Education, Economics of

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Abstract

The explosion of research work on the economics of education has covered a wide range of issues. A key element of modern analyses is a focus on the outcomes of schooling and how various factors affect outcomes. Along with this, there has been considerable attention to production relationships and particularly to efficiency of production. The existing work suggests that variations in how well schools convert resources and inputs into student learning are a very important issue that has direct implications for education policy. Because commonly measured characteristics of teachers and schools – such as teacher experience, teacher degree levels, or class size – are not consistently related with student outcomes, the research suggests that these are not good policy instruments. On the other hand, the strong evidence about the importance of teacher quality points toward noticeable changes in the finance and governance of schools.

Study of the economics of education has expanded very rapidly, becoming one of the more popular fields of study of economists. The breadth of study is perhaps easiest to see by the fact that there are now four separate Handbook volumes addressing the various topics that are logically included in the area (Hanushek and Welch, 2006; Hanushek et al., 2011). This breadth and depth of research implies that it is logically impossible to do justice to the full field that ranges from the demand for schooling, the supply of alternative educational opportunities, and the impacts of schooling on subsequent outcomes. This discussion, rather than attempting to be exhaustive, concentrates on the more limited range of issues related to the organization, funding, and performance of schools, although these will be put into the context of the broader field.

Many facets of the broader field overlap those of labor economics, public finance, and growth theory, and they can best be put into those contexts – leaving this discussion to the unique facets of schools. The economics of education also borrows from other disciplines such as sociology and psychology, but the underlying behavior perspective remains unique to economics.

The economics of education is naturally linked to the study of human capital. Human capital refers to the skills and productive capacity embodied in individuals. While implicitly part of economics for several centuries (Kiker, 1968), the idea of human capital developed into a central concept in both theoretical and empirical analyses with the foundational work of Schultz (1961), Becker (1964), and Mincer (1970, 1974). Nonetheless, while abstractly dealing with skills and capabilities of individuals, human capital – to be both predictive and testable – must be defined in terms of more concrete measures. This requirement most often brings up school attainment as a clear, measurable aspect of human capital that can serve as a proxy for major skill differences. While an expansive view could include all research topics that touch on schooling, it is useful to define the economics of education more narrowly in terms of unique aspects not covered in other subdisciplines: namely, consideration of the education sector itself. This discussion is also limited by available data and analyses. Due to a dearth of reliable outcome data from higher education as well as schools in other countries, the economics of education has concentrated its study largely on K-12 schools. (The study of the economics of higher education, largely lacking student performance information, has directed most attention to issues of access and attendance and particularly of the influence of financial aid and costs on these (see, for example, McPherson and Schapiro (2006), Kane (2006), or Bettinger et al. (2009)). More recent analyses, benefiting from an expansion of administrative data for higher education, have moved to other questions about the production process (for example, Bound and Turner (2007) or Bettinger and Long (2010)). Nonetheless, because these analyses have such a different perspective from those related to primary and secondary education, they are not included in this discussion.)

Interestingly, however, the field has rapidly expanded to cover the entire world. While once restricted largely to American schools, data and analysis have expanded to cover the globe.

Part of the expansion of interest in the economics of education has reflected the development of extensive data on schools – partially as a result of movements to expand accountability of schools for performance. But a complementary impetus for this expansion has been the direct relationship between research and educational policy. The recent demands for 'evidence-based decision making' has heightened interest in the information about program effectiveness and the impacts of institutions on educational outcomes.

Outcomes

It is natural for economists to think in terms of a production model where certain factors and influences go in and products of interest come out. This model, called the 'production function' or 'input-output' approach, is the model behind much of the analysis in the economics of education. The measurable inputs are things like school resources, teacher quality, classroom peers, and family attributes, and the outcome is student achievement. Let us focus on the outcome,

first, and then move on to inputs, where more controversy has historically existed.

In the development of the field, the most frequently employed measure of schooling has been school attainment or simply years of schooling completed. The United States tradition led the world in investing in schooling. By the mid-1970s, three-quarters of US students completed high school, culminating a long national investment period that started with just 6% graduating from high school at the turn of the century. Many developed and developing countries, however, have recently mimicked this trend, as illustrated in **Figure 1**, which displays the increasing completion of secondary schooling for more recent age cohorts. By 2008, the growth in attainment around the world is readily seen.

The value of school attainment as a rough measure of individual skill has been verified by a wide variety of studies of labor market outcomes. In the United States, Mincer (1974) pioneered the approach that is now standard. Psacharopoulos and Patrinos (2004) have taken this analysis to the rest of the world, surpassing 100 countries for which estimates of the returns to years of schooling are available. The estimation considers the relationship between earnings (viewed as a direct measure of individual productivity) and schooling and labor market experience.

However, the difficulty with this common measure of outcomes is that it assumes a year of schooling produces the same amount of student achievement over time and in every country. This measure simply counts the time spent in schools without judging what happens in schools. Moreover, it neglects any complementary source of human capital development such as families, peers, or health inputs – thus, it does not provide a complete or accurate picture of outcomes. Today, more attention is focused on quality outcomes, and the most common measure is tests for cognitive skills (for a more general discussion, see Hanushek and Woessmann (2008)).

To the extent that the productive value of schooling largely involves the ability to make decisions under uncertainty and to adapt to new ideas and technologies (cf Nelson and Phelps, 1966; Welch, 1970), cognitive skills appear to be a valid measure of human capital. This conclusion is supported by recent studies that show a direct correlation between test scores and earnings in the labor market (Hanushek and Zhang, 2009).

