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The role of Foreign Direct Investment in higher education in the developing countries
(Does FDI promote education?)

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Abstract

This paper studies the impact of FDI inflows on higher education in developing countries for the period 1998-2008. A large panel of developing countries is analyzed using different econometric techniques and specifications. We find evidence of short-term negative effect of the FDI on tertiary education measured by school enrolment. The negative effect of FDI is confirmed for both secondary and tertiary education when measured as the adult population having acquired the level. Among other control variables, GDP, demographic growth and the services sector value added seem to have a significant impact on higher education. GDP and services value-added show the expected positive impact, while population growth appears to affect education enrollment and attainment negatively. The study highlights the need for considering the differential aspects of foreign investments' nature and characteristics, rather than treating them as a cure-all pill for the developing countries' development problem.

Keywords: FDI, Education, Human capital, Developing countries.
JEL classification: F21, I21, O11

1. Introduction

Of late, there has been much debate over the benefits of globalization, in particular over the place of developing countries in this accelerating process. Do they have something to offer or something to gain in taking part into world economy? As for having something to offer, they sure do: African and Latin American countries possess many natural resources, often extracted by foreign investors, while multinational enterprises (MNEs) are establishing production units all over the developing world in order to take advantage of the abundant low cost labor (Fujita and Thisse (2006)), more competitive fiscal environment or weak environmental norms (Candau and Musson (2010)). But having something to gain is less straightforward. Even though high economic growth in recent years has benefited many poor countries, many of them are still lagging behind. As Kemal Dervis, (the former UNDP administrator) put it: 'Globalization has fundamentally altered the world economy, creating winners and losers. […] building a more inclusive globalization is the most important development challenges of our times' (UNDP (2007), pp. 2).

One of the channels through which globalization helped developing countries is the foreign direct investment (FDI) inflows. FDIs, which can be a significant conduit for the acquisition of technology, technical and managerial skills, have taken an altogether new magnitude and have begun playing an increasingly important role in the development of the emerging and developing countries. FDIs have also proved to be more reliable than other forms of foreign capital during financial crises: while portfolio investment and debts dried up during the East Asian crisis of 1997-98, the Latin American debt crisis of the 1980s, and the Mexican crisis (1994-95), FDIs held up well (Dadush et al. (2000), Lipsey (2001)), even though their flow was stalled during the 2008-09 economic crisis, primarily due to the freezing of the international banking sector. FDI can contribute both directly as well as indirectly to the growth of an economy, by improving knowledge, technical know-how and technology spillovers (the learning by doing and the learning by watching effect), by boosting capital stock and by instigating domestic production and consumption (Feenstra and Markusen (1994, Blomström and Kokko (2003)). Beugelsdijk et al. (2008) distinguish between horizontal and vertical FDIs, concluding that these two types of FDIs have different impacts and the difference arises not only from the type of FDIs, but also the level of development of the countries. Horizontal FDIs have a much larger effect on economic growth than vertical FDIs but only in developed countries, while in developing countries they found no significant relationship between the two and economic growth. On the other hand, vertical FDIs have a more important impact on labor demand. FDIs may not only bring new technology and knowledge to the host countries, but also contribute to human capital accumulation by increasing the demand for skilled labor and thus, creating an incentive to participate into higher education. Furthermore, as described in the Millennium Development Goals, education is a key element for human development and economic growth and the mechanisms that interact with it need to be studied carefully.

This brings us to the relationship between FDI and human capital accumulation, particularly in the short-run, a yet unresolved question in both the theoretical and empirical literature. Defining human capital as 'the knowledge and skills embodied in humans that are acquired through schooling, training and experience, which are useful in the production of goods, services and further knowledge' (De La Fuente and Ciccone (2003)), we could find some indications in the endogenous growth theory, which assumes that human capital accumulation is an increasing returns to scale process, mainly due to the learning by doing effect happening between the physical and human capital (Lucas (1988)). The Lucas–Romer endogenous growth model suggests that endogenously accumulated human capital has a direct impact on

the productivity of labor and, as a result, human capital becomes specific to the individual, leaving innovation in the stock of knowledge as an exogenous factor. It is an important source of long-term growth, either because it is a direct input into research (Romer (1990), Aghion and Howitt (1992)) or because of its positive externalities (Lucas (1988), Becker et al. (1990)). Moreover, Lucas (1988) posits that the difference in the growth rates of various countries is a result of the difference in their rates of human capital accumulation.

Workers gain experience and improve their productivity through working as well as on-the-job training. This effect is not limited to lower-tier workers and operators, but includes all the employees up to the top management (Blomström et al. (1994)). However, even though schooling is the most natural way of accumulating human capital, the theory only deals with knowledge spillovers and does not say anything about the impact of capital flows on formal education. Empirical studies are also scarce, with most research focusing on the impact of FDIs or human capital on growth or on the determinants of the two variables.

This paper contributes to the literature by shedding light on this hitherto not well-lit section of the economy. Using data for the time period from 1998 to 2008 for groups of low and middle-income countries, we study the impact of FDI inflows on human capital growth in the recent years, measured alternatively by school enrolment and population with higher education attainment. The paper takes tertiary education as the primary variable of interest rather than secondary education, not only because higher education is non-compulsory, and hence responds more closely to individual incentives arising from the economic environment, but also because it suits more to the increasingly complex and sophisticated nature of technology in use in modern services and industrial sectors. Furthermore, secondary and tertiary-educated workers are deemed imperfect substitutes (Card (2009)). For the same reason, we hypothesize that post-secondary education should be more responsive to foreign capital inflows than secondary education. Empirical studies on developing countries have often suffered from lack of comparability due to poor quality and quantity of data, and the use of different regression techniques, variables selected and definitions considered. This study attempts to take into account these problems. The size of the dataset employed is sufficiently large (a maximum of 885 observations) and the model examined has been kept parsimonious. Different measures are used for key variables such as education, FDI and GDP and efforts have been made to avoid econometric misspecification.

We find that FDI shows a negative relationship with tertiary education, regardless of the method or the education proxy used. A 1% increase in FDI (FDI ratios) may lead to about 0.03-0.04% (0.02-0.04%) decrease in tertiary enrolment, while a 1% increase is associated with about 0.01% decrease in total population with secondary or tertiary education. The variables with the most significant impact are, in decreasing order, GDP per capita, GDP, services value added as a percentage of GDP and population growth rate.

The remainder of the study is organized as follows. Section two reviews the theoretical and empirical literature, while section three presents some descriptive statistics. Section four discusses the choice of variables, the data sources and the econometric methodology employed followed by the results of the analysis in section five. Section six concludes.

2. Literature review

Literature on the relationship between FDIs and human capital accumulation through education is limited, and in the absence of clear evidence on the relationship, we have to rely on the indirect inferences drawn from the extensive literature on the role of FDIs and human capital in economic growth. Beugelsdijk et al. (2008) show that FDIs should have different impact on human capital accumulation and education depending on the type of FDIs. Vertical FDIs or efficiency-seeking FDIs look for cost advantages, mostly cheap low qualified labor to

work in sweatshops, which may not add much to the human capital of an economy. On the contrary, it may lead to specialization into low value added products, thus providing the local population with little incentive to participate in higher education. Horizontal FDIs or market-seeking FDIs pursue increased market shares in the host countries, competing directly with one another as well as with the local firms. This is generally synonymous with technology transfer, thereby contributing to the host country's technological upgrading and human capital accumulation. Accordingly, MNEs, usually associated with FDIs, seem to be responsible for a large part of R&D activities, which are human capital intensive (UNCTAD (2004)). Furthermore, recent data shows that much of the greenfield investments that the developing countries have attracted in the recent years have involved R&D activities, pointing to a higher skilled labor demand and thus, increased participation into higher education.

Major empirical studies on the issue seem to support the idea of a positive impact of FDIs on human capital accumulation, but the findings are subject to the proxy used for the latter, the time period under study or the sample of countries studied.

Using cross-sectional data for the period of 1960-2000 from 87 countries, Egger et al. (2005) examine the link between capital market integration (measured by net FDI inflows), higher education and growth. They show that net FDI inflows increase individual incentives to acquire higher education by raising the relative marginal productivity of skilled to unskilled labor, ultimately leading to higher economic growth.

Gittens (2006) shows how the impact of FDI changes depending on the sample of countries. In a global sample of developing countries, FDI shows a positive impact on the accumulation of human capital as measured by primary and secondary school enrolment, but no impact on tertiary education. In Asia, FDI seems to be positively and significantly associated with school enrolment at the primary and tertiary levels but shows no relationship with secondary school enrolment. FDI seems to have no impact on primary and secondary school enrolment in Africa. Moreover, FDI inflows to Africa have a negative and statistically significant impact on tertiary school enrolment. Finally, in Latin America, they seem to have a generally positive effect on primary and secondary enrolment, but no impact on tertiary enrolment.

