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Impact of Duration of Primary Education on Enrollment in Secondary Education: Panel Data Evidence from Developing Countries

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Abstract

Using panel data for non-OECD countries covering the period 1970-2012, this paper analyzes the impact of the duration of primary education on school enrollment in secondary education. The empirical results show that in those countries where the duration of primary education is increased, the enrollment rate in secondary education decreases, and the opposite is observed in those countries where the duration of primary education is reduced. These results are in line with the fertility model approach; that is, in developing and underdeveloped countries parents do not have incentive to pursue further education for their children given the high perceived present economic value of children.

JEL Classification: I21, I25, I28

Keywords: primary education, secondary education, school enrollment, education policy, developing countries, school duration

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1. Introduction

The acquisition of education is a significant and indivisible investment, where individuals incur costs at the present time in return for rewards in the future. Consequently, individual schooling attainment is largely constrained by family resources and influenced by factors affecting the costs and benefits to households of sending children to school. In contrast with developed countries, where primary and secondary education is universal, for developing and underdeveloped countries parental preferences play a crucial role in these schooling decisions, since families have to choose between sending children to work or keeping them in the school (Bursztyn and Coffman, 2012). Hence, costs to the family include not only the direct costs of school attendance but also the opportunity cost, namely, foregone earnings of time spent in school instead of in alternative productive activities at paid work or at home.

Since, mainly in developing countries, the relative costs incurred by families can constitute an impediment for acquiring education because of the presence of borrowing constraints, empirical evidence suggests a direct link between schooling costs and school attendance. For example, some of this evidence report dramatic increases in school enrollment with initiatives to eliminate school fees (Kremer, 2003) and to reduce costs associated with accessing schooling (Kremer et al., 1997). However, to the best of our knowledge, previous studies do not pay attention to the implications of the opportunity cost, which is an important factor influencing the decision to send children to school, especially in developing countries.[1] One reason why families might choose not to send children to or dropping out them from school is a low perceived return of attending school (Edmonds and Pavcnik, 2005).

[1] The literature analyzing the impact of the opportunity cost is mainly focused on high school graduates who face the decision to enroll in college or get a job (Hansen, 1963; Catsiapis, 1987; Cameron and Taber, 2004). Therefore, students are the ones who plan their investment in education, contrary to what is considered in this paper where parents are the decision makers.

In this context, an increase in the duration of primary education makes school enrollment and termination decisions more difficult for parents and foregone earnings have a greater say in the decision. Educational reforms that a government can carry out in order to delay leaving school can be translated into both an increase in direct expenditures on tuition, books or transportation, and in the opportunity cost by staying an extra year in primary school; this especially affects students in the age of attending post-compulsory school that may have the option to work. Thus, a reform in the number of years an individual must spend in the school system could imply a decrease in the enrollment rate of post-compulsory/secondary education, to be summed to the already accumulated in compulsory/primary education (or decrease in school enrollment in the following educational level, i.e., secondary), since an additional year not only involves a greater allocation of education resources from the government but also by families. On the one hand, schools are required to deal with a significantly enlarged student body and this can create logistical problems with staff and classroom numbers. On the other hand, families lose another economically active member for an additional year. The latter is especially problematic if family income is near to subsistence level. Although this is an extremely important issue, as far as we are aware there is no previous empirical evidence on the impact of this type of reform on educational outcomes in developing and underdeveloped countries.

Considering that from an empirical point of view little is known about the impact of the duration of primary education might have on education in terms of attendance for secondary school in developing and underdeveloped, the aim of this paper is to fill this gap. In our study we exclude developed countries (OECD) since they use other mechanisms in order to avoid drop-outs and parent's decision of sending children to school is based on different criteria than that of developing and underdeveloped countries, where child labor is more common.[2] We

[2] In most of developed countries not sending children to school can cause that parents loose the custody of their children.

focus on developing and underdeveloped countries where the context is different and the opportunity cost for families can be substantial because most working children are employed by their parents (especially in rural areas) rather than in manufacturing establishments or other forms of wage employment (Edmonds and Pavcnik, 2005). Furthermore, empirical evidence supports the importance of borrowing constraints for developing countries affecting children's progression through the school system and causes them to withdraw from school earlier (Jacoby, 1994). Although education is compulsory and free for almost all children, the law in these countries is loosely enforced.[3]

