# *Does FDI promote higher education? Evidence from developing countries*

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***Preliminary version***

***April 2009***

# 1 Introduction

In recent times, there has been much debate over the benefits of globalization, and particularly, over the place of developing countries in this accelerating process. Do they have something to offer or something to gain from taking part into world economy? 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. But having something to gain is less straightforward. Even though high economic growth in last years has benefited many poor countries, many of them are still lagging behind. As Kemal Dervis, (the former UNDP administrator) put it very well: “Globalization has fundamentally altered the world economy, creating winners and losers. […] building a more inclusive globalization is the most important development challenges of our time”.

One of the channels through which globalization helped developing countries is the foreign direct investment inflows. FDIs, in the form of capital, technology, technical and managerial skills bundled together, have taken an altogether new magnitude and have begun playing an increasing role in the developing countries. They have also proved to be more reliable than other forms of foreign capital during financial crises. While portfolio investment and debts dried out during the East Asian crisis of 1997 and the Mexican crisis (1994-95), FDIs held up well (Lipsey 2001). 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 labour and thus, creating an incentive to participate into higher education. Furthermore, among the Millennium Development Goals, education is a key element for human development and economic growth and every mechanism that might have an impact on it should be studied carefully.

This brings us to question of the relation between FDIs and human capital accumulation measured by school enrolment. Economic theory proposes an important relation between FDIs and human capital, which can be defined as "the knowledge and skills embodied in humans that are acquired through schooling, training and experience, and are useful in the production of goods, services and further knowledge" (De La Fuente and Ciccone 2000). The endogenous growth theory assumes increasing returns to scale, mainly due to the learning by doing effect happening between the physical and human capital (Lucas 1988). Workers gain experience and improve their productivity through working as well as on-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, this theory is only about knowledge spillovers and does not say much about the impact on formal education. Moreover, empirical studies are also scarce, with most research focusing on the impact of FDIs on growth or on the determinants of FDIs.

The 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 1999 to 2006 for groups of low-income and middle-income countries, we study the impact of FDI inflows on human capital growth in the recent years. The paper takes higher education as the primary variable of interest rather than the secondary education[1] 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

[1] Secondary and tertiary-educated workers are deemed imperfect substitutes (Card, 2009).

in use in modern services and industry. Data for education is taken from the better quality UNESCO database. We also take into account the fact that countries at different stages of development function differently and react in their particular way to the same stimuli. For this reason, we study low and middle-income countries separately. The remainder of the paper 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

The importance of FDIs and human capital accumulation or education for economic growth has been largely discussed in the literature. Economic theory recognizes FDI and human capital as two important conduits for economic growth. 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). Beugelsdijk et al. (2008), in their very interesting study, distinguish between horizontal and vertical FDIs. They find that these two types of FDIs have different impacts and the difference comes not only from the type of FDIs, but also from the type of countries. Horizontal FDIs have a much larger impact 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 labour demand.
As for human capital, the Lucas–Romer endogenous growth model suggests that endogenously accumulated human capital has a direct impact on the productivity of labour 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). 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.

There is also a lot of literature on the FDI – human capital – economic growth triangle.
Borensztein et al. (1998) find in their study of 69 developing countries during the period 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.
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 labour, and economic growth ».
As foreign investments are associated with superior technological contents, an increase in FDI inflows ultimately leads to growth in human capital.
Stijns (2001, 2006) in his study 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 and for the period 1967-1997. They 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 must have attained a threshold level of development or human capital to benefit from capital inflows.

If many economists have analyzed the impact of FDIs and human capital on economic growth or the relation between the three, very few have focused on the relation between the two important determinants of economic performance. Hence, the question as to whether FDI is conducive to human capital accumulation has, as yet, neither too many, nor very clear answers.

Intuitively, as Beugelsdijk et al. (2008) have shown for the impact on economic growth, FDIs should have different impacts 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 labour 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 little incentive to participate into higher education. Horizontal FDIs or market-seeking FDIspursue increased market shares in the host countries, competing directly with one another as well as with the local firms. This is generally synonym to 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 show that most of greenfield R&D projects have been conducted in developing countries, suggesting that this type of FDIs should boost skilled labour demand and thus, participation into higher education.

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 pull factor of FDI in the process of globalization since the 1990s.

Gittens (2006) shows that FDI has a positive impact on the accumulation of human capital as measured by primary school enrollment. He also suggests that the level of tertiary education in developing countries does not depend on FDI inflows. In Asia, FDI has a positive and statistically significant impact on school enrolment at the primary and tertiary levels but FDI has no impact on secondary school enrolment. FDI has no impact on primary and secondary school enrolments in Africa. Moreover, FDI inflows to Africa have a negative and statistically significant impact on tertiary school enrolment.

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

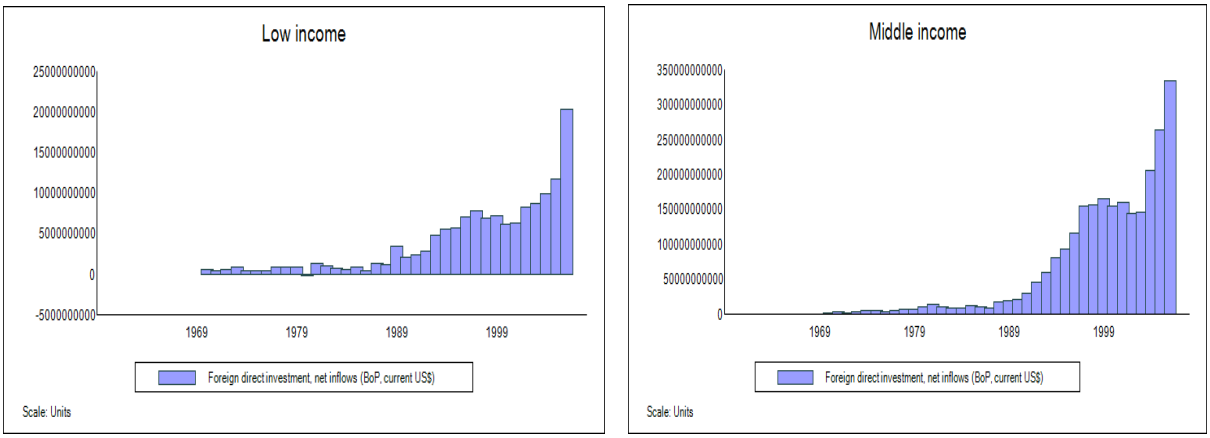
Blomström et al. (1994) study the impact of local competition and the availability of skilled labor on the technology imports of foreign MNC affiliates in Mexican manufacturing industries, and find no evidence that education is critical. Instead, they indicate the necessity of high per capita income for a positive impact of FDI inflows.