Using data for 29 Chinese provinces from 1978 to 1999, Zhuang (2008) argues that FDI contributes to the accumulation of skilled labor and the participation in middle school education. The increase in the share of population with college education and professional and technical education is larger in provinces with economic and technological development zones relative to other provinces. Moreover, the effect of FDI on human capital development is greater in the 1990s, even though its impact on high school education attainment is negative.

There is also some evidence of multinational firms (such as Intel and Toyota) engaging in formal education, for instance by granting scholarships or involving in joint research projects with universities in the developing countries where they have established production facilities (Miyamoto (2003)).

Economic theory recognizes FDI and human capital as two important conduits for economic growth, mostly bearing a positive influence: human capital has been identified in the empirical literature as a determinant of FDIs (Noorbakhsh et al. (2001), Nunnenkamp (2002), Miyamoto (2003)). Some studies discuss the existence of a virtuous circle involving the two (Miyamoto (2003), Checchi et al. (2007)). Nunnenkamp (2002) performs a panel data analysis for 38 developing countries for the 1975-2000 period and finds a strong and positive relationship between FDIs and human capital proxied by the level of schooling. His study concludes that the availability of local skills has become a relevant FDI pull factor in the process of globalization since the 1990s. Blomström et al. (1994) study the impact of local competition and the availability of skilled labor on the technology imports of foreign MNE affiliates in Mexican manufacturing industries, and find no evidence that education is critical.

Instead, they indicate the necessity of high per capita income for a positive impact of FDI inflows. In the similar vein, Ram and Zhang (2002) conclude that while the interaction between human capital and FDI might have been important in the 1980s, it was no longer the case in the 1990s.

Several studies deal with the FDI-human capital-economic growth triangle. Borensztein et al. (1998) find in their study of 69 developing countries during the period of 1970-1989 that the benefits of FDI are contingent on the country having the capacity to absorb the embodied technologies, and therefore a threshold level of human capital. They estimate that 0.45 years of secondary school education is necessary to benefit from an infusion of foreign technology. Stijns (2005, 2006) in his analysis of the role of natural resource abundance on human capital accumulation in various developing and developed countries suggests that FDI can have a lasting effect on a country's per capita income through a higher human capital stock. Butkiewicz and Yanikkaya (2008) empirically investigate the relationship between capital account openness, international trade and economic growth for a sample of over 100 countries for the period of 1967-1997, and find a positive role of human capital in the economy, regardless of the country's level of development. According to them: "Long-term capital flows increase growth through a number of channels including technology diffusion, human and physical capital accumulation, improved financial development, and enhancement of external sectors in the host countries". Their results challenge the belief that countries require a threshold level of development or human capital in order to benefit from capital inflows.

In their theoretical model, Galor and Tssidon (1997) suggest a positive relationship between investment in human capital and the level of technological advancements. They demonstrate that "the interplay between a local home environment externality and a global technological externality governs the evolution of the distribution of human capital, the distribution of income, the wage differential between skilled and unskilled labor, and economic growth". As foreign investments are associated with superior technological contents, an increase in FDI inflows ultimately leads to growth in human capital.

In light of the discussion above, it seems that the importance of human capital in an economy is two-fold: on the one hand, as a major driver of FDI, and on the other hand, as an important determinant of the impact of FDIs on growth. The higher the human capital endowment, the higher the FDI inflows and the stronger the impact of FDIs on growth. This leads to the indirect inference that higher FDI inflows provide a strong incentive to participate in higher education as a way of accumulating human capital.

Nevertheless, we observe that there is no consensus in the literature on the direction and level of association of FDI with human capital. A major reason behind such divergent and conflicting results lies in the difficulty in defining and computing human capital. Often average years of schooling or initial school enrolment are used to represent returns to education. These measures are calculated using perpetual inventory method (PIM), interpolation, extrapolation and some subjective estimation (De La Fuente and Domenech (2006)). Portela et al. (2004) estimate that on average, the PIM underestimates the observed results by about one-fifth of a school year every five-year period. Other serious deficiencies include missing data, differences in classification of various levels of data across different countries and difficulties in data collection. Moreover, these measures of formal education do not encompass on-the job training, experience, and learning by doing (Baldacci et al. (2008)). Unavailability of data (particularly in the case of low-income developing countries), use of different econometric techniques, different time periods and choice of variables has also led to divergent and variant regression results. This study tries to tackle these issues by taking care of the choice of indicators, data quality and econometric problems.

3. Some descriptive statistics

The current phase of globalization has been on the march since the 1980s, when various countries began opening up their economies, welcoming foreign investment and increasing international trade. Global FDI stock jumped from $636 billion in 1980 to $12 trillion in 2006, despite a brief slump in the early 21st century due to the 'dot com' crash. The global FDI inflows crossed $1.8 trillion, an all-time high, showing a nine fold increase from 1980 (UNCTAD (2008)). Even though developed countries remain the main sources and destinations for foreign investments, the share of developing countries in global FDI inflows has risen steadily, reaching $500 billion in 2007, equivalent to over a third of their GDP compared to only ten percent in 1980 (see Figure 1).

Figure 1 here

Least developed countries (LDCs) also reached a record amount of $13 billion. In many low and middle income countries, foreign direct investment has become the single highest source of capital inflows, often making up more than sixty percent of total private capital inflow.
In this context of accelerating globalization, human capital has been highlighted as an important determinant of FDIs and economic growth. In its quantifiable forms, whether school enrolment, average years of schooling or on-the-job training, it has also been growing, though less spectacularly than the FDI inflows. For instance, in 2006, some 513 million students worldwide – or 58% of the relevant school-age population – were enrolled in secondary school, an increase of nearly 76 million since 1999 (UNESCO (2009)). While human capital accumulation is already a major strength of developed countries, the developing countries are also striving to catch up by upgrading their formal education systems. Major improvements have been made regarding primary school enrolment in all developing countries. In Sub-Saharan Africa for instance, net primary school enrolment rose from 50 % to over 70 % (World Bank (2009)). Nevertheless, as can be seen in Figure 2 below, more efforts are needed for secondary education. Finally, tertiary enrolment rates are however far behind those in the developed countries.

Figure 2 here

At first glance, one finds that FDI and education in developing countries have both risen in recent years. But at the same time, their growth rates are very different, FDIs growing very much faster than tertiary or secondary education. Consequently, one may question, at least in the short-run, the beneficial influence of FDIs on education. In the following section, we analyze this question empirically.

4. Data & methodology

4.1 Choice of variables

According to Egger et al. (2005), the relation between FDI inflows and human capital accumulation may be positive or negative, depending on the developing country's level of development and its integration in the world markets.
The indicator for human capital chosen in the literature is usually the primary or secondary school enrolment rate (Mankiw et al. (1992), Levine and Renelt (1992), Borensztein et al. (1998), Nunnenkamp (2002)). However, we find tertiary education a more pertinent indicator

of human capital in the developing countries. Three reasons can be given in this regard: firstly, primary and secondary education are becoming compulsory in more and more developing countries, hence an increase in the level or size of primary or secondary educated population does not properly reflect the incentives from FDI. Second, primary and secondary education is more often than not in public sector and responds more to public policy preferences than to individual choice and market forces. Moreover, foreign investments of today are increasingly skill intensive and require more professional, technical and managerial skills than could be proxied by primary or secondary schooling. In the absence of an adequate measure for learning by doing effect, increase in tertiary education appears to be the best alternative.

We use both the flow variables, tertiary and secondary enrolment ($Enrol_{Ter}$ and $Enrol_{Sec}$, respectively) as well as the stock variables, population with tertiary or secondary education (POP_{Ter} and POP_{Sec}, respectively). Secondary school data is used for the sake of comparison.

GDP is a standard variable in the empirical studies on human capital, due to its theorized two-way correlation with education. The relationship is suggested to be positive and significant (see Barro (1996), Bils and Klenow (1998), Baldacci et al. (2008) among others). We use both total *GDP* and GDP per capita in constant 2000 US$ (*GDPC*). The degree of openness of the economy (*Open*), taken as the ratio of imports and exports to the GDP, reflects the international trade regime and the overall economic system prevailing in the country. We expect a positive sign for this variable, given the purported benefits of trade openness on the development of a developing country.

As the FDI inflows to developing countries depend on their individual natural, physical and human capital endowments, we alternatively use the share of industry (*Ind*), agriculture (*Agr*) and services (*Serv*) in the value-added of the GDP to analyze their significance in human capital growth. In addition, many low and middle-income countries have undergone a major demographic transition in the last few decades. We include population growth rate (*Pop*) to account for this factor.

Finally, *inflation* measured by the evolution of the consumer price index is taken as a proxy for countries' economic and socio-political stability. Some health-related indicators, like fertility rate, life expectancy, general medical care etc, are sometimes used in human capital analyses (Pitt and Rosenzweig (1990), Gittens (2006)). However, the theoretical and empirical evidence regarding these variables is vague. For this reason and in order to avoid model misspecification, these variables are not included in the study.