Using cross-country panel data covering the period 1970-2012, we find that one additional grade of primary education has a negative impact on enrollment rate in secondary education. These results are in line with fertility models and indicate that families in developing and underdeveloped countries do not have incentive to educate their children further, because they need them for providing resources to the household. In this context, policies consisting of increasing the duration of primary education may not have the same desirable effect as in developed countries. In developing and underdeveloped countries, where families face severe borrowing constraints, children represent a high economic value; therefore, families prefer to send children to work and to gain from their earnings rather than investing in their education. Although previous literature provides evidence that increasing compulsory schooling in developed countries has positive returns in terms of earnings and non-pecuniary outcomes (school externalities), this may not apply to developing and underdeveloped countries where children earnings are one component of the household income and in many cases represent the support of the entire family.

[3] For instance, in Brazil "...Although working is only legal at the age of 16, over 15 percent of 15-year-old children from the bottom quartile households in the income distribution were not enrolled in school in 2006, and over 22 percent reported having a job during the week they were interviewed for the 2006 PNAD..." (Bursztyn and Coffman, 2012, p. 365).

The rest of the paper is structured as follows. The next section provides the conceptual framework of our study. Section 3 presents an overview of related literature. Section 4 describes the econometric strategy and data. Section 5 presents the empirical results. Finally in Section 6, we discuss our main findings.

2. Conceptual framework

Schooling decisions occur largely while the person is still a child and living with her parents. From the theoretical point of view, the standard approach for schooling decisions considers either a single decision-maker, parents making the decision for their children or dynasties with unified utility functions. Ota and Moffatt (2007) identify three broad approaches to the modeling of the determinants of children's schooling: *human capital investment model*, *demographic models* and *fertility decision models*.

In the *human capital investment model* parents are assumed to make the decision by maximizing their lifetime utility which depends on consumption in two periods, subject to an inter-temporal budget constraint.[4] This model is often used to explain the lower school enrollment for girls compared to boys (see Psacharopoulos and Woodhall, 1985; Haddad et al., 1997). Since the choice between schooling and work is assumed to be made by an individual agent, the effect of the household situation, particularly those of an individual child's position within the household, are not fully taken into account.

The *demographic models* establish a link between the demographic characteristics of a child (e.g. number of siblings, birth order) and their educational attainment (as measured by test scores, completed years of schooling or earnings). In these models, two theories are tested. The first is the "resource dilution effect" which predicts that the more children there are in the

[4] In the first period, they either invest in children's education or send them to work and gain from their earnings. In the second period, parents become economically inactive and rely on the economic support of their children, whose incomes depend on educational level.

household, the lower the educational achievements, since the resources of the household, in terms of both material resources and parents' attention, are diluted. The second theory, the "teaching effect", predicts that the presence of siblings has a positive influence on educational achievement through the benefit of either teaching younger siblings or being taught by older siblings. Empirical studies, which include the number of children in the household as an explanatory factor, tend to support the resource dilution effect, which is also suggested by the fertility decision model. However, when birth order is included as a variable, the results are mixed for both resource dilution and teaching effects (see Kessler, 1991; Travis and Kohli, 1995). Using data from Peru, Patrinos and Psacharopoulos (1997) find that having a greater number of younger siblings implies less schooling, more age-grade distortion in the classroom and more child labor.[5]

The third approach, *fertility decision model*, is precisely the conceptual framework we adopt in this paper. This model is based on household production models and assumes that high fertility in developing countries results from the high perceived economic value of children and investigates what drives a transition in parents' preference of children. Following this theoretical contribution, some empirical work has been undertaken. These studies typically examine a household's joint decision on how many children to have; how children's time is allocated between schooling, wage work and family work; and how resources are distributed among household members (see e.g. De Tray, 1980; Mueller, 1984). This approach can be used to identify what types of household are more likely to choose to educate their children, particularly in the case of schooling choices in rural areas. Our paper can be framed in this third approach.

