THE EFFECTS OF FOREIGN DIRECT INVESTMENT ON THE ACCUMULATION OF HUMAN CAPITAL IN DEVELOPING COUNTRIES: ARE THERE IMPLICATIONS FOR FUTURE GROWTH?

By

Dexter Gittens
BA, University of the West Indies, 1989
MA, Hunter College, 1996

DISSERTATION
SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
IN THE DEPARTMENT OF ECONOMICS
AT FORDHAM UNIVERSITY

NEW YORK

JANUARY, 2006

UMI Number: 3216910

FORDHAM UNIVERSTIY

Graduate School of Arts & Sciences

Date January 30, 2006

This dissertation prepared under my direction by:

Dexter Gittens

entitled "The Effects of Foreign Direct Investment on the Accumulation of Human Capital in Developing Countries: Are There Implications for Future Growth?"

Has been accepted in partial fulfillment of the requirements for the Degree of

Doctor of Philosophy

in the Department of

ECONOMICS

MENTOR

READER

READER

Acknowledgement:

This research is dedicated to the memory of my dear parents Mr. and Mrs. Victor and Ena Gittens. They taught me a lot about commitment and perseverance.

I would like to thank my wife Ann, and my two daughters Lashon and Ashley for their understanding throughout the process of my education.

I would like to thank my mentor Professor Dominick Salvatore for his kindness, professionalism, and commitment towards my objects.

Finally, I would like to thank the other members of my committee, Professor Cornell and Professor Alexander for their efforts in seeing me through this process.

		Page no.
	Title	
	Acknowledgements	i
	Tables of Contents	ii
I	Introduction	1-2
II	Review of the Literature	3-13
III	Human Capital: Empirical and measurement Issues	14-22
IV	Foundations for the Analysis of FDI and Human Capital Accumulation	23-32
V	Theoretical Foundations of the Empirical Model	33-40
VI	The Empirical Model	41-44
VII	Limitations of Research	45
VIII	Selection of Variables	46-49
IX	Regression Results	50-59
X	Additional Test of Robustness	60-64
XI	Conclusions	65-66
XII	Bibliography	67-72
XIII	Appendices	73-95
XIV	Abstract	
XV	Vita	

I) Introduction

This research will attempt to contribute to the literature on growth and development by investigating the effects of Foreign Direct Investment (FDI), on the accumulation of human capital in developing countries. My interest in this topic is based on the following events. First, the literature tells us that there has been a surge in FDI inflows to developing countries in recent decades This phenomena began in the early 1980's due in part to the debt crisis of the 1970's, and the subsequent reduction in official and other private capital inflows into developing countries. These events were followed by the easing of restrictions on the operations of transnational corporation, and the increase in the free market operations of the global economies, (Globalization). Thus for developing countries FDI became an important source of funding. Secondly, empirical evidence suggests that FDI may be the leading conduit by which technological advancements are made in developing countries. A threshold level of human capital is required for technological transfers and spillovers from FDI activities to take place. However, there is evidence in the literature which suggests that most developing countries have reached or are close to the threshold level, but evidence on spillovers is inconclusive. Third, there is evidence in the literature which suggest that human capital plays an important part in the growth and development of lesser developed countries. Even though there is disagreement in the empirical findings as to the exact relationship between human capital, and economic growth, there is still an abundance of evidence which suggest some positive impact between these variables. Finally, it has been suggested that FDI and human capital levels may have a dynamic non-linear connection whereby the type and level of human capital dictates the type of FDI inflows.

Subsequently, FDI inflows will lead to technological advances and growth which in turn spurs human capital accumulation.

There is a noticeable lack of empirical findings in the literature on the impact of FDI on the accumulation of human capital in developing countries. The event of globalization and the increasing inflows of FDI to developing countries create a potential for technology transfers and spillovers which suggest a potential for future growth of human capital, and output. In fact, Monge-Naranjo (2002) suggest that we should look for the effects of FDI on the host economy in their implications for human capital of future workers, and not the productivity of contemporaneous local firms, (p.2). This paper will contribute to the literature on human capital, FDI, and economic growth by examining the impact of FDI on the accumulation of human capital in developing countries.

II) <u>REVIEW OF THE LITERATURE</u>.

