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REVIEW OF *SCHOOL SPENDING AND STUDENT ACHIEVEMENT IN MICHIGAN: WHAT'S THE RELATIONSHIP?*

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Summary of Review

A recent report from Michigan's Mackinac Center asserts that there is little or no relationship between student achievement and marginal increases to what the report characterizes as the already "high" levels of spending in that state. Yet the report never substantiates its assertion that present spending levels are high, on average, or uniformly high across all children, districts, or schools statewide. The report discounts a significant body of peer-reviewed research that specifically shows positive effects of previous Michigan school finance reforms, including positive effects on state assessments and educational attainment, concentrated on those students who attended, before those reforms, the lowest funded schools or lower performing schools. Additionally, while the report argues that increased spending on schools as they presently exist would necessarily be inefficient and ineffective, this contention is undermined by the lack of evidence for more efficient alternatives and by existing research validating the value of traditional resources. Both a recent major national study and a Michigan-specific study show funding increases as efficacious when allocated primarily toward traditional investments (increased teacher salaries and smaller class sizes). Finally, the empirical analysis included in the report lacks depth and rigor when compared to four other studies—three of which were peer-reviewed—each of which find positive effects of prior school finance reforms in Michigan.



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REVIEW OF *SCHOOL SPENDING AND STUDENT ACHIEVEMENT IN MICHIGAN: WHAT'S THE RELATIONSHIP?*

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I. Introduction

In the spring of 2016, the Mackinac Center for Public Policy released a report titled “School Spending and Student Achievement in Michigan: What’s the Relationship?” (hereinafter referred to simply as the Mackinac report). The report appears to have been produced in part as a pre-emptive strike challenging the validity of a “comprehensive statewide cost study” contracted by the Michigan Legislature to determine the costs of achieving desired outcome standards, and expected to be released on May 13th. Combining a facile empirical analysis with a highly selective review of existing literature, the Mackinac report broadly challenges whether money matters for improving school quality (as measured by student outcomes) generally, or for Michigan schools in particular.

The authors assert that marginal increases to the already “high” levels of spending in Michigan would likely yield little or no gain in student outcomes and that additional dollars allocated to the system as it presently exists would therefore be inefficient (contending, e.g., that spending on increased salaries or reduced class sizes is inefficient). Whether asserting that present spending levels are uniformly high across all children, districts, or schools statewide, or perhaps just high on average, the report never substantiates this key assertion. It fails to acknowledge research showing positive effects of reforms providing additional funding and finding that this increased funding was allocated primarily toward traditional investments (increased teacher salaries and smaller class sizes). Finally, the authors’ own empirical analysis falls short when compared to the three existing peer-reviewed studies, and one non-peer-reviewed study, each finding positive effects of prior school finance reforms in Michigan.

II. Findings and Conclusions of the Report

The Mackinac report claims to address three issues:

1. Whether money for schools in general, or money driven to specific schools and districts through state school finance reform can be expected to lead to improved schooling quality as measured through student outcomes;
2. Whether in the state of Michigan, there exists any relationship between school

funding and school quality; and

3. The validity of attempts to derive cost estimates tied to student outcomes for setting future levels of funding for Michigan schools and for guiding state school finance reforms.

Through a highly selective, largely dated and inadequate review of literature, the report asserts, “The bulk of the academic research suggests that there is no statistically meaningful correlation between school spending and student outcomes” (p. 2). Based on a new statistical analysis, it then concludes, “Based on these results, it is unlikely that injecting new resources into Michigan’s public school system, all else remaining equal, will make a meaningful difference in improving student achievement” (p. 9).

Much of the report presents a (slightly) more nuanced perspective than the bold conclusive statements above. Regarding school finance reform generally, and for Michigan in particular, it implies:

- a. The research indicates that, at best, relatively large investments yield relatively modest or small increases;
- b. But those increases only matter(ed) where prior spending was/is low, and given that presently in Michigan, all spending is high, little or no marginal effect can be expected; and
- c. Citing Hanushek (2001),¹ investments in traditional structures of schooling (salaries and class sizes) are unlikely to yield any positive effects because of the inefficiencies of those structures.

As explained below, the report mischaracterizes the substantial body of major peer-reviewed works, including studies of Michigan. Specifically, the authors ignore major national studies and Michigan-specific studies on the effectiveness of investment in traditional educational inputs—specifically teacher salaries and class sizes. They also provide no evidence regarding what types of reforms or changes to resource allocation might be more cost-effective than these traditional investments.

III. The Report’s Rationale for Its Findings and Conclusions

The report bases its main conclusions on a selective review of school finance literature, plus a series of simple regression models and scatterplots relating school spending and student outcome measures for Michigan schools. As explained below, both approaches fail to support the report’s claims in the face of substantial countervailing evidence, much of it specific to Michigan.

IV. The Report's Use of Research Literature

Does Money Matter for Schools?

The report provides a brief (less than two-page) review of the research literature. The bulk of the first page is consumed with a summary of a nearly 20-year-old (Hanushek, 1997) review of 30- to 50-year-old, primarily crude, correlational studies of the relationship between spending measures and outcome measures.² The thesis of this review is that:

The bulk of the academic research suggests that there is no statistically meaningful correlation between school spending and student outcomes. In cases where the correlation is positive and statistically significant, the effects are quite small—suggesting that even large increases in spending are likely to translate into only small academic effects, on average. (p. 2)

In a recent report *Revisiting the Age Old Question: Does Money Matter in Education (2nd Edition)*,³ I chronicle the various waves of research on the effect of money in schools. In that report, I explain the empirical shortcomings of the literature summarized by Hanushek (1997).⁴ I also summarize the more rigorous, high-quality studies of the same era⁵ as well as subsequent re-analyses of data from that era,⁶ which document a more positive role of schooling resources. Further, I explain that this 20- to 30-year-old debate⁷ over correlational studies relating spending and outcomes at high levels of aggregation (schools, districts, states and nations), is largely moot, given the vast body of more recent, more precise, and more statistically rigorous literature evaluating the short- and long-run impact of school finance reforms on student outcomes.