3. Literature review

[5]See related studies by Knodel et al. (1990) and Knodel and Wongsith (1991) for more information. These literature is framed into the demographic approach.

A large literature investigates the causal effect of years of compulsory schooling (either primary or secondary) on pecuniary and non-pecuniary outcomes. Using compulsory laws as an instrument to analyze this effect, several papers have consistently documented gains to adult outcomes from an additional year of schooling in developed countries. In terms of earnings, Angrist and Krueger (1991) and Acemoglu and Angrist (2001) using data from United States estimate that annual adult earnings are about 10 percent higher for students compelled to stay a year longer in compulsory education. Harmon and Walker (1995) and Oreopoulos (2006) find about 14 percent higher earnings from school compulsion in the United Kingdom. Regarding non-pecuniary outcomes (schooling externalities), Lochner and Moretti (2004) estimate that compulsory schooling in the U.S. lowers the likelihood of committing crime or ending up in jail. Black et al. (2004) find that compulsory schooling reduces the chances of teen pregnancy in the U.S. and Norway. Meanwhile, Lleras-Muney (2005) estimates an additional year of compulsory schooling increases the age of death among elderly people in the United States.

Despite the fact that there is extensive literature that addresses the issue of the impact of an additional year of schooling on future outcomes in the long-run (earnings or lifetime wealth), previous papers have not yet considered the short-term effect, that is school attendance or drop-outs. To the best of our knowledge, this paper is the first to analyze the potential effect of the changes in the duration of primary education on school drop-outs and enrollment rates in primary and secondary education.[6]

Since education involves an investment decision, an additional year of schooling implies some cost for both, families and the government. Empirical research in this field links schooling decisions with both direct and indirect costs of sending children to school. As pointed out

[6] Most related to our work, Krashinsky (2006) studies the effect of elimination of the fifth year of high school in Ontario, Canada on academic performance in first-year university courses. He finds that cohorts with four years of high school had substantially lower grade point averages in college than those who attended high school for five years.

earlier, the direct costs of schooling include school fees, books, uniforms and commuting costs. Some studies have found a direct link between these directs schooling costs and school attendance. Kremer et al. (1997) evaluate a randomized intervention in Kenya providing uniforms to students who would otherwise need to pay for uniforms. After five years, students with the free uniforms had completed 15 percent more schooling than their counterparts without free uniforms. Also, the dropout rate was 6.8 percent at program schools, and 16.5 percent in comparison schools. The analysis suggests that reducing school fees would reduce drop-out rates. In a related study, Deininger (2003) evaluates the impact of "Universal Primary Education" program in Uganda which dispensed with fees for primary enrollment. He finds that a dramatic increase in primary school attendance and a substantial reduction in inequalities in attendance related to gender, income, and region were associated with the program.

The indirect schooling costs, such as the costs associated with accessing schooling, may also be important. In Mexico, Schultz (2004) examine the impact of school enrollment of a school subsidy program in poor rural communities in Mexico called *Progresa*. He finds an average increase in enrollment of 3.4 percent for all students in grades 1 through 8; the increase was largest among girls who had completed grade 6, at 14.8 percent.[7]

To our understanding, an indirect cost, as foregone income of the child while going to school, is the most important costs that families face in developing and underdeveloped countries. Households may be forced to keep children away from school because their income is close to subsistence level. In Becker's (1965) model of household production and consumption, the opportunity cost of an individual's time is the marginal value of his or her output in alternative valued activities at home or family business, such as farming. Thus, for these families, if the net return to human capital investment is too low compared to investment

[7] See Kremer, 2003 for a summary of evaluations of educational programs in developing countries.

in other assets, children may be sent to work instead of attending school. According to this, as we hypothesize in this paper, one additional grade level in primary education should increase school dropouts, in addition to the already existent dropout rate, and reduce enrollment. Jacoby (1994) investigates the effect of borrowing constraints by looking at how quickly children, with different family backgrounds, progress through the primary school system in Peru. In his model children from very high income households or with very low (initial) opportunity costs attend school full-time for essentially their entire educational careers. But, children with a high opportunity cost relative to household income may start school with only part-time attendance. Jacoby (1994) finds that children start withdrawing from school earlier in households with lower incomes and durable good holdings and when children are more closely spaced.

