

Education Production Functions (Part III)

Evidence from Developed Countries

EE473




Glossary

- Education production function
- Value-added model

Education production function

- ❖ The constitutes all combinations of inputs that produce a given set of outputs
- ❖ In education, outputs are typically measured by achievement scores and graduation rates
- ❖ Inputs include both school and family factors that influence outcomes

Value-added model

- ❖ A way of estimating the impact of school programs in inputs that uses data on individual students linked over time so that each individual's achievement growth can be calculated
 - ❖ Value-added models can be used to estimate effects of programs and inputs (e.g. teacher experience) as well as the effects of individual teachers and schools
 - ❖ The concept of value-added is rooted in economics and refers to the difference in the economic value of outputs and inputs
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Basic Assumptions

- ❖ School inputs – funding levels, class size, teacher education, teacher experience, and availability of computers and textbooks
- ❖ School outputs – family and other nonschool inputs
- ❖ The specification of the EPF is to express this basic theory mathematically.


$$A_{it} = f(S_{it}, S_{it-1}, \dots, F_{it}, F_{it-1}, \dots, I_i, \varepsilon_{it})$$


Define education output for individual student i at time t as A_{it} which is a function of the school inputs S and family inputs F from current and all previous time periods, a fixed student contribution I_i ; and an error term ε_{it}

The fixed student contribution is often called innate ability by economists and is akin to what psychologists consider general intelligence

Measured School Inputs

90 individual publications that appeared before 1995 contain 377 separate production function estimates

- ❖ For classroom resources, only 9 % of estimates for teacher education and 14% for teacher-pupil ratios yielded a positive and statistically significant relationship between the factors and student performance
 - ❖ 29% of 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)
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- ❖ Studies on the effect of financial resources indicate that there is a 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
 - ❖ These studies make a clear case that resource usage in schools is subject to considerable inefficiency, because schools systematically pay for inputs that are not consistently related to outputs
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Study Quality

The available estimates can be categorized by a few objective components of quality

1. While education is cumulative, frequently only current input measures are available, which results in analytic errors
2. Schools operate within a policy environment set almost always at higher levels of government


The first problem is ameliorated if one uses the value added versus level form in estimation

- ❖ If the achievement relationship holds across grades, it is possible to concentrate on the growth in achievement and on exactly what happens educationally between those points when outcomes are measured
 - ❖ This approach ameliorated problems of omitting prior inputs of schools and families, because they will be incorporated in the initial achievement levels that are measured (Hanushek, 1979)
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The second problem of imprecise measurement of the policy environment can frequently be ameliorated by studying performance of schools operating within a consistent set of policies

- ❖ For example, within individual states in the United States – as all schools within a state operate within the same basic-policy environment, comparisons of their performance are not strongly affected by unmeasured policies (Hanushek et al, 1996)

If the available studies are classified by whether or not they deal with these major quality issues, the prior conclusions about research usage are unchanged (Hanushek, 2003)

- ❖ The best quality studies indicate no consistent relationship between resources and student outcomes
 - ❖ The studies finding strong resource effects, particularly for expenditure per pupil, are heavily concentrated in the group of lowest quality studies
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Benefits and Costs

The context debates over class size reduction


- ❖ In economic term, the potential impacts of class-size reduction are very small when contrasted with the costs of such large class-size reduction, which typically involve some of the most expensive policy changes currently contemplated
- ❖ The relevant alternative policy would be to compare the gains from spending on class size reduction with the potential gains from improving the quality of teachers

Do Teachers and School Matter?

- ❖ Teachers do indeed matter when assessed in terms of student performance instead of the more typical input measures based on characteristics of the teacher and school
- ❖ The alternative approach to the examination of teacher quality concentrates on pure outcome-based measures of teacher effectiveness
- ❖ The general idea is to investigate total teacher effects by looking at differences in growth rates of student achievement across teachers
- ❖ A good teacher would be one who consistently obtained high learning growth from students, while a poor teacher would be one who consistently produced low learning growth

- ❖ The general research design is to estimate models of the growth in individual student achievement that can be attributed to various measured school and family factors and to mean differences in learning across the students with different teachers
 - ❖ The differences in student-achievement growth across classroom, which can be taken as a measure of teacher quality, appear to be very large
 - ❖ Hanushek (1992) estimates that the variation in student outcomes from a good to a bad teacher can be as much as a full year of knowledge per academic year; in other words, while a poor teacher gets gains of 0.5 grade-level equivalents during a school year, a good teacher gets gains of 1.5 grade-level equivalents
 - ❖ With a string of good or bad teachers, the implications for student performance could be very large
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Rivkin et al. (2005) and Hanushek, et al. (2005) are able to provide rough bounds on the variation in teacher quality as seen within Texas

- ❖ By these studies, one standard deviation in teacher quality implies around a 0.15 standard deviation in teacher growth of student achievement
 - ❖ By this, having a series of good teachers (teachers at the 84 percentile of the quality distribution) instead of average teachers would lead to substantially different learning after just a few year
 - ❖ E.g. 4-5 years of a good teacher could close the average achievement gap between low-income and high-income students
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- ❖ Teacher credential and teacher training do not make a consistent difference when assessed against student-achievement gains (Boyd et al., 2006; Kane et al., 2006)
- ❖ Teacher quality does not appear to be closely related to salaries or to market decisions
 - ❖ Teacher exiting for other schools or for job outside of teaching do not appear to be of higher quality than those who stay (Hanushek et al., 2005)