While early studies of wage determination indicated relatively modest impacts of variations in cognitive ability after holding constant quantity of schooling, more recent direct investigations of cognitive achievement find generally larger labor market returns to measured individual differences in cognitive achievement. Three US studies provide very consistent estimates of the impact of test performance on earnings of young workers (Mulligan, 1999; Murnane et al., 2000; Lazear, 2003). These studies employ different nationally representative data sets that follow students after they leave school and enter the labor force. When scores are standardized, they suggest that one standard deviation increase in mathematics performance at the end of high schools translates into 10–15% higher annual earnings. In a different set of estimates using data on a sample of workers for the United States, Hanushek and Zhang (2009) provide estimates of returns of 20% per standard deviation. (The estimates for the United States do, however, exceed those for other countries.) One distinguishing feature of these estimates is that they come for a sample of workers throughout the career, as opposed to the prior estimates that all come from early-career earnings. Using yet another methodology that relies upon international test scores and immigrants into the United States, Hanushek and Woessmann (2012) obtain an estimate of 14% per standard deviation.

Even more significantly, society appears to gain in terms of productivity. Hanushek and Kimko (2000) demonstrate that quality differences in schools have a dramatic impact on

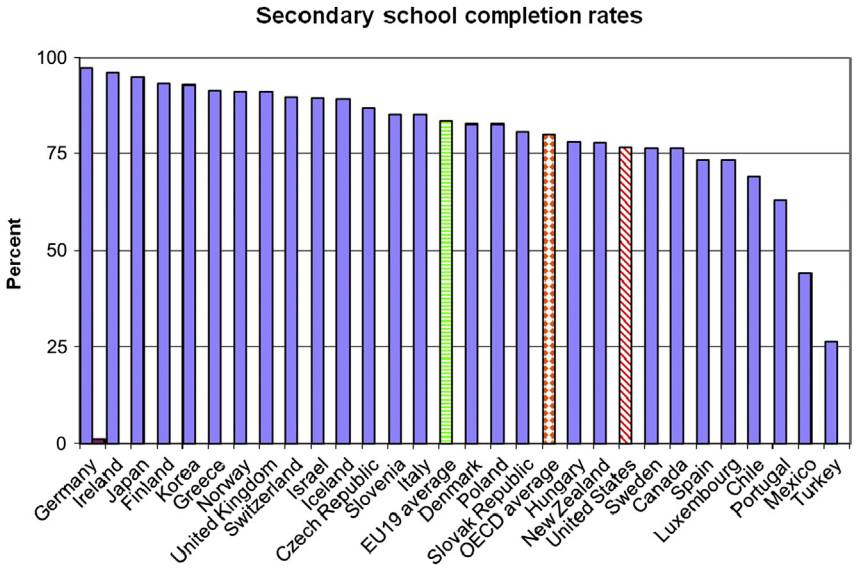

Figure 1 Secondary school completion rates, 2008. Source: Organisation for Economic Co-operation and Development, 2008. Education at a Glance 2008: OECD Indicators. OECD, Paris.

productivity and national growth rates. These estimates have been duplicated in a variety of studies (see Hanushek and Woessmann (2008)). Moreover, the implications of long-term growth and economic well-being of having different levels of achievement are truly astounding (Hanushek and Woessmann, 2011). There is also reason to believe that there is a causal relationship between cognitive skills and economic growth (Hanushek and Woessmann, 2012). These estimates of the impact of school quality on economic outcomes parallel the attention to quality and cognitive skills that has become a growing policy interest of many countries. As countries have approached more universal access to schooling, they have turned to issues of quality of publicly provided schooling.

Production

Let us now look at the other side of the education equation – the inputs, or determinants, of student achievement. Because outcomes cannot be changed by fiat, much attention has been directed at inputs – particularly those perceived to be relevant for policy such as school resources or aspects of teachers.

Analysis of the role of school resources in determining achievement begins with the 'Coleman Report,' the US government's monumental study on educational opportunity released in 1966 (Coleman et al., 1966). The report was conducted in compliance with a mandate of the Civil Rights Act of 1964 to investigate the extent of inequality in the nation's schools. Although this was not the first such effort, it was much larger and much more influential than any previous study. Only recently, with the now-common use of administrative databases on student performance compiled by states, have studies exceeded the survey information from the Coleman Report in breadth of samples and ability to investigate different educational circumstances.

The Coleman Report's greatest contribution was directing attention to the distribution of student performance – the outputs as opposed to the inputs. Instead of addressing questions of inequality by simply listing an inventory of differences of schools and teachers by race and region, it highlighted the relationship between inputs and outputs of schools.

Unfortunately, most of the attention the report generated focused on the report's conclusions rather than its innovative perspective. The controversial conclusion was that schools are not very important in determining student achievement; on the contrary, families and, to a lesser extent, peers are the primary determinants of performance variance. The findings immediately led to a large (but decentralized) research effort to compile additional evidence about input-output relationships in schools. (There were also extensive analyses of the report's methodology and of the validity of its inferences. See, for example, Bowles and Levin (1968), Cain and Watts (1970), and Hanushek and Kain (1972).) And, as discussed below, the common interpretations of the results of the Coleman Report are now recognized to be quite incorrect.

The underlying model that evolved as a result of this research is very straightforward. The output of the educational process – that is, the achievement of individual students – is directly related to a series of inputs. Some of these inputs – the characteristics of schools, teachers, curricula, and so forth – are directly controlled by policy makers. Other inputs – those of families and friends plus the innate endowments or learning capacities of the students – are generally not controlled. Further, while achievement may be measured at discrete points in time, the educational process is cumulative; inputs applied sometime in the past affect students' current levels of achievement.

Family background is usually characterized by such sociodemographic characteristics as parental education, income, and family size. Peer inputs, when included, are typically totals of a student population's sociodemographic characteristics for a school or classroom. School inputs include teacher background (education level, experience, sex, race, and so forth), school organization (class sizes, facilities, administrative expenditures, and so forth), and district or community factors (e.g., average expenditure levels). As discussed elsewhere, one set of analytical problems flows from the lack of measurement of innate abilities of individuals and the imprecise measurement of the history of educational inputs (Hanushek, 1979, 1986). A second set of concerns that has received extensive recent attention relates to applying causal interpretations to the estimates. Both are discussed below.