In 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.
Using data for 29 provinces from 1978 to 1999, Zhuang (2008) finds that FDI contributes to the accumulation of skilled labour and the participation in middle school education. The findings are that the increase in share of population with college education and professional and technical education is larger in provinces with economic and technological development zones (ETDZs) 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.

We observe that there is no consensus in the literature on the direction and the level of association of FDI and human capital. A major reason behind such divergent and contradictory results lies in the difficulty in defining and computing human capital. Often average years of schooling or initial school enrollment 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, 2000). Portela et al (2003) 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 developing countries), use of different econometric techniques, different time periods and choice of variables has also led to divergent and variant regression results.

## 3 Descriptive statistics

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 early 21st century due to the dot com crash. The global FDI inflows crossed $1.8 trillion, an all-time high (UNCTAD, 2008). 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 (Figure 1a&b).



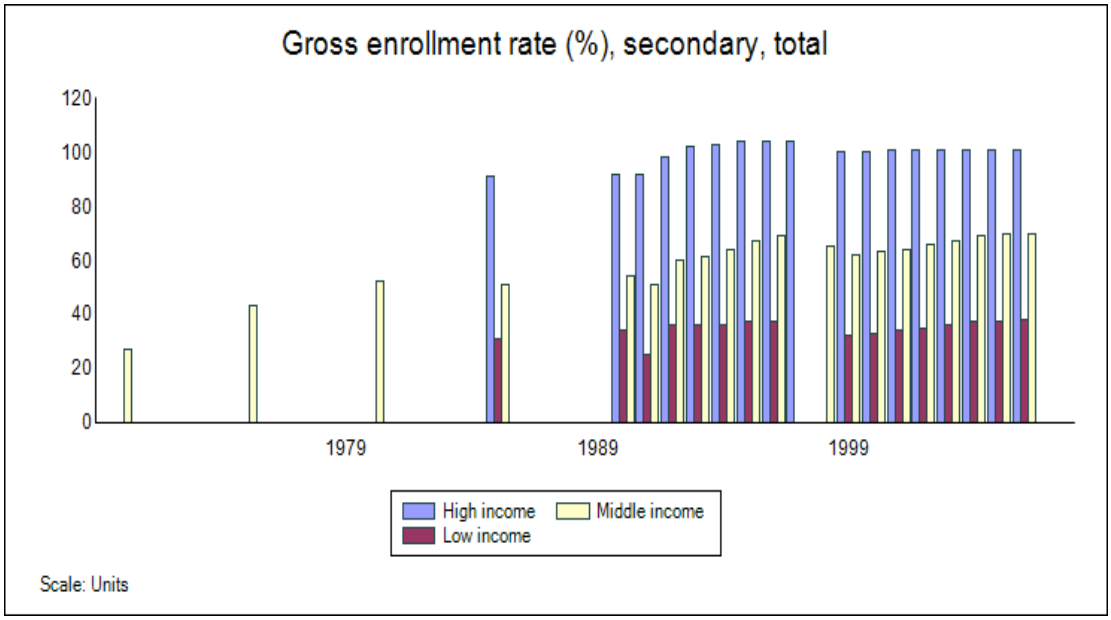

*Source : World Bank*

**(a)** **(b)**

**Figure 1. FDI Evolution: (a) Low income countries; (b) Middle-income countries**

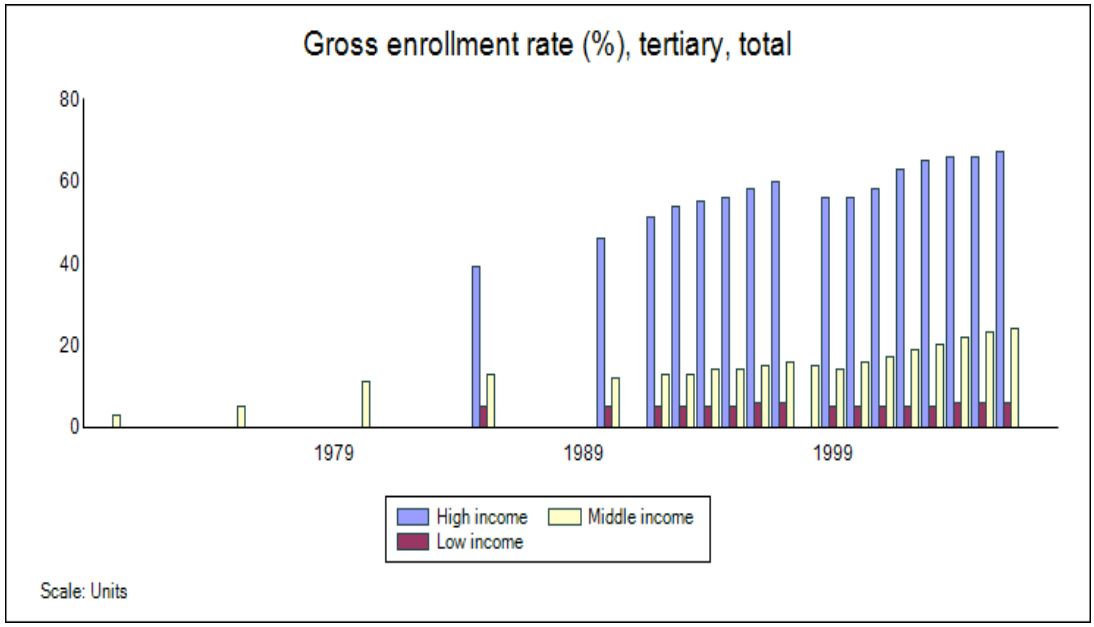
The least developed countries (LDCs) also reached a record amount of $13 billion. In many low and middle income countries, foreign direct investment has become the single highest source of capital inflows, often making up more than sixty percent of total private capital inflow. In this context of accelerating globalization, human capital has been highlighted as an important determinant of FDIs and economic growth. In its quantifiable forms, whether school enrollment, average years of schooling or on-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, a lot of stress is put on developing countries to catch up with the former by upgrading their educational system. Great improvements have been made regarding primary school enrolment in all developing countries. Nevertheless, as can be seen on Figures 1 and 2 below, some effort is still needed for secondary education, but there is a long way to go for tertiary education.

