial shares of the studies had conflicting or statistically insignificant findings, he concluded that “no strong or systematic relationship between school expenditures and student performance” existed (p. 1162). Hanushek’s surveys become very widely known and helped to establish a new narrative in policy discussions that ‘money doesn’t matter’ in schools.

Reconsidering Early Production Function Research

The surprising conclusions of both the Coleman report and Hanushek’s literature reviews were subsequently drawn into question by researchers who reexamined the underlying data.

Two studies, by Konstantopolous and Borman and Borman and Dowling, used more robust statistical methods to re-analyze Coleman’s data.³ Both studies reversed the original Coleman report findings, and concluded that increased school resources are in fact associated with improved student outcomes even after accounting for students’ family background.

Other studies revisited the methods Hanushek used to review education production function studies. Academic researchers have established rigorous procedures for meta-analyses that seek to synthesize the results of multiple studies in order to develop consensus around their findings. Hanushek, however, failed to use one of those methods. Instead he opted for a ‘vote counting’ approach which does not consider the quality of the studies reviewed.

A key weakness of Hanushek’s vote counting method is the lax criteria used in deciding whether a study was included or excluded from the sample. His method assessed high- and

² Hanushek, Eric A. "The economics of schooling: Production and efficiency in public schools." *Journal of economic literature* 24, no. 3 (1986): 1141-1177. Hanushek, Eric A. "Assessing the effects of school resources on student performance: An update." *Educational evaluation and policy analysis* 19, no. 2 (1997): 141-164.

³ Konstantopoulos, Spyros, and Geoffrey Borman. "Family background and school effects on student achievement: A multilevel analysis of the Coleman data." *Teachers College Record* 113, no. 1 (2011): 97-132.

Borman, Geoffrey, and Maritza Dowling. "Schools and inequality: A multilevel analysis of Coleman’s equality of educational opportunity data." *Teachers College Record* 112, no. 5 (2010): 1201-1246.

low-quality studies equally. Greenwald, Hedges, and Laine⁴, as well as Wenglinsky⁵, used a more robust selection criteria and found that eleven of the twelve studies that were statistically significant showed a positive relationship between educational inputs and outcomes.⁶ Of the studies that were not statistically significant, the majority still showed a positive relationship.

Better Data and Methods

Since Hanushek's reviews, there have been major advances in research probing the relationship between educational inputs and outcomes. Modern studies are superior because they employ better data and better methods than previous work. Because of these advances, researchers can establish causal relationships among variables, not merely correlations.

Social scientists studying the relationship between educational inputs and outcomes benefit from three major improvements in the data. First, available data has become much richer. Newly available variables that capture formerly overlooked features of students or schools give researchers more power to overcome omitted variable bias, which was a major problem in early production function studies. Second, the unit of observation has become more focused. Whereas studies in the 1970s and 1980s sometimes used states or even nations as their unit of observation, masking extensive variation within states or nations, more recent studies take districts and even students as the unit of observation. Finally, scholars now utilize longitudinal data-sets (also known as panel data) which represent the relationships among variables over time. Importantly, longitudinal data allow researchers to employ more advanced methods than are possible with cross-sectional data.

With longitudinal data, researchers can exploit shifts in funding policy to isolate the impact of spending on student outcomes. When changes in state policy generate shifts in district funding that are not premised on district outcome levels, researchers can employ sophisticated quasi-experimental statistical methods such as fixed effects (FE), difference-in-differences (DD), regression discontinuity (RD), and instrumental variables (IV). Unlike the old-style production function studies, these improved methods allow researchers to estimate the causal impacts of educational inputs on outcomes.

These improvements have given researchers more confidence in their results than ever before.

⁴ Greenwald, Rob, Larry V. Hedges, and Richard D. Laine. "The effect of school resources on student achievement." *Review of educational research* 66, no. 3 (1996): 361-396.

⁵ Wenglinsky, Harold. "How money matters: The effect of school district spending on academic achievement." *Sociology of Education* (1997): 221-237.

⁶ To replicate Hanushek's review of the literature, Greenwald, Hedges, and Laine (1996), as well as Wenglinsky (1997) employed rigorous meta-analysis as well as more refined selection criteria. Studies were selected if they appeared in peer-reviewed journals, used US data, included measures of academic achievement, used district level or lower data, and included covariates for socioeconomic characteristics.

Progress has also come from more precise specifications of the functional relationship between inputs and outputs and from the inclusion of controls for regional cost differences.⁷

Together these improvements have given researchers more confidence in their results than ever before. And as we will explain, the newer research has consistently shown that additional financial support for schools generates improved student outcomes.