In many ways, the analysis of educational production breaks into two distinct periods. The first – running from the Coleman Report in the mid-1960s through the mid-1990s – largely relied upon relatively small and specialized data sets that contained information on student outcomes and on some set of measures of school resources. The second period – running from the mid-1990s until now – largely moved to administrative databases with longitudinal information on student achievement for entire states over time. It took the results of the early period research that indicated no consistent relationship between measured school inputs and outcomes as a starting point (see the next section) and turned to intensive investigations of teacher quality and other specific aspects of schools.

The Importance of Measured School Inputs

The state of knowledge about the impacts of resources is best summarized by reviews of available empirical studies. Most traditional analyses of education production functions directed their attention at a relatively small set of resource measures, and this makes it easy to summarize the results (Hanushek, 2003).

Table 1 provides a tabulation of estimates of the impact of school inputs for studies that appeared before 1995. (Such reviews of empirical studies appeared first in 1981 (Hanushek, 1981) and were updated over time with additional studies. With stable results to the overall pattern of findings, there has been no subsequent updating of research past 1995, and the general pattern of results has become widely accepted.) The 90 individual publications for this analysis contain 377 separate production function estimates and form the basis of the conclusions about the impacts of measured inputs. The table indicates the sign of the estimated impact of a given resource on student performance; positive estimates imply that more resources are associated with

Table 1 Percentage distribution of estimated effect of key resources on student performance, based on 377 studies available through 1995

Resources	Number of estimates	Statistically significant		Statistically insignificant
		Positive	Negative	
Real classroom resources				
Teacher-pupil ratio	277	14%	14%	72%
Teacher education	171	9	5	86
Teacher experience	207	29	5	66
Financial aggregates				
Teacher salary	119	20%	7%	25%
Expenditure per pupil	163	27	7	34
Other				
Facilities	91	9	5	86
Administration	75	12	5	83
Teacher test scores	41	37	10	53

Source: Hanushek, Eric, A., Summer, 1997. Assessing the effects of school resources on student performance: an update. Educational Evaluation and Policy Analysis 19 (2), 141–164, revised.

higher student outcomes and the opposite for negative estimates. Additionally, information is provided about statistical significance or our confidence that there is a real effect of the resources.

For classroom resources, only 9% of studies on teacher education and 14% of studies on teacher-pupil ratios found a positive and statistically significant relationship between these factors and student performance. (This summary concentrates on the results. Details of the underlying analyses and of the selection of studies for this tabulation are found in Hanushek (1986, 1997). The first column provides a count of the total number of estimates addressing the impact of the given resource.) Moreover, these studies were offset by another set of studies that found a similarly negative correlation between those inputs and student achievement. Twenty-nine percent of the studies found a positive correlation between teacher experience and student performance; however, 71% still provided no support for increasing teacher experience (being either negative or statistically insignificant).

Studies on the effect of financial resources provide a similar picture. There is very weak support for the notion that simply providing higher teacher salaries or greater overall spending will lead to improved student performance. Per pupil expenditure has received the most attention, but only 27% of studies showed a positive and significant effect. In fact, 7% even suggested that adding resources would harm student achievement. It is also important to note that studies involving pupil spending have tended to be the lowest-quality studies, and thus there is substantial reason to believe that even the 27% figure overstates the true effect of added expenditure (Hanushek et al., 1996; Hanushek, 2003).

While the general conclusions about the inconsistent impacts of school resources were intensely debated through the 1980s and 1990s, the general conclusions have now been broadly accepted, and the research has moved to other areas. (Some idea about the debates can be seen in the various chapters in Burtless (1996). The controversy did continue with more specific debates about the effects of class size reduction, see Hanushek (1999), Krueger (1999), and Mishel and Rothstein (2002), although that too has largely disappeared.) Specifically, both the research and policy discussion now recognizes that 'how' resources are used is generally much more important than simply 'how much' is available.

On the research side, as suggested, the previous discussions do not distinguish among studies on the basis of any quality differences, so the results could be distorted by not adjusting the tabulations. While 'study quality' has a variety of subjective components, the available estimates can be separated by a few objective components of quality. First, while education is cumulative, frequently only current input measures are available, which results in analytical errors. Second, schools operate within a policy environment set almost always at higher levels of government. These reasons, combined with large panel data sets on student outcomes that come from state accountability data have led almost all studies in the second phase of research to focus on gains in student learning over time and on samples of individual students and classrooms rather than aggregate data on schools, districts, or states. (While these issues of estimation had been known for a considerable time (see Hanushek (1979)), the broad empirical application did not come until administrative databases became more readily available.)

There has also been a proliferation across the globe of studies of educational performance. One surprising result has been that many of the conclusions hold equally for developing countries, where resource constraints would seem to be much more important (Hanushek, 1995; Glewwe et al., 2013). Moreover, there has been a move toward using more evidence in policy decisions, led in part by the international assessments of evidence by John Hattie (2009).

Do Teachers and Schools Matter?

Because of the Coleman Report and subsequent studies discussed above, many people tended to argue that schools do not matter and that only families and peers affect performance. Unfortunately, these interpretations have confused measurability with true effects.

Extensive research over the past 45 years has made it clear that teachers do indeed matter. The simple definition of teacher quality used here, as first developed in Hanushek (1971), is an output-based measure. In this work, teacher effectiveness is assessed directly from student performance, instead of the more typical input measures based on characteristics of the teacher and school. High-quality teachers are ones who consistently obtain higher than expected gains in student performance, while low-quality teachers are ones who consistently obtain lower than expected gains. (In statistical terms these estimates employ covariance models, where fixed effects are estimated for individual teachers.) When this approach has been used, large variations in performance have been uncovered.

