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INTRODUCTION

1. PRESENTATION

This book aims to provide answers to the following questions: (i) Why do parents allow their children to work instead of attending school and (ii) How can we explain the schooling and its relationship with a country's economic development? Underlying these questions is a look at the way in which less developed countries behave with regard to schooling. For this purpose, this book deals with different perspectives of schooling and academic performance. The text is organized into chapters that are designed to provide answers to these questions through empirical evidence which shows quantitative results (through the use of various methods); policy considerations are laid out in detail in the conclusion to each chapter. With the exception of the introduction, the remaining chapters are organized like articles with an abstract, descriptions of the approach, background, empirical evidence, and results, conclusions, and a bibliography. Aside from the bibliographical references, each one of these chapters focuses on a specific topic and carries out an empirical exercise that helps to provide answers and policy considerations regarding the aforementioned questions.

While the empirical analysis is conducted on a global level in most chapters, in some cases results are considered for Latin America; subsequently, complementary information on remaining countries is included in an appendix. This decision was made firstly because it is certainly simpler and more appropriate for tables in the text, and secondly because this publication is based on research carried out by the University of Alcalá's Latin American Studies Institute (Instituto Universitario de Investigación en Estudios Latioamericanos).

The first chapter focuses on the issue from a point of view concerning economic growth and how this ties in with academic performance and completion of studies. It tries to answer the questions by first making an estimate of the relationship between these phenomena. This chapter also presents evidence that sheds light on the reverse causality of the high cost of low academic performance on long term economic growth. Carrying out this analysis employs theories which relate human capital and growth from a critical point of view, as it is often overestimated (we should be more careful regarding the variables to be measured when it comes to discussing human capital and education).

In fact, this study aims to establish variables tied to education (usually through a stock variable) more accurately in order to define academic performance and enrolment rates as flow variables and thus allow us to understand their influence on economic growth. This same chapter will also cover the impact that economic growth has on the changes to various educational programs in very general terms.

The empirical analysis is carried out on a sample of data from 205 countries taken during the 1980-2010 period, and it utilizes Arellano and Bond's original 1991 article on Generalized Method of Moments (GMM).

The second chapter addresses the issue of globalization and how it influences child labor rates. In this case, not only are the academic variables themselves (primary and secondary education) considered, but also their composition with respect to the whole labor force. Taking into account the traditional assumptions of international trade theory (the Heckscher-Ohlin model and the Stolper-Samuelson theorem), cases are considered where there are two or three types of specialization, considering the distribution of income and how it alters the prices of goods and factors. Once trade begins, it has an influence on the demand for education and supply of child labor. The empirical analysis uses data from 18 countries over a period of 12 years, including variables like GDP (which replaces other traditional trade indicators).

The third chapter deals with the relationship between public expenditure and education which has been widely studied using a variety of methodologies in the literature. In this sense, the chapter aims to find a more specific explanation by analyzing public spending on education and how this affects levels of school enrolment.

The initial hypothesis is that public expenditure does not always have the desired effect on educational output. This focus is centered on the effect of public spending considering two very important elements: levels of extreme poverty and different kinds of public expenditure.

The main objective here is to study the role that poverty plays in determining the effectiveness of public spending on education, measured principally via improvements in enrolment rates. The empirical analysis is based on the World Bank's World Development Indicators (WDI) data taken from 1960 to 2013 with two statistical techniques: fixed-effects (FE) and random effects (RE).

The fourth chapter analyzes an issue that the literature covers over and over again with widely varying results: the relationship between child labor, poverty, and education indicators. In this chapter, poverty is covered in both absolute and relative (inequality) terms, and education is basically considered through school dropout rates and return rates on investment in education. Although many studies show that investment in human capital is important in determining child labor rates, the empirical evidence does not support this correlation.