4. Empirical Strategy and Data

4.1. Empirical Model

To evaluate and test the link between the duration of primary education and various educational outcomes such as school enrollment and drop-out rates, we first estimate the following linear model:

$$y_{it} = \alpha + DURPRIM_{it}\gamma + \mathrm{X}_{it}\beta + \mu_i + \varepsilon_{it} \qquad (1)$$

where y_{it} is the educational outcome in country *i* at time *t*; X_{it} is a matrix containing a set of covariates regarding country characteristics; μ_i are country fixed-effects that allows us to control for country's unobserved heterogeneity (such as history and culture that might affect global macro-trends –e.g., rising levels of educational attainment); ε_{it} is a time-varying error term, and α, γ and β are a set of parameters to be estimated. $DURPRIM_{it}$ is a variable

picking-up the duration of primary education in country *i* at time *t*. In this equation, our main coefficient of interest is γ, which picks-up the effect of the duration of primary education on the level of enrollment and drop-outs. Equation (1) is estimated using a linear fixed-effect panel data model.

Equation (1) just estimates whether in countries where the duration of primary education is longer, the educational outcomes are better or worse. However, since we are primarily interested in analyzing the impact of changes in educational policy inputs, i.e. whether changes in the duration of primary education causes changes in educational outcomes, we rather consider equation (2), which is obtained by differentiating equation (1):

$$\Delta y_{it} = \alpha + y_{i,t-1}\delta + \Delta DURPRIM_{it}\gamma + \Delta X_{it}\beta + \mu_i + \varepsilon_{it} \qquad (2)$$

The size of growth between *t* and *t-1* of y_t (Δy_{it}) clearly depends on its starting level in *t-1* (y_{t-1}), i.e. laggard countries have larger margin to grow; therefore, in equation (2) we also consider our dependent variable lagged one period (y_{t-1}).

In equation (2), $\Delta DURPRIM_{it}$ may be either negative, positive or zero in *t* depending on whether duration of primary education is reduced, increased or kept constant in a given country *i*. The fact that this variable may provide negative values can difficult the interpretation of γ. Furthermore, the consideration of $\Delta DURPRIM_{it}$ implies that the impact of an (de)increase in the number of grades in primary education has a symmetric impact on school outcomes, which is not necessarily true since an increase in the duration of primary education may provide a (in)decrease in educational outcomes larger (shorter) than a decrease in this input would do. In order to allow for this possibility, we propose a more flexible specification:

$$\Delta y_{it} = \alpha + y_{i,t-1}\delta + dpositive_{it}\theta + dnegative_{it}\rho + \Delta X_{it}\beta + \mu_i + \varepsilon_{it} \quad (3)$$

where *dpositive* is a dummy variable picking up an increase in the duration of primary education in country *i* at time *t*. If in period *t-1* an increase in *DURPRIM* occurs, *dpositive* takes the value 1 only in *t* and zero before and after the change. The variable *dnegative* is constructed analogously in the event of a decrease in *DURPRIM*. In equation (3) our main coefficients of interest are θ and ρ. Since *dpositive* and *dnegative* take the value one only when a change in the duration of primary education occurs, θ and ρ pick-up the short-term effect of such a changes. We find this remark is relevant, since we think that in developing and undeveloped countries parents will react quick about whether keeping children or not at school in the event of a change in the duration of schooling. In all equations, our outcome variables (y_{it}) is the enrollment rate in secondary education

In equations (2) and (3), by construction, $y_{i,t-1}$ is correlated with the error term, which generates a severe problem of endogeneity. In addition, the estimation of Equations (2) and (3) may present other econometric problems such as the country-specific effect and the presence of non-strictly exogenous variables. In order to overcome these problems, the strategy used to estimate these equations is the following. First, as in the fixed-effects model, we first difference Equations (2) and (3) in order to remove the country-specific effect μ_i . However, differencing means that even strictly exogenous variables can become endogenous, in addition to the presence of non-strictly exogenous variables. Therefore, our core specifications will include not only correlated and heteroskedastic residuals, but also non-strictly exogenous and endogenous variables as covariates. In this context, a fixed-effects model with the Newey–West corrected covariance matrix provides consistent estimates of the standard errors in the presence of serial correlation and heteroskedasticity in the residuals. However, the presence of endogenous