Data for all the variables except for school enrolment have been taken from the World Bank online database. The secondary and tertiary enrolment data come from the UNESCO online educational database.

Given the quality and the availability of education data, we have used two different samples. The first sample for education measured by enrolment comprises 57 developing countries and the period of interest is 1999-2007. The second sample comprising 130 countries is based on education measured by total population with secondary and tertiary education available from 1998 to 2008. The list of countries included in the study is given in Appendix 1. Table 1 and 2 below give some salient statistics of the chosen variables for each of the samples used.

Table 1 here
Table 2 here

Over all, the correlation matrices (Table 3 for school enrolment and Table 4 for total population with secondary or tertiary education) indicate a rather positive correlation between the different measures of FDI and education, the correlation being much stronger when considering FDI levels instead of FDI ratios. However, even though the correlation matrices

together with the data analyzed in the previous section seem to confirm rather that education figures went up together with FDI inflows in the last decade, it may merely be a partial correlation, and education figures might have grown regardless of the recent round of capital account opening and trade liberalization in the developing countries. Market opening in the presence of fragile infrastructure may well have a negative outcome on the countries' socioeconomic development. An econometric analysis is hence in order.

Table 3 here
Table 4 here

4.2 Methodology

In the first step, fixed and random-effect panel data regression methods are used (the results are shown in the appendix). These otherwise useful pooled estimation techniques do not handle the problem of endogeneity that pervades the empirical economic studies. Given the limited number of observations in our dataset, non-parametric or dynamic panel estimation techniques cannot be employed. Consequently, we use the Two-Stage Least Squares (2SLS) method. The variables are taken in their log form, therefore allowing for their interpretation in terms of elasticity.

The shortage of intuitively appealing and econometrically sound instruments for 2SLS estimations makes dealing with endogeneity a tough task. In our model, FDI and GDP have a potential two-way relationship with the dependent variable. Rising foreign investments may influence the educational decisions of the population but at the same time, improving skill levels of a country's population can also attract higher FDI inflows. We take the sum of the output of three principal investing countries, each weighted by the distance with the FDI destination, as instrument for FDI flows entering a country. The intuition behind this choice is that although during the twentieth century, foreign investment to developing countries was often motivated by colonial or linguistic ties, e.g. British investments in the Asian Subcontinent, French investments in Africa etc. (and a colonial heritage or use of a common official language could thus serve as an instrument for FDI), with the rise of off-shoring in the recent decades however, investing firms are increasingly looking for cheaper factors of production and access to markets, often basing their decisions on purely economic grounds. The interest of American multinationals in Mexico, the West-European firms in Central and Eastern European countries, the Japanese firms in China and East Asia, or the Gulf investors scouring South Asia and North Africa can only be construed as looking for investment opportunities in their neighborhood, key determining factors thus being the geographical dimensions and the labor-wage differentials. Our selected instrument can take care of both these driving forces. For instance, this instrument not only explains the investment of Japanese firms in China, but also that of US and European multinational corporations in this country.

As regards the GDP, it is an obvious and probably the most important driving force in the improvement of higher education attainment of a developing country. We use the country's total energy use as an instrument for its annual output, the data being taken from United Nations online database. The use of energy can be a good instrument, as it is strongly correlated with a country's output, while having little direct link with the change in the course of its higher education attainment.

There is also some possibility of reverse causality with our trade openness indicator. Increased trade flows, if due to higher productivity and competitiveness, may owe to the better skills of the workforce, and may further promoted human capital accumulation in the economy. This appears to be the case with some East Asian economies. However, exports from many developing countries mainly comprise of agricultural commodities and natural resources besides less skill-intensive manufactured products, whose prices are often volatile. Evolution of trade openness ratio due to price changes in the international market may not relate to the human capital of the developing countries. The relationship between the two variables should therefore not suffer from a strong endogeneity problem.
In order to validate our results with 2SLS, first we need to check the validity of our instruments, based on statistics in the first stage of 2SLS. The energy use, our selected instrument for GDP, performs very well under the rule of thumb (Stock et al. (2002)), the F-statistic and the partial R-squared being very high (between 200 and 600 and 0.4 and 0.8, respectively), while the Stock-Yogo test also rules out the possibility of the instrument being weak. On the other hand, our instrument for FDIs is not validated by any of the aforementioned tests. As a result, we choose a more common way of dealing with endogeneity and instead of using an external instrument for FDI, we use its lagged value as a determinant for education.

In all, we perform estimations for different specifications of the baseline equation and using fixed and random effects, 2SLS instrumenting GDP, 2SLS with lagged FDI and energy use as an instrumental variable for GDP.

5. Results and discussion

In this section we present the main results of our 2SLS estimations for tertiary education determinants using both enrolment (Table 5) and total population having achieved tertiary education (Table 6). In the estimations presented in tables 5 and 6 below energy consumption is used as an instrument for GDP, while FDI is replaced by its lag. The results of the corresponding estimations for secondary education are given in Appendix 2. Appendix 3 presents the results of standard panel methods (fixed and random effects) for both tertiary and secondary education (both flow and stock measures), while Appendix 4 presents the results of 2SLS instrumenting GDP for both tertiary and secondary education (both measures).

The baseline equation to be estimated is given as:

$$LnEnrol_{Ter,t} = \alpha_1 LnFDI_t + \alpha_2 LnGDP_t + \alpha_3 LnOpen_t + \alpha_4 LnPop_t + \alpha_5 LnInflation_t + \alpha_6 LnAgr_t + \beta_t + \varepsilon_t \quad (1)$$

where β is the intercept and ε the error term.
$Enrol_{Ter}$, *FDI, GDP* and *AGR* are alternatively replaced by POP_{Ter}, *FDIratio, GDPC* and *Ind* and *Serv*, respectively.

Table 5 here
Table 6 here

GDP and GDP per capita, always significant at 1%, show the most consistent and strongest association with both levels of education, in terms of enrolment as well as population with higher education. Rising income levels allow the financial space to the middle and low-income households to delay or temporarily withdraw from the labor market and improve their

education level. Higher income also provides the governments and the households the wherewithal to afford the cost of higher education. Globally, the impact of the two GDP measures is stronger on education flows as compared to education stocks as well as on tertiary education as compared to secondary education. For instance, a 1% increase in GDP per capita may lead to about 2% increase in tertiary enrolment but to only 0.7% increase in total population with tertiary education or 0.6% increase in secondary enrolment. This healthy association of per capita output with tertiary education as opposed to the one with secondary education points to the incentives for higher education that higher income provides. This should especially be the case if the rising tide lifts many, if not all, boats in the economy. The bulging middle class in the developing countries as a result of the recent spur of growth appears to be keen to improve its education and skill level, and this is obvious in the increasing enrollment rates in the universities and technical colleges. High school education, being compulsory in many developing countries does no more react to personal or household income in the same way as does tertiary education A point to note is that the per capita output shows a stronger (3 times higher) impact than the country's over all output.

The impact of FDI on higher education is found to be mostly insignificant in the case of fixed and random effects panel data estimations, this being the case for both the variables used for FDI. The association turns significant once the endogeneity of the countries' GDP is taken into account, and stays significant once FDI is replaced by its lagged value. FDIs show a strong association with tertiary enrolment (mostly significant at 1%), but little impact on secondary enrolment: a 1% increase in FDI (FDI ratios) may lead to about 0.03-0.04% (0.02-0.04%) decrease in tertiary enrolment, while a 1% increase is associated with about 0.01% decrease in total population with secondary or tertiary education.
The sign of the impact is however counterintuitive. The studied period saw a substantial rise in vertical FDI in the developing countries: as trade barriers came tumbling down and financial controls relaxed, multinational corporations sought to take advantage of abundant low cost and low skilled labor force available in developing countries. The better availability of jobs and rise in wages that ensued provided a strong incentive to delay or give up education and join the labor market. FDI inflows thus appear to reduce the enrollment rate in the short-run. The impact of FDI on education enrolment should also depend on whether these are greenfield or brownfield projects. A greenfield project typically takes a year or two to complete and hence it takes a long time before its impact on the demand for human capital accumulation and thus, on higher education can be felt. As for brownfield projects, their impact on higher education should be rather limited, given that it is mainly about change of owners and does not necessarily imply new jobs.
Some technology or management knowhow may indeed be transferred, for which on-the-job training may be provided with the help of expatriated professionals or hired managers and engineers, but this skill transfer may not significantly raise the returns to education in the domestic economy. Here, it must be mentioned that a short-run negative impact due to the above mentioned factors does not preclude a beneficial long-run effect of foreign investments.