One recent major national study by Jackson, Johnson and Persico (2015)⁸ found that infusions of funding to districts serving low-income children have substantive long term impacts. The Mackinac report attempts to trivialize this study by asserting that the infusions of funding were helpful to only specific children and the effects relatively small at very high cost. “This research,” the report authors contend, “suggests that it may be possible to boost student achievement through spending more on certain types of schools, but it has limitations. For instance, it finds statistically meaningful positive outcomes for some students only after they were exposed to a 10 percent increase in spending every year for 12 consecutive years of schooling” (p. 2, internal footnote omitted).

By contrast, Jackson, Johnson and Persico characterize their own findings as follows:

Thus, the estimated effect of a 22 percent increase in per-pupil spending throughout all 12 school-age years for low-income children is large enough to eliminate the education gap between children from low-income and non-poor families. In relation to current spending levels (the average for 2012 was \$12,600 per pupil), this would correspond to increasing per-pupil spending

permanently by roughly \$2,863 per student.

Specifically, increasing per-pupil spending by 10 percent in all 12 school-age years increases the probability of high school graduation by 7 percentage points for all students, by roughly 10 percentage points for low-income children, and by 2.5 percentage points for nonpoor children.

For children from low-income families, increasing per-pupil spending by 10 percent in all 12 school-age years boosts adult hourly wages by \$2.07 in 2000 dollars, or 13 percent.⁹

In addition to this mischaracterization of the Jackson, Johnson and Persico study, the report fails to consider an even more recent national analysis, conducted by Lafortune, Rothstein and Schanzenbach (2015),¹⁰ which concluded:

Using test score data from the National Assessment of Educational Progress, we also find that reforms cause gradual increases in the relative achievement of students in low-income school districts, consistent with the goal of improving educational opportunity for these students. The implied effect of school resources on educational achievement is large.¹¹ (p. 1)

School Finance Reforms in Michigan

The Mackinac report faces an uphill battle in asserting the relative unimportance of school finance reform in Michigan, because it is one of the few states for which several peer-reviewed empirical studies have already found positive effects of previous reforms (finance reforms addressing inequities that have since re-emerged, as discussed below). It attempts to discount two peer-reviewed studies from the highly respected journals *Education Finance and Policy* (Roy, 2011) and *The Journal of Public Economics* (Papke, 2005) with the following explanation:

These two studies have limited relevance to the current debates about school funding in Michigan, however. It's unlikely that public schools would again receive large increases in funding like the ones these studies analyzed; current policy debates about school resources only concern marginal changes to school funding levels. Additionally, their findings show the most positive gains for relatively low-spending schools and little or no gains for relatively high-spending schools. Per-pupil funding has increased in real terms since the time period examined by these studies, and most Michigan schools today would be high spending ones if compared to the schools these studies analyzed. (p. 3)

So, rather than incorporating the conclusions of these Michigan-specific studies into their broader assessment of the role of money, school finance reform and schools (instead, opting to rely on the 20-year-old review of non-Michigan studies to address that broader question),

the authors assert that the studies lack relevance to the present policy debate in Michigan.

In *Revisiting the Age Old Question: Does Money Matter in Education (2nd Edition)*, I explain Papke and Roy's findings as follows, along with a third not yet peer-reviewed study by Hyman (2013):

Studies of Michigan school finance reforms of the 1990s have shown positive effects on student performance in both the previously lowest-spending districts¹² and previously lower-performing districts.¹³ For instance, Roy (2011) found that Michigan's school finance reforms of the 1990s led to a significant increase among previously low-spending districts. Roy, whose analyses measure both *whether* the policy resulted in changes in funding and *who* was affected, found that Michigan's school finance plan "was quite successful in reducing interdistrict spending disparities. There was also a significant positive effect on student performance in the lowest-spending districts as measured in state tests" (abstract).¹⁴

Similarly, Papke (2005), also evaluating Michigan school finance reforms of the 1990s, found that "increases in spending have nontrivial, statistically significant effects on math test pass rates, and the effects are largest for schools with initially poor performance" (p. 821).¹⁵

Most recently, Hyman (2013) also found positive effects of these Michigan school finance reforms, but the paper raised some concerns regarding the distribution of those effects. Hyman found that much of the increase was targeted to schools serving fewer low-income children. However, the study did find that students exposed to "\$1,000, or 12%, more spending per year during grades four through seven experienced a 3.9 percentage point increase in the probability of enrolling in college, and a 2.5 percentage point increase in the probability of earning a degree" (p. 1).¹⁶

The Mackinac report acknowledges but discounts Hyman's work in a footnote (p.3), asserting that the study found a relatively high cost of relatively small improvements, but without comparison to more cost effective alternatives. A fourth peer-reviewed study, from the *Economics of Education Review*, also finds a positive impact of Michigan school finance reforms.¹⁷ Chaudhary (2009) concludes, "A 60% increase in spending increases the percent satisfactory score by one standard deviation. The positive impact of expenditures on test performance seems largely due to higher teacher salaries"¹⁸ (p. 90).

Chaudhary's findings also challenge the assertion put forth by the Mackinac authors that, because the structure of the public education system is generally "inefficient," infusion of funding into the current education system structure is unlikely to yield positive effects. Chaudhary (2009) finds specifically that infusion of new funding under Michigan's *Proposal A* led primarily to increased teacher salaries and secondarily to reduced class sizes and it was through these resource allocations that increased outcomes were realized. These findings are entirely consistent with those of Jackson, Johnson and Persico (2015), in their

national analysis.¹⁹

Literature on Education Cost Studies

A secondary critique offered in the Mackinac report is that the state’s ongoing attempt to determine the cost of achieving adequate educational outcomes amounts to alchemy. In fact, the report was apparently triggered by the state’s decision to contract an outside firm (Augenblick, Palaich and Associates (APA)) to conduct a study of education costs—a study that may then inform the design of an updated foundation aid formula. The Mackinac authors rely on Guthrie and Springer’s (2007) critique of education cost studies and a Hanushek *Education Next* article (2005).²⁰ Yet a wider and more balanced literature on this topic does exist.²¹

The report includes three main critiques of APA studies: (a) the majority of studies conducted by APA resulted in proposed increases in funding, (b) studies based on prescribed staffing inputs have yielded different prescriptions from one state to the next, and (c) studies based on school spending behavior have resulted in wide variations, implying that “adequate levels of funding can vary district by district or school by school” (p. 4).