covariates creates severe identification problems in the econometric estimation that in turn lead to inconsistent estimates of the model. To deal with this problem of endogeneity, we use a variant of the generalized method of moments (GMM) estimator proposed in Arellano and Bond (1991). Arellano and Bover (1995) and Blundell and Bond (1998) show that often lags for the levels of these variables are poor instruments, and they suggest suitable conditions for fixing this problem. One alternative is to instrument endogenous and non-strictly exogenous variables with lags of their own first differences, instead of with lags for the variables in levels. The GMM variant of the original Arellano and Bond's estimator used here incorporates these elements. In particular, the method we use here has both one-and two-step versions. We adopt the two-step method as it is the most efficient, though the estimated variances tend to be biased downwards. In other to fix this, we apply the finite-sample correction of the two-step covariance matrix proposed in Windmeijer (2005). [8]

The consistency of the GMM estimator depends on whether the lagged values of the explanatory variables are valid instruments in the regression and the error term is not serially correlated. The validity of these assumptions is addressed by using different specification tests. For the validity of the instruments, we use the Hansen test of over-identifying restrictions where the null hypothesis is the joint validity of the instruments.[9] The Hansen J statistic replaces the Sargan test used in the original one-step Arellano-Bond estimator, since the Hansen test is robust to heteroskedasticity or autocorrelation.[10] In order to test the hypothesis of the absence of first and second-order serial correlation in the first differenced residuals, we use the Arellano-Bond test for autocorrelation.

[9] Under the null hypothesis the statistic follows a chi-square where the degrees of freedom are determined by the number of instruments used in the estimation.
[10] See Roodman (2010) for details.

4.2. Data

The empirical analysis draws on a variety of datasets. We assemble a database that contains information on a population's educational attainment at country level, income per capita and other country characteristics. In total we have information about 124 countries for the period 1970-2012. We use World Bank data which provides various measures on educational outcomes (drop-outs and enrollment rates) at the country level, per capita income and composition of the population.[11] Polity IV data provides a measure of democracy.

Our outcome variable is the *enrollment rate* in secondary education. We consider both, gross and net enrollment. *Gross enrollment ratios* are defined as the total number of children enrolled in secondary education, regardless of age, divided by the population of the age group that officially corresponds to the same level. Gross enrollment ratios can exceed one-hundred percent due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition. *Net enrollment ratios* are calculated as the ratio of children of the official school age who are enrolled in secondary education to the total population of the same age group.

We considered the following covariates: *Duration of primary* (*DURPRIM*) is the number of grades (years) required to complete primary education. As we already mention in the previous section, in order to evaluate the impact of the corresponding change in the duration of primary education, we construct two variables for capturing this effect: *dpositive* and *dnegative,* which are dummy variables that take the value 1 when a country increases (decreases) the number of years (grades) required to complete primary education.[12]

As controls for country characteristics we include the level of the *GDP per capita* lagged one period, and its annual growth. These two variables allow to control for differences in

[11] Education data comes from wbopendata available in Stata developed by Azevedo (2011).
[12] According to our data in 39 countries (45 obs.) there is an increase in the duration of primary, meanwhile in 36 countries (37 obs.) there is a decrease in the duration of primary.

income across countries. Following previous authors, we also include a measure of *Democracy*, which is a dummy variable that takes the value one if country *i* in period *t* is a democratic regime (Persson and Tabellini, 2009; Besley et al., 2011). Finally, as a control for urban bias of access to education, we include the percentage of urban population. We include this control since children living in rural areas are less likely to be enrolled in school (Deininger, 2003). Table 1 (see Appendix) contains the description of the outcome variables and the explanatory.

