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Educational Test Scores, Education Spending, and Productivity in Public Education: National Trends and Evidence Across States and Over Time, 1990-2015

- **This study finds a decades-long, substantial rise in national educational funding but only very modest increases in test scores**
- **These imply that productivity, as measured by test score points per dollar of funding, has steadily decreased**
- **Funding variations across states and over time indicate a minimal association of funding to test scores, consistent with the decline in educational productivity**

Concerns about the performance of traditional public schools have been with us for quite a number of years. Though disputes regarding school funding seem to occur regularly, the data are clear in showing increasing resources being devoted to public schools over the past several decades. The increasing use of resources has reinforced concerns regarding public school performance. Essentially, this is a question about what is being attained with the dollars spent on K-12 education.

Thus, an important aspect of this paper is to examine the relationship of school funding to student outcomes. A closely related concept is the productivity of education spending, i.e., educational “output” (or outcome) per dollar spent. In an examination of this question over ten years ago, Hoxby (2004) finds that the productivity of public education declined substantially – by nearly 50 percent – from the 1970s to 2000. Her measure of educational outcomes is the National Assessment of Education Progress (NAEP) test scores. From 1970 to 2000, these scores hardly changed, yet inflation-adjusted, per-pupil spending almost doubled.

There have been some signs of improvement in the NAEP test scores in the 2000s, though these experiences have varied across states, as have changes in resources devoted to schools.

Accordingly, this paper considers two related aspects of these issues. First, we update overall national trends on educational funding, test score outcomes, and productivity. Second, we examine variations in funding and test scores over time and across states to assess how changes in educational spending are (or are not) related to changes in educational test score outcomes for states.

Our findings regarding national trends show small increases in test scores, large increases in educational funding (until the last recession), and a continued fall in educational productivity. The cross-state, over time analysis indicates a statistically significant but very small association of state funding to test scores. Our preferred estimates imply that the magnitude is so small that higher funding of \$1,000 is associated with trivially higher NAEP test scores.¹ This is consistent with the continued decline in productivity that we verify in the cross-state data. Also, note that we find the patterns for black students are essentially the same as for all students, implying that the increased funding has not served to raise minority outcomes and reduce racial inequality.

Hoxby (2004) suggests that the decline in the productivity of K-12 education is due to the decline of competition among jurisdictions for students and provides evidence to support this. Moreover, there is a good deal of literature regarding the incentive problems of government operated organizations that face little competition, which characterizes most public schools. For an overview and discussion of this literature as it pertains to schools, see Garen (2016). The results of our paper are consistent with Hoxby (2004). Though it is appropriate to be cautious regarding causality with respect to funding and outcomes, the continued decline in productivity of public schools that we find adds further reason to question the ability of non-competitive, public organizations to improve educational performance and to look for alternatives that embrace or emulate private-sector, competitive organizations.

The question of the effect of school resources and spending on educational outcomes has a long history. Coleman (1966) was perhaps the first to do a broad-based examination of the importance of school resources in K-12 education, finding that other factors were much more critical. Hanushek (1986) reviews the empirical work that followed Coleman (1966), indicating that differences in school quality do not seem to reflect variations in expenditure, class size, or other commonly measured attributes of schools and teachers. A good deal of empirical work on this topic continued with improved data and more advanced methods. Later surveys by Hanushek (2003), Gustafsson (2003), and Glewwe (2013) find strong effects of teachers but an absence of consistent effects of school expenditures in reviews of research pertaining to many countries around the world. These lack-of-effects findings are the norm. However, there are some

exceptions, and some studies find positive effects on the subsequent earnings and employment experiences of students “exposed” to higher education spending when young. See, for example, Jackson, Johnson, and Persico (2016), Fredriksson, Ockert, Oosterbeek (2013), and Card and Krueger (1992). Betts (1995), however, following a similar methodology, finds no effects of school resources, consistent with the bulk of the literature.

Our paper fits into this stream of research with focus on the recent experiences of states in the U.S. Though the small effects of expenditures on public school performance suggests an evaluation of alternative types of school organizations (e.g., charter schools and voucher programs), this is beyond the scope of this paper. The reader is referred to Garen (2016) for a discussion and critique of that literature.

The remainder of the paper is organized as follows. Section II discusses our measure of educational outcomes, as well as our data on school expenditures. We follow Hoxby (2004) and others in using the National Assessment of Educational Progress (NAEP) test scores to measure educational outcomes. Section III provides an update on and discussion of the long-term trend in productivity in education in the U.S. from 1971 to 2012. As we detail below, though test scores have improved in the recent past, spending rose even faster and productivity continues to decline. Section IV examines the data on test scores and spending by state and over time to assess the association of test score improvements with increased state spending. We find a positive and statistically significant association, though very small in magnitude, e.g., a \$1,000 increment to per pupil spending is associated with minimal changes in NAEP test scores. The findings for black students are approximately the same, indicating that the funding has not reduced racial inequality in test scores. We also find somewhat more robust effects of local funding relative to state and federal, though magnitudes remain small. The decline in educational productivity is also verified in the cross-state panel data.