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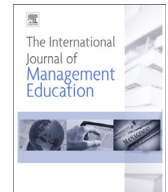
The cost of educational effectiveness: Evidence from financing basic education in Brazil

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ABSTRACT

This paper investigates evidence for a relationship between public expenditure and the effectiveness of basic schools in developing countries, a relevant subject at the time the Brazilian National Congress discusses a National Education Plan (PNE 2011–2020). This paper also aims to challenge the current approach of assessing educational performance by cross-sectional analysis, a widespread short-term instrument for assessing multi-variable behavior among different entities at a same moment. In contrast with a cross-sectional approach, our research has adopted the time-series analysis, a long-term methodology that can generate econometric coefficients and parameters from a cause-effect investigation, which is more appropriate for the purpose of drawing up projections and forecasts. Because our analysis extends over time, we develop, by the end of the study, an Abacus for Education based on cause-effect relationships derived from time series, the use of which will assist in understanding the future impact of educational policies, and therefore lead to the development of better policies. This paper makes two important contributions: it provides empirical evidence on the effects of public expenditure on educational effectiveness and it also sheds light on methodological issues by indicating that endogenous and exogenous variables can help in predicting values for public education outcomes.

1. Introduction

The link between public expenditure and education outcome has been scrutinized in investigations, which have mostly used cross-sectional analysis. Those studies compare the performance of different jurisdictions, at a single instant, in terms of economic or social circumstances. For example, some research compares the education budget of different countries with pupils' performance on standardized tests (OECD, 2009), the quality of education associated with public expenditure in municipal and state schools (Brunet, Borges, & Bertê, 2008), the level of scholarly achievement in several municipalities within a single state (Delgado, 2007), or even the relatively high levels of American expenditure on the first grade, but

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without the achievement of higher scores on international math tests (Gruber, 2009). All these studies are cross-sectional and produce some evidence that there is not a universal relationship between budgets and educational outcomes. In fact, the reported weak correspondence between these endogenous educational variables can be observed when intervening factors, regarded as exogenous variables — like regional wealth or social and cultural diversity — are not properly taken into account, as is very common in most studies. In these cases, some effects of external factors are inadequately captured by the education variables, leading to erroneous results. Therefore, the peculiarities of each environment and case mean that the conclusions cannot be generalized. In contrast with the cross-section approach adopted in the extant literature, this paper aims to investigate the temporal correlation and causality between public expenditure and educational outcomes through a time series analysis, between 1995 and 2009, in a single jurisdiction, taking Brazil as a single unit of analysis. This study is not designed to be a suitable basis for policy judgments or multiple allocations in the management of public education. Although it is not the main objective of the paper, the tools developed here shed light on decisions related to education policies, for example the definition of feasible targets given the resources available, and this is likely to make the implementation of such policies more effective. As an exploratory investigation, this study is intended to determine how much money should be invested in the Brazilian education sector in order to achieve a desired level of effectiveness in the medium term. Econometric programs were used to test and quantify correlations and causal relationships between variables.

The investigation uses federal data on national finances grouped in three categories: basic education, higher education, and other sub-functions. Brazilian basic education includes people enrolled at the regular stages, from early childhood until post-secondary non-tertiary education. It includes the modalities of special education, youth and adult education, and professional education (technical level). Because the extent of the time series data available is somewhat limited, we were not able, using the econometric program, to explore the expenditure on education disaggregated into all these subdivisions in the regression equations. This is work that can be progressed in future studies with longer time series. For the moment, we have to treat the temporal analysis synthetically, combining all the steps and modalities of basic education. Expenditure and outcomes are taken as single annual units in the series. The three spheres of government, federal, states and local, were aggregated to give total public expenditure, and two annual educational indexes were constructed: the Basic Education National Expenditure (ONEB), our first unit of analysis, and the Basic Education Outcomes Index (IREB), which was developed as our final unit of analysis.

The determinants of performance and the choice of appropriate outcome indicators are controversial issues. In this study focus on the effectiveness of educational policies, so we devised a synthetic indicator that aims to assess, as an approximation, the three main attributes of education, namely quality, universality and equity. More methodological details are given in the section on the construction of the indicators. The whole data set is available on the Internet, and is, therefore, in the public domain.

The analysis of causality requires a sufficiently long time-series, which is hard to find, because in the past availability of budgetary and social data has been limited. We collected data for a period of 15 years for the time series, although some gaps had to be filled in order to meet the requirements imposed by the econometric assessment. This was sufficient to allow simulations with a minimum of two endogenous variables (one dependent and one independent), one exogenous variable, and the consideration of a time lag between cause and effect. We are confident that our methods of statistical adjustments are appropriate and that they do not affect the results for causality in a substantial way.

After concluding the time series for the period of 1995—2009, with the educational expenditure and outcomes, our endogenous variables, we added an exogenous socioeconomic variable to the analysis in order to perform the econometric calculations. For this purpose we used the Vector Autoregressive Technique (VAR) and the Granger Causality Test (Granger, 1969). To isolate external influences, the analysis included and tested, successively, three exogenous variables, one at a time: Gross Domestic Product (GDP), GDP per capita, and the Human Development Index (HDI), together with the endogenous variables for public expenditure and educational outcomes. The statistical results were significant and revealed Granger evidence of a causal link between public expenditure and educational outcomes. In this scenario, we are able to state that the amount of money spent, together with other factors, is associated with the effectiveness of educational services.

The main conclusion of the study was that future outcomes in education can be affected and also quantitatively measured by a combination of the expected development in educational expenditure together with the rate of annual growth rate of the economy. Recently, the Brazilian Constitution prescribed that a goal for public resources invested in education should be established by law as a proportion of the Gross Domestic Product (GDP). A bill is under discussion in the Congress for renewing the National Educational Plan (PNE) for the next ten years and it proposes a target of increasing public investment in education, from 5 per cent of GDP in 2009 to 7 per cent by 2020, a goal that is generating much discussion in civil society. Our study concludes that there is a causal link between expenditure and educational effectiveness, and quantifies the effect of the exogenous variable GDP as a contributing factor to educational outcomes. Some graphics were developed, that could shed lights on the subject and challenge the goal of the PNE. A target for educational investment of 7 per cent of GDP by 2020 may be insufficient to achieve the educational effectiveness foreseen by the PNE for that year, due to the very low projections for economic growth being forecast after the 2008 World Crisis. However, there is also a best case scenario which would mean that effectiveness targets could be met in the unlikely event that GDP performs unexpectedly well in medium term.

The paper is structured as follows. The next section puts the Brazilian effort to finance education in the context of other developing countries. In the following section we discuss the causal relationship employed in this study, and we also discuss the difference between correlation and causality. This is followed by a discussion of the knowledge behind the proposed