This chapter aims to measure, via the Generalized Method of Moment (GMM), the relationship between the Gini index and the school dropout rate as well as the combined effects of workers' contributions to the household. The re-

sults, which do not necessarily coincide with other literature, were obtained from a sample of countries grouped into regions as well as by income levels with data ranging from 1970 to 2010. The return on investment rate in education does not explain child labor levels while the relationship between levels of inequality, as well as the relationship between inequality and an improvement in income from working, do show an important level of correlation with child labor rates.

All of this seems to indicate that efforts to improve inequality could have a significant effect on child labor.

The fifth chapter introduces the topic of international aid and its effect on schooling. Using empirical analysis, the chapter basically aims to look closely at whether public expenditure on education complements or substitutes payments coming from Official Development Assistance (ODA). On the other hand, the data is used to estimate whether the effects of the aid can be seen in the educational output through the Primary Completion Rate (PMC) variable.

The empirical study in this chapter, like others performed in this book, is based on the Generalized Methods of Moments (GMM) and is performed on a data sample from 213 countries taken during the 2003-2007 period. In low-income countries, and in the whole sample, complementarity is found between the aid and public expenditure on education. Nevertheless, the results do not suggest a significant relationship between the aid and the PMC.

The sixth chapter focuses on crime and violence, a hot topic given that any outbreak of this kind is a concern that receives extra attention both in society and in people's minds. There are many perspectives from which to analyze the cause of such events. However, in line with the main concern of this book, this chapter focuses on education and child labor and how they can create important components that can be used to analyze problems related to crime and violence.

Thus, the chapter aims to explore the relationship between schooling (attendance, quality of schooling, and school dropout) and crime. As crime is made up of a large series of variables, we focus on one relevant and available piece of data: intentional homicide.

The empirical evidence comes from a panel of 214 countries during the 1995-2012 period. The econometric analysis finds non-biased and robust evidence that relates crime and schooling when considering various characteristics, most notably that school dropout (which, as seen in previous chapters, is often related to child labor) and the student/teacher ratio are positively associated with intentional homicides. Public policy implications can be drawn from this that could at least be used to improve criminality and violence rates, especially in medium- and low-income countries.

Chapters seven and eight consider case studies specifically tied to one country: Bangladesh. Chapter eight aims to analyze the difference between *efficiency* and *effectiveness*, terms which are often confused in the literature, when it comes to the use of public resources for education. This study analyzes academic performance from a small group of low-income, mostly African, countries and

compares the data with Bangladesh. This is done by employing the Malmquist Total Factor Productivity (TFP) index which provides a significant level of differentiation when it comes to finding differences between two concepts. From the original proposal from Färe, Grosskopf and Roos in 1994, the Data Envelopment Analysis (DEA) method is used for the estimation.

Then, once the TFP is broken down, the kernel density function is used to analyze the convergence/divergence process of countries, both in terms of efficiency and effectiveness.

From the database generated with the World Bank's World Development Indicators and the World Bank's Education Indicators, the behavior of a group of 26 low-income countries is analyzed from 1998 to 2011, and the variables used to measure efficiency and effectiveness in Bangladesh during the same period are produced for all 26 countries. The results obtained vary according to the subgroup of countries although, at first glance, the conclusion can be drawn that efficient use of resources does not imply that they are used effectively, and vice versa.

The last chapter returns to the relationship between public expenditure, aid, and education, in this case with a specific example regarding districts and regions in Bangladesh. Over the last 25 years, the country has invested a significant amount of public resources and international aid in education, most specifically focusing on primary and secondary school enrolment. However, not much attention has been paid to analyzing how efficiently these resources have been used.

This study aims to examine exactly this point: efficiency in the use of resources allocated to education (secondary and higher secondary) and its determinants. The specific objective is to measure the technical efficiency of schools in Bangladesh at both the division (regional) and district level via the Data Envelopment Analysis (DEA) methodology in order to estimate technical efficiency and check for a significant relationship between factors exogenous to the education production function.