Studies of Specific School Resources and Student Outcomes

While education production function studies examined the relationship between dollars and student outcomes, other research has examined the impact of specific school resources. The research literature on class size reductions and teacher salary increases are particularly well developed. Reductions in class size are costly because they require hiring additional teachers, and teacher compensation constitutes the majority of education spending.⁸

The famous Tennessee Project STAR (for Student-Teacher Achievement Ratio) was a large-scale experiment which tested the effect of class size on student achievement. The project's experimental design provides unparalleled evidence that has been evaluated by several researchers. Krueger like others, concluded that smaller class sizes increased academic achievement and had especially high returns for minority students and those from low-income families.⁹

Among more recent re-evaluations of the Tennessee STAR data, Konstantopolous and Chun find durable positive impacts of early-grade class size reductions on achievement for all types of students in later grades.¹⁰ Dynarski, Hyman, and Schanzenbach utilized the STAR data and found that students who had been taught in smaller elementary-school classes had an increased probability of attending and completing college and that the benefits were especially large for the poorest third of students.¹¹

A large body of research supports the conclusion that teacher salaries and salaries relative to other occupations matter for teacher quality. Figlio, for example, concludes that higher

⁷ While older research generally assumed a linear relationships between educational inputs and outcome, recent research has examined more flexible and precise specifications to capture the actual relationships among these variables. Likewise, controlling for regional cost difference is clearly important in establishing statistical relationships between school funding and student outcomes. For instance, \$1 in Lansing Michigan has more purchasing power than \$1 in Manhattan.

⁸ Education spending numbers gathered from the National Center for Education Statistics. In the 2014-15 academic year, salaries and benefits made up 80% of per-student expenditures. Information can be found at https://nces.ed.gov/programs/coe/indicator_cmb.asp#info.

⁹ Krueger, Alan B. "Experimental estimates of education production functions." *The Quarterly Journal of Economics* 114, no. 2 (1999): 497-532.

¹⁰ Konstantopoulos, Spyros, and Vicki Chung. "What are the long-term effects of small classes on the achievement gap? Evidence from the lasting benefits study." *American Journal of Education* 116, no. 1 (2009): 125-154.

¹¹ Dynarski, Susan, Joshua Hyman, and Diane Whitmore Schanzenbach. "Experimental evidence on the effect of childhood investments on postsecondary attainment and degree completion." *Journal of Policy Analysis and Management* 32, no. 4 (2013): 692-717.

teacher salaries are associated with more qualified teachers.¹² Loeb and Page found that increases in teacher wages decreased high school dropout rates. Such studies have established a solid research foundation for a proposition that many view as self-evident: it is easier to attract and maintain effective teachers with higher salaries.¹³

Studies of State School Finance Reforms

Changes in state school funding policies provide another avenue for researchers to study whether and how money matters. Statewide finance reforms enable scholars to use quasi-experimental research designs, which are more rigorous than the education production function studies of years past. In effect, when policy changes generate shifts in district funding that are not premised on their prevailing educational outcomes, it creates a natural experiment for researchers to examine how changes in spending influence student outcomes.

Research on the impacts of state school funding policy reforms have become more prevalent since the turn of the 21st century. Analyzing finance reform in Kansas, Deke showed that increased educational spending improved college enrollment and completion.¹⁴ Downes found that a Vermont finance reform that narrowed spending gaps among districts narrowed achievement gaps among districts.¹⁵ These and other studies reinforce Card and Payne conclusion “that equalization of spending levels leads to a narrowing of test score outcomes across family background groups.”¹⁶

Downes, Zabel, & Ansel studied accountability and school finance reforms in Massachusetts and found that finance equalization was “successful in raising the achievement of students in the previously low-spending districts.”¹⁷ Similarly, Guryan found that increased spending associated with Massachusetts’ finance reform generated large increases in student achievement. An additional \$1,000 in low-spending districts increased achievement by between 0.3 and 0.5 standard-deviations.¹⁸

Using a uniquely powerful dataset that followed 15,000 students into adulthood, Jackson, Johnson, and Persico provide compelling evidence of the effects of increased K-12

¹² Figlio, David N. “Can public schools buy better-qualified teachers?” *ILR Review* 55, no. 4 (2002): 686–699.

¹³ Loeb, Susanna, and Marianne E. Page. “Examining the link between teacher wages and student outcomes: The importance of alternative labor market opportunities and non-pecuniary variation.” *Review of Economics and Statistics* 82, no. 3 (2000): 393–408.