Globalization

Globalization is the growing integration of economies and societies around the world. There have been three episodes of globalization cited in the literature in modern times, (World Bank, 2002). The first episode occurred between 1870-1915. The second episode occurred between 1945-1980. The third wave, which started in 1980 and continues to this present time, came about due to the reduction of transportation cost, lower trade barriers, faster communication of ideas, rising capital flows, and the intensifying pressure for migration, (World Bank, 2002). What makes this present wave of globalization different is that more developing countries have broken into the world markets for manufactured goods and services. Manufactured exports from developing countries rose from about 25 percent in 1980 to more than 80 percent in 2002, (World Bank, 2002). Another distinguishing characteristic of this present wave of globalization is the ongoing rise in Foreign Direct Investment, (FDI), (M. Slaughter, 2002; World Bank, 2002). UNCTAD (2000), reports that from 1997 to 1999 the ratio of world FDI stock to world gross domestic product rose from 5 percent to 16 percent and the ratio of world FDI inflows to global gross domestic formation rose from 2 percent to 14 percent. During the period 1980 to 1997 global FDI outflows increased at an average rate of about 13 percent a year, (Mallapally and Sauvant, 1999), In 1998 global FDI inflows increased for the seventh consecutive year, and outflows for the third consecutive year to reach some $ US 430-440 billion, (Mallapally and Sauvant, 1999).

The share of developing countries in world FDI inflows has increased. Between 1991 and 1997 their world FDI inflows have exceeded their share in world imports and exports, (UNCTAD, 1999). Developing countries' share in total FDI inflows rose from 23 percent in 1980 to 37 percent in 1997, and their share in total outflows rose from 3 percent in 1980 to 14 percent in 1997, (Mallampally and Sauvant, 1999). Therefore, developing countries as a group play a more important role in world inward FDI inflows than as participants in world trade, (UNCTAD, 1999).

The increase in FDI inflows was experienced throughout the developing world and, not just in specific areas, but the most striking feature has been the sharp decline in the share of the primary goods sector (Miyamoto, 2003). The share of the primary goods has more than halved between 1988 and 1997. The share of the services sector in mergers and acquisitions in the year 2000 was more than twice the sum of the primary and manufacturing sectors (World Bank, 2002).However, the African region appears to go against the overall developing country trends. The share of the primary goods sector remains high and constant while the share of services is diminishing. This is due to the fact that a large number of multi-national firms (MNF) operating in Africa are still attracted by the abundance of natural resources rather than the market or host – country investment climate (Miyamoto, 2003). Flow of FDI to Latin America has increased from U.S. $ 7.2 billion in the early 1990's to U.S. $ 66.5 billion in 1999, which is just under 97 percent of net private capital inflows in 1999, (Hausman, 2000).

FDI, technology transfer and economic growth

Many authors contend that FDI is a major avenue for the transfer of technology from the leading countries to the follower countries, and that this has positive consequences for future growth in income, (see for example, Xu (2000), Benhabib and

Speigel (1994), and Borensztein, De Gregorio, and Lee (1998)). Crafts (2000) argues that economic historians have long cited the profitability of using technology developed in the leader countries in potential follower countries with different factor endowments and demand elasticities. This he calls technological congruence. However according to Blomstrom, Globerman, and Kokko (1999), technology is embodied not only in machinery, equipment, patent rights, and expatriate managers and technicians, but also in the human capital of the affiliate's local employees. These employees may acquire much of their human capital through direct and indirect training received while working for foreign affiliates. Blomstrom, Globerman, and Kokko (1999) further contend that the training supplied to host country employees working for foreign owned firms could affect most levels of employees - from manufacturing operatives through supervisors to advanced professionals and top level managers. The various skills gained while working for foreign owned affiliates may in turn generate spillover benefits for the host economy. This process takes place as employees migrate to domestically owned firms .These employees in turn use the knowledge and skills gained through training to enhance their productivity in other organizations, or start their own business. Authors such as Lucas (1988), Arrow (1962), and Romer (1986, 87, 90) also recognized the generation of human capital accumulation through the process of learning by doing. Lucas (1988) called this specialized capital. The capital accumulated through schooling he simply called Human capital.

However, many studies produce conflicting results between the transfer of technology and spillovers from foreign owned firms to domestic owned firms. For example while Blomstrom (1986), finds that in Mexico, sectors with a higher degree of foreign ownership grow faster, Aitken and Harrison (1999), find no such evidence of positive technology spillover to domestically owned firms from foreign owned firms.

FDI is a key ingredient in economic growth. It can impact the host economy in a variety of ways. First it adds to capital formation. Second it transfers technology, skills, innovative capacity, and organizational and managerial practices from rich t to poor countries. Thirdly it helps lesser countries access international markets (Mallampally and Sauvant, 1999). All these avenues have a positive effect on growth and development.

The literature is rife with evidence on the effects of FDI on economic growth[1]. The general consensus is that FDI has a positive impact on economic growth in developing countries. The economic rational is that FDI produces externalities in the form of technology transfers and spillovers which improves productivity and growth,(Carkovic and Levine 2002).