The study includes a series of econometric procedures to search for robust results and while it does not reach an overall conclusion, the estimations suggest that there are some factors that explain district level differences in the technical efficiency of schools at secondary and higher secondary levels. These factors (institutional barriers) are related to input quantity and quality (*i. e.* modernization of schools, increases in the number of teachers) and are conditioned by geographical and socioeconomic barriers to school access.

2. METHODOLOGICAL NOTE

This book compiles a series of noticeably empirical articles which cover a diverse spectrum of parametric, non-parametric, and semi-parametric techniques and statistical sources.

Regarding the databases that are used to conduct the empirical analyses, the authors have used information aggregated on both country and micro levels (e.g., regarding school facilities).

Specifically, the World Development Indicators (WDI) provided by the World Bank are used, as well as a wide set of other indicators created from officially recognized international sources. The WDI provides data on current global development and includes regional, national, and worldwide estimations.

In the disaggregated studies, namely any concerning Bangladesh, the information is obtained from the «Bangladesh Bureau of Educational Information and Statistics» (BANBEIS), an institution that makes school level observations in 64 districts across 6 territorial divisions in the country. Also, the permanent survey of households is used for the impact study carried out in chapter seven where a non-experimental evaluation method is employed: propensity score matching.

The variety of methodologies implemented is due to the nature of the data that is used to analyze the specific questions presented in each of the investigations. In other words, the appropriateness or inappropriateness of the data fit to a known distribution is the reasoning behind choosing each of the techniques used.

Nevertheless, it is important to note that these quantitative techniques follow a line that is deeply rooted in Education Economics. When the kind of questions posed concern: i) social benefits of education, ii) efficient allocation of resources, iii) financing, etc., the type of methodology that is used is chosen due to its substantial descriptive, explicative, and predictive aspects when it comes to designing and measuring the effectiveness of public policies with regard to education.

Considering the social benefits of education, the methodologies used are fundamentally parametric and focus on studying phenomena concerning the relationship between investment in education, human capital, and national economic growth, as well as the role of education in development, considering various education levels.

Regarding the allocation of resources in education, the quantitative methodologies that are predominantly used are non-parametric or semi-parametric, and they focus on analyzing efficiency in how education resources are managed (physical structures, teacher labor categories, etc.) in populations where a known distribution of the data cannot be assumed.

CHAPTER 1
ECONOMIC GROWTH AND SCHOOL ATTAINMENT

1. ABSTRACT

We examine the relationship between school attainment, school completion, and economic growth. We apply the Generalized Method of Moments (GMM) proposed by Arellano and Bond (1991) to a sample of 205 countries over the period 1980-2010. The empirical evaluations confirm a positive and significant relation between GDP per capita and primary completion rate and net primary enrollment rate. We also find a negative and significant influence of primary age of entrance on GDP per capita. However, the identification of the combined effect of net enrollment and primary completion rates on GDP per capita is far from being clear from the different estimations. Finally, we propose a simulation that could illustrate the high cost of low educational performance in terms of long-run economic growth.

2. INTRODUCTION

According to Cohen and Soto (2007), the idea that human capital can generate long-term sustainable growth was one of the critical features of the *new growth* literature initiated by Lucas (1988) and Romer (1990). Under this theoretical approach, economic growth is enhanced by education.

However, taking a neo-classical approach, Mankiw, Romer and Weil (1992) consider human capital to be an ordinary input unable to generate endogenous growth. Following this theoretical approach, several works such as Benhabib and Spiegel (1994), Pritchett (2001) or Bils and Klenow (2000) consider that the role of human capital in economic growth has been greatly overstated.

For Cohen and Soto (2007), the reason why the debate erred in these theoretical positions is due to the measurement of human capital, both conceptually and empirically. Chaudhuri and Maitra (2008) argue that as a result of this, empirical studies have failed to arrive at a consensus on how important education is for economic growth.

For example, several authors such as Barro (1991) and Barro and Lee (1993, 1997), show a positive and significant impact of schooling on the growth of real GDP per capita across countries. However, other authors such as Lau, Jamison and Louat (1991), and Pritchett (2001) find that education does not have a statistically significant effect on economic growth.