Whether the cost of achieving adequate outcomes is more or less than what is currently being spent is context specific, depending on the outcome goals in question, on prior and existing levels of spending, and on factors that affect the costs of achieving those outcome goals. Indeed, cost studies should not find that districts already exceeding specific standards with current resources require additional resources merely to meet those standards, and some studies by APA deserve critique for that reason.²²

It may make sense, however, where state outcome goals and regulatory requirements exist, that staffing prescriptions from input-oriented analysis differ across states. The presence of such variations across studies is an insufficient basis for condemning their validity.²³ I, along with Jesse Levin (2014) and previously in a National Research Council report with Lori Taylor and Arnold Vedlitz (2008), have raised concerns regarding the usefulness for determining “costs” by relying on mere calculations of the average spending of schools or districts meeting specific outcome standards (Successful Schools/Districts method).²⁴ To summarize, the Mackinac report assertion that any and all attempts to guide school finance policy with cost analysis are alchemy is refuted by more thorough reviews of methods for conducting such analysis.²⁵ That said, the authors are correct to assert that the “successful school districts” approach is not generally a valid method for determining education “costs.”

V. Review of the Report’s Methods

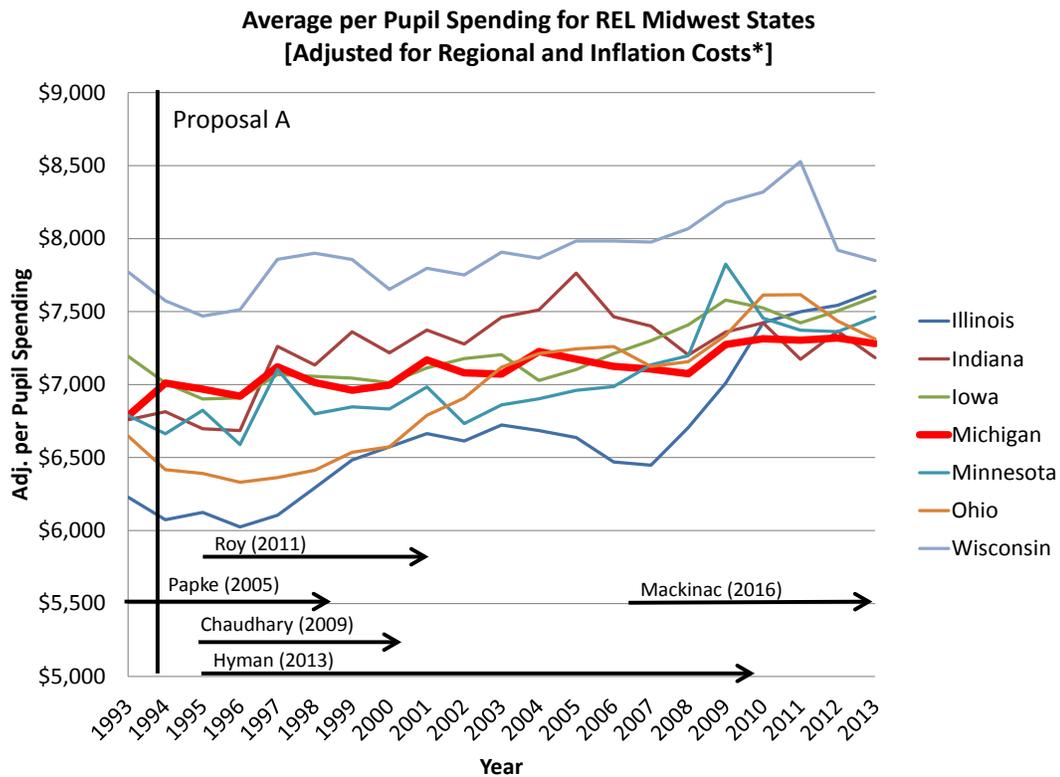
The report concludes with an empirical analysis intended to validate that there exists little or no relationship between school spending and a variety of outcome measures for Michigan

schools. The authors apply two methods: (a) school fixed effects regression analysis modeling, to determine whether year-over-year, within-school changes in spending are associated with concurrent year-over-year changes in the various outcome measures (from 2007-2013);²⁶ and (b) scatterplots of the relationship between changes in school-level spending and changes in school-level outcomes from 2007 to 2013. Based on their models, the authors find that for 27 of 28 academic indicators no statistical relationship exists between changes in spending and changes in those indicators.

The Mackinac results differ from the three peer-reviewed studies, and one rigorous non-peer-reviewed study, addressed earlier. These different findings may arise in part as a function of the different time frames studied, but the differences also arise because of differences in measures and models used. First, the Mackinac authors use data from 2007 to 2013, asserting that one reason earlier studies may have found a more positive impact is that all Michigan districts were spending at much higher levels by the time period of the Mackinac study. Thus, they argue, the benefits of previous increases are unlikely to be realized by further increasing spending.

Figure 1 refutes the premise that Michigan per-pupil spending has risen substantively since the reform periods studied by other researchers. Adjusted for labor costs, both regionally and over time (expressed in year 2000 dollars), Michigan per-pupil spending has risen slightly over time, but still slower than states in the same region—called “Regional Education Laboratory Midwest” —falling from the middle of the pack to near the bottom by the end of the period.

Figure 1.

