

Determinants of Primary Education Outcomes in Developing Countries

This paper reviews the literature on the determinants of primary education outcomes, with special attention to the developing country context. First, various methods of identifying and measuring the impacts of determinants of outcomes are reviewed. Next, some specific inputs and their impacts are examined in detail.

Studies of education outcomes are often framed in terms of supply- and demand-side factors, where households are consumers and schools are producers of schooling. The paper discusses factors that have been proposed as important for the supply or demand side of education, noting that some factors can actually enter into both sides of a large model. For example, school quality and learning outcomes can be both supply and demand; if quality and learning outcomes are perceived to be low, parents may be reluctant to send their children and demand for schooling will be low.

Methods of identifying determinants of outcomes

Production Functions

Thinking of schools as producers of education services leads naturally to the notion of the production function as used in microeconomic theory. While schools are treated as “producers”, they are typically not profit-maximizing firms. Thus, they are best viewed as organizations that should try to maximize output, subject to their budget constraints. Output is usually specified as some level of achievement, measured by test scores. Production function studies have been used extensively as a way to identify factors which “produce” good learning outcomes. In recent years, however, a number of inherent problems with these kinds of studies have been identified, especially in developing countries, including weakness in data, omitted variables, endogeneity of school quality variables, and sample bias. Some of these problems are being addressed through efforts to improve data quality and design rigor, as in the Third International Mathematics and Science Study (TIMSS), which covers a number of developing countries.

Some well designed production functions studies have been significant enough to withstand methodological challenges, such as that conducted by Heyneman in Uganda (1979). He demonstrated that specific education inputs generally matter more in low-income countries than in high-income ones. More recent results from developing countries and in low-resource contexts in developed countries also reinforce these early findings. Other studies suggest that both the level and *mix* of educational inputs are important in producing educational outcomes. Efficiency might be improved by reallocating expenditures to areas of higher marginal productivity. For example, Table 1 would suggest that investing in learning materials would result in far higher achievement gains than, for example teacher salaries.

Table 1. Increases in Test Scores per Dollar Spent on Input (re : teacher salary)

| <i>Input</i> | <i>Northeast Brazil (1980s)</i> | <i>India (1990s)</i> |
|-------------------------|---------------------------------|----------------------|
| Teacher Salary | 1.0 | 1.0 |
| School Facility Measure | 7.7 | 1.7 |
| Instructional Material | 19.4 | 14.0 |

Source: Pritchett and Filmer (1999) using data from Harbison/Hanushek (Brazil) and Kingdon (India).

Other kinds of Research on Determinants

Researchers have also dealt with the methodological problems in production functions by pioneering new kinds of methods.

Randomized or Quasi-Experimental Designs. Randomized evaluations are like controlled experiments in that control and treatment groups are established, with individuals randomly assigned into either. This method allows a rigorous and unbiased way to study demand-side issues, which are particularly important in achieving the Millennium Development Goals of universal primary education and gender equity at all levels of education. However, these types of studies can be very expensive and may create ethical issues regarding access to a “treatment” which is considered beneficial.

Natural Experiments. A natural experiment type study comes about when governments have undertaken a program initiative in a way that allows for some controlled comparisons. These have been done in Indonesia and in the United States.

Comparative Benchmarking. Bruns and Mingat (2003) used an approach similar to education production functions to identify factors important for primary school completion. They used a data-mining approach to identify factors and then set benchmark levels of various inputs deemed important at the national level. Their goal was to formulate a simulation model for estimating the costs of achieving universal primary completion.

Qualitative Methods. Qualitative methods include classroom observations to examine in detail the teaching and learning process and identify factors which may be important in improving educational outcomes.

Impact of specific inputs

Hardware

Hardware includes school buildings, classrooms and furniture, sanitation facilities, and other types of school “infrastructure.” There is some ambiguity in the importance of this factor which may be partly explained by evidence suggesting that the quality of facilities may be more important in disadvantaged settings. Also, costs of hardware inputs affect their marginal productivity; where construction costs are higher, hardware seems to have less per dollar impact. Finally, there seems to be a threshold effect of facility quality; a minimum basic quality of school facilities matters significantly. Above this threshold, its impact appears negligible.

Software

Software includes curriculum, pedagogy, textbooks, writing materials, and other supplies. Across various studies, this category of inputs is the most consistent predictor of achievement, again possibly because the very low starting point of resource levels in developing countries.