In the literature we can find two possible explanations for this. First, according to Hanushek and Kimko (2000) and Barro and Lee (1997), it may be the quality of education rather than the quantity of schooling which matters for economic growth. Second, following Bils and Klenow (2000), one can argue the existence of a reverse causality running from economic growth to education.

Examining these points of view using a sample of 21 OECD countries, De la Fuente and Domenech (2006) find a clear positive correlation between data quality and the size and significance of human capital coefficients in growth regressions [1].

Chaudhuri and Maitra (2008) argue that under these circumstances it is very important to clarify the definition of «education». These authors believe that education is generally measured as a stock variable, but educational attainment is in fact a flow variable. In order to take this flow aspect into account, in this chapter we use school progression in terms of school attainment and completion rates, as Chaudhuri and Maitra (2008) propose. In this context, the main objective is to study the relationship between school attainment, school completion, and economic growth (as a second stage analysis we also study the effect of other macroeconomic variables on school attainment and completion).

At the same time, we consider it essential to explore the dynamics of the impact on economic growth of education reform programs. This second objective can provide country-specific information about the economic impact of change, and also an indication of the long-run impact on economic growth rates of a labor force with varying skills, as measured by primary school attainment (in terms of Net and Adjusted enrollment rate) and primary school completion rate (in terms of % of relevant age group).

In order to achieve the two main objectives, this chapter is organized as follows: in the next section we present a brief critical review of the theoretical and empirical studies on human capital and economic growth. In section 4 we develop the methodology for the analysis. Section 5 presents an empirical analysis at country level to explain how skills affect economic growth and offers a simulation of several skill improvement levels. Section 6 ends with a summary of the most important conclusions and policy implications and, finally, section 7 contains all the references.

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[1] By extending the classical errors in modelling variables to correct for measurement error bias, De la Fuente and Domenech (2006) construct a set of meta-estimates of the coefficient of years of schooling in an aggregate Cobb-Douglas production function. Their results suggest that the value of this parameter is likely to be above 0.60.

3. BACKGROUND: THE EFFECT OF EDUCATION ON ECONOMIC GROWTH

Theories of economic growth

According to Hanushek and Woessmann (2010), theoretical economic growth models have emphasized different mechanisms through which education may affect economic growth. These authors highlight three theoretical models applied to the modeling of economic growth in line with Solow, from which it is ultimately understood not only how and why an economy grows, but also how to reduce the impact of the so-called *residual factor or measure of ignorance*.

The first theoretical approach is the basic Solow growth model (1957) where the output of the economy is a direct function of the capital and labor in that economy. Following this neoclassical approach, Mankiw, Romer and Weil (1992) extend this analysis to incorporate education, focusing on the role of education as a factor of production. Nevertheless, as Pritchett (2006) argues, in this approach the role of human capital is limited because there are natural constraints on the amount of schooling in which a society will invest. In this first approach we can already see how these authors are attempting to find the basis for the productivity measure, not only replacing the amount of labor for quality (education) but also by looking in more depth at the aspects that influence quality (years of schooling).

The second theoretical approach regarding the role of education in economic growth focuses on the diffusion of technologies. Several theories on technological diffusion are proposed by authors such as Nelson and Phelps (1966), Welch (1970), and Benhabib and Spiegel (2005). All these approaches assume that education may facilitate the transmission of the knowledge needed to implement new technologies. This second generation progress incorporates the secondary effects of education in the technological process.

The third theoretical approach comes from the endogenous growth literature. Several authors, such as Lucas (1988), Romer (1990) and Aghion and Howitt (1998), consider the role of education as essential in increasing the innovative capacity of the economy by helping develop new ideas and technologies.