[Table 1, around here]

Table 2 shows summary statistics of these variables. In our sample of non-OECD countries,[13] on average, the drop-out rate is about 34 %. Net and gross enrollment rate in secondary education are 53.19% and 51.97%, respectively. The duration of primary education is about 6 years. In about 0.6% of the years there is an increase in the duration of primary and 0.5% of the years there is a decrease in the duration of primary education. In about 41% of the country-year observations the regime is democratic. On average, the percentage of urban population is about 46%. 5. Results

[Table 2, around here]

Table 3 reports the results of the estimation of our core model in levels (Equation 1). This model is estimated using a linear panel fixed-effect model. We start by discussing the results of our explanatory variable of interest, that is, duration of primary education. We find that the link between duration of primary education and enrollment rate is statistically significant and negative, which means that in those countries where duration of primary education is longer,

[13] Since we have a large pool of countries (124), for the sak of brevity we do not provide detailed statistics on educational outcomes for each country, however, these feagures are available from the authors upon request.

the enrollment rate in secondary education (gross and net) is lower. The remaining of the covariates behave according to expectations. That is, those factors that are positively linked with enrollment rates show a negative relationship with dropouts. We observe that in those countries where the GDP per capita is higher, the enrollment rate in secondary education is also higher; but the drop-out rate is lower. One common hypothesis is that credit constraints limit the investment of the poor in their children's education (Schultz, 2004). Children from very low income households or with a high opportunity cost relative to household income may have lower attendance rates than wealthier households (Jacoby, 1994).Thus, countries with higher income levels will have higher levels of educational attainment and lower levels of drop-outs.

Similarly, we find that countries with a higher percentage of people living in urban areas have higher levels of enrollment in secondary education. This is explained by the fact that people living in rural areas, which may imply higher commuting costs, have limited access to resources and a lower concentration of schools compared to those people in urban areas, where the infrastructure tends to be concentrated. This is consistent with previous findings in the literature analyzing borrowing constraints and access to school in rural areas where children are employed by their parents to work on the family farm (Schultz, 2004). In countries where the political regimen is democratic, we also observe that gross enrollment rates in secondary education is higher. A common view, is that democratic countries have higher levels of educational attainment compared to non-democratic countries where the educational levels tend to be lower (Lipset, 1959; Barro, 1999; Glaeser et al., 2004).

[Table 3, around here]

So far, results regarding the estimates of equation (1) reported in table 3 provide some interesting insights on the link between duration of primary education and educational outcomes. However, they do not tell us much about the impact of policies consisting in changing the duration of primary education. In order to evaluate its impact, we resort to equations (2) and (3). In Table 4 we report the results of our model in differences (Equation 2). In this table we present the impact of changes in the duration of primary education on enrollment in secondary education. We estimate the model using the variant of the Arellano and Bond (1991) Generalized Method of Moments (GMM) for dynamic panels described previously. We begin by discussing the results of our variable of interest, i.e. the changes in the duration of primary education. Our results indicate that changes in the duration of primary education matters for children's educational outcomes. This variable exerts a statistically significant negative impact on the annual growth of enrollment rate in secondary education.

The remaining covariates also behave according to expectations. An increase in the percentage of urban populations increases the enrollment rate in secondary education. The growth rate of the logarithm of GDP per capita exerts a statistically significant and positive impact on the growth of enrollment rates in secondary education. The first lag of the enrollment rate in secondary education (y_{t-1}) has turned out to be statistically significant. This means that laggard countries in terms of educational achievement tend to experience a higher growth in educational outcomes.

In Table 4 we also report the results of the Hansen test of over-identifying restrictions on the validity of the instruments, and the Arellano-Bond test of first and second order autocorrelation.[14] While autocorrelation of the first order prevails by definition, the null hypothesis of second-order autocorrelation must be rejected in order to obtain consistent estimators. In all models in this table we find that the validity of the instruments is confirmed

[14] The null hypothesis is no autocorrelation and is applied to the differenced residuals.

in all the specifications. For the autocorrelation test, we observe that AR(1) structure cannot be rejected in any of the estimated models, while the AR(2) structure is rejected in all of them. These results indicate that there is no serial correlation between the first-differenced variables used as instruments and the first differences of the residuals, ε_{it}; therefore, they are good instruments.