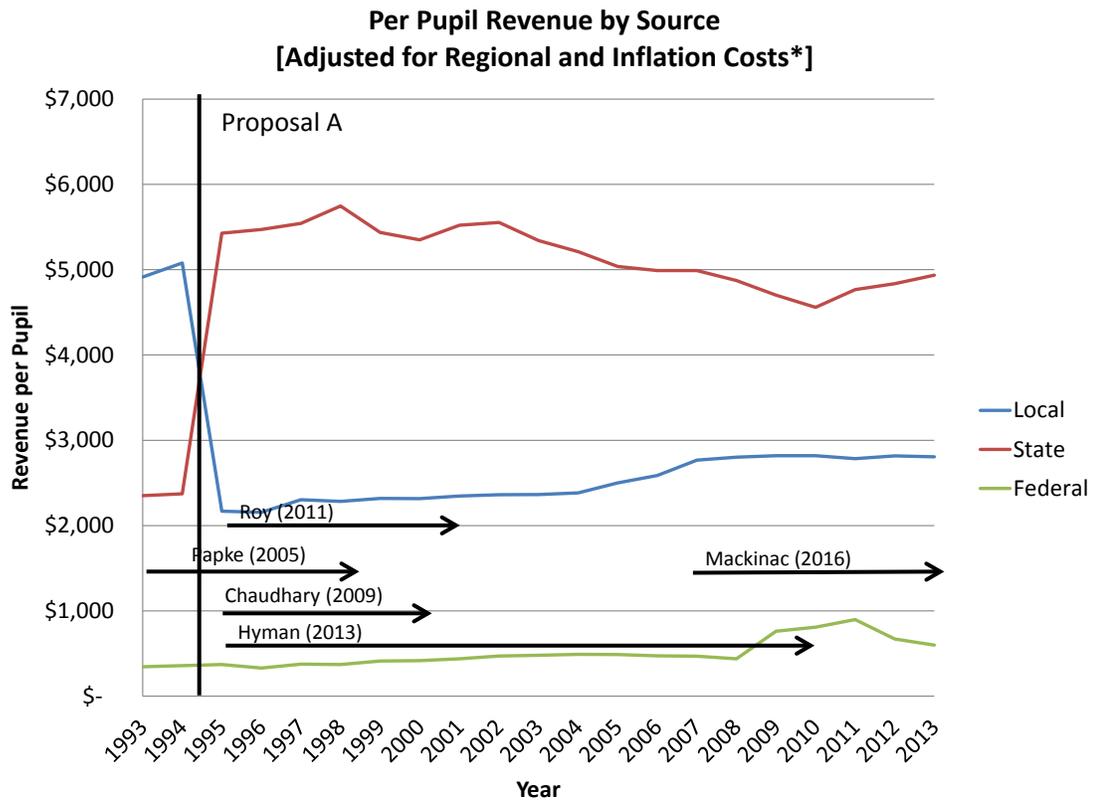


Data Sources: Per Pupil Spending from the Census Fiscal Survey of Local Governments (PPCSTOT),²⁷ adjusted for inflation and regional cost variation using the *Education Comparable Wage Index²⁸ (expressed in year 2000\$).

Roy (2011) studied the period from 1995 to 2001, Papke (2005) from 1992 to 1998, Chaudhary (2009) from 1995 to 2000 and Hyman from 1995 to 2010. All were attempting to capture the effect of a disruptive reform implemented in 1994 (Proposal A). If the goal of policymakers moving forward is to implement a new, disruptive reform—one that alters both the level and distribution of school spending—these studies, while from an earlier period, are as relevant if not more so than a study over a period (2007-2013) where no such reforms have been attempted.

Figure 2 displays the disruptive policy effect investigated by these authors. Proposal A primarily involved a substitution of local property tax revenue with substantially increased state aid to schools, the effect of which was to marginally reduce overall disparity across Michigan districts. In particular, Proposal A leveled up revenues of low-property-wealth districts. As shown in Figure 2, the reform resulted in an initial stark change; but after about 2001 state aid began to taper off, and local revenue increase.

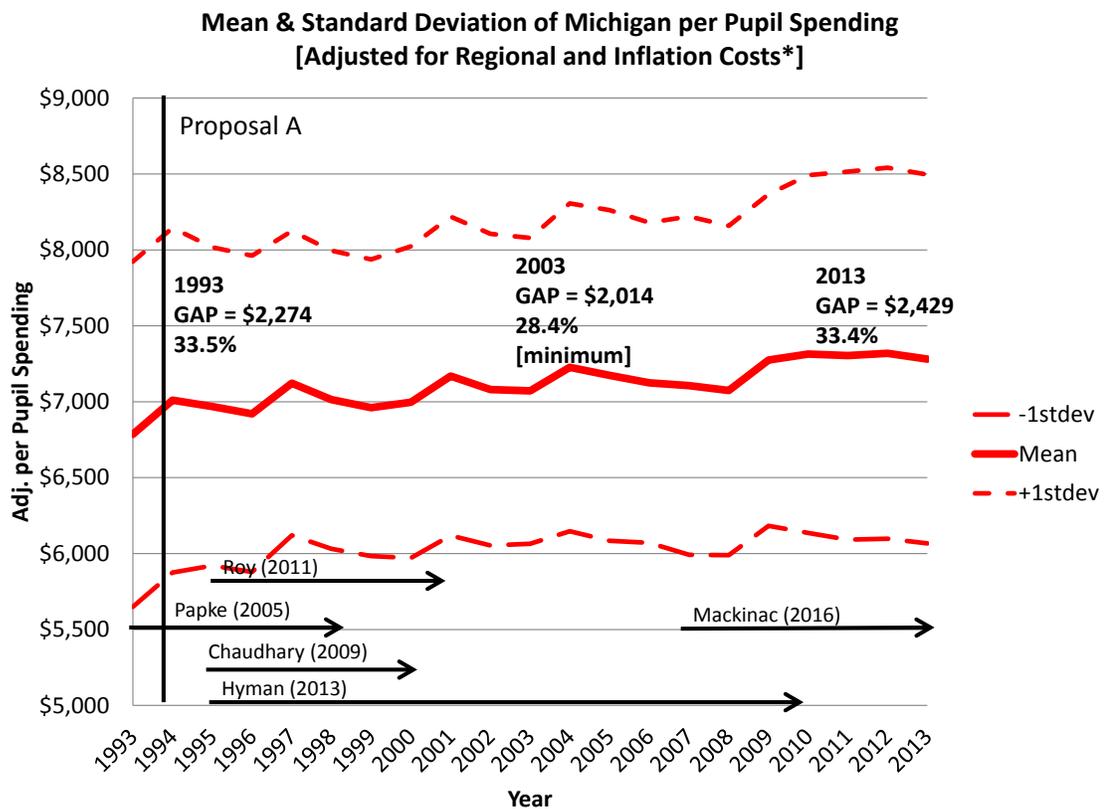
Figure 2.



Data Sources: State, Local and Federal Revenue from the Census Fiscal Survey of Local Governments,²⁹ adjusted for inflation and regional cost variation using the *Education Comparable Wage Index³⁰ (expressed in year 2000\$).