In fact, the degree to which teacher differences affect performance is impressive. Looking at the range of quality for teachers within a single large urban district, teachers near the top of the quality distribution can get an entire year's worth of additional learning out of their students, compared to those near the bottom (Hanushek, 1992). In subsequent work,

Rivkin et al. (2005) provide another estimate of the importance of teachers: having a good teacher instead of an average teacher for 3–5 years in a row can lead to achievement gains that equal the average difference in achievement of a student from a poor family as opposed to a better off family.

This work, now commonly called 'value-added analysis' because of the focus on what individual teachers contribute to student learning, has produced quite consistent estimates of how much variation there is in the impact of teachers (Hanushek and Rivkin, 2010). And, it has become one of the largest and most vibrant areas of educational research. Numerous recent investigations of teacher quality have focused on issues such as the best statistical approaches to employ and the interpretation of estimated differences across classrooms when students might not be randomly assigned to individual teachers. (For a discussion of these issues and the competing views, see Hanushek and Rivkin (2012).)

Part of the interest in these estimation issues has been raised by the application of estimates of teacher value added to policy. For example, in 2011, the Los Angeles Times newspaper published value-added ratings for individual teachers (Song and Felch, 2011), and this was followed by similar publications in New York City and elsewhere. Additionally, the teachers in the Washington, DC, schools have been partially evaluated on the basis of such value-added calculations (Isenberg and Hock, 2010). Moreover, early evidence suggests that use of these teacher evaluations has a positive impact on student outcomes (Dee and Wyckoff, 2013). These discussions have elevated the research attention to estimating the impacts of teachers and principals. (Investigations of principals are more difficult from a statistical viewpoint and have only recently been developed; see Branch et al. (2012).)

Based on existing value-added measures, the economic impact of teacher quality appears to be very large. **Figure 2** provides estimates that combine information about the impact on achievement of teachers at different points in the quality distribution with estimates of the impact of achievement on a student's future income (Hanushek, 2011). The figure plots the gains (or losses) in future income from a class of students having a high- (low-) quality teacher, all compared to an average teacher. Class size directly affects these estimates because a given teacher has a greater impact on outcomes when there are more students in the class. From this figure, a teacher at the 75th percentile of the quality distribution with a class of 25 students produces over $300 000 more future income compared with an average teacher. A teacher at the 25th percentile produces a similar loss compared to the average teacher.

These estimates, produced from combining the results of many existing studies, have been confirmed by an innovative study that links student outcomes for individual teachers with their actual labor market earnings observed through tax records (Chetty et al., 2014). They find individual teachers in the bottom 5% can reduce lifetime earnings of their students each year that they teach by over $250 000.

Efficiency

Efficiency involves the relationship between inputs and outputs in a production process. The underlying notion is that production is efficient if given inputs produce the maximum output. The simplicity of this statement, however, obscures a variety of complexities that arise when the concept is actually applied.

Typically economics does not devote much attention to the analysis of efficiency. If there are competitive markets, the behavior of producers and consumers tends to drive outcomes toward efficient production. Because of this basic theorem, it is common simply to assume efficiency.

In education, however, efficiency is never a given. First, education is generally publicly provided. Governmental organizations, which do not face the same incentives as private firms, cannot be expected to move toward efficient production. In particular, few school personnel are rewarded

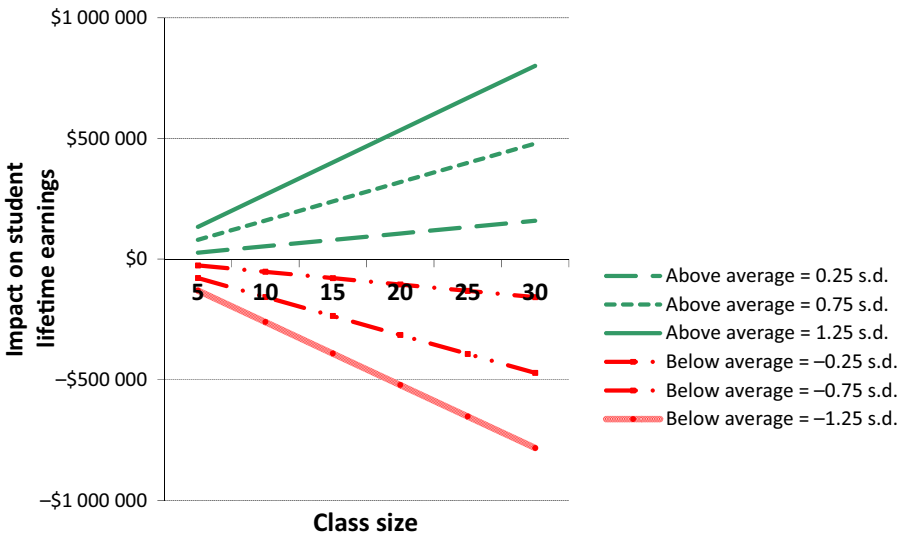

Figure 2 Impact on student lifetime incomes by class size and teacher effectiveness (compared to average teacher).

or punished based on the outcomes students obtain, making the incentives for performance minimal or nonexistent. Second, it is difficult to find information on school efficiency. With complete information, parents might be expected to pressure schools to use resources – either through local political processes or through moving to districts that did better (Tiebout, 1956). Because student performance is influenced by factors schools cannot control – i.e., input from family and friends – simply observing student achievement does not accurately reflect school contribution. Thus, parental and voter pressures on schools are lessened by imperfect information.

The underlying political economy of schools that can preserve such apparently large inefficiencies in resource use deserves considerably more research.