In general, the *endogenous growth* models link GDP per capita growth rates to the initial level of GDP per capita, the years of education attained, and the level of skills[2]. In other words, a country's economic growth rate (g) is a function of the skills of the workers (H) and other factors (X), which include initial levels of income and technology, economic institutions, and other systematic factors.

$$g = \gamma \cdot H + \beta \cdot X + \varepsilon \qquad [1]$$

Usually, skills (H) refer to the workers' human capital stock, and in order to specify the measurement of H, most existing theoretical and empirical work on

[2] As Hanushek and Woessmann (2009) argue, the inclusion of initial income reflects the fact that lower income countries simply have to imitate more developed countries, and find this easier than innovating with new products, technologies, or production techniques. Thus, the «catch up» process will be more dynamic.

growth begins by taking the quantity of schooling of the workers (S) as a direct measure of H.

Nevertheless, Hanushek (2002) goes further and argues that these skills are affected by a range of factors such as family inputs (F), the quantity and quality of the inputs provided by schools (qS), individual ability (A), and other relevant factors (Z) which include labor market experience, health, and so forth. This gives us:

$$H = \lambda \cdot F + \varphi \cdot \left(qS\right) + \eta \cdot A + \alpha \cdot Z + \nu \qquad [2]$$

In (2), human capital is a latent variable (not directly observed) and the schooling term combines school attainment (S) and its quality (q).

Economic impact of education reform programs

The aforementioned growth theories provide an indication of the long-term impact on growth rates of a labor force with varying skills in terms of the pupils enrolled in school. However, this long-term relationship does not describe the benefits arising from programs to change the skills of the population.

In others words, as argued by Hanushek and Woessmann (2010), the historical record of the relationship between skills and economic growth provides a means of directly evaluating the benefits from education reform programs without taking a position on how much school improvement is possible or desirable.

In this context, the simulation approach can be a useful way to establish several alternative benchmarks in order to provide country-specific information about the economic impact of education reform programs.

To do this, as Hanushek and Woessmann (2010) suggest, it is necessary to consider some important assumptions such as: i) programs to improve skills through schools take time to have an impact on pupils; ii) the impact of improved skills will not be felt until the pupils with greater skills move into the labor force, and moreover, this will depend on the hiring sector and type of company (large, small, national or international), and finally iii) the economy will respond over time as new technologies are developed making use of the new better skills.

Methodology: Econometric models, projections, data and variables

Arellano and Bond (1991) proposed an extension of the GMM initially introduced by Hansen (1982) to the case of panel data for a simple AR model. We specify a dynamic model characterized by the presence of one lagged endogenous variable among the explanatory variables. Our specific model is a dynamic panel model arrived at by:

$$y_{it} = \alpha \cdot y_{it-1} + \beta^{'} \cdot x_{it} + \mu_i + \nu_{it} \qquad [3]$$

Where y_{it} is the endogenous variable; y_{it-1} is the endogenous variable appearing in the regression as a lagged explanatory variable. X represents the vector of

exogenous variables; (α, β) represent the parameters to estimate; and μ_1 is the specific effect of country (i). This specific effect can be a stationary or uncertain effect, and constitute individual heterogeneity: μ_1 i.i.d ~ N[(0,1)]; v_{it} is a stochastic term: v_{it} ~ i.i.d N[(0,1)]. The bias is positive and increases with the variance of the specific effect. Indeed, y_{it} is a function of v_{it}, as is y_{it-1}. y_{it-1} is an explanatory variable correlated with the stochastic term. It introduces a bias in the value of ordinary least squares. Even under the assumption that the stochastic terms are not correlated, this value is non-convergent[3].

In our model, y_{it} is GDP per capita in country (i). This figure is explained by: i) GDP per capita rates for the period ($t-1$), ii) a latent human capital variable not directly observed, and iii) some control variables about the education system in each case, namely Primary School Duration (*Dps*), age of entry to Primary School (*AEps*), and Total School age population in primary school (*TAPps*). More specifically, the human capital variable combines primary school attainment (*Aps*) and quality, measured through the primary school completion rate (c).