Among the other control variables, the evidence pertaining to the argument that the economies more open to foreign trade show higher propensity for post-secondary and high school education is tenuous at best, even though the relationship appears to be positive. Population growth rate shows an intuitive negative sign and is statistically significant in most of the regressions. The harmful effects of high population growth on human development and welfare measures have been well established in the literature. In the presence of high birth rate, households are constrained from keeping the grownups away from work and need more hands to feed the younger mouths.

We selected inflation as a general proxy for the countries' economic management and socio-political stability, so we expected a rather negative relationship between inflation and higher education. Our findings show that the variable mostly appears to have an insignificant impact on both the stock and flow of education measures in the developing countries. This suggests that inflation, taken as an indicator of monetary and economic stability, has little effect on the decision to go for higher studies, at least as long as the inflation rate is not too high. It may be noted that during the period from 1999-2006, many developing countries experienced benign inflation: price levels remained stable or rose slowly. The effects of higher prices on tertiary enrolment may not be evident at levels below 20 percent, even in countries with expensive higher education systems which are often in the hands of the private sector. Inflation is thought to interact with growth fully only when it crosses a certain threshold. For example, Kremer et al. (2009) estimate that inflation hampers growth in the developing countries only when it exceeds 17%.

Among the sectorial variables studied, services appear to have the strongest relationship with education, being mostly significant at 1% with a positive sign. From this, it can be inferred that in the developing countries, the recent growth in the services sector has led to increased importance of secondary and post-secondary education. Services such as information technology, telecommunication and financial services are human capital and skill intensive, and their growth should increase people's incentives to further pursue education.

As already implied above, a possible explanation for the positive impact of trade openness and the rise in the share of services in the economy, coupled with a negative relationship with the FDI, could lie in the nature of FDI entering the developing countries, as explained by Beugelsdijk et al. (2008). Efficiency seeking and resource seeking foreign investments in the manufacturing or natural resources sectors require only a limited amount of skilled labor. The textiles, footwear and other such sweatshops opening in the developing countries demand low-cost unskilled or semi-skilled labor, so higher education is unnecessary. In the case of natural resources-seeking investments, the prospecting, exploration and site operations demand qualified teams of engineers and technicians, skills that many developing countries lack. Besides, such operations create a small number of jobs relative to their value-added. Horizontal FDI, in contrast, may demand educated local workforce in sizeable numbers, but its incidence and impact in the studied period must not be important enough to reverse the over all negative sign. Educated and skilled workers may also be at a premium in the case of services offshoring, but so far, these operations have gone to a small part of the South.
The consistent and positive impact of services on tertiary and secondary education variables, as opposed to the mostly insignificant and often negative impact of agricultural and industrial value-added, may point to the structural changes taking place in the developing countries: a gradual rise in importance of the services sector among developing countries, along with a concomitant decline in the share of agricultural sector in the economy. An increase in the importance of the agricultural sector in the economy which may be due to the rise in the prices of several food and non-food crops towards the end of the studied period (in real terms, prices jumped by 75 percent from 2005 to 2007 (The Economist (2007)) or an increase of the industrial sector (due to the offshoring of low-tech manufacturing plants) may even act as a disincentive to continuing education.

6. Concluding remarks

This empirical study investigated the determinants of tertiary and secondary education for the period from 1998 to 2008, with a special focus on FDIs. We use several measures for education (enrolment and population), FDIs (levels and ratios to GDP) and GDP (total and per capita), as well as fixed and random effects panel and 2SLS techniques. The fixed and random effects regressions globally give a non significant impact of FDI, but after controlling for endogeneity, we find a non-negligible negative impact of FDIs on tertiary enrolment as well as on total population with secondary or tertiary education. We find no evidence of a significant impact on secondary enrolment. A 1% increase in FDIs (FDI ratio) may lead to about 0.03-0.04% (0.02-0.04%) decrease in tertiary enrolment and to a 0.01% decrease in total population with secondary or tertiary education. These findings can be understood in the context of the economic conjuncture prevailing in the last decade. During our studied period, many developing countries experienced export-led economic growth, implying increasing specialization in low value added manufacturing sectors. The FDI has also often been of the efficiency seeking type, looking mainly for cheap unskilled labor and thus, the potential long-term incentives for higher education have been overshadowed by the immediate increased job availability. Our findings therefore corroborate the theoretical assertions of Beugelsdijk et al. (2008). The results indicate that there are some short term adjustment costs to the FDI bonanza that should not be neglected by the governments. The wave of foreign investments that flooded the shores of developing countries in recent years may not yet had the time to show its beneficial effects on people's higher education preferences, as these individual incentives-based decisions take shape after a period of contemplation.
The paper confirms the theoretical proposition that a country's growth rate exerts a strong positive impact on education. Per capita output is found to have a very strong positive impact on both levels of education.

This study looked into the short-run effects of foreign investments on education in the developing countries. The impact of FDI critically depends on the type and nature of investments. A next step can therefore be to study the impact of FDI by sector. By region and country studies on the topic will help the developing countries better gage the changing labor and human capital endowment and adequately respond to the incoming capital flows.

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APPENDICES

Appendix 1

Enrollment sample

Algeria, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Benin, Bolivia, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Chile, China, Colombia, Costa Rica, Djibouti, El Salvador, Ethiopia, Georgia, Ghana, India, Indonesia, Kazakhstan, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lebanon, Lithuania, Macedonia, Madagascar, Malaysia, Mali, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Namibia, Panama, Poland, Romania, South Africa, Swaziland, Tajikistan, Thailand, Tunisia, Turkey, Uganda, Ukraine, Uruguay, Uzbekistan, Viet Nam

Population with higher education sample

Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo, Congo Dem. Rep., Costa Rica, Côte d'Ivoire, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Gabon, Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lebanon, Lesotho, Liberia, Libyan Arab Jamahiriya, Lithuania, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Senegal, Serbia, Seychelles, Sierra Leone, Solomon Islands, South Africa, Sri Lanka, Sudan, Suriname, Swaziland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Togo, Tonga, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Viet Nam, Yemen, Zambia, Zimbabwe

Table 2.1 *Secondary enrolment determinants: 2SLS estimations*
Dependent variable $LnEnrol_{Sec}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.189***	0.201***			0.196***	0.207***			0.192***	0.202***		
	(0.0427)	(0.0377)			(0.0435)	(0.0383)			(0.0425)	(0.0372)		
LnGDPC			0.607***	0.635***			0.631***	0.658***			0.616***	0.639***
			(0.139)	(0.122)			(0.142)	(0.124)			(0.139)	(0.120)
L.LnFDI	0.0143		0.0100		0.0142		0.00976		0.0129		0.00837	
	(0.0124)		(0.0132)		(0.0124)		(0.0132)		(0.0124)		(0.0132)	
L.LnFDIratio		0.0149		0.00875		0.0148		0.00847		0.0136		0.00720
		(0.0120)		(0.0126)		(0.0120)		(0.0126)		(0.0120)		(0.0126)
LnOpen	0.151*	0.148*	0.0726	0.0680	0.172*	0.169*	0.0923	0.0880	0.167*	0.165*	0.0916	0.0882
	(0.0893)	(0.0897)	(0.0973)	(0.0973)	(0.0901)	(0.0905)	(0.0976)	(0.0976)	(0.0891)	(0.0895)	(0.0966)	(0.0966)
LnPop	-0.0409*	-0.0413*	-0.0451**	-0.0457**	-0.0408*	-0.0411*	-0.0451**	-0.0457**	-0.0414**	-0.0417**	-0.0457**	-0.0462**
	(0.0213)	(0.0213)	(0.0219)	(0.0218)	(0.0212)	(0.0211)	(0.0218)	(0.0218)	(0.0211)	(0.0211)	(0.0217)	(0.0216)
LnInflation	-0.00307	-0.00274	-0.0155	-0.0158	-3.38e-05	0.000289	-0.0127	-0.0130	0.00127	0.00157	-0.0106	-0.0107
	(0.0146)	(0.0146)	(0.0151)	(0.0151)	(0.0146)	(0.0146)	(0.0150)	(0.0150)	(0.0147)	(0.0146)	(0.0149)	(0.0149)
LnAgr	0.0205	0.0200	0.0235	0.0235								
	(0.0443)	(0.0443)	(0.0453)	(0.0454)								
LnInd					-0.157	-0.157	-0.171	-0.172				
					(0.113)	(0.113)	(0.117)	(0.117)				
LnServ									0.246*	0.248*	0.294**	0.299**
									(0.142)	(0.141)	(0.146)	(0.145)
Observations	237	237	237	237	237	237	237	237	237	237	237	237
R-squared	0.236	0.236	0.207	0.204	0.242	0.242	0.213	0.209	0.247	0.246	0.222	0.219