Analyzing the evolution of education in the MICs, one can see that from the beginning of the XXI$^{st}$ century the increase of tertiary enrolment has been as strong as in the developed countries, even though at a less than half their level. On the contrary, in the LICs, tertiary enrolment has remained nearly unchanged and at a very low level during the same period. However, in terms of secondary education, the patterns are less striking, with developed and developing countries both being at a higher plane, but with little improvement from 1999 onwards.




*Source : World Bank*

**Figure 2. Comparison of secondary enrolment rates**




*Source : World Bank*

**Figure 3. Comparison of tertiary enrolment rates**

# 4 Data & methodology

## 4.1 Choice of variables

The variable of choice as a proxy for human capital in the literature is usually the primary or secondary school enrollment rate (Mankiw et al. 1992, Levine and Renelt 1992, Borensztein et al. 1998, Nunnenkamp et al. 2002). However, we find tertiary education a more pertinent indicator of human capital. Three reasons can be given in this regard: firstly, primary and secondary education is 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. Secondarily, 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 challenging, and require more professional, technical and managerial skills that could be proxied by primary or secondary schooling. In the absence of an adequate measurement of learning by doing effect, increase in tertiary education appears to be the best alternative.

In order to avoid the drawbacks due to cross-country comparison issues, we choose tertiary enrolment as our main variable, rather than the years of higher education. Secondary school data is also used for the sake of comparison. Similarly, public education budget to GDP ratio is taken as a proxy for educational expenditures, even though its use as a proxy for tertiary education expenditure is progressively becoming inappropriate. This is because for several developing countries, private educational spending is playing an important role in tertiary education; hence the significance of individual choice.

Per capita national income 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), and Baldacci et al. (2008) among others. The degree of openness of the economy, taken as the ratio of imports and exports to the GDP, is a widely employed indicator of the international trade regime and the overall economic system prevailing in the country. As the FDI inflows to developing countries depend on their individual natural, physical and human capital endowments, we use the share of industry, agriculture and services in the value-added of the GDP to analyse their significance in human capital growth.

The extent of urbanization and internet usage are considered as a sign of the level of a country's development. The relevance of urbanization is also due to the fact that most of the institutions imparting higher education are located in urban areas. Many low and middle income countries have seen a sharp rise in their populations in the last fifty years. We take in demographic growth rate to account for this factor.

Finally, we choose inflation measured through the evolution of the CPI index, as a proxy for countries' economic and socio-political stability. Some health-related indicators, like fertility rate, life expectancy, general medical care etc, are also used in human capital analyses (Pitt and Rosenzweig 1990, Gittens 2006). However, no clear evidence of a substantial role of these variables has been suggested in the literature. For this reason and also in order to avoid the misspecification problem in our panel-data based econometric equations, we do not include these variables.

### 4.2 Data sources

The data for all the variables except for education indicators have been taken from the World Bank online database. Secondary and tertiary education indicators come from the UNESCO online educational database. Countries are divided into low and middle income groups according to their respective per capita income levels using the classification of World Bank. 13 low-income and 35 middle-income countries are included in the study of tertiary education (a description of the data is given in Table 1)[2]. Given that the data for secondary education are more abundant, we could expand our sample of middle-income countries to 57 countries and

[2] A list with the countries can be found in APPENDIX 1.

that of low-income countries to 33 countries (a description of data can be found in Appendix 3)[3]. As the study is primarily concerned with the impact of FDI inflows on human capital, natural resource countries (particularly oil and gas rich countries) are excluded from the study. The period chosen is from 1999 to 2006 due to availability of better quality data for this period.

*Table 1. Summary statistics*

| **Middle-income countries** | | | | | |
|---|---|---|---|---|---|
| Variables | Obs | Mean | Std. Dev. | Min | Max |
| Tertiary | 265 | 1340507 | 2672034 | 175 | 2.34e+07 |
| Inflation | 264 | 9.403652 | 22.45194 | -1.40789 | 293.679 |
| GNI | 280 | 6273.821 | 3285.418 | 1250 | 15300 |
| Openness | 280 | 86.07559 | 39.32073 | 20.22726 | 228.8752 |
| FDI | 280 | 4.67e+09 | 1.04e+10 | -4.55e+09 | 7.91e+10 |
| Popgrowth | 280 | .7256721 | 1.085137 | -1.878577 | 3.24898 |
| Internet | 280 | 10.62591 | 10.85564 | .1057225 | 56.2805 |
| IndVA | 280 | 31.18851 | 7.966804 | 13.71962 | 50.72535 |
| AgrVA | 280 | 11.76436 | 6.419591 | 3.489712 | 41.21941 |
| ServVA | 280 | 57.04787 | 10.0769 | 35.85699 | 81.62109 |
| Urban | 280 | 62.91836 | 15.35313 | 27.48 | 92.1 |
| **Low-income countries** | | | | | |
| Variables | Obs | Mean | Std. Dev. | Min | Max |
| Tertiary | 96 | 151367 | 254868.8 | 3994 | 1053566 |
| Inflation | 89 | 7.919176 | 14.50174 | -8.23784 | 128.419 |
| GNI | 104 | 1058.942 | 483.8276 | 300 | 2410 |
| Openness | 103 | 71.28687 | 35.06411 | 23.53975 | 175.3388 |
| FDI | 104 | 2.07e+08 | 4.93e+08 | -7870000 | 4.27e+09 |
| Popgrowth | 104 | 2.415454 | .8534501 | .7720183 | 4.312322 |
| Internet | 103 | .9575236 | 2.07434 | .0125364 | 12.51902 |
| IndVA | 102 | 23.12899 | 6.840907 | 12.35603 | 47.80788 |
| AgrVA | 102 | 32.17673 | 9.721584 | 12.8946 | 53.71351 |
| ServVA | 102 | 44.69422 | 9.200564 | 23.65231 | 62.13865 |
| Urban | 104 | 25.82596 | 9.238946 | 8.34 | 40.6 |