Competition and Incentives

The lack of direct incentives within schools has led to investigations of circumstances where incentive forces may be stronger. While there have been a wide variety of proposed changes (e.g., Hanushek et al. (1994)), most have not been implemented or analyzed sufficiently to draw any conclusions about their efficacy.

The classic argument for competition comes from Friedman (1962) with his arguments for vouchers. The well-known arguments suggest that separating the finance of schooling from the production of schooling by allowing students to choose the school they attend would improve individual satisfaction with the outcomes (Nechyba, 2006). Within the United States, this approach has been vigorously debated, but few examples of implementation have occurred. The most celebrated application has been Milwaukee, Wisconsin, where vouchers have been available to a (constrained) number of poor children since 1990 (Rouse, 1998; Carnoy et al., 2006), but they have also been available in Cleveland, Washington, DC, and elsewhere (Wolf et al., 2010). A number of privately financed alternatives have also been offered (Howell and Peterson, 2002). Most of the attention to these voucher programs has centered on the student outcomes of students in them as compared to public schools. (A variety of controversies has developed in these analyses. Perhaps the primary analytical issue is dealing with selection of students and an appropriate comparison group. See, for example, the discussions in Witte (1999), Rouse (1998), and Greene et al. (1998).) Because these programs have been very marginal to the education system, there has been little suggestion that the public schools have made any adjustments in response. Thus, these choice experiences have not provided information about how public schools might react to a larger, more institutionalized program.

Private schools offer one possibility for better understanding the effects of competition. They must compete with the public schools in order to attract clients and thus they are subject to stronger pressures to provide high levels of performance. The literature on Catholic school performance is summarized in the articles by Neal (1997) and Grogger and Neal (2000). The evidence has generally indicated that Catholic schools on average outperform public. This superiority seems clearest in urban settings, where disadvantaged students face fewer options than others. This evidence is, nonetheless, subject to some caveats. First, as recognized since some of the earliest work on the topic (Coleman et al., 1982), it is difficult to separate performance of the private schools from pure selection phenomena. Specifically, since private school students could have attended public schools but instead pay extra for private schooling, they are clearly different than the public school students with identical measured characteristics. A variety of alternative approaches has been taken to deal with the selection problem, and a rough summary of the results after those efforts is that there remains a small advantage from attending Catholic schools. (Grogger and Neal (2000) suggest, however, that there is no advantage to attending private elite schools – a surprising result given the extra cost generally involved in that. These results are possibly due to selection problems, but it is not a simple relationship because most people would expect positive selection into these elite schools.) Second, this literature says little about the distribution of school quality within the Catholic sector.

Within the public sector, it is widely believed that school quality varies considerably across schools, and one might suspect that the same holds true for private schools.

One important potential element competition comes from other public school jurisdictions. Specifically, households can choose the specific jurisdiction and school district, in the manner of Tiebout (1956), by their choice of residential location. While adjustment is costly, these choices permit individuals to seek high-quality schools if they wish (Epple and Nechyba, 2004). Residential location decisions are of course complicated, involving job locations, availability of various kinds of housing, school costs and quality, and availability of other governmental services. Given choice opportunities plus voting responses, this model suggests pressure on schools to use resources effectively. Otherwise one might expect housing values to be affected.

The simple choice model would suggest naturally that larger numbers of schools or school districts per student would offer more opportunities for residents and thus more competition across schools. This simple model motivates the empirical analyses of Borland and Howsen (1992) and its extension and refinement in Hoxby (2000) and in Hanushek and Rivkin (2003). The simple inclusion of measures of concentration indicates that areas with less choice have poorer schools on average (Borland and Howsen, 1992). Hoxby (2000) pursues alternative strategies to look at the causal impact of concentrations and finds a larger estimated impact of competition on the performance of schools, although the robustness of her conclusions has been challenged by Rothstein (2007). Hanushek and Rivkin (2003), pursuing an alternative strategy, find competitive impacts on performance of urban schools and that these are particularly important for low-income students who have fewer mobility options.

In the United States, the rise of charter schools has provided an additional element of choice. Charter schools are public schools that have the freedom to be subject to less regulation and to offer different programs from the traditional public schools. They are schools of choice and do not charge any tuition fee. In 2011, there were over 5000 charter schools in the

United States, serving 3.6% of the school population (U.S. Department of Education, 2013: Table 117). The analysis of their performance shows considerable variation in effectiveness – ranging from much better than corresponding public schools to much worse (see, e.g., Hanushek et al. (2007), CREDO (2009, 2010, 2013), Abdulkadiroğlu et al. (2011)).

Finance of Schools

Public finance economists have devoted considerable energy to the study of the finance of schools, largely from the viewpoint of traditional tax and expenditure policy. The educational policy component of this involves equity in the provision of education. These considerations are largely motivated by the many studies that show wide disparities in achievement by race and socioeconomic background (e.g., Coleman et al. (1966), Hanushek (2001)). Nonetheless, the typical discussion of equity concentrates primarily on spending disparities across schools and districts, even in the face of evidence suggesting that student outcomes are not closely related to spending and resources (Hanushek, 2003).

Indeed, one of the most significant policy issues of the past 30 years in the United States has been the appropriate way for states to fund local schools (Fischel, 2006). While most states have employed a compensatory aid formula to ameliorate some local governments' difficulty in raising taxes, these measures have only partially solved the problem. The issue became the subject of court action in the 1960s, with the case of Serrano versus Priest in California. Suits in many other states followed (Hanushek and Lindseth, 2009). As a result, some significant narrowing of spending variations occurred (Murray et al., 1998).