Textbooks have been shown to have a strong impact. Curriculum factors such as instructional time, subject mix, and teacher preparation are also very important, but can be more difficult to measure. Teacher absenteeism can result in overestimates of instructional time, already lower in developing countries. Instruction in students' mother tongue appears to be important for achievement. The impacts of interventions like multi-grade teaching and double-shifting are ambiguous; more qualitative research may shed light on the conditions under which these impact learning.

| Confirmation Percentages from Various Review Studies | | | |
|---|--------------------|------------------------------------|--------------------|
| Specific Inputs | Fuller('94) | Harbison/ Hanushek('92) | Velez ('93) |
| School Facilities | | 64.7(34) | 32.9(70) |
| Textbooks | 73.1(26) | | 76.5(17) |
| School Libraries | 88.9(18) | | |
| Class Instruction Time | 81.8(17) | | |
| Homework Frequency | 81.8(11) | | |
| Pupil-Teacher Ratio | 34.6(26) | 26.7(30) | 9.5(43) |
| Teacher Education | 50(18) | 55.6(63) | 45.6(68) |
| Teacher Experience | 56.5(23) | 34.8(46) | 40.3(62) |
| Teacher Salary | 36.4(11) | 30.8(13) | |

Note: First number indicates percentage of cases in which the variable is significantly positive. Second number in parentheses is the number of cases in that review study. Blank cells show indicate data was not available.

Teachers

Teacher characteristics and class size/pupil-teacher ratio are also believed to have a role in learning. Teachers' education and certification have a positive association with achievement test scores in developing countries, but not in developed countries. Teacher training is a consistent predictor of achievement, perhaps more important than formal qualifications. For the early grades of primary, it does not appear necessary to have university education teachers and it is often sufficient to give a one-year pre-service training coupled with well-designed follow-up and support. Some studies also link teachers' knowledge of subject matter (particularly math) to student achievement. Teacher morale is another area which may have an effect on learning, and is one where improvements could be made at a low cost.

The strategy of reducing class size is one of the most costly and controversial in terms of impact. Research results are mixed, though it does seem to make a difference in the early grades. However, it does seem clear that excessively large classes (above 60 students per teacher) are detrimental to learning.

Management and Institutional Structure

Introduction of competition among schools via various school choice strategies such as vouchers and private schools has been studied quite extensively. The degree of choice available to families with regard to schools seems to have a positive impact on achievement. Moreover,

there may be other benefits besides educational achievement, such as social mobility. Decentralization and school autonomy are other features of the institutional structure of education systems that have received much attention recently. Some studies have found that central control of curriculum and textbooks, coupled with local autonomy in setting school budgets and hiring teachers improved achievement. Central examination systems also have a significant positive effect on learning outcomes.

Contextual factors

Contextual factors include individual student characteristics, family background, and community characteristics. Students' innate ability obviously has a significant positive impact on learning, but "intelligence" is an ill-defined and difficult concept to measure. In any case, it is not amenable to adjustment through policies or programs. Readiness to learn, however, includes students' health and nutrition status, which does affect learning outcomes. Illness can lead to school absenteeism and poor nutrition can lead to poor performance, especially by causing various physical and mental disabilities. Health and nutrition can also be seen as *outcomes* of schooling. Various studies conclude that mother's education influences the children's health and nutrition status, which in turn influence their schooling outcomes. Family socioeconomic status in general has an impact on schooling outcomes, but not the overwhelming impact that it has in the developed countries.

Conclusions

Pulling the various pieces together, the paper closes with the following conclusions concerning the determinants of education outcomes. First, the best studies using education production functions tend to show that there is higher marginal productivity for additional educational inputs in developing countries compared to developed countries. A second important pattern is that the outcomes of primary education in poor countries are far below those of the rich countries. Third, government policy and implementation capacity is important, especially for determining the provision of schools and equity of access. And finally, when it comes to specific factors influencing education outcomes, numerous studies using a variety of methodologies have converged in showing the relatively strong impact of textbooks and other learning materials.

With respect to research methodology, many lessons have been learned that should be incorporated into future research to get a better picture of more effective interventions. There is no reason why research methods cannot be combined in studying education in a given country, or even the same region a country. Education production function methods and random evaluations can both be used as cross checks. Good qualitative research, especially at the school and management level, can provide very practical insights. Especially important, countries need to build up their local research capacity as they experiment and innovate.