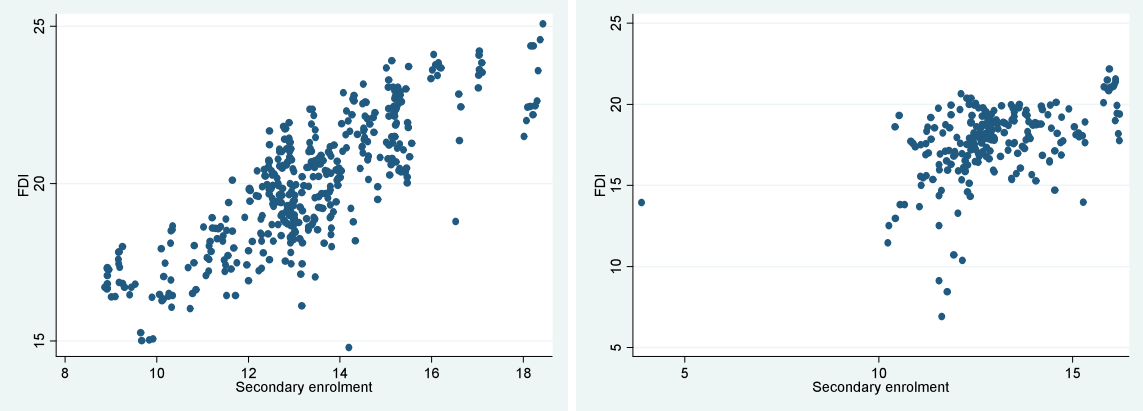
At first sight, the inspection of data gives quite an irregular pattern of relation between FDI inflows and tertiary enrolment (Figure 4). In middle-income countries, it seems that higher FDI inflows are associated with higher enrolment rates although in many cases tertiary enrolment appears stable for very different levels of FDI. In the LICs, the prima facie idea would be that there is almost no connection between FDI and tertiary enrolment, but the tendencies are irregular enough for one not to jump to conclusions.

[3] A list with the countries can be found in APPENDIX 2.


**(a)** **(b)**

**Figure 4 Tertiary enrolment and FDI inflows: (a) middle-income countries; (b) low-income countries**

For secondary education (Figure 5), there appears a more visible positive correlation between FDI inflows and enrolment in the MICs, whereas in the LICs, no clear pattern could be discerned from the graphic representation.




**(a)** **(b)**

**Figure 5 Secondary enrolment and FDI inflows: (a) middle-income countries; (b) low-income countries**

Still, it can not be said whether FDI inflows had a real impact on enrollment attaining a certain level. Even though the data seem to confirm that enrolment rates went up together with FDI inflows in the last decade, it maybe that enrolment grew regardless of accelerating financial liberalization. Especially, in developing countries, market opening and fragile infrastructure might have some counterproductive effects on development. A deeper analysis is needed in order to get more reliable results.

### 4.3 Methodology

A two-stage least squares instrumental variable technique is used in the paper. Given every country has its unique history, culture and socioeconomic environment which affect economic performance, such country-specific factors must be taken into consideration for an analysis to be meaningful. The paper uses a fixed-effect panel data technique in this regard. This technique also allows us to observe time series related dynamic effects. However, the equations have the endogeneity problem due to a bi-directional causality link between enrollment, our dependent variable, and per capita income, a key independent variable. The use of 2SLS IV regressions helps correct for this problem. For this, appropriate instrumental

indicators are required, which represents an important challenge (Temple, 1999; Bloom et al., 2004).

A good instrumental variable (IV) is the one that is correlated with the endogenous independent variable but uncorrelated with the dependent variable. In the first stage, the endogenous variable is regressed on the instrumental variable as well as the exogenous independent variables. In the second stage, the dependent variable is regressed on the usual equation with the endogenous and exogenous variables; however the endogenous variable is replaced by its estimated value from the first stage.

As the effect of foreign investments on higher education enrollment rates can take some time to take its course, we do the regressions using the variable FDI with a lag of one year so as to better gauge this lagged effect. We use only one endogenous variable (per capita GNI) and the urbanisation rate as the unique instrument.

# 5 Results and discussion

## 5.1 Tertiary enrolment

In this section, we estimate the impact of all variables on higher education using the baseline equation:

$$LnTertiary = GNI + Inflation + Openness + LnFDI_{t-1} + Population\ growth + Internet + Agriculture$$

### 5.1.1 Middle-income countries

First, we begin by testing de validity of our instrument. Given that we have only one endogenous regressor and one instrument, we use Shea's partial $R^2$ and the F-statistic given by Stata in the first stage of the 2SLS procedure. The results confirm that the endogenous regressor and the instrument are correlated, even though the correlation is not very strong. Furthermore, the hypothesis of exogeneity of the instrument is strongly accepted: the P-value is 0 and the F-value is much higher than 10. We also conducted the Hausman specification test and found a P-value of 0.08, which means that the choice of 2SLS IV as well as the instrument is a good one.