However, there has been surprisingly little analysis of the impacts of these suits. This is important to undertake, because the prior research discussed above does not show a clear link between increased funding and school quality or student performance. From the perspective of educational outcomes, then, the value of spending changes related to equalization court cases and the related legislative actions remain an open question (Hanushek, 1991; Hanushek and Lindseth, 2009). To date, little research has focused on the achievement impacts of school finance policies and those that have looked at outcomes have not found much impact (e.g., Downes (1992), Cullen and Loeb (2004), Greene and Trivitt (2008)). Hanushek and Lindseth (2009) investigate the achievement impact of major court decisions in Kentucky, Massachusetts, New Jersey, and Wyoming. With the possible exception of Massachusetts, there is little evidence of any impact of major court spending decisions on student achievement. A broader, nation-wide analysis of district spending on earnings outcomes also found no beneficial relationship between the two, except perhaps for Black females (Hanushek and Somers, 2001).

Some Conclusions and Implications

The existing research suggests inefficiency in the provision of schooling. It does not indicate that schools do not matter. Nor does it indicate that money and resources never affect achievement. The accumulated research simply says there is no clear, systematic relationship between resources and student outcomes.

The persistence of this raises important questions about current education policy, as well as a real need for further research.

The main conclusion of this research is that policy decisions should not focus on school resources, because the impact of resources on student achievement is unknown at this time. The policy solution seems to be to establish incentives – rewards or consequences related to student outcomes – and then to permit local schools to develop their own game plans for meeting these goals. While a wide variety of incentives have been proposed – such as vouchers, merit pay, or contracting out – most have not been implemented or analyzed sufficiently to determine their efficacy.

A final major issue raised by these analyses is their implication for other kinds of studies (Hanushek, 1996). Most studies involving human capital are interested in its effect on other aspects of behavior. For these studies schooling is largely tangential to other interests, and researchers are typically simply looking for an easy and readily available measure of school quality. The most common has been spending per pupil. However, the inefficient production of human capital introduces natural measurement problems. Direct spending is no longer a good measure of quality because it has no perceivable bearing on performance. Second, it is well known that families have considerable influence on student achievement, implying that school resources are only part of the equation. Both factors suggest studies that measuring student achievement just through resource investment has a high potential for distortion.

See also: Class Size; Earnings Inequality; Education and Economic Growth; Education and Employment; Education and Income Distribution; Education: Skills Training; Educational Effectiveness, The Field of; Educational Productivity; Educational Systems: North America; Equity and Education; Family and Schooling; School Choice; School Effectiveness Research; Schooling: Total Impact of; Social Inequality and Schooling.

Bibliography

Abdulkadiroğlu, Atila, Angrist, Joshua D., Dynarski, Susan M., Kane, Thomas J., Pathak, Parag A., 2011. Accountability and flexibility in public schools: evidence from Boston's charters and pilots. Quarterly Journal of Economics 126 (2), 699–748.

Becker, Gary S., 1964. Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. National Bureau of Economic Research, New York.

Bettinger, Eric, Long, Bridget T., Oreopoulos, Philip, Sanbonmatsu, Lisa, 2009. The Role of Simplification and Information in College Decisions: Results from the H&R Block FAFSA Experiment. NBER Working Paper 15361. National Bureau of Economic Research, Cambridge, MA.

Bettinger, Eric P., Long, Bridget T., 2010. Does cheaper mean better? The impact of using adjunct instructors on student outcomes. Review of Economics and Statistics 92 (3), 598–613.