¹⁴ Deke, John. “A study of the impact of public school spending on postsecondary educational attainment using statewide school district refinancing in Kansas.” *Economics of Education Review* 22, no. 3 (2003): 275–284.

¹⁵ Downes, Thomas A. “School finance reform and school quality: Lessons from Vermont.” *Helping children left behind: State aid and the pursuit of educational equity* (2004): 284–313.

¹⁶ Card, David, and A. Abigail Payne. “School finance reform, the distribution of school spending, and the distribution of student test scores.” *Journal of Public Economics* 83, no. 1 (2002): 49–82.

¹⁷ Downes, Thomas A., Jeffrey Zabel, and Dana Elizabeth Ansel. *Incomplete grade: Massachusetts education reform at 15*. MassINC, 2009.

¹⁸ Guryan, Jonathan. *Does money matter? Regression-discontinuity estimates from education finance reform in Massachusetts*. No. w8269. National Bureau of Economic Research, 2001.

expenditure on high school graduation rates, adult income, and poverty.¹⁹ By looking at the differential effects of resource infusion resulting from school finance reforms in different states, they estimate that a 22 percent increase in per-pupil spending directed at low-income students can eliminate the achievement gap between students coming from low and high income households. A 10 percent increase in per-pupil spending improved low-income students' graduation rates by seven percentage points, and their adult hourly wages by 13 percent.

In a nationwide study, University of California-Berkeley and Northwestern University economists Lafortune, Rothstein, and Schanzenbach found that court orders and legislative reforms generated sharp, immediate and sustained increases in school spending and relative spending in low-income school districts.²⁰ These reforms, moreover, produced gradual increases in the achievement of students in low-income districts. They conclude that "finance reforms are arguably the most important policy for promoting educational opportunity since the turn away from school desegregation in the 1980s."

Studies of School Funding and Student Outcomes in Michigan

Michigan is the setting for a substantial portion of the best research examining the relationship between educational inputs and outcomes, because the passage of Proposal A in 1994 established a "natural" experiment. District-level revenue and spending changes associated with Proposal A were agnostic to student outcomes. This is an ideal context for the implementation of quasi-experimental methods. Indeed, because of Proposal A's particular features, researchers are able to estimate the causal impact of educational spending on outcomes with greater validity than is possible in other states.

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In 2005, Michigan State University economist Leslie Papke used a powerful district-level panel dataset to study the impact of increased spending on students' Michigan Educational Assessment Program (MEAP) passage rates. Papke updated this research in a 2008 study published in *Public Finance Review*.²¹

To estimate the impact of spending changes on MEAP passage rates, Papke used both fixed-effect (FE) and fixed-effect instrumental variable (FE-IV) models. Both methods

¹⁹ Jackson, Kirabo, C., Rucker Johnson, and Claudia Persico. "The effects of school spending on educational and economic outcomes: Evidence from school finance reforms." *The Quarterly Journal of Economics* 131(1), 157-218.

²⁰ Lafortune, Julien, Jesse Rothstein & Diane Whitmore Schanzenbach, School finance reform and the distribution of student achievement 1, 3 (Northwestern Inst. for Policy Research, Working Paper No. WP-16-04, 2016), <https://www.ipr.northwestern.edu/publications/docs/workingpapers/2016/WP-16-04.pdf>.

²¹ Papke, Leslie E. "The effects of changes in Michigan's school finance system." *Public Finance Review* 36, no. 4 (2008): 456-474.

Papke, Leslie E. "The effects of spending on test pass rates: Evidence from Michigan." *Journal of Public Economics* 89, no. 5-6 (2005): 821-839.

showed large positive effects of spending on fourth-grade pass rates. Papke's FE model showed that a ten percent spending increase raised pass rates by 2.5 percentage points, while the FE-IV model found that a 3.7 percentage point increase pass rates from a ten percent increase in funding. The learning gains were larger for students in low-performing districts,

Joydeep Roy, a Columbia University professor and senior economist at the New York City Independent Budget Office, updated and refined Papke's research in a 2011 study published in *Education Finance and Policy*.²² Roy examined several measures of student achievement. He controlled for the presence of charter schools and shifts in the composition of district students. He also examined changes in spending inequality between high- and low-income districts, and isolated both the immediate and longer-term effects of the Proposal A spending reforms.

Roy concluded that Proposal A reduced spending inequality in Michigan to a greater degree than the average among states in which courts mandated funding reform, such as in California following the first *Serrano* case.²³ Moreover, reductions in funding inequality narrowed achievement gaps, as low-income schools' performance improved relative to their high-funded peers. Consistent with previous research in Michigan and elsewhere, Roy found that increases in school spending, especially in less affluent districts, improved student outcomes.