Figure 3 shows the mean and standard deviation of per-pupil spending across Michigan districts over time. It therefore offers a way of looking at resource equity. The figure reveals that differences between districts that were one standard deviation above and below the mean shrunk modestly from 1993 to 2003 and then reverted to their previous levels by 2013. So, the period over which the Mackinac authors are studying the effect of funding is one in which disparity grew, in important contrast to the period studied by other authors, which involved marginal reductions in disparities.

Figure 3.



Data Sources: Per Pupil Spending from the Census Fiscal Survey of Local Governments (PPCSTOT)³¹, adjusted for inflation and regional cost variation using the *Education Comparable Wage Index³² (expressed in year 2000\$)

Importantly, each of the other studies includes analyses of the differential effects of increased funding, either on districts and schools that were previously lower performing or on districts that were previously lower spending.

- Papke (2005) specifically finds greater impact of additional resources in those schools initially lower performing;
- Roy (2011) similarly splits his sample, but into multiple groups by pre-reform spending levels³³ to find that those initially with low spending saw the greatest benefits in student outcomes of increased funding; and
- Hyman (2013) finds stronger positive effects on educational attainment for schools initially in the bottom half of revenue.³⁴

Further, while the Mackinac report’s analysis is most similar to that of Papke (2005), controlling for low income shares and school size,³⁵ the other studies addressed herein include

richer sets of controls:

- Roy (2011) accounts for racial and gender compositions and free lunch eligibility;
- Chaudhary (2009) accounts for racial composition, rural status and economies of scale (2nd order term on district enrollment);³⁶ and
- Hyman (2013), using a student-level data panel, accounts for gender, race, (low) income status, English language proficiency and disability status, providing the richest set of potentially relevant covariates as well as addressing longer term outcomes—college enrollment and degree attainment.³⁷

Other non-trivial differences add rigor to the Hyman (2013), Roy (2011) and Chaudhary (2009) analyses.³⁸ And again, each of these studies finds substantive, positive effects of school finance reforms adopted in the 1990s in Michigan, where those effects are most substantial for children attending either previously low-performing or previously low-spending districts. Scatterplots lacking any covariates are insufficient to counterbalance the weight of evidence provided by these studies.

VI. Review of the Validity of the Findings and Conclusions

Given substantial rigorous and peer-reviewed evidence to the contrary, and the empirical shortcomings of the report's own analyses, the assertion that money in general or school finance reforms cannot and will not help Michigan's schools is simply not supported by the facts. Substantive school finance reforms in the past have helped those schools in Michigan most in need of help at the time. School finance reforms more broadly have been shown to help those who were, at the outset of those reforms, the most disadvantaged. The evidence produced by the authors of the Mackinac report provides little compelling support for their conclusions.

The report's discussion section expands on its assertion that introducing money in the current system would be unlikely to produce positive results because of the inefficiencies of the structure of that system (citing the work of Hill and Roza (2008) of the Center for Reinventing Public Education,³⁹ and again citing Hanushek (2006)).⁴⁰ The report's suggestion is that any money that might go into traditional investments in the system as it presently exists (increased salaries and reduced class sizes) is necessarily less efficient than the preferred policy alternatives of Hanushek, Hill, and Roza and the Mackinac authors. At the extreme, the contention seems to be that any investments into the system as it currently exists will have no positive effect at all (thus each marginal dollar is 100% inefficient). As noted herein, the national research (Johnson, Jackson and Persico, 2015) and the Michigan-specific research (Chaudhary, 2009) find otherwise—that money infused through school finance reforms, which led to higher salaries and smaller classes, did in fact lead to improved outcomes. Further, as explained extensively by Baker and Welner (2011, 2012), claims of vastly more efficient or cost-effective alternatives remain unsubstantiated.⁴¹

VII. Usefulness of the Report for Guidance of Policy and Practice

The authors' conclusion that "it is unlikely injecting new resources into Michigan's public school system, all else remaining equal, will make a meaningful difference in improving student achievement" (p. 9) is simply not a credible talking point to inform whether the state should or should not consider reforming its school finance system, which may include injecting substantial new resources into those schools and districts most in need. The Mackinac report wrongly assumes that all Michigan districts are now high spending and that none could benefit from any marginal increase to funding; it fails to evaluate thoroughly the overall level of spending in context, nor does it adequately consider whether and to what extent spending varies across children and contexts within Michigan.

The Mackinac report does, read more carefully (or perhaps generously between the lines), identify some nuanced issues of the current policy context of Michigan school finance. The authors appropriately express concern that the conversation may be too focused on marginal, across-the-board increases to funding, which might be supported by the pending adequacy cost study. In doing so, the authors acknowledge that the existing body of research reveals positive effects of substantive, sustained school finance reform on those most in need, while also pointing out that increased funding to those less in need might be an inefficient endeavor. This bit of wisdom should likely guide Michigan's legislators as they consider findings presented to them from the pending cost study and as they move forward on reforming Michigan's system of school finance. Policy solutions moving forward should focus on areas of greatest need, and some children, schools and districts may face greater deficits and have greater needs than others in the current policy context, as was the case in the early 1990s.⁴²

Notes and References

- 1 Hanushek, E.A. (2001). Spending on Schools. In T. Moe (Ed.), *A Primer on American Education* (81-82). Stanford, CA: Hoover Institution Press. Retrieved May 9, 2016, from <https://perma.cc/3YHR-MYJS>
- 2 This is not to condemn the studies of this era but rather to point to the limitations of large scale quantitative policy research from the 1950s through the 1980s, the most prominent of which was the Coleman Report of 1966. These studies, in many cases, did the best they could (some, like Coleman's, being herculean efforts) given the data and methods of their time. In my report *Revisiting the Age-Old Question: Does Money Matter in Education? 2nd Edition* (2016), I explain:

The saga over whether money matters in American public education can be traced back to the broader question of whether *schools* matter. That is, whether schools and school quality have any influence on student achievement, educational attainment and future earnings. The first national, large-scale quantitative analysis to explore this question was sociologist James Coleman's widely cited "Equality of Educational Opportunity" report, which came about as part of the Civil Rights Act of 1964.