Borland, Melvin V., Howsen, Roy M., March 1992. Student academic achievement and the degree of market concentration in education. Economics of Education Review 11 (1), 31–39.
Bound, John, Turner, Sarah, June 2007. Cohort crowding: how resources affect collegiate attainment. Journal of Public Economics 91 (5–6), 877–899.
Bowles, Samuel, Levin, Henry M., Winter 1968. The determinants of scholastic achievement – an appraisal of some recent evidence. Journal of Human Resources 3 (1), 3–24.
Branch, Gregory F., Hanushek, Eric A., Rivkin, Steven G., January 2012. Estimating the Effect of Leaders on Public Sector Productivity: The Case of School Principals. NBER Working Paper W17803. National Bureau of Economic Research, Cambridge, MA.
Burtless, Gary (Ed.), 1996. Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success. Brookings, Washington, DC.
Cain, Glen G., Watts, Harold W., April 1970. Problems in making policy inferences from the Coleman Report. American Sociological Review 35 (2), 328–352.
Carnoy, Martin, Adamson, Frank, Chudgar, Amita, Luschei, Thomas F., Witte, John F., 2006. Vouchers and Public School Performance: A Case Study of the Milwaukee Parental Choice Program. Economic Policy Institute, Washington, DC.
Chetty, Raj, Friedman, John N., Rockoff, Jonah, 2014. Measuring the impacts of teachers II: teacher value-added and the student ourcomes in adulthood. American Economic Review.
Coleman, James S., Campbell, Ernest Q., Hobson, Carol J., McPartland, James, Mood, Alexander M., Weinfeld, Frederic D., York, Robert L., 1966. Equality of Educational Opportunity. U.S. Government Printing Office, Washington, DC.
Coleman, James S., Hoffer, Thomas, Kilgore, Sally, 1982. High School Achievement: Public, Catholic and Private Schools Compared. Basic Books, NY.
CREDO, 2009. Multiple Choice: Charter School Performance in 16 States. Center for Research on Education Outcomes, Stanford University, Stanford, CA.
CREDO, 2010. Charter School Performance in New York City. Center for Research on Education Outcomes, Stanford University, Stanford, CA.
CREDO, 2013. National Charter School Study 2013. Center for Research on Education Outcomes, Stanford University, Stanford, CA.
Cullen, Julie B., Loeb, Susanna, 2004. School finance reform in Michigan: evaluating proposal A. In: Yinger, John (Ed.), Helping Children Left behind: State Aid and the Pursuit of Educational Equity. Massachusetts Institute of Technology Press, Cambridge, MA, pp. 215–249.
Dee, Thomas, Wyckoff, James, October 2013. Incentives, Selection, and Teacher Performance: Evidence from IMPACT. NBER Working Paper 19529. National Bureau of Economic Research, Cambridge, MA.
Downes, Thomas A., December 1992. Evaluating the impact of school finance reform on the provision of public education: the California case. National Tax Journal 45 (4), 405–419.
Epple, Dennis, Nechyba, Thomas, 2004. Fiscal decentralization. In: Vernon Henderson, J., Thisse, Jacques-François (Eds.), Handbook of Regional and Urban Economics. Elsevier, Amsterdam, pp. 2423–2480.
Fischel, William A., 2006. The courts and public school finance: judge-made centralization and economic research. In: Hanushek, Eric A., Welch, Finis (Eds.), Handbook of the Economics of Education. North Holland, Amsterdam, pp. 1277–1325.
Friedman, Milton, 1962. Capitalism and Freedom. University of Chicago Press, Chicago.
Glewwe, Paul, Hanushek, Eric A., Humpage, Sarah D., Ravina, Renato, 2013. School resources and educational outcomes in developing countries: a review of the literature from 1990 to 2010. In: Glewwe, Paul (Ed.), Education Policy in Developing Countries. University of Chicago Press, Chicago, pp. 13–64.
Greene, Jay P., Peterson, Paul E., Du, Jiangtu, 1998. School choice in Milwaukee: a randomized experiment. In: Peterson, Paul E., Hassel, Bryan C. (Eds.), Learning from School Choice. Brookings Institution, Washington, DC, pp. 335–356.
Greene, Jay P., Trivitt, Julie R., April 2008. Can judges improve academic achievement? Peabody Journal of Education 83 (2), 224–237.
Grogger, Jeffrey, Neal, Derek, 2000. Further evidence on the effects of Catholic secondary schooling. In: Gale, William G., Pack, Janet Rothenberg (Eds.), Brookings-Wharton Papers on Urban Affairs. Brookings Institution Press, Washington, DC, pp. 151–193.
Hanushek, Eric A., May 1971. Teacher characteristics and gains in student achievement: estimation using micro data. American Economic Review 60 (2), 280–288.
Hanushek, Eric A., Summer 1979. Conceptual and empirical issues in the estimation of educational production functions. Journal of Human Resources 14 (3), 351–388.
Hanushek, Eric A., Fall 1981. Throwing money at schools. Journal of Policy Analysis and Management 1 (1), 19–41.
Hanushek, Eric A., September 1986. The economics of schooling: production and efficiency in public schools. Journal of Economic Literature 24 (3), 1141–1177.
Hanushek, Eric A., Summer 1991. When school finance 'reform' may not be good policy. Harvard Journal on Legislation 28 (2), 423–456.
Hanushek, Eric A., February 1992. The trade-off between child quantity and quality. Journal of Political Economy 100 (1), 84–117.
Hanushek, Eric A., August 1995. "Interpreting recent research on schooling in developing countries. World Bank Research Observer 10 (2), 227–246.
Hanushek, Eric A., Fall 1996. Measuring investment in education. Journal of Economic Perspectives 10 (4), 9–30.
Hanushek, Eric A., Summer 1997. Assessing the effects of school resources on student performance: an update. Educational Evaluation and Policy Analysis 19 (2), 141–164.
Hanushek, Eric A., 1999. The evidence on class size. In: Mayer, Susan E., Peterson, Paul E. (Eds.), Earning and Learning: How Schools Matter. Brookings Institution, Washington, DC, pp. 131–168.
Hanushek, Eric A., May 2001. Black-white achievement differences and governmental interventions. American Economic Review 91 (2), 24–28.
Hanushek, Eric A., February 2003. The failure of input-based schooling policies. Economic Journal 113 (485), F64–F98.
Hanushek, Eric A., June 2011. The economic value of higher teacher quality. Economics of Education Review 30 (3), 466–479.
Hanushek, Eric A., Kain, John F., 1972. On the value of 'equality of educational opportunity' as a guide to public policy. In: Mosteller, Frederick, Moynihan, Daniel P. (Eds.), On Equality of Educational Opportunity. Random House, New York, pp. 116–145.
Hanushek, Eric A., Kain, John F., Rivkin, Steve G., Branch, Gregory F., June 2007. Charter school quality and parental decision making with school choice. Journal of Public Economics 91 (5–6), 823–848.
Hanushek, Eric A., Kimko, Dennis D., December 2000. Schooling, labor force quality, and the growth of nations. American Economic Review 90 (5), 1184–1208.
Hanushek, Eric A., Lindseth, Alfred A., 2009. Schoolhouses, Courthouses, and Statehouses: Solving the Funding-achievement Puzzle in America's Public Schools. Princeton University Press, Princeton, NJ.
Hanushek, Eric A., Machin, Stephen, Woessmann, Ludger (Eds.), 2011. Handbook of the Economics of Education, vols. 3 and 4. North Holland, Amsterdam.
Hanushek, Eric A., et al., 1994. Making Schools Work: Improving Performance and Controlling Costs. Brookings Institution, Washington, DC.
Hanushek, Eric A., Rivkin, Steven G., 2003. Does public school competition affect teacher quality? In: Hoxby, Caroline M. (Ed.), The Economics of School Choice. University of Chicago Press, Chicago, IL, pp. 23–47.
Hanushek, Eric A., Rivkin, Steven G., May 2010. Generalizations about using value-added measures of teacher quality. American Economic Review 100 (2), 267–271.
Hanushek, Eric A., Rivkin, Steven G., 2012. The distribution of teacher quality and implications for policy. Annual Review of Economics 4, 131–157.
Hanushek, Eric A., Rivkin, Steven G., Taylor, Lori L., November 1996. Aggregation and the estimated effects of school resources. Review of Economics and Statistics 78 (4), 611–627.
Hanushek, Eric A., Somers, Julie A., 2001. Schooling, inequality, and the impact of government. In: Welch, Finis (Ed.), The Causes and Consequences of Increasing Inequality. University of Chicago Press, Chicago, pp. 169–199.
Hanushek, Eric A., Welch, Finis (Eds.), 2006. Handbook of the Economics of Education, vols. 1 and 2. North Holland, Amsterdam.
Hanushek, Eric A., Woessmann, Ludger, September 2008. The role of cognitive skills in economic development. Journal of Economic Literature 46 (3), 607–668.
Hanushek, Eric A., Woessmann, Ludger, July 2011. How much do educational outcomes matter in OECD countries? Economic Policy 26 (67), 427–491.
Hanushek, Eric A., Woessmann, Ludger, December 2012. Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. Journal of Economic Growth 17 (4), 267–321.
Hanushek, Eric A., Zhang, Lei, Summer 2009. Quality-consistent estimates of international schooling and skill gradients. Journal of Human Capital 3 (2), 107–143.
Hattie, John, 2009. Visible Learning: A Synthesis of over 800 Meta-Analyses Relating to Achievement. Routledge, London.
Howell, William G., Peterson, Paul E., 2002. The Education Gap: Vouchers and Urban Schools. Brookings, Washington, DC.

