# (In)equality in Education and Economic Development

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## Introduction

The aggregate level of education crucially shapes economies' welfare. This is true for industrialized countries, where human capital is vital for technology driven, sustainable development and for developing countries, where education is an essential factor for hauling societies out of poverty. Beyond that, an equitable distribution of educational achievement constitutes a precondition for individual productivity and ability to rise above poverty. However, even if access to education to education is among the basic human rights, huge educational gaps between various groups exist within countries, whereby education is prevented from unfolding its welfare enhancing effects entirely.

Not only neoclassical but also endogenous growth theories - even if attributing peculiar roles to human capital - ignore any impact the distribution of human capital might have on the growth progress. However, at least two forces are at work, causing human capital not to be distributed homogenously. First, education is imperfectly traded (L'opez et al., 1998), causing marginal products not to be equalized across individuals and aggregate income to depend not only on the total level but also on the distribution of the respective asset. Second, human capital is, as opposed to physical capital, tied to humans, thus subject to physiological constraints and diminishing returns to scale at the individual level (Galor & Moav, 2004). It is due to these peculiarities that, in the presence of credit market constraints and human capital indivisibility (Galor & Zeira, 1993), social inheritance of education (Castell'o-Climent & Dom'enech, 2008) and/or education externalities (Glomm & Ravikumar, 1992), the degree of human capital inequality negatively affects the average stock of human capital and hence economic development.

These theoretical approaches have clear and strong empirical implications, generally predicting a negative relation between inequality in the distribution of education and economic development. However, the e.ect might differ across countries according their state of development. By now, the relevance of the degree of inequality in the distribution of education for economic performance has been scarcely explored empirically. One line of research departs from the failure of empirical studies to support the theoretical implication of a strong causal link from education to growth. The distribution of education is considered as an omitted variable, whose inclusion should deliver more reliable estimates of the social return to education. In aiming to reveal the relationship between the general concept of inequality and economic development, another line of research allows for educational inequality as an important indicator besides income, wealth and land inequality.

Our work is motivated by two ideas. First, we aim at demonstrating that education matters for income growth. Second, we seek to find evidence on the relevance of the distribution of

educational attainment for economic development. In doing so we contribute to the existing empirical literature in combining two seminal papers and adding a third element. On the one hand, we continue along the lines of L'opez et al. (1998) in computing reliable estimates of the social return to education which account for the relevance of its distribution among the population. On the other hand, we follow Castell'o-Climent (2004) by controlling for unobservable individual effects, dynamic panel bias and endogenous explanatory variables by applying the system GMM estimator. Most importantly, however, we take the theoretical literature which predicts a nonlinear relationship between inequality and development serious. A straight forward approach for dealing with heterogeneous coefficients is the inclusion of an interaction term between the distribution and the average level of human capital. As this approach has not been applied in empirical studies so far, it provides new insight into the mechanics and channels of the link between the distribution of education and economic development.

## Data and Methodology

In order to empirically test for the relationship between educational inequality and economic development, we use Barro and Lee's (2010) education data set in order to compute Gini coefficients of educational attainment for a panel of 144 countries ranging from 1950 to 2005 at five-year intervals. We add this distributional measure to a conventional convergence specification following the augmented Solow model. However, based on theoretical predictions, we claim that a specification which properly reveals the relationship between average educational attainment, its distribution and economic development should allow for heterogeneous and decreasing social returns to education as well as nonlinearities in the effect of educational inequality. Hence, we apply the system GMM estimator not only to linear benchmark equations but also to an interactive specification.

## Results

Like our main objectives, our results continue along two lines. First, we show that the coefficient on average schooling increases and becomes significant as the appropriate functional form is being estimated. Accordingly, education exhibits a positive impact that is substantially declining in the inequality of education. The failure to allow for distributional aspects and to recognize the flexible coefficient may be the reason for unsatisfactory results in previous studies. Second, the introduction of an interaction term between the education Gini and average schooling turns out to be crucial in understanding the relevance of educational inequality for economic development. Doing so reveals that the relation between educational inequality and income growth is positive for low levels of development, i.e. relatively low educational attainment. Thus, at least a slight degree of inequality is necessary in order to haul initially poor and low educated economies out of the poverty trap. The effect becomes, however, insignificant as economies become more educated. Yet this is only the e.ect of educational inequality which remains after controlling for average schooling. The conditional relationship between average educational attainment and income growth uncovers the central channel through which inequality negatively affects income growth to work through its adverse effect on average human capital.