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 2.2 *Educated population determinants (secondary): 2SLS estimations*
Dependent variable $LnPOP_{Sec}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.0827***	0.0741***			0.0823***	0.0738***			0.0805***	0.0716***		
	(0.00889)	(0.00789)			(0.00898)	(0.00799)			(0.00845)	(0.00745)		
LnGDPC			0.314***	0.276***			0.310***	0.273***			0.306***	0.267***
			(0.0391)	(0.0334)			(0.0391)	(0.0334)			(0.0371)	(0.0314)
L.LnFDI	-0.0106***		-0.0127***		-0.0106***		-0.0127***		-0.0109***		-0.0129***	
	(0.00240)		(0.00292)		(0.00240)		(0.00292)		(0.00238)		(0.00289)	
L.LnFDIratio		-0.0109***		-0.0131***		-0.0109***		-0.0131***		-0.0111***		-0.0132***
		(0.00229)		(0.00265)		(0.00229)		(0.00265)		(0.00227)		(0.00262)
LnOpen	0.0681***	0.0689***	0.0231	0.0298*	0.0742***	0.0750***	0.0268	0.0337*	0.0747***	0.0753***	0.0303*	0.0369**
	(0.0136)	(0.0136)	(0.0177)	(0.0174)	(0.0144)	(0.0144)	(0.0180)	(0.0176)	(0.0136)	(0.0138)	(0.0178)	(0.0174)
LnPop	-0.0130**	-0.0130**	-0.0179***	-0.0173***	-0.0131**	-0.0131**	-0.0180***	-0.0174***	-0.0132***	-0.0132***	-0.0180***	-0.0174***
	(0.00513)	(0.00513)	(0.00598)	(0.00584)	(0.00513)	(0.00513)	(0.00598)	(0.00584)	(0.00508)	(0.00508)	(0.00593)	(0.00579)
LnInflation	0.000492	0.000380	-0.00329	-0.00295	0.000647	0.000538	-0.00310	-0.00276	0.00142	0.00129	-0.00233	-0.00199
	(0.00258)	(0.00257)	(0.00299)	(0.00292)	(0.00258)	(0.00257)	(0.00298)	(0.00291)	(0.00257)	(0.00256)	(0.00296)	(0.00290)
LnAgr	0.0138	0.0141	0.0136	0.0140								
	(0.00916)	(0.00914)	(0.0106)	(0.0104)								
LnInd					-0.0304	-0.0302	-0.0181	-0.0195				
					(0.0241)	(0.0240)	(0.0273)	(0.0267)				
LnServ									0.0828***	0.0814***	0.0761**	0.0755**
									(0.0261)	(0.0261)	(0.0302)	(0.0295)
Observations	503	503	503	503	503	503	503	503	503	503	503	503
R-squared	0.348	0.348	0.125	0.163	0.347	0.347	0.126	0.164	0.359	0.359	0.142	0.180

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Appendix 3

Table 3.1 *Tertiary enrolment determinants*
Dependent variable $LnEnrol_{Ter}$

Model / Variable	(1) FE	(2) RE	(3) FE	(4) RE	(5) FE	(6) RE	(7) FE	(8) RE
LnGDP	0.692***	0.794***	0.643***	0.742***				
	(0.0430)	(0.0379)	(0.0383)	(0.0330)				
LnGDPC					2.038***	1.232***	1.957***	1.666***
					(0.138)	(0.124)	(0.124)	(0.116)
LnFDI	-0.0490***	-0.0517***			-0.0388***	0.0154		
	(0.0127)	(0.0133)			(0.0130)	(0.0156)		
LnFDIratio			-0.0490***	-0.0517***			-0.0502***	-0.0412***
			(0.0127)	(0.0133)			(0.0131)	(0.0138)
LnOpen	0.402***	0.276***	0.402***	0.276***	0.209**	0.222*	0.224**	0.263***
	(0.0895)	(0.0864)	(0.0895)	(0.0864)	(0.0968)	(0.114)	(0.0960)	(0.0991)
LnPop	-0.0473*	-0.0590**	-0.0473*	-0.0590**	-0.0461	-0.0247	-0.0473*	-0.0374
	(0.0273)	(0.0284)	(0.0273)	(0.0284)	(0.0284)	(0.0356)	(0.0282)	(0.0297)
LnInflation	0.00146	0.00649	0.00146	0.00649	-0.0338*	-0.0268	-0.0310*	-0.0289
	(0.0173)	(0.0179)	(0.0173)	(0.0179)	(0.0179)	(0.0225)	(0.0177)	(0.0187)
LnServ	0.937***	0.756***	0.937***	0.756***	0.886***	0.593***	0.911***	0.821***
	(0.159)	(0.161)	(0.159)	(0.161)	(0.166)	(0.205)	(0.164)	(0.173)
Constant	-8.622***	-9.783***	-8.622***	-9.783***	-5.643***	-0.0330	-6.199***	-3.973***
	(1.104)	(1.039)	(1.104)	(1.039)	(1.030)	(1.083)	(1.046)	(1.067)
Observations	323	323	323	323	323	323	323	323
R-squared	0.602	0.801	0.602	0.801	0.569	0.117	0.578	0.11

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 3.2 *Educated population determinants (tertiary)*
Dependent variable $LnPOP_{Ter}$

Model / Variable	(1) FE	(2) RE	(3) FE	(4) RE	(5) FE	(6) RE	(7) FE	(8) RE
LnGDP	0.159***	0.179***	0.156***	0.176***				
	(0.00646)	(0.00802)	(0.00573)	(0.00710)				
LnGDPC					0.376***	0.298***	0.406***	0.387***
					(0.0230)	(0.0283)	(0.0216)	(0.0225)
LnFDI	-0.00259	-0.00349			0.00856***	0.0146***		
	(0.00225)	(0.00282)			(0.00246)	(0.00313)		
LnFDIratio			-0.00259	-0.00349			0.00131	0.00165
			(0.00225)	(0.00282)			(0.00259)	(0.00273)
LnOpen	0.115***	0.0879***	0.115***	0.0879***	0.0827***	0.0722***	0.0895***	0.0881***
	(0.0136)	(0.0170)	(0.0136)	(0.0170)	(0.0162)	(0.0206)	(0.0164)	(0.0172)
LnPop	-0.0107*	-0.00679	-0.0107*	-0.00679	-0.0147**	-0.0115	-0.0156**	-0.0147**
	(0.00550)	(0.00690)	(0.00550)	(0.00690)	(0.00633)	(0.00810)	(0.00638)	(0.00672)
LnInflation	0.00314	0.00326	0.00314	0.00326	-0.00198	-0.000151	-0.00147	-0.000769
	(0.00264)	(0.00332)	(0.00264)	(0.00332)	(0.00308)	(0.00394)	(0.00311)	(0.00327)
LnServ	0.110***	0.0844**	0.110***	0.0844**	0.0625**	0.0273	0.0752**	0.0669**
	(0.0265)	(0.0332)	(0.0265)	(0.0332)	(0.0305)	(0.0390)	(0.0309)	(0.0325)
Constant	9.034***	8.717***	9.034***	8.717***	10.18***	10.69***	10.07***	10.13***
	(0.175)	(0.236)	(0.175)	(0.236)	(0.184)	(0.253)	(0.190)	(0.258)
Observations	885	885	885	885	882	882	882	882
R-squared	0.576	0.635	0.576	0.635	0.440	0.053	0.431	0.087

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 3.3 *Secondary enrolment determinants*
Dependent variable $LnEnrol_{Sec}$

Model / Variable	(1) FE	(2) RE	(3) FE	(4) RE	(5) FE	(6) RE	(7) FE	(8) RE
LnGDP	0.351***	0.533***	0.341***	0.515***				
	(0.0457)	(0.0404)	(0.0407)	(0.0349)				
LnGDPC					0.871***	0.435***	0.900***	0.733***
					(0.146)	(0.113)	(0.133)	(0.116)
LnFDI	-0.0104	-0.0184			0.00288	0.0486***		
	(0.0138)	(0.0149)			(0.0140)	(0.0156)		
LnFDIratio			-0.0104	-0.0184			-0.00720	-0.00148
			(0.0138)	(0.0149)			(0.0143)	(0.0145)
LnOpen	0.176*	-0.0485	0.176*	-0.0485	0.101	-0.00327	0.107	0.106
	(0.0958)	(0.0941)	(0.0958)	(0.0941)	(0.105)	(0.113)	(0.105)	(0.103)
LnPop	-0.0482	-0.0574*	-0.0482	-0.0574*	-0.0435	-0.0334	-0.0441	-0.0382
	(0.0300)	(0.0322)	(0.0300)	(0.0322)	(0.0311)	(0.0365)	(0.0311)	(0.0317)
LnInflation	0.00276	0.0105	0.00276	0.0105	-0.0132	-0.00692	-0.0123	-0.00936
	(0.0190)	(0.0205)	(0.0190)	(0.0205)	(0.0197)	(0.0232)	(0.0197)	(0.0201)
LnServ	0.523***	0.277	0.523***	0.277	0.486***	0.251	0.507***	0.442**
	(0.173)	(0.180)	(0.173)	(0.180)	(0.180)	(0.208)	(0.180)	(0.183)
Constant	3.021**	0.744	3.021**	0.744	5.456***	8.929***	5.171***	6.600***
	(1.166)	(1.119)	(1.166)	(1.119)	(1.076)	(1.027)	(1.105)	(1.065)
Observations	329	329	329	329	329	329	329	329
R-squared	0.280	0.739	0.280	0.739	0.226	0.065	0.227	0.014