We can rewrite our model as shown below:

$$GDPpc_{it} = \alpha \cdot GDPpc_{it-1} + \beta_1 \cdot Aps(c)_{it} + \beta_2 \cdot AEps_{it} + \\ + \beta_3 \cdot Dps_{it} + \beta_4 \cdot TAPps_{it} + \mu_i + v_{it} \quad [4]$$

Forecasting of the Economic Value of Education Reforms

In order to conduct the country level benchmarks previously proposed we need to use a simple simulation model. The basic idea is that moving from one workforce quality level to another depends on the proportions of workers with different skills.

Using Hanushek and Woessmann's (2010) approach, the impact of skills on GDP at any point in time will be proportional to the average skill levels of workers in the economy. According to these authors, the expected working life is assumed to be 40 years[4], and after an educational reform is fully implemented it takes 40 years until the full labor force reaches a new skill level. We use the Hanushek and Woessmann (2010) methodology to provide a formal description of the different steps of the forecasting of the growth effects of education reforms[5].

i) Increase in the annual growth rate in each different phase: in this first step we can define three phases:

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[3] The evaluation of the models using traditional methods (Ordinary Least Square «OLS» and LSDV) gives biased and non-convergent values because of the inter-relationship of the lagged endogenous variable and individual heterogeneity. In this context, our models should not be estimated using the OLS method and LSDV because estimating with these methods leads to ad hoc results. We propose a method which results in consistent estimators.

[4] Which implies that each new cohort of workers accounts for 2.5% of the workforce.

[5] The parameter values underlying the simulations are: 1) start of the reform 2011; 2) reform duration (years) 20; 3) working life (years) 40; 4) growth coefficient 0.8156606, and 5) Δ primary completion rate, 5%.

a) Phase 1 (2010-2030): The education reforms are assumed to take 20 years to complete, and the path of increased achievement during this phase is expected to be linear. The additional growth in GDP per capita due to the reform in year t is given by:

$$\Delta^t = Growth\,Coefficient * \Delta School\,Completition\,Rate\ * \\ * \frac{1}{Working\,Life} * \frac{t-2010}{20} + \Delta^{t-1} \qquad [5]$$

In [9] the growth coefficient stems from the underlying regression estimation and school completion in terms of the increase in the primary completion rate (as a % of the relevant age group).

b) Phase 2 (2031-2050): The education reform is now fully enacted. At the end of 40 years, the assumed working life, the current workforce is fully replaced. During this phase the additional growth in GDP per capita due to the reform in year t is given by:

$$\Delta^t = Growth\,Coefficient * \Delta School\,Completition\,Rate\ * \\ * \frac{1}{Working\,Life} + \Delta^{t-1} \qquad [6]$$

c) Phase 3 (2051-2070): Here the first 20 labor-market cohorts, which had not fully profited from the education reform, are replaced by cohorts that fully profited from the enacted education reform:

$$\Delta^t = Growth\,Coefficient * \Delta School\,Completition\,Rate * \\ * \frac{1}{Working\,Life} - \left(\Delta^{t-40} - \Delta^{t-41}\right) + \Delta^{t-1} \qquad [7]$$

ii) Change in GDP with and without the reform: in this second step we can differentiate between two possibilities: *a)* without the reform the annual growth rate (Δ^t) is increased by the growth effect (Δ^{t-1}) and *b)* with the reform, the annual growth rate (Δ^t) is again increased by the growth effect (Δ^{t-1}) but now also by the Δ School Completion Rate (in our simulation we assume an average increase in the total primary completion rate of 5% of relevant age group).

4. EMPIRICAL ANALYSIS: THE RELATIONSHIP BETWEEN GDP PER CAPITA AND PRIMARY SCHOOL COMPLETION RATES (DATA AND VARIABLES)

The statistical sources used in this analysis are the World Bank's World Development Indicators[6] (WDI) and its Education Statistics[7] (ES). These databases

[6] World Development Indicators (WDI) is the primary World Bank database for development data from officially-recognized international sources.

[7] Education Statistics provides data on education from national statistical reports, statistical annexes of new publications, and other data sources.