Among other things, the Coleman report explored the relationship between school resource measures and student outcomes, finding little relationship between the two. Using the (more limited) statistical techniques of the day, Coleman concluded that, on balance, the strongest correlations with student outcome measures were not found in schools but rather among factors related to parental income, parental education levels and resources in the home. That said, among school resource measures, Coleman did find that teacher characteristics were positively associated with student outcomes, and more strongly so for minority students compared with white students. Nonetheless, the implication drawn by many was that schools simply don't matter. An extension of this implication was that putting more money into schools to try to improve quality was unlikely to matter either.

However, recent re-analyses of the Coleman report data, using up-to-date statistical techniques and computing capacity, found that even Coleman's data indicate that schooling quality has significant effects on student outcomes. In one recent example, Konstantopolous and Borman (2011) conclude:

"Our results also indicated that schools play meaningful roles in distributing equality or inequality of educational outcomes to females, minorities, and the disadvantaged."

In a related analysis, Borman and Dowling (2010) report:

"Even after statistically taking into account students' family background, a large proportion of the variation among true school means is related to differences explained by school characteristics."

In short, while family background certainly matters most, schools matter as well. Furthermore, there exist substantive differences in school quality that explain a substantial

portion of the variation in student outcomes.

For an early discussion of the Coleman findings and misinterpretations of those findings with respect to policy implications, see Kain, G.C. & Watts, H.W. (1970).. Problems in Making Policy Inferences from the Coleman Report. *American Sociological Review*, 35(2) , 228-242; and Bowles, S. & Levin, H.M.. (1968). The Determinants of Scholastic Achievement—an Appraisal of Some Recent Evidence. *Journal of Human Resources*, 3(1), 24

Coleman, J.S., Campbell, E.Q., Hobson, C.F. McPartland, J, Mood, A.M, et al, (1966). *Equality of Educational Opportunity*. Washington, DC: U.S. Office of Education.

Konstantopolous, S. & Borman, G. (2011). Family Background and School Effects on Student Achievement: A Multilevel Analysis of the Coleman Data. *Teachers College Record*, 113(1), 97-132.

Borman, G.D. & Dowling, M. (2010) Schools and Inequality: A Multilevel Analysis of Coleman’s Equality of Educational Opportunity Data,” *Teachers College Record*, 112(5), 1201-1246.

Baker, B.D. (2016). *Revisiting the Age-Old Question: Does Money Matter in Education? 2nd Edition*. Washington, D.C.: Albert Shanker Institute. Retrieved May 10, 2016, from http://www.shankerinstitute.org/sites/shanker/files/moneymatters_edition2.pdf

- 3 Baker, B.D. (2016). *Revisiting the Age-Old Question: Does Money Matter in Education? 2nd Edition*. Washington, D.C.: Albert Shanker Institute. Retrieved May 10, 2016, from http://www.shankerinstitute.org/sites/shanker/files/moneymatters_edition2.pdf
- 4 Hanushek, E.A. (1997). Assessing the Effects of School Resources on Student Performance: An Update. *Educational Evaluation and Policy Analysis*, 19(2) 141-164.
- 5 Greenwald, R., Hedges, L. & Laine, R. (1996). The Effect of School Resources on Student Achievement. *Review of Educational Research*, 66(3), 361-396.

Greenwald and colleagues explain: “Studies in the universe Hanushek (1989) constructed were assessed for quality. Of the 38 studies, 9 were discarded due to weaknesses identified in the decision rules for inclusion described below. While the remaining 29 studies were retained, many equations and coefficients failed to satisfy the decision rules we employed. Thus, while more than three quarters of the studies were retained, the number of coefficients from Hanushek’s universe was reduced by two thirds” (p. 363). Greenwald and colleagues further explain that: “Hanushek’s synthesis method, vote counting, consists of categorizing, by significance and direction, the relationships between school resource inputs and student outcomes (including but not limited to achievement). Unfortunately, vote-counting is known to be a rather insensitive procedure for summarizing results. It is now rarely used in areas of empirical research where sophisticated synthesis of research is expected” (p. 362).

Hanushek (1997) provides his rebuttal to some of these arguments, and he returns to his “uncertainty” position: “The close to 400 studies of student achievement demonstrate that there is not a strong or consistent relationship between student performance and school resources, at least after variations in family inputs are taken into account” (p. 141). Hanushek, E.A. (1997). Assessing the Effects of School Resources on Student Performance: An Update. *Educational Evaluation and Policy Analysis* 19(2), 141-164. See also Hanushek, E.A. (1994, May). Money Might Matter Somewhere: A Response to Hedges, Laine and Greenwald. *Educational Researcher* 23, 5-8.

- 6 Borman, G.D. & Dowling, M. (2010). Schools and Inequality: A Multilevel Analysis of Coleman's Equality of Educational Opportunity Data. *Teachers College Record*, 112(5),1201-1246.

Konstantopolous, S. & Borman, G. (2011). Family Background and School Effects on Student Achievement: A Multilevel Analysis of the Coleman Data. *Teachers College Record* 113(1), 97-132.
- 7 Instigated in the modern era by a highly influential piece written by Hanushek in which he concluded: "There appears to be no strong or systematic relationship between school expenditures and student performance." (p. 1162).

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Jackson, C.K., Johnson, R.C., & Persico, C. (2015, Fall). Boosting Educational Attainment and Adult Earnings. *Education Next* 15(4). Retrieved May 10, 2016, from <http://educationnext.org/boosting-education-attainment-adult-earnings-school-spending/>
- 9 Jackson, C.K., Johnson, R.C., & Persico, C. (2015, Fall). Boosting Educational Attainment and Adult Earnings. *Education Next* 15(4). Retrieved May 10, 2016, from <http://educationnext.org/boosting-education-attainment-adult-earnings-school-spending/>
- 10 Lafortune, J., Rothstein, J., & Schanzenbach, D.W. (2015). *School Finance Reform and the Distribution of Student Achievement* (Working Paper). University of California at Berkeley. Retrieved May 10, 2016, from http://eml.berkeley.edu/~jrothst/workingpapers/LRS_schoolfinance_120215.pdf
- 11 Lafortune, J., Rothstein, J., & Schanzenbach, D.W. (2015). *School Finance Reform and the Distribution of Student Achievement* (Working Paper). University of California at Berkeley. Retrieved May 10, 2016, from http://eml.berkeley.edu/~jrothst/workingpapers/LRS_schoolfinance_120215.pdf
- 12 Roy, J. (2011). Impact of School Finance Reform on Resource Equalization and Academic Performance: Evidence from Michigan. *Education Finance and Policy*, 6(2), 137-167. Roy (2011) published an analysis of the effects of Michigan's school finance reforms of the 1990s, which led to a significant leveling up for previously low-spending districts. Roy, whose analyses measure both whether the policy resulted in changes in funding and who was affected, found that "Proposal A was quite successful in reducing interdistrict spending disparities. There was also a significant positive effect on student performance in the lowest-spending districts as measured in state tests" (p. 137).
- 13 L. Papke (2005). The Effects of Spending on Test Pass Rates: Evidence from Michigan. *Journal of Public Economics* 89(5-6), 821-839; and