Hoxby, Caroline M., December 2000. Does competition among public schools benefit students and taxpayers? American Economic Review 90 (5), 1209–1238.
Isenberg, Eric, Hock, Heinrich, August 20 2010. Measuring School and Teacher Value Added for IMPACT and TEAM in DC Public Schools: Final Report. Mathematica Policy Research, Princeton, NJ.
Kane, Thomas J., 2006. Public intervention in post-secondary education. In: Hanushek, Eric A., Welch, Finis (Eds.), Handbook of the Economics of Education. North Holland, Amsterdam, pp. 1369–1402.
Kiker, B.F., 1968. Human Capital: In Retrospect. University of South Carolina, Columbia, SC.
Krueger, Alan B., May 1999. Experimental estimates of education production functions. Quarterly Journal of Economics 114 (2), 497–532.
Lazear, Edward P., 2003. Teacher incentives. Swedish Economic Policy Review 10 (3), 179–214.
McPherson, Michael S., Schapiro, Morton, 2006. US higher education finance. In: Hanushek, Eric A., Welch, Finis (Eds.), Handbook of the Economics of Education. North Holland, Amsterdam, pp. 1403–1434.
Mincer, Jacob, March 1970. The distribution of labor incomes: a survey with special reference to the human capital approach. Journal of Economic Literature 8 (1), 1–26.
Mincer, Jacob, 1974. Schooling, Experience, and Earnings. NBER, New York.
Mishel, Lawrence, Rothstein, Richard (Eds.), 2002. The Class Size Debate. Economic Policy Institute, Washington, DC.
Mulligan, Casey B., December 1999. Galton versus the human capital approach to inheritance. Journal of Political Economy 107 (6 pt. 2), S184–S224.
Murnane, Richard J., Willett, John B., Duhaldeborde, Yves, Tyler, John H., Fall 2000. How important are the cognitive skills of teenagers in predicting subsequent earnings? Journal of Policy Analysis and Management 19 (4), 547–568.
Murray, Sheila E., Evans, William N., Schwab, Robert M., September 1998. Education-finance reform and the distribution of education resources. American Economic Review 88 (4), 789–812.
Neal, Derek, January 1997. The effect of Catholic secondary schooling on educational attainment. Journal of Labor Economics 15 (1 Part 1), 98–123.
Nechyba, Thomas J., 2006. Income and peer sorting in public and private schools. In: Hanushek, Eric A., Welch, Finis (Eds.), Handbook of the Economics of Education. North Holland, Amsterdam, pp. 1327–1368.
Nelson, Richard R., Phelps, Edmund, May 1966. Investment in humans, technology diffusion and economic growth. American Economic Review 56 (2), 69–75.
Organisation for Economic Co-operation and Development, 2008. Education at a Glance 2008: OECD Indicators. OECD, Paris.
Psacharopoulos, George, Patrinos, Harry A., August 2004. Returns to investment in education: a further update. Education Economics 12 (2), 111–134.
Rivkin, Steven G., Hanushek, Eric A., Kain, John F., March 2005. Teachers, schools, and academic achievement. Econometrica 73 (2), 417–458.
Rothstein, Jesse, December 2007. Does competition among public schools benefit students and taxpayers?. Comment The American Economic Review 97 (5), 2026–2037.
Rouse, Cecilia Elena, May 1998. Private school vouchers and student achievement: an evaluation of the Milwaukee Parental Choice Program. Quarterly Journal of Economics 113 (2), 553–602.
Schultz, Theodore W., March 1961. Investment in human capital. American Economic Review 51 (1), 1–17.
Song, Jason, Felch, Jason, May 7, 2011. Times Updates and Expands Value-Added Ratings for Los Angeles Elementary School Teachers. Los Angeles TImes.
Tiebout, Charles M., October 1956. A pure theory of local expenditures. Journal of Political Economy 64 (5), 416–424.
U.S. Department of Education, 2013. Digest of Education Statistics, 2012. National Center for Education Statistics, Washington, DC.
Welch, Finis, January/February 1970. Education in production. Journal of Political Economy 78 (1), 35–59.
Witte, John F., 1999. The Market Approach to Education. Princeton University Press, Princeton, NJ.
Wolf, Patrick, Gutmann, Babette, Puma, Michael, Kisida, Brian, Rizzo, Lou, Eissa, Nada, Carr, Matthew, June 2010. Evaluation of the DC Opportunity Scholarship Program: Final Report. Institute for Education Sciences, Washington, DC.