Data on public expenditure are rather poor and not very reliable due to excess of missing data. This drawback undermines the quality of our initial estimation: most of the explanatory variables in the regression are not statistically significant, especially our variable of interest, the FDIs. Consequently, we ignore public expenditure on education in the subsequent regressions and the results improve considerably, with most of the variables being significant. Considering the sectorwise development of the countries, we begin with agriculture (base case equation) and then, as a robustness check, replace it with industry and services. The results are summarized in Table 2 below:

Table 2 Dependent variable Tertiary enrolment

| Explanatory variables | 1[4] | 2 | 3 |
|---|---|---|---|
| LnGNI | 1.488068*** | 1.668438*** | 1.633196*** |

[4] baseline estimation

| | | | |
|---|---|---|---|
| | (6.13) | (4.76) | (4.86) |
| Inflation | .0004063 | .0018044* | .0014191 |
| | (0.50) | (1.70) | (1.40) |
| Openness | -.0030303** | -.0030092 | -.0039663** |
| | (-2.02) | (-1.65) | (-2.05) |
| L1.LnFDI | -.0320138** | -.0693896*** | -.0650645*** |
| | (-2.53) | (-3.38) | (-3.24) |
| Population growth | -.0305004 | -.1207784** | -.098412** |
| | (-0.89) | (-2.54) | (-2.18) |
| Internet | -.0059361** | -.0095403** | -.0090731** |
| | (-2.00) | (-2.09) | (-2.05) |
| Agriculture value-added | .0405408*** | | |
| | (3.92) | | |
| Industry value-added | | -.0068295 | |
| | | (-1.22) | |
| Services value-added | | | -.0104392** |
| | | | (-2.56) |
| Observations | 214 | 214 | 214 |
| *R*-squared | 0.53 | 0.28 | 0.32 |
| Shea's partial *R*-squared | 0.15 | 0.08 | 0.08 |
| *F*-value | 32.19 | 16.40 | 16.01 |
| *P*-value (joint F) | 0.000 | 0.0001 | 0.0001 |

*** significant at 1%, ** significant at 5%, * significant at 10%

In the baseline regression, all variables are significant at least at 5%, except for inflation and population growth.

*GNI per capita* has a very significant and positive impact on education in all the regressions. It is well-known that higher per capita income raises the demand for human capital and thus, the incentive for higher education.

*Openness and FDIs* seem to have a negative impact on tertiary enrollment, which may be linked with the exponential growth of foreign private capital inflows and international trade in the period between the 1997-98 East Asian crisis and 2006. In his very provocative book, Globalization and its discontents (2002), Joseph Stiglitz discusses the impact of trade and financial openness on the economies of developing countries and the role of international financial institutions, such as IMF and the World Bank. It clearly appears that opening up a country which is not ready to compete in international markets may have disastrous effects for the country. Lack of the proper financial structure, as it is the case in many developing countries, weakens the economy, having strong negative impacts on individual incomes and education decisions.
On the other hand, during our study period, plenty of FDIs were vertical: as trade barriers came down and financial controls relaxed, multinational corporations sought to take advantage of abundant low cost and low skilled labour force available in developing countries. This created a strong incentive for individuals to enter the labour market as soon as possible, thus giving up higher education. Furthermore, the impact of FDIs on education enrolment should also depend on whether these are greenfield or brownfield projects. A greenfield project takes a long time before it can get to have its impact felt on the demand for human capital accumulation and thus, on higher education. As for brownfield projects, it is obvious that its impact on higher education should be rather limited, given that it is mainly about renting cheap labour, with some training on the job with foreign expatriates, which does not necessarily effect higher education demand and enrolment.

*Internet* shows negative effects on tertiary enrolment. Its use is still not that widespread in many developing countries. However, there is a growing demand for its use as a means of improving educational techniques, especially in the universities. In a first stage, given the high costs of constructing the necessary infrastructure, this puts some strain on the accessibility and affordability of higher education. It takes a longer time to reap the benefits of Internet (e.g lower education costs through cheap access to huge quantities of educational materials, distant education etc) than the short period under study.

Finally, *agriculture* has a positive impact. Many developing countries are essentially agricultural and have applied development models based on this primary income source. In India for instance, even though services, especially banking, and information technology have strongly developed in recent years, this middle-income country remains primarily an agrarian one. Today, modern agriculture is more and more technology-based, thus requiring better knowledge, and consequently, education at all levels, especially higher education has a great role to play. In this perspective, growth in a countries' agricultural sector enhances the demand for higher education and consequently, the incentive to achieve it.

When using industry value added as a proxy for the sectorwise development, some slight changes appear in the results.
Inflation and population growth become statistically significant, while openness and industry are not significant. We selected inflation as a general proxy for the countries' economic management and sociopolitical stability, so we expected a rather negative relation between inflation and higher education. However, in our sample of MICs, inflation appears to have a positive impact on tertiary enrolment, indicating that in the considered period, education enrolment has grown inspite of inflation. It may be noted that during the period 1999-2006, many MICs experienced benign inflation: inflation saw a gradual decline or at least remained stable in many developing countries. The effects of higher prices on tertiary enrollment may not be evident at levels below 20 percent, even in countries with expensive higher education systems, often in the hands of the private sector.

Even though inflation is not always found to be significant in our estimations, it nevertheless has an important impact on the quality of the regression as a whole as well as on the significance of each variable: the R-sq improves considerably (sometimes, its value may even double), while the significance lowers for some variables and increases for others. Generally, inflation lowers the significance of FDI, our variable of interest. This behaviour of the inflation variable may indicate that the direct link between higher education and price level may not be evident, but inflation does affect the tertiary enrolment rate through other means.

As for population growth, which has a negative impact on tertiary enrolment in our study, its negative impact on income and, more generally, on welfare has been emphasized in the literature, especially during the latter stages of development. As mentioned above, this directly affects education decisions.

We get more robust results when we use services value added as a proxy for sector development. The only variable that changes significance is population growth. If it had no impact in the baseline estimation, now it has a significant negative impact on tertiary enrolment. We think it might affect tertiary enrolment through its negative impact on incomes.

Services such as the information technology, telecommunication and financial services are human capital and skill intensive, and their growth should increase people's incentives to further pursue education. However, these incentives do materialize with some lag, which our short studied period does not properly catch.

### 5.1.2 Low-income countries

The results for lower income countries are quite similar to the ones regarding MICs (Table 3 below). Regarding the instrument validity test, the results are better than for the MICs, both Shea's partial R-squared and the F-value are very high.