J. Hyman (2013). *Does Money Matter in the Long Run? Effects of School Spending on Educational Attainment*. Retrived May 10, 2016, from www-personal.umich.edu/~jmhyman/Hyman_JMP.pdf
- 14 Roy, J. (2011). Impact of school finance reform on resource equalization and academic performance: Evidence from Michigan. *Education Finance and Policy*, 6(2), 137-167.
- 15 Papke, L. (2005). The Effects of Spending on Test Pass Rates: Evidence from Michigan. *Journal of Public Economics* 89(5-6), 821-839. In a separate study, Leuven and colleagues attempted to isolate specific effects

of increases to at-risk funding on at-risk pupil outcomes but did not find any positive effects. Leuven, E., Lindahl, M., Oosterbeek, H. & Webbink, D. (2007). The Effect of Extra Funding for Disadvantaged Pupils on Achievement. *Review of Economics and Statistics* 89(4) 721-736.f

16 J. Hyman (2013). *Does Money Matter in the Long Run? Effects of School Spending on Educational Attainment*. Retrived May 10, 2016, from www-personal.umich.edu/~jmhyman/Hyman_JMP.pdf

17 Chaudhary, L. (2009). Education inputs, student performance and school finance reform in Michigan. *Economics of Education Review*, 28(1), 90-98.

The Mackinac authors also never mention a fifth Michigan study—one that makes assertions most consistent with their own: that outcomes may be relatively insensitive to infusion of additional resources, making school finance reform a potentially costly option for improving outcomes. However, this study, like the Mackinac report, fails to make a direct comparison to cost effectiveness of policy alternatives. Also, it relies on a more speculative general equilibrium model to project impacts across decennial data. Finally, it applies that model to Detroit only. Roy’s (2011) study provides analyses that include and exclude Detroit, finding greater impacts when Detroit is excluded.

Ferreya, M.M. (2009). An empirical framework for large-scale policy analysis, with an application to school finance reform in Michigan. *American Economic Journal: Economic Policy*, 1(1), 147-180.

18 Chaudhary, L. (2009). Education inputs, student performance and school finance reform in Michigan. *Economics of Education Review*, 28(1), 90-98.

19 Jackson, Johnson and Persico (2015) explain:

“We find that when a district increases per-pupil school spending by \$100 due to reforms, spending on instruction increases by about \$70, spending on support services increases by roughly \$40, spending on capital increases by about \$10, while there are reductions in other kinds of school spending, on average.

“We find that a 10 percent increase in school spending is associated with about 1.4 more school days, a 4 percent increase in base teacher salaries, and a 5.7 percent reduction in student-teacher ratios. Because class-size reduction has been shown to have larger effects for children from disadvantaged backgrounds, this provides another possible explanation for our overall results.

“While there may be other mechanisms through which increased school spending improves student outcomes, these results suggest that the positive effects are driven, at least in part, by some combination of reductions in class size, having more adults per student in schools, increases in instructional time, and increases in teacher salaries that may help to attract and retain a more highly qualified teaching workforce.”

Jackson, C.K., Johnson, R.C., & Persico, C. (2015, Fall). Boosting Educational Attainment and Adult Earnings. *Education Next* 15(4). Retrieved May 10, 2016, from <http://educationnext.org/boosting-education-attainment-adult-earnings-school-spending/>

20 Guthrie, J.W. & Springer, M.G. (2007, Winter). Courtroom Alchemy: Adequacy Advocates Turn Guesstimates into Gold. *Education Next* 7(1), 24-25. Retrieved May 10, 2016, from <https://perma.cc/HQF8-RBT7>

Hanushek, E.A. (2005). Pseudo-Science and a Sound Basic Education. *Education Next* 5(4), 71–72. Retrieved May 10, 2016, from <https://perma.cc/9KA6-QZA5>

21 Baker, B. D. (2006, Fall). Evaluating the reliability, validity, and usefulness of education cost studies. *Journal of Education Finance* 32(2), 170-201.

Chambers, J. G., & Levin, J. (2009). *Determining the Cost of Providing an Adequate Education for All Students*. Washington, D.C.: National Education Association.

Duncombe, W. (2006). Responding to the charge of alchemy: Strategies for evaluating the reliability and validity of costing-out research. *Journal of Education Finance* 32(2), 137-169.

Downes, T. (2004). What is Adequate? Operationalizing the Concept of Adequacy for New York State. Retrieved May 10, 2016, from <https://www.bostonfed.org/economic/nesc/papers/Downes.pdf>

Baker, B.D., Taylor, L.L., & Vedlitz, A. (2008). Adequacy estimates and the implications of common standards for the cost of instruction. *National Research Council*.

- 22 Hanushek, E.A. (2005). Pseudo-Science and a Sound Basic Education. *Education Next* 5(4), 71-72. Retrieved May 10, 2016, from <https://perma.cc/9KA6-QZA5>

Baker, B.D. (2006, Fall). Evaluating the reliability, validity, and usefulness of education cost studies. *Journal of Education Finance* 32(2), 170-201.

- 23 As implied by the chosen Guthrie and Springer (2007) quote: "... suggest, at a minimum, that there is no science involved in such estimations."

- 24 Baker, B., & Levin, J. (2014). *Educational Equity, Adequacy, and Equal Opportunity in the Commonwealth: An Evaluation of Pennsylvania's School Finance System*.

Baker, B.D., Taylor, L.L., & Vedlitz, A. (2008). Adequacy estimates and the implications of common standards for the cost of instruction. *National Research Council*.