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 3.4 *Educated population determinants (secondary)*
Dependent variable $LnPOP_{Sec}$

Model / Variable	(1) FE	(2) RE	(3) FE	(4) RE	(5) FE	(6) RE	(7) FE	(8) RE
LnGDP	0.0943***	0.114***	0.0922***	0.111***				
	(0.00662)	(0.00820)	(0.00587)	(0.00726)				
LnGDPC					0.158***	0.0979***	0.183***	0.169***
					(0.0224)	(0.0270)	(0.0209)	(0.0216)
LnFDI	-0.00214	-0.00301			0.00716***	0.0122***		
	(0.00230)	(0.00288)			(0.00238)	(0.00297)		
LnFDIratio			-0.00214	-0.00301			0.000920	0.00118
			(0.00230)	(0.00288)			(0.00251)	(0.00263)
LnOpen	0.0771***	0.0514***	0.0771***	0.0514***	0.0710***	0.0600***	0.0770***	0.0750***
	(0.0139)	(0.0174)	(0.0139)	(0.0174)	(0.0157)	(0.0196)	(0.0159)	(0.0166)
LnPop	-0.0246***	-0.0209***	-0.0246***	-0.0209***	-0.0274***	-0.0247***	-0.0281***	-0.0274***
	(0.00564)	(0.00705)	(0.00564)	(0.00705)	(0.00614)	(0.00768)	(0.00617)	(0.00647)
LnInflation	-0.00482*	-0.00474	-0.00482*	-0.00474	-0.00683**	-0.00542	-0.00637**	-0.00581*
	(0.00271)	(0.00339)	(0.00271)	(0.00339)	(0.00298)	(0.00373)	(0.00301)	(0.00315)
LnServ	0.0795***	0.0551	0.0795***	0.0551	0.0515*	0.0219	0.0625**	0.0552*
	(0.0272)	(0.0339)	(0.0272)	(0.0339)	(0.0296)	(0.0370)	(0.0299)	(0.0313)
Constant	11.12***	10.81***	11.12***	10.81***	12.14***	12.52***	12.04***	12.08***
	(0.180)	(0.243)	(0.180)	(0.243)	(0.179)	(0.243)	(0.184)	(0.252)
Observations	884	884	884	884	881	881	881	881
R-squared	0.327	0.562	0.327	0.562	0.202	0.074	0.193	0.146

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 4.1 *Tertiary enrolment determinants: 2SLS estimations*
Dependent variable $LnEnrol_{Ter}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.665***	0.619***			0.680***	0.632***			0.662***	0.611***		
	(0.0478)	(0.0395)			(0.0479)	(0.0393)			(0.0447)	(0.0367)		
LnGDPC			2.086***	1.946***			2.137***	1.991***			2.083***	1.926***
			(0.156)	(0.127)			(0.157)	(0.127)			(0.147)	(0.119)
L.LnFDI	-0.0385***		-0.0445***		-0.0412***		-0.0472***		-0.0449***		-0.0509***	
	(0.0131)		(0.0139)		(0.0131)		(0.0140)		(0.0128)		(0.0136)	
L.LnFDIratio		-0.0284**		-0.0435***		-0.0319***		-0.0474***		-0.0360***		-0.0513***
		(0.0122)		(0.0128)		(0.0122)		(0.0129)		(0.0120)		(0.0126)
LnOpen	0.226***	0.215***	-0.0599	-0.0413	0.272***	0.260***	-0.0231	-0.00219	0.288***	0.276***	0.00241	0.0250
	(0.0832)	(0.0834)	(0.0936)	(0.0924)	(0.0837)	(0.0839)	(0.0932)	(0.0921)	(0.0813)	(0.0817)	(0.0913)	(0.0901)
LnPop	-0.0543***	-0.0540***	-0.0628***	-0.0622***	-0.0526**	-0.0524**	-0.0613***	-0.0607***	-0.0523***	-0.0521***	-0.0606***	-0.0600***
	(0.0210)	(0.0209)	(0.0219)	(0.0216)	(0.0208)	(0.0207)	(0.0218)	(0.0214)	(0.0203)	(0.0202)	(0.0212)	(0.0208)
LnInflation	0.0167	0.0171	-0.0207	-0.0182	0.0195	0.0197	-0.0195	-0.0169	0.0233*	0.0234*	-0.0147	-0.0118
	(0.0140)	(0.0139)	(0.0147)	(0.0144)	(0.0138)	(0.0138)	(0.0145)	(0.0142)	(0.0135)	(0.0135)	(0.0142)	(0.0139)
LnAgr	0.0112	0.00998	-0.00116	-0.000394								
	(0.0394)	(0.0392)	(0.0407)	(0.0401)								
LnInd					-0.277**	-0.265**	-0.256**	-0.258**				
					(0.113)	(0.111)	(0.117)	(0.114)				
LnServ									0.565***	0.546***	0.560***	0.562***
									(0.140)	(0.139)	(0.145)	(0.143)
Observations	258	258	258	258	258	258	258	258	258	258	258	258
R-squared	0.642	0.644	0.614	0.625	0.649	0.651	0.619	0.631	0.667	0.669	0.639	0.651

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 4.2 *Educated population determinants (tertiary) : 2SLS estimations*
Dependent variable $LnPOP_{Ter}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.226***	0.205***			0.231***	0.209***			0.226***	0.204***		
	(0.0134)	(0.0107)			(0.0135)	(0.0107)			(0.0123)	(0.00972)		
LnGDPC			0.865***	0.779***			0.863***	0.778***			0.865***	0.781***
			(0.0650)	(0.0502)			(0.0638)	(0.0489)			(0.0603)	(0.0464)
L.LnFDI	-0.0160***		-0.0194***		-0.0166***		-0.0193***		-0.0171***		-0.0191***	
	(0.00334)		(0.00442)		(0.00340)		(0.00445)		(0.00331)		(0.00434)	
L.LnFDIratio		-0.00867***		-0.0144***		-0.00934***		-0.0143***		-0.00971***		-0.0142***
		(0.00292)		(0.00372)		(0.00297)		(0.00375)		(0.00290)		(0.00369)
LnOpen	0.117***	0.110***	-0.0251	-0.0155	0.134***	0.124***	-0.0271	-0.0175	0.127***	0.119***	-0.0277	-0.0176
	(0.0157)	(0.0156)	(0.0239)	(0.0226)	(0.0172)	(0.0170)	(0.0242)	(0.0230)	(0.0158)	(0.0157)	(0.0245)	(0.0232)
LnPop	-0.0127*	-0.0129**	-0.0247***	-0.0236***	-0.0122*	-0.0125*	-0.0247***	-0.0237***	-0.0123*	-0.0126**	-0.0248***	-0.0237***
	(0.00649)	(0.00639)	(0.00829)	(0.00788)	(0.00652)	(0.00641)	(0.00827)	(0.00787)	(0.00642)	(0.00632)	(0.00828)	(0.00789)
LnInflation	0.00564*	0.00492	-0.000790	-0.000613	0.00554*	0.00482	-0.000773	-0.000621	0.00718**	0.00629**	-0.00120	-0.000946
	(0.00317)	(0.00312)	(0.00402)	(0.00383)	(0.00317)	(0.00312)	(0.00399)	(0.00381)	(0.00316)	(0.00310)	(0.00402)	(0.00385)
LnAgr	0.00317	0.00181	-0.00100	-0.00146								
	(0.0114)	(0.0112)	(0.0144)	(0.0137)								
LnInd					-0.0664**	-0.0557*	0.00941	0.00890				
					(0.0308)	(0.0298)	(0.0366)	(0.0348)				
LnServ									0.110***	0.101***	-0.0292	-0.0214
									(0.0327)	(0.0322)	(0.0429)	(0.0410)
Observations	555	555	555	555	555	555	555	555	555	555	555	555
R-squared	0.562	0.576	0.292	0.358	0.560	0.574	0.294	0.359	0.572	0.586	0.293	0.357