Table 3 Dependent variable Tertiary enrolment

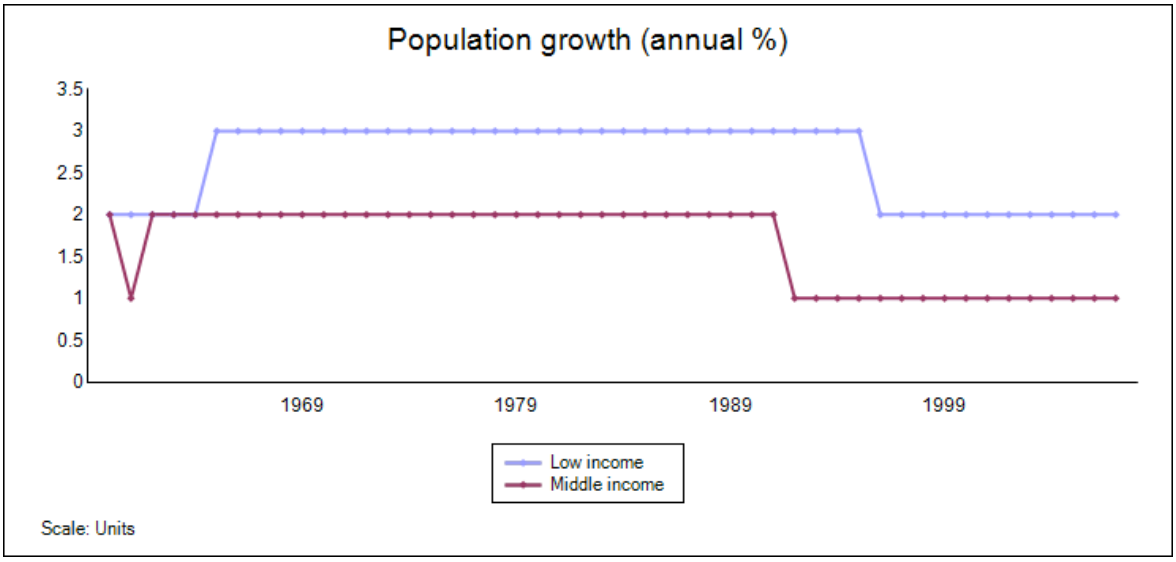
| Explanatory variables | 1[5] | 2 | 3 |
|---|---|---|---|
| LnGNI | 2.524059*** | 2.755357*** | 2.768078*** |
| | (7.95) | (9.03) | (9.22) |
| Inflation | 0.0062882 | 0.0058166 | .005657 |
| | (1.30) | (1.15) | (1.12) |
| Openness | -.0066389** | -.0063584* | -.005483 |
| | (-2.05) | (-1.86) | (-1.63) |
| L1.LnFDI | -.0545427*** | -.0510071** | -.049066** |
| | (-2.77) | (-2.49) | (-2.40) |
| Population growth | .3977932*** | .4203997*** | .4042242*** |
| | (3.45) | (3.48) | (3.31) |
| Internet | -.0134196 | -.0086462 | -.0196152 |
| | (-0.75) | (-0.44) | (-0.93) |
| Agriculture value-added | -.0203317* | | |
| | (-1.80) | | |
| Industry value-added | | -.0070151 | |
| | | (0.80) | |
| Services value-added | | | .0080679 |
| | | | (0.63) |
| Observations | 70 | 70 | 70 |
| *R*-squared | 0.89 | 0.89 | 0.65 |
| Shea's partial *R*-squared | 0.76 | 0.66 | 0.80 |
| *F*-value | 167.71 | 197.62 | 210.51 |
| *P*-value (joint F) | 0.0000 | 0.0000 | 0.0000 |

*** significant at 1%, ** significant at 5%, * significant at 10%

In the baseline estimation, all variables are statistically significant, except for inflation and internet usage. Agriculture is significant at only 10%, while all the other variables are significant at least at 5%. Again, most of the variables have similar impacts as those for the MICs. GNI per capita and population growth have a positive impact on education, whereas FDI, openness and agriculture are found to have a negative influence on tertiary enrolment. Regarding the impact of population growth on tertiary enrolment, the result is somewhat surprising, but can be explained through the mechanism of demographic transition. The passage to a low fertility rate in the MICs began earlier than in the LICs (Figure 6) and, given that it takes several years for an individual to get into higher education, the benefits of the transition do not fully actualize before twenty years.

[5] baseline estimation

So, unlike the MICs, which are nearing the demographic phase of developed countries, where the decrease of the fertility rate and population growth brings higher revenues and better access to education, in the LICs, such benefits of the decrease of the fertility have yet to bear fruit. Accordingly, in the short term, the slowing down of population growth may only reveal its cost in the form of slower economic activity, while the beneficial effects may be further down the line. Furthermore, many MICs are nowadays enjoying the demographic dividend[6], with plentiful of working-age labour force, something many LICs will achieve in a decade or later.




*Source : World Bank*

**Figure 6. Demographic transition on low and middle income countries**

The negative effect of agricultural value-added over the growth of tertiary education in the LICs, as opposed to the positive impact in the MICs, requires an economic explanation. It may be linked to the structural changes taking place in the developing economies: a gradual rise in importance of the services and industrial sector among the low-income developing countries, along with a concomitant decline in the share of agriculture sector in the economy. This may no more be the case in the MICs, several of whom have already a productive, mechanized agricultural sector[7] and have thus benefited from a steep rise in agricultural prices in the recent years, particularly towards the end of the studied period[8]. Checking for sector robustness, we found even stronger results than those for the MICs. The only changes we get are that trade openness becomes insignificant with services as the sectoral control variable and the sectoral proxies (industry and services) are not significant.

### 5.2 Secondary enrolment

The baseline equation is given as:

$$LnSecondary = GNI + Inflation + Openness + LnFDI_{t-1} + Population\ growth + Internet + Agriculture$$

Regarding secondary enrolment, estimations are generally of poor quality, especially for the MICs. The R-sq value is higher for the LICs compared to the MICs estimations and more

[6] See Bloom et al. (2007) for further details on the phenomenon.
[7] Brazil, Thailand and Argentina can be considered examples of this group.
[8] In real terms, prices jumped by 75 percent from 2005 to 2007 (The Economist, 12 December 2007).

variables are found significant. However, our variable of interest, the FDI, does not have a significant impact on secondary enrolment in the LICs and has a weak one in the MICs. A summary of the results may be found in Appendix 4, for both groups of countries.