[Table 4, around here]

In equation (2), we only have one coefficient picking up the impact of a change in the duration of primary education on educational outcomes. Therefore, the direction of the effect depends on whether the sign of the difference in the duration of primary education between *t-1* and *t* is positive or negative. In addition, as we mention earlier, the assumption behind this model is that the size of the impact, regardless the direction, is the same whether the duration of primary education is either reduced or increased. We find this assumption on the symmetry of the effect is quite restrictive, since it could the case that increasing the duration of primary education could have a different impact in terms of magnitude on educational outcomes than if the number of grades is reduced, or the other way around. In order to overcome this, we proposed a more flexible specification that uses dummy variables (equation 3). Results are reported in table 5.

The estimate of Equation (3) disentangles the net effect of the reform and considers separately the impact of an increase (*dpositive*) and a decrease (*dnegative*) in the number of years required to complete primary education. Since we consider simultaneously both dummies (dpositive and dnegative) the base category stands for those countries that hold the duration of primary education constant. We estimate this model using the same method (GMM) as for Equation (2). In line with the evidence presented earlier, we obtain the same

qualitative results. That is, an increase in duration of primary education (*dpositive*) reduces the enrollment rate in secondary education, while a decrease in the duration of primary education (*dnegative*) exerts the opposite effect. As we anticipated earlier, the magnitude of the impact on educational outcomes is not symmetric, since it varies depending on if we consider an increase or a decrease in the duration of primary education.

If the duration of primary education is lasted, enrollment rates in secondary education decreases significantly. On the contrary, a reduction in the number of grades causes the opposite effect. The magnitude of the impact is much larger on gross enrollment than on net enrollment rates, i.e. lasting the duration of primary education exerts a negative impact on both gross and net enrollment rates, -3.2 and -1.6, while reducing the number of grades to complete primary education exerts the opposite effect, 6.5 and 7.1, respectively. Again, all estimated coefficients are statistically significant at 1 percent level. In Table 5, we also find that the validity of the instruments is confirmed in all the specifications. Regarding the autocorrelation tests, we observe that AR(1) structure cannot be rejected in any of the estimated models, while the AR(2) structure is rejected in all of them. The results of both tests confirm the consistency of the GMM estimation.

6. Conclusions

Using panel data for non-OECD countries covering the period of 1970-2012, we analyzed the impact of the duration of primary education on the enrollment rate in secondary education. Our results show that one additional grade of primary education has a negative impact on enrollment rate. Results stemming from this paper are in line with the fertility model approach, that is, in developing and underdeveloped countries parents do not have incentive to send children to school given the high perceived economic value of children. Thus, an increase in duration of primary education discourages their continuation in the education system.

Furthermore, this result can be also extended to children or adults who are not in the official age of attending a given education level. Another interesting result is that the impact of a (de)increase of the duration in secondary education on the enrollment rate is not symmetric. In absolute value, a reduction in the number of grades has a remarkable larger effect on secondary education enrollment rates than an increase in the duration of schooling.

Although previous literature provides evidence that increasing compulsory schooling in developed countries has positive returns in terms of earnings and non-pecuniary outcomes (school externalities), this would not apply to developing and underdeveloped countries. This is so because in these countries children's earnings are an important component of the household income and in many cases represent the support of the entire family. Parents might decide not keeping their children in the education system if the schooling time is lasted. On the contrary, enrollment rates increase significantly when the duration of primary education is shortened. Therefore, policies consisting in delaying the completion of primary education, which have proven to be successful in developed countries, may fail in developing and underdeveloped countries, since they might have an undesired impact on children's educational outcomes. Our results suggest that reducing the duration of primary education is a useful policy tool in developing and underdeveloped countries to incentive children attending secondary education.

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Table 1. Variables description and sources.

Variables	Description	Source	Period Covered
Dependent Variables			
Gross Enrollment Rate Secondary	Total enrollment in secondary education, regardless of age, expressed as a percentage of the population of official secondary education age.	UNESCO Institute for Statistics	1970-2050
Net Enrollment Rate Secondary	Ratio of children of the official secondary school age who are enrolled in secondary school to the population of the official secondary school age.	UNESCO Institute for Statistics	1970-2050
Independent Variables			
Duration of Primary	Number of grades (years) required to complete Primary education.	UNESCO Institute for Statistics	1970-2050
Dpositive	Dummy that takes value 1 if a country increases the duration of primary education.	Own elaboration	1970-2012
Dnegative	Dummy that takes value 1 if a country decreases the duration of primary education.	Own elaboration	1970-2012
Democracy	Dummy that takes value 1 if the country is democratic.	Polity IV data	1800-2010
Log (GDP)	Log of per capita income.	World Bank data	1960-2011
Urban population(%)	Urban population refers to people living in urban areas as defined by national statistical offices.	United Nations, World Urbanization Prospects	1960-2012

Table 2. Summary Statistics.