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 4.3 *Secondary enrolment determinants: 2SLS estimations*
Dependent variable $LnEnrol_{Sec}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.233***	0.239***			0.238***	0.244***			0.233***	0.236***		
	(0.0488)	(0.0403)			(0.0495)	(0.0405)			(0.0466)	(0.0382)		
LnGDPC			0.718***	0.742***			0.739***	0.762***			0.721***	0.736***
			(0.150)	(0.125)			(0.153)	(0.126)			(0.144)	(0.119)
L.LnFDI	0.00777		0.00677		0.00711		0.00602		0.00398		0.00316	
	(0.0134)		(0.0135)		(0.0136)		(0.0137)		(0.0134)		(0.0135)	
L.LnFDIratio		0.0100		0.00508		0.00921		0.00398		0.00523		0.000471
		(0.0125)		(0.0128)		(0.0127)		(0.0130)		(0.0125)		(0.0127)
LnOpen	0.201**	0.199**	0.0926	0.0903	0.213**	0.211**	0.102	0.101	0.239***	0.238***	0.128	0.128
	(0.0829)	(0.0834)	(0.0912)	(0.0911)	(0.0847)	(0.0852)	(0.0914)	(0.0915)	(0.0825)	(0.0831)	(0.0907)	(0.0908)
LnPop	-0.0490**	-0.0489**	-0.0506**	-0.0507**	-0.0484**	-0.0483**	-0.0499**	-0.0500**	-0.0473**	-0.0473**	-0.0489**	-0.0490**
	(0.0217)	(0.0217)	(0.0217)	(0.0217)	(0.0217)	(0.0217)	(0.0216)	(0.0217)	(0.0214)	(0.0214)	(0.0214)	(0.0214)
LnInflation	0.000197	0.000203	-0.0117	-0.0121	-2.35e-05	-4.93e-05	-0.0124	-0.0127	0.00389	0.00386	-0.00843	-0.00862
	(0.0146)	(0.0146)	(0.0147)	(0.0147)	(0.0146)	(0.0146)	(0.0146)	(0.0145)	(0.0144)	(0.0144)	(0.0145)	(0.0144)
LnAgr	-0.0141	-0.0144	-0.0169	-0.0167								
	(0.0406)	(0.0405)	(0.0403)	(0.0403)								
LnInd					-0.0496	-0.0468	-0.0530	-0.0558				
					(0.115)	(0.114)	(0.115)	(0.114)				
LnServ									0.374***	0.372**	0.353**	0.358**
									(0.145)	(0.145)	(0.145)	(0.145)
Observations	260	260	260	260	260	260	260	260	260	260	260	260
R-squared	0.298	0.298	0.302	0.301	0.298	0.298	0.302	0.301	0.318	0.318	0.320	0.319

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 4.4 *Educated population determinants (secondary) : 2SLS estimations*
Dependent variable $LnPOP_{Sec}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.112***	0.0978***			0.111***	0.0963***			0.111***	0.0957***		
	(0.0114)	(0.00932)			(0.0115)	(0.00927)			(0.0106)	(0.00851)		
LnGDPC			0.430***	0.372***			0.415***	0.359***			0.424***	0.366***
			(0.0525)	(0.0412)			(0.0511)	(0.0398)			(0.0485)	(0.0379)
L.LnFDI	-0.0134***		-0.0151***		-0.0134***		-0.0147***		-0.0139***		-0.0149***	
	(0.00286)		(0.00357)		(0.00291)		(0.00356)		(0.00285)		(0.00349)	
L.LnFDIratio		-0.0118***		-0.0145***		-0.0118***		-0.0141***		-0.0123***		-0.0144***
		(0.00254)		(0.00305)		(0.00257)		(0.00306)		(0.00254)		(0.00302)
LnOpen	0.0725***	0.0709***	0.00178	0.0110	0.0739***	0.0718***	-0.00354	0.00624	0.0768***	0.0751***	0.00113	0.0110
	(0.0134)	(0.0135)	(0.0193)	(0.0185)	(0.0147)	(0.0147)	(0.0193)	(0.0187)	(0.0136)	(0.0137)	(0.0197)	(0.0190)
LnPop	-0.0156***	-0.0156***	-0.0215***	-0.0207***	-0.0156***	-0.0156***	-0.0216***	-0.0208***	-0.0154***	-0.0155***	-0.0215***	-0.0207***
	(0.00556)	(0.00555)	(0.00669)	(0.00646)	(0.00556)	(0.00555)	(0.00662)	(0.00641)	(0.00554)	(0.00553)	(0.00667)	(0.00645)
LnInflation	0.000457	0.000295	-0.00274	-0.00235	0.000652	0.000491	-0.00238	-0.00202	0.00140	0.00120	-0.00271	-0.00220
	(0.00272)	(0.00271)	(0.00324)	(0.00314)	(0.00271)	(0.00270)	(0.00319)	(0.00310)	(0.00273)	(0.00271)	(0.00324)	(0.00314)
LnAgr	0.00805	0.00775	0.00598	0.00619								
	(0.00977)	(0.00971)	(0.0116)	(0.0112)								
LnInd					-0.00794	-0.00555	0.0285	0.0243				
					(0.0263)	(0.0258)	(0.0293)	(0.0284)				
LnServ									0.0549*	0.0528*	-0.0134	-0.00465
									(0.0282)	(0.0281)	(0.0345)	(0.0335)
Observations	555	555	555	555	555	555	555	555	555	555	555	555
R-squared	0.351	0.352	0.065	0.125	0.351	0.352	0.084	0.140	0.356	0.357	0.072	0.131

*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

FIGURE LEGENDS

Figure 1

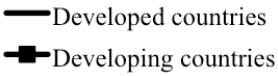
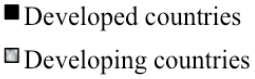


Figure 2



TABLES

Table 1. Summary statistics: School enrolment sample

Variable	Obs	Mean	Std. Dev.	Min	Max
FDI (current US$)	513	3.47E+09	1.03E+10	-4.75E+09	1.38E+11
FDI ratio (% of GDP)	513	0.0411358	0.0500361	-0.14369	0.451499
GDP (current US$)	513	1.15E+11	3.11E+11	5.31E+08	3.38E+12
GDP/capita (constant 2000 US$)	513	2013.251	1939.821	107.0322	9359.589
Secondary enrolment	498	5039770	1.52e+07	15511	1.02e+08
Tertiary enrolment	489	1002372	2699512	175	2.53e+07
Inflation (CPI)	480	8.172248	18.11712	-8.515815	293.6787
Openness (% of GDP)	511	83.07749	39.70761	20.22714	220.4073
Population growth (annual %)	513	1.184465	1.14439	-1.878577	3.4333
Agriculture VA (% of GDP)	508	17.00123	11.77633	0.801097	53.71351
Industry VA (% of GDP)	508	30.42047	9.886414	12.35603	68.71317
Services VA (% of GDP)	507	52.60454	11.98852	23.65231	81.62109

Table 2. Summary statistics: Population education sample

Variable	Obs	Mean	Std. Dev.	Min	Max
FDI (current US$)	1399	2.11e+09	8.32e+09	-4.75E+09	1.48e+11
FDI ratio (% of GDP)	1395	0.0463839	0.0647459	-0.1658887	0.907411
GDP (current US$)	1423	6.83e+10	2.45e+11	6.23e+07	4.33e+12
GDP/capita (constant 2000 US$)	1423	2203.315	2361.544	84.71101	14908.29
Population secondary, total	1380	5179804	1.90e+07	2181	1.70e+08
Population tertiary, total	1381	3710604	1.32e+07	1205	1.18e+08
Inflation (CPI)	1270	31.55805	686.0559	-9.797647	24411.03
Openness (% of GDP)	1376	84.24314	38.87663	15.865	283.4363
Population growth (annual %)	1430	1.589573	1.226723	-1.878577	10.04283
Agriculture VA (% of GDP)	1341	19.71804	14.17798	0.801097	78.64294
Industry VA (% of GDP)	1341	29.08621	11.99403	6.809189	78.51812
Services VA (% of GDP)	1340	51.20465	13.51431	12.87172	84.30547

Table 3. Correlation matrix: FDI and Enrolment

	LnFDI	*LnFDIratio*	$LnEnrol_{Sec}$	$LnEnrol_{Ter}$
LnFDI	1.0000			
LnFDIratio	0.6174	1.0000		
$LnEnrol_{Sec}$	0.6651	-0.0224	1.0000	
$LnEnrol_{Ter}$	0.7571	0.0908	0.9273	1.0000

Table 4. Correlation matrix: FDI and Population education

	LnFDI	*LnFDIratio*	*LnPOP$_{Sec}$*	*LnPOP$_{Ter}$*
LnFDI	1.0000			
LnFDIratio	0.5189	1.0000		
LnPOP$_{Sec}$	0.5216	-0.2805	1.0000	
LnPOP$_{Ter}$	0.5548	-0.2621	0.9958	1.0000