In the base case for middle-income countries, all variables are statistically significant, except for inflation, openness and FDI. They are significant at 1%, except for population growth, which is significant at 5%.
When tested for sector robustness, FDI becomes significant with industry and also with services, but only at 10%. GNI per capita and internet are always significant at 1%, while the significance of population growth goes up from 5% to 1% for both proxies for sectorwise development, industry and services.
GNI per capita and agriculture have a very significant positive impact on secondary enrolment, just like in the case of tertiary education. The relation between FDI and secondary education also remains negative. This signals the existance of similar economic forces (as discussed above) in both the LICs and the MICs leading the foreign investments slightly away from the growth pattern of secondary and tertiary education.

In the baseline estimation for the LICs, all variables are significant, except for inflation, FDIs and population growth. Openness is significant at 5% and agriculture at 10%, while the other variables are significant at 1%. When checked for sector robustness, we get very robust results. All variables remain significant or non-significant, as they were in the base case. However, openness becomes much less significant using industry and much more significant when using services. As for the sectors, services are found significant at 10%, while industry is significant at 1%.

The per capita income has a positive relation with secondary education, as in all the earlier estimations. Trade openness remains negatively associated, also like the preceding estimations. However, the effect of the agricultural value-added on secondary enrollment is positive in the LICs, in contrast with a negative effect on higher education, showing that secondary and tertiary education do not evolve in the same way in the LICs in response to sectoral changes in the economy. The reason might be rudimentary and low productivity agriculture (low skilled labour intensive) combined with a low quality education system. A large agricultural sector which uses mostly low skilled labour will definitely have a positive impact on secondary education and a negative impact on tertiary education, as there is little additional demand for highly qualified labor. On the contrary, in the MICs, the evolution of education enrolment with regard to agriculture is the same for both levels of education. This might be because in these countries, modern agriculture also combines higher skill levels. Thus, the higher the agricultural production, the higher the demand for skilled labour, which can be provided by secondary as well as tertiary education.

A fall in the share of agricultural sector in the national income and a corresponding rise in industrial and services sectors may demand a higher share of highly educated population, while for low-skill incentive tasks, secondary enrolment may still not be a requirement. We find GNI per capita to have a strong impact throughout our study, while many variables have small coefficients, meaning that their impact on the education growth is at best marginal.

# 6 Conclusion

To sum up, this empirical study investigated the determinants of tertiary and secondary education for the period 1999 to 2006, with a special focus on FDIs and economic growth. The paper contributes to the literature by analyzing two samples of low-income and middle-income developing countries (as defined by the World Bank) using the most recent available reliable data published by UNESCO. This helps avoid the pitfalls of studying together countries at disparate levels of economic development.

We find a rather weak, but statistically significant negative impact of FDIs on tertiary as well as secondary education. A 1% increase in FDI inflows may cause between 0.032% and 0.069% decrease in tertiary education enrolment or between 0.025% and 0.018% decrease in secondary enrolment in the MICs. In the case of the LICs, a 1% rise in FDI inflows may lead to only about 0.05% reduction in tertiary enrolment.

Possible causes suggested for these results include the premature liberalization of trade and financial sectors, in the absence of appropriate infrastructure and institutions that may provide the requisite social safety net in an environment of increased volatility, as well as the short period examined, suggesting that there are some short term adjustment costs 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 GNI is found to have a very strong positive impact on both levels of education in both groups of countries. However, it seems that the importance of GNI in the evolution of education enrollment is much higher in the LICs than in the MICs. In the former, a 1% increase in per capita GNI may lead to an increase of about 2.8% in both levels of school enrolment, while in the latter, the corresponding figure is about 1.3% on average. Finally, several variables have similar impacts on education growth, regardless of the sample of countries used or the level of education analyzed. However, some important differences have been identified between the MICs and the LICs (for instance, the role of population growth and agricultural sector in the two groups of countries does not appear to be the same), suggesting that the level of development has definitely an impact, at least in the short term, on the evolution of various macroeconomic indicators.
Accordingly, instead of the one size fits all approach followed by the international financial institutions, national and regional development policies need to be tailor-made to take into account the countries' specific level of human capital and economic development.

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APPENDIX 1

**Tertiary enrolment**

| Low-income countries | Middle-income countries |
|---|---|
| Bangladesh | Argentina |
| Benin | Armenia |
| Burundi | Belarus |
| Cambodia | Bolivia |
| Eritrea | Brazil |
| Ethiopia | Bulgaria |
| Kyrgyz Rep | Chile |
| Lao PDR | China |
| Madagascar | Colombia |
| Mali | Costa Rica |
| Mauritania | Croatia |
| Pakistan | Djibouti |
| Tajikistan | El Salvador |
| | Georgia |
| | India |
| | Indonesia |
| | Kazakhstan |
| | Latvia |
| | Lebanon |
| | Lithuania |
| | Malaysia |
| | Mauritius |
| | Mexico |
| | Moldova |
| | Mongolia |
| | Morocco |
| | Panama |
| | Paraguay |
| | Philippines |
| | Poland |
| | Romania |
| | Thailand |
| | Turkey |
| | Ukraine |
| | Uruguay |

APPENDIX 2

**Secondary enrolment**

| Low-income countries | Middle-income countries |
|---|---|
| Bangladesh | Albania |
| Benin | Algeria |
| Burkina Faso | Argentina |
| Burundi | Belarus |
| Cambodia | Belize |
| Central African Republic | Bolivia |
| Chad | Botswana |
| Comoros | Brazil |
| Eritrea | Bulgaria |
| Ethiopia | Cameroon |
| Gambia | Cape Verde |
| Ghana | Chile |
| Guinea | China |
| Kenya | Colombia |
| Kyrgyz Republic | Congo |
| Lao PDR | Costa Rica |
| Madagascar | Croatia |
| Mauritania | Djibouti |
| Mozambique | Dominica |
| Nepal | Dominican Republic |
| Niger | Ecuador |
| Pakistan | El Salvador |
| Rwanda | Fiji |
| Senegal | Georgia |
| Tajikistan | Guatemala |
| Tanzania | Guyana |
| Togo | India |
| Uganda | Indonesia |
| Uzbekistan | Jordan |
| Vietnam | Kazakhstan |
| Yemen | Latvia |
| Zambia | Lebanon |
| | Lesotho |
| | Lithuania |
| | Macedonia |
| | Malaysia |
| | Maldives |
| | Mauritius |
| | Mexico |
| | Moldova |
| | Mongolia |
| | Morocco |
| | Nicaragua |
| | Panama |
| | Paraguay |
| | Poland |
| | Romania |
| | Serbia |
| | South Africa |
| | St. Vincent and the Grenadines |
| | Sudan |
| | Thailand |
| | Tunisia |
| | Turkey |
| | Ukraine |
| | Uruguay |
| | Vanuatu |