Joshua Hyman built upon Papke and Roy's research by examining the long-run effects of Proposal A funding changes.²⁴ His study, published in the *American Economic Journal*, examined the impacts of funding changes on student-to-staff ratios and teacher salaries in students' elementary schools, and then documented how these resource changes influenced students' college enrollment and persistence.

To test these relationships, Hyman created an original dataset that linked data on fourth grade Michigan students and their schools from 1995 to 2000 with data on students' subsequent postsecondary enrollment.²⁵

Hyman's causal analysis found that a \$1,000 increase in school spending increased college enrollment by 3.3 percentage points and college completion by 2.1 percentage points. Relative to their starting points, these are increases of seven and 12 percent, respectively, resulting from an approximately 10 percent increase in spending.

²² Roy, Joydeep. "Impact of school finance reform on resource equalization and academic performance: Evidence from Michigan." *Education Finance and Policy* 6, no. 2 (2011): 137-167.

²³ For information on California's *Serrano* cases, along with other relevant education litigation, see summaries provided by Stanford's Equality of Opportunity and Education, here: <https://edeq.stanford.edu/sections/landmark-us-cases-related-equality-opportunity-education>

²⁴ Hyman, Joshua. "Does money matter in the long run? Effects of school spending on educational attainment." *American Economic Journal: Economic Policy* 9, no. 4 (2017): 256-80.

²⁵ Hyman used district foundation allowances under Proposal A as an instrument (IV) to predict district spending in order to guard against potential bias in his results. He further mitigated potential bias by tracking students across grades and districts and by controlling for student's previous achievement.

An Outlier Study

While much research, using progressively more sophisticated methods, has established that spending increases produce significant improvement in student outcomes, a recent Michigan-based study arrived at contrary conclusions. Ben DeGrow, director of Education Policy at the Mackinac Center for Public Policy, and Dr. Edward Hoang, an assistant professor at the University of Colorado-Colorado Springs find no impact of educational spending on standardized test scores.²⁶

DeGrow and Hoang's study was released by a policy advocacy organization, the Mackinac Center, so it was not subject to peer review like other research surveyed above. Perhaps for this reason, the study's description of its research methods is more cryptic than is customary.

DeGrow and Hoang use a basic regression model similar to education production function studies to predict 28 test score measures. The authors find insignificant statistical relationships between spending and most test score measures and on this basis conclude that money doesn't matter for student performance in Michigan.

The methods underlying these conclusions, however, are highly unorthodox. The models exclude standard control variables in education research (e.g., special education enrollment). Insofar as these omitted variables are correlated with test scores, the authors' findings are biased. Meanwhile, an unusual and poorly explained variable, grade enrollment, has a huge impact on the authors' results. The authors do not explain why the number of students enrolled in a grade should have such an outsized impact on test scores.

In another break from previous research, DeGrow and Hoang use school buildings as their unit of observation. They note using 4,000 Michigan schools in their sample. (But Michigan did not have that many public schools during their study period.) Because much public education spending is accounted for at the district-level, and not allocated to the school-level in administrative data, their use of building-level data could bias the results.

Another curious feature of DeGrow and Hoang's findings is the extraordinarily high R-squared values of their models. The R-squared statistic measures the share variance in the outcome variable (test scores) that is explained by a model's predictor variables. Rarely in social science research do these values go higher than 0.7. Without explanation, DeGrow and Hoang's models have R-squared values of approximately 0.9—a remarkably high value rarely seen outside of studies using simulated data. If the authors have truly discovered such striking results from their parsimonious statistical models, they should certainly share these findings more widely by publishing them in a peer-reviewed scholarly journal.

Conclusions

Research on the impacts of educational inputs on student outcomes has vastly changed since the time when the “money doesn't matter” slogan first appeared in education policy discussions. Recent research using improved data and methods has reversed earlier negative conclusions, and consistently found that expenditure increases improve student

²⁶ DeGrow, Ben, and Ed Hoang. “School spending and student achievement in Michigan: What's the relationship? A Mackinac Center Report.” *Mackinac Center for Public Policy* (2016).

achievement, high school graduation rates, adult income and earnings, and reduced poverty for disadvantaged students. The studies that have established these effects employed more sophisticated statistical methods and more comprehensive datasets than earlier research.

Some of the best research establishing this new and clearer understanding of how K-12 financial resources benefit children has been based on Michigan. As they consider the funding needs of Michigan's schools, it is only fitting that Michigan's citizens and policymakers understand what the research community already knows.