Table 5. Tertiary enrolment determinants: 2SLS estimations
Dependent variable $LnEnrol_{Ter}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.594***	0.567***			0.608***	0.579***			0.602***	0.571***		
	(0.0405)	(0.0358)			(0.0413)	(0.0365)			(0.0392)	(0.0344)		
LnGDPC			1.914***	1.796***			1.965***	1.842***			1.946***	1.813***
			(0.148)	(0.127)			(0.152)	(0.130)			(0.143)	(0.121)
L.LnFDI	-0.0278**		-0.0427***		-0.0283**		-0.0438***		-0.0315***		-0.0476***	
	(0.0120)		(0.0142)		(0.0119)		(0.0143)		(0.0116)		(0.0138)	
L.LnFDIratio		-0.0190		-0.0378***		-0.0190*		-0.0383***		-0.0221**		-0.0418***
		(0.0116)		(0.0133)		(0.0115)		(0.0133)		(0.0112)		(0.0128)
LnOpen	0.126	0.123	-0.110	-0.0913	0.156*	0.152*	-0.0796	-0.0621	0.161*	0.156*	-0.0675	-0.0493
	(0.0858)	(0.0859)	(0.104)	(0.102)	(0.0864)	(0.0864)	(0.104)	(0.102)	(0.0831)	(0.0833)	(0.0994)	(0.0975)
LnPop	-0.0431**	-0.0415**	-0.0585**	-0.0560**	-0.0439**	-0.0423**	-0.0599**	-0.0572**	-0.0447**	-0.0430**	-0.0605***	-0.0577***
	(0.0203)	(0.0201)	(0.0233)	(0.0228)	(0.0201)	(0.0200)	(0.0232)	(0.0227)	(0.0195)	(0.0194)	(0.0223)	(0.0217)
LnInflation	0.0240*	0.0232	-0.0182	-0.0167	0.0302**	0.0293**	-0.0121	-0.0106	0.0346**	0.0335**	-0.00550	-0.00412
	(0.0142)	(0.0141)	(0.0163)	(0.0159)	(0.0142)	(0.0141)	(0.0162)	(0.0158)	(0.0138)	(0.0137)	(0.0156)	(0.0152)
LnAgr	0.0583	0.0583	0.0676	0.0678								
	(0.0422)	(0.0421)	(0.0482)	(0.0472)								
LnInd					-0.277**	-0.274**	-0.326***	-0.320***				
					(0.108)	(0.108)	(0.125)	(0.122)				
LnServ									0.568***	0.553***	0.725***	0.701***
									(0.131)	(0.131)	(0.150)	(0.146)
Observations	237	237	237	237	237	237	237	237	237	237	237	237
R-squared	0.616	0.619	0.503	0.522	0.620	0.623	0.505	0.525	0.643	0.646	0.547	0.565

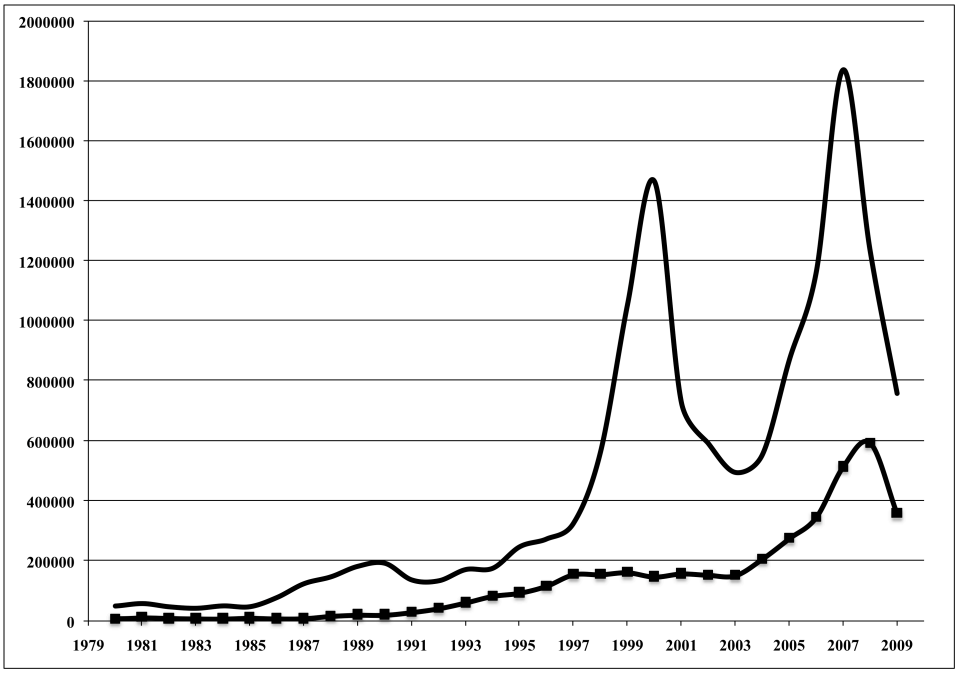
*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Table 6. Educated population determinants: 2SLS estimations
Dependent variable $LnPOP_{Ter}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LnGDP	0.188***	0.177***			0.193***	0.182***			0.187***	0.175***		
	(0.00971)	(0.00857)			(0.00972)	(0.00858)			(0.00906)	(0.00793)		
LnGDPC			0.715***	0.661***			0.725***	0.672***			0.710***	0.655***
			(0.0463)	(0.0390)			(0.0465)	(0.0393)			(0.0437)	(0.0365)
L.LnFDI	-0.0118***		-0.0165***		-0.0116***		-0.0165***		-0.0121***		-0.0168***	
	(0.00262)		(0.00346)		(0.00259)		(0.00347)		(0.00256)		(0.00340)	
L.LnFDIratio		-0.00862***		-0.0139***		-0.00875***		-0.0141***		-0.00896***		-0.0142***
		(0.00248)		(0.00310)		(0.00246)		(0.00312)		(0.00242)		(0.00305)
LnOpen	0.0982***	0.0957***	-0.00438	0.00205	0.121***	0.118***	0.00978	0.0165	0.110***	0.107***	0.00698	0.0133
	(0.0148)	(0.0148)	(0.0210)	(0.0203)	(0.0156)	(0.0155)	(0.0214)	(0.0207)	(0.0146)	(0.0146)	(0.0209)	(0.0202)
LnPop	-0.00934*	-0.00943*	-0.0205***	-0.0197***	-0.00867	-0.00876	-0.0202***	-0.0194***	-0.00928*	-0.00937*	-0.0204***	-0.0196***
	(0.00561)	(0.00556)	(0.00708)	(0.00684)	(0.00555)	(0.00551)	(0.00711)	(0.00686)	(0.00545)	(0.00541)	(0.00697)	(0.00672)
LnInflation	0.00853***	0.00819***	-8.48e-05	0.000235	0.00865***	0.00834***	-0.000103	0.000226	0.00989***	0.00952***	0.00119	0.00150
	(0.00282)	(0.00279)	(0.00354)	(0.00342)	(0.00279)	(0.00277)	(0.00354)	(0.00342)	(0.00275)	(0.00273)	(0.00349)	(0.00337)
LnAgr	0.00722	0.00714	0.00676	0.00692								
	(0.0100)	(0.00992)	(0.0126)	(0.0121)								
LnInd					-0.0971***	-0.0955***	-0.0684**	-0.0692**				
					(0.0261)	(0.0258)	(0.0324)	(0.0313)				
LnServ									0.135***	0.132***	0.120***	0.118***
									(0.0280)	(0.0277)	(0.0355)	(0.0342)
Observations	503	503	503	503	503	503	503	503	503	503	503	503
R-squared	0.618	0.624	0.399	0.439	0.626	0.631	0.395	0.436	0.639	0.645	0.418	0.459

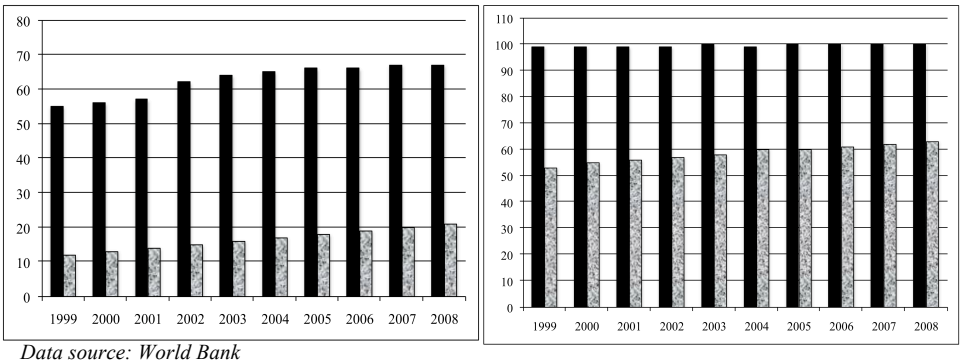
*Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

FIGURES



Data source: World Bank, net inflows in million dollars

Figure 1. The course of FDI in developing countries



Data source: World Bank

(a) **(b)**

Figure 2. Tertiary and secondary gross enrolment rates (% of total enrolment): (a) tertiary; (b) secondary