	Obs.	Mean	Std. Dev.		
			overall	between	within
Enrollment Rate Secondary					
Levels (Gross)	4180	51.938	31.583	29.577	14.874
Δ (Gross)	3587	1.109	2.990	1.366	2.840
Levels (Net)	1382	53.194	27.473	26.394	11.153
Δ (Net)	1005	0.944	2.844	1.861	2.597
Log (GDP. Per cap)	5501	7.253	1.450	1.411	0.300
Urban Population (%)	6868	45.727	24.264	23.450	6.378
Duration of Primary	7052	5.643	0.981	0.931	0.319
# of countries	198				
# of countries increasing the duration of primary education	47				
# of countries decreasing the duration of primary education	37				

Table 3. Estimation results for enrollment in secondary education: OLS fixed-effects. Model in levels.

	Gross Enrollment	**Net Enrollment**
Duration of Primary	-4.107***	-6.136***
	(1.502)	(1.560)
$Log(GDP)_t$	10.514***	11.946***
	(3.374)	(4.075)
Democracy	3.002*	3.250
	(1.523)	(2.719)
Urban population (%)	1.355***	1.004***
	(0.130)	(0.261)
Constant	-61.015***	-50.971**
	((20.669)	(21.765)
Sample size	2,919	942
No. Countries	122	101
R2 Adj.	0.628	0.664
F-stat	59.96	31.47

Notes: The outcome variables are in levels. All specifications include country-fixed effect. Standard errors in parentheses. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 4. Estimation Results for Secondary Education: Effect of Changes in Duration of Primary Education (Equation 2). Model in differences.

	Gross Enrollment	**Net Enrollment**
y_{t-1}	-0.009***	-0.015***
	(0.002)	(0.001)
Δ Duration of Primary	-3.440***	-4.449***
	(0.044)	(0.042)
$\Delta Log(GDP)_t$	10.413***	2.657***
	(0.100)	(0.013)
Δ Democracy	0.095	-5.064***
	(0.074)	(0.074)
Δ Urban pop. (%)	5.694***	0.535***
	(0.178)	(0.048)
Constant	-1.193***	1.417***
	(0.082)	(0.058)
Sample size	2517.00	685.00
No. Countries	122.00	92.00
Hansen Test (stat.)	117.71	85.41
Test AR(1) (z-stat.)	-5.25	-1.69
Test AR(2) (z-stat.)	-0.17	-1.38

Notes: The outcome variables are in first differences. This Table reports the results using estimation method. All specifications include country-fixed effect. Standard errors in parentheses. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 5: Estimation Results for Secondary Education: Effect of increase and decrease in Duration of Primary Education (Equation 3). Model in differences

	Gross Enrollment	**Net Enrollment**
y_{t-1}	-0.004*	-0.016***
	(0.002)	(0.001)
Dpositive	-3.213***	-1.654***
	(0.081)	(0.095)
Dnegative	6.529***	7.714***
	(0.207)	(0.066)
$\Delta Log(GDP)_t$	10.500***	2.293***
	(0.168)	(0.072)
Δ Democracy	0.157	-5.037***
	(0.101)	(0.117)
Δ Urban pop. (%)	6.125***	0.533***
	(0.291)	(0.044)
Constant	-1.638***	1.462***
	(0.255)	(0.052)
Hansen Test (stat.)	114.28	85.03
Test AR(1) (z-stat.)	-5.35	-1.68
Test AR(2) (z-stat.)	0.11	-1.24
Sample size	2517	685
Number of Countries	122	92

Notes: The outcome variables are in first differences. This Table reports the results using estimation method. All specifications include country-fixed effect. Standard errors in parentheses. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.