- 25 Baker, B., & Levin, J. (2014). *Educational Equity, Adequacy, and Equal Opportunity in the Commonwealth: An Evaluation of Pennsylvania's School Finance System*.

Baker, B.D., Taylor, L.L., & Vedlitz, A. (2008). Adequacy estimates and the implications of common standards for the cost of instruction. *National Research Council*.

- 26 I should add a few notes regarding the authors' reported regression findings, suggesting red flags that cannot be resolved given the report's poor documentation. It would appear, based on the limited information provided in the report, that the authors simply included a dummy variable for each school statewide, thus explaining on the order of 90% of the variance in student outcomes. This is certainly one way to approach a school fixed effects model, but it then conceals how much variation exists "within" schools over time and how much of that within school variation is explained by the model, for comparison with the other studies. Moreover, reported numbers of schools included in each model are confusing if not simply wrong. There exist approximately 4,000 schools in Michigan, a figure with which the authors concur in their text. But, the report's regression output indicates N=6,434 fourth grades for which MAEP scores were available. This figure may be the number of fourth grades over the seven-year period, which may indicate a problem with the data and/or analysis. For example, it may indicate that fewer than 1,000 schools per year are included in the panel. Whatever the explanation, documentation and output are insufficient and sloppy, if not simply wrong.

- 27 See <http://www.census.gov/govs/school/>

- 28 See http://bush.tamu.edu/research/faculty/taylor_CWI/, (values prior to 1997 imputed linearly within labor market).

- 29 See <http://www.census.gov/govs/school/>

- 30 See http://bush.tamu.edu/research/faculty/taylor_CWI/, (values prior to 1997 imputed linearly within labor market).
- 31 See <http://www.census.gov/govs/school/>
- 32 See http://bush.tamu.edu/research/faculty/taylor_CWI/, (values prior to 1997 imputed linearly within labor market).
- 33 He split 524 K–12 districts into five equal groups based on the 1993–94 level of per pupil spending (Group 1 consists of the lowest-spending 105 districts, Group 2 consists of the next 105 districts, and so on) p. 146
- 34 Much of Hyman’s analysis focuses on just those districts from the bottom half of initial revenue. Table 7 (page 45) of his analysis presents findings of alternative specifications of the relationship between spending and college attainment for all schools and for school from the bottom half of revenue.
- 35 Mackinac’s data and model are perhaps most closely aligned with those of Papke (2005) in that they construct school level (rather than district) estimates of per pupil spending and associate changes in those estimates to changes in test score measures over a relatively short panel, including covariates for shares of low income children and enrollment. But Papke (2005) runs multiple alternative specifications including use of instrumental variables to address endogeneity of her spending measure. Mackinac uses grade level enrollment and Papke uses school enrollment (ln) and enrollment squared (ln). It is important that Papke uses the second order term, because a significant body of literature on economies of scale in education finds the relationship between school or district size and costs (thus the value of the education dollar spent in schools) to be non-linear.

Andrews, M., Duncombe, W., & Yinger, J. (2002). Revisiting economies of size in American education: are we any closer to a consensus?. *Economics of Education Review*, 21(3), 245-262.

- 36 See Footnote 23 regarding the importance of the second order term.
- 37 It is particularly important to understand that special education shares, especially with school level data, are a major determinant of spending variation because they are a major determinant of staffing requirements. In Michigan in particular, special education shares are a dominant determinant of both variations in school site and district level current spending per pupil. Failure to control for special education populations can compromise models of the input-outcome relationship because districts or schools with higher rates of disability will likely have both higher average spending (all else equal) and lower outcome levels and potentially lower outcome change over time.
- 38 Hyman (2013), Chaudhary (2009), Papke (2005) and Roy (2011) each apply fixed effects instrumental variables models, instrumenting the spending measure with state foundation allowances. Hyman uses a student level panel to determine long term effects of spending shifts resulting from Proposal A, with specific emphasis on districts in the lower half of 1994 revenue. Both Roy and Hyman also take steps to reconcile their findings with those of Papke.

Comparing his findings to those of Papke, Roy (2011) explains:

“Finally, it might be useful to compare the results obtained above with the estimates in Papke (2005). The IV estimates in her study suggest that a 10 percent increase in spending increases the pass rates in fourth-grade mathematics by about 2.2 percentage points. Since the average per pupil spending in Michigan during her sample period was slightly over \$5,000 (see tables 2 and 3 in her study), a 10 percent increase in spending

translates to about \$500. This is comparable to but slightly smaller than my estimates reported above. I find an increase of between 3 and 4 percentage points in fourth-grade mathematics pass rates for every \$500 of additional spending. The differences in actual magnitudes can be attributed to differences in sample and methodology—for example, she uses a smaller number of years (ending at 1998, while this study uses data through 2001). The regressions here also control for racial composition, etc.” (p. 159)

- 39 Hill, P.T., Roza, M. & Harvey, J. (2008, December). *Facing the Future: Financing Productive Schools*. Seattle, WA: Center on Reinventing Public Education. Retrieved May 10, 2016, from <https://perma.cc/YCM4-CG4K>
- 40 Hanushek, E.A. (2006). School Resources. In E.A. Hanushek and F. Welch (Eds.), *Handbook of the Economics of Education Volume 2*. Amsterdam: North Holland Publishing Co.
(Elsevier B.V., 2006), 889–890, <https://perma.cc/7FWX-7LC5>
- 41 Baker, B.D. & Welner, K.G. (2011). *Productivity Research, the U.S. Department of Education, and High-Quality Evidence*. Boulder, CO: National Education Policy Center. Retrieved May 10, 2016 from <http://nepc.colorado.edu/publication/productivity-research>
- Baker, B., & Welner, K.G. (2012). Evidence and rigor scrutinizing the rhetorical embrace of evidence-based decision making. *Educational Researcher*, 41(3), 98-101.
- 42 Others, including myself, have found previously that existing distributions of state aid in Michigan are in some cases inefficiently allocated to those less in need of support, diminishing the available pool of state resources for those with greater needs. This is not to suggest that there already exists enough revenue in the system to resolve inequities and inadequacies. But state policymakers should consider the equitable targeting of resources that do presently exist within the system as part of the solution. See <https://www.americanprogress.org/wp-content/uploads/2012/09/StealthInequities.pdf>

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