APPENDIX 3

*Table 1. Summary statistics*

| **Middle-income countries** | | | | | |
|---|---|---|---|---|---|
| Variables | Obs | Mean | Std. Dev. | Min | Max |
| Secondary | 421 | 4191015 | 1.41e+07 | 7126 | 1.01e+08 |
| Inflation | 440 | 8.32772 | 19.34452 | -9.61615 | 293.679 |
| GNI | 456 | 5559.364 | 3055.579 | 1000 | 15300 |
| Openness | 448 | 89.69736 | 40.03836 | 20.22726 | 228.8752 |
| FDI | 456 | 3.05e+09 | 8.41e+09 | -4.55e+09 | 7.91e+10 |
| Popgrowth | 456 | .9988991 | 1.057933 | -1.878577 | 3.24898 |
| Internet | 450 | 8.808366 | 9.726959 | .009202 | 56.2805 |
| IndVA | 440 | 30.77376 | 10.37693 | 8.612013 | 72.15267 |
| AgrVA | 440 | 12.58888 | 7.545887 | 1.873824 | 45.22711 |
| ServVA | 440 | 56.63656 | 11.07071 | 22.54308 | 81.62109 |
| Urban | 448 | 58.14888 | 16.74382 | 17.72 | 92.1 |
| **Low-income countries** | | | | | |
| Variables | Obs | Mean | Std. Dev. | Min | Max |
| Secondary | 241 | 1312406 | 2432875 | 49 | 1.11e+07 |
| Inflation | 225 | 7.162129 | 10.60579 | -8.23784 | 128.419 |
| GNI | 264 | 1031.78 | 431.8898 | 300 | 2410 |
| Openness | 257 | 66.16274 | 30.39173 | 23.53975 | 175.3388 |
| FDI | 264 | 2.00e+08 | 4.28e+08 | -3.08e+08 | 4.27e+09 |
| Popgrowth | 264 | 2.491565 | .896331 | .1552043 | 8.784943 |
| Internet | 263 | 1.168657 | 2.141604 | .0122407 | 17.45823 |
| IndVA | 254 | 22.83083 | 8.098136 | 10.99472 | 54.81597 |
| AgrVA | 254 | 32.68909 | 10.25733 | 10.30883 | 56.78791 |
| ServVA | 254 | 44.31663 | 8.188773 | 23.65231 | 62.13865 |
| Urban | 264 | 27.86045 | 10.41084 | 8.34 | 54.74 |

# APPENDIX 4

Table 1 MICs Dependent variable Secondary enrolment

| Explanatory variables | 1[9] | 2 | 3 |
|---|---|---|---|
| LnGNI | 1.102604*** | 0.9837092*** | 1.027756*** |
| | (4.97) | (5.06) | (4.98) |
| Inflation | -2.13e-06 | .0006164 | .0004674 |
| | (-0.00) | (0.72) | (0.55) |
| Openness | -.0010331 | -.0013262 | -.0019826 |
| | (-0.81) | (-1.00) | (-1.43) |
| L1.LnFDI | -.0180761 | -.0261916* | -.0257642* |
| | (-1.35) | (-1.87) | (-1.84) |
| Population growth | -.0724158** | -.1032055*** | -.0988354*** |
| | (-2.03) | (-3.03) | (-2.87) |
| Internet | -.0130647*** | -.0121623*** | -.012576*** |
| | (-4.17) | (-4.13) | (-4.12) |
| Agriculture value-added | .0234133*** | | |
| | (3.03) | | |
| Industry value-added | | -.0023519 | |
| | | (-0.62) | |
| Services value-added | | | -.0065815* |
| | | | (-1.70) |
| Observations | 329 | 329 | 329 |
| *R*-squared | -0.29 | -0.27 | 0.32 |
| Shea's partial *R*-squared | 0.24 | 0.25 | 0.24 |
| *F*-value | 89.37 | 92.26 | 87.27 |
| *P*-value (joint F) | 0.0000 | 0.0000 | 0.0000 |

Table 2 LICs Dependent variable Secondary enrolment

| Explanatory variables | 1 | 2 | 3 |
|---|---|---|---|
| LnGNI | 2.833672*** | 2.949984*** | 2.880458*** |
| | (8.58) | (8.66) | (8.70) |
| Inflation | 0.0014993 | 0.0005712 | .00128 |
| | (0.33) | (0.12) | (0.28) |
| Openness | -.0061829** | -.00569** | -.0070309** |
| | (-2.27) | (-2.1) | (-2.56) |
| L1.LnFDI | -.0257125 | -.025149 | -.0316596 |
| | (-1.27) | (-1.25) | (-1.56) |
| Population growth | .071517 | .06199 | .0760993 |
| | (1.26) | (1.11) | (1.33) |
| Internet | -.0448361*** | -.0535647*** | -.0530799*** |
| | (-2.97) | (-3.4) | (-3.33) |
| Agriculture value-added | .0157943*** | | |
| | (1.89) | | |
| Industry value-added | | -.0161635*** | |
| | | (-2.72) | |
| Services value-added | | | .0142587*** |
| | | | (1.92) |
| Observations | 163 | 163 | 163 |
| *R*-squared | 0.40 | 0.40 | 0.39 |
| Shea's partial *R*-squared | 0.57 | 0.54 | 0.54 |
| *F*-value | 171.89 | 156.19 | 154.87 |
| *P*-value (joint F) | 0.0000 | 0.0000 | 0.0000 |

[9] baseline estimation