However, additional studies seem to suggest that FDI has no independent effect on economic growth. Such results can be found in Haddad and Harrison (1993), Mansfield and Romeo (1980), and Carkovic and Levine (2002). But Carkovic and Levine (2002) conclude that depending on the econometric specification of the model FDI will have a positive impact on growth.

Human capital in the modern economy.

In this research I will follow the definition of De La Fuente and Ciccone (2000) and define human capital as "the knowledge and skills embodied in humans that are

[1] De Mello (1997) gives a survey on the relationship between FDI and economic growth in developing countries.

acquired through schooling, training and experience, and are useful in the production of goods, services, and further knowledge". Generally, the literature suggests that the theoretical connection between human capital and growth is based on three premises, (De La Fuente and Ciccone, 2000). First, educated workers are more productive with any given level of technology. Second, educated workers are better at developing and implementing new technology. Third, externalities due to educated workers are important to overall technology spillover,

Human capital accumulation has long been considered an important factor in economic growth and development, and today it is widely agreed that human capital development is the key factor underpinning a country's effort for economic and social development, (Benhabib and Spiegel, 1994). Lucas (1988) has argued that human capital is an input into the production process like any other productive factor. He contends that the accumulation of human capital implies capital deepening, which leads to a period of accelerated growth towards a new steady state growth path. Lucas (1988) along with other researchers expanded the definition of capital in the neoclassical growth model to include human capital. In fact, Cohen and Soto, (2001), state that human capital is the most important productive factor in modern times. They site the increasing need for nations and individuals to invest heavily on their human capital because machines and capital are increasingly being substituted for what used to be the "raw force of labor".

The idea that human capital externalities could generate sustained growth over the long run has been a critical feature of the "New Growth"[2] literature following the work of economists like Romer (1986), Lucas (1988), and Robelo (1991). These growth theories argued that long term growth was determined by forces within the analysis, for

[2] New Growth Theories generally refers to theories relating to endogenous growth.

example government policies. There were no diminishing returns to a broadened concept of capital that included human capital. For instance, Lucas (1988) focused on human capital as a productive input that generated externalities which eliminated decreasing returns other productive inputs. The accumulation of human capital became the important variable in Lucas' (1988) model. Romer (1986) also argued that Investments in knowledge, for example research and development, education, and training and development, may generate externalities that prevent diminishing returns to scale for labor and physical capital.

Subsequent models of endogenous growth argued how technological progress generated by the discovery of new ideas was the only way to avoid diminishing returns in the long run. Economists have long argued that technical progress or more generally knowledge creation is the major determinant of economic growth. Thus, other researchers, for example, Romer (1990), and Aghion and Howitt (1992) went further than previous models in assuming that human capital is necessary for the discovery of new technology and thus its stock is permanently related to the growth rate of output. These new growth theories are largely built on the accumulation of knowledge, which is to some extent viewed as a public good, (Romer, 1990, and Aghion and Howitt 1992). These subsequent endogenous growth models highlighted the importance of education in growth theories by arguing that education created human capital which directly affects knowledge accumulation and therefore productivity growth (Blomstrom and Kokko, 2001, Gemmell, 1996).

Human capital in models of economic growth

Human capital can be introduced into models of economic growth as an input into the production function with or without externalities. Human capital can also be modeled as a determinant of technological progress. It has been argued that the main contribution of the recent growth theories is to endogenize the underlying source of per capita income growth, namely the accumulation of knowledge or technological advances. Technological advances can be made via formal education, on-the-job training, scientific research, learning by doing, process innovations, and product innovations, (Aghion and Hewitt, 1992, p.323).

Mankiw, Romer, and Weil (1992), extended the Solow model by including human capital as an input into the production function, and solving for the equilibrium growth rate within the context of the Solow Model. This model is called the augmented Solow Model. In this model there are no externalities to human capital, that is, the benefits of human capital to a firm does not spill over to other firms. However, they argued the level of human capital can be replaced by the human capital investment rate in the model. Thus, Mankiw, Romer, and Weil (1992) provide a link between educational expenditure and economic growth.

Lucas (1988) also models human capital as an input into the production function analogous to the augmented Solow model. However, Lucas, (1988), modeled human capital as having both an internal effect and an external effect. The internal effect relates to human capital's role in eliminating diminishing returns. The external effect is when the average level of human capital in the economy affects a firms output, but when that firm addresses its' profit-maximizing decisions it does not take this into account. Human capital is seen as an alternative source to technological progress, for sustained economic growth, (Lucas, 1988). He concluded that the differences in growth rates across countries are due to the differences in the rates at which countries accumulate human capital over time. Sala-i-Martin(1996) also used Lucas' (1988) version of the augmented Solow model to further disaggregated Lucas' external effects into intra-firm and inter-firm externalities. The intra-firm effect captures the effects that educated workers have on other workers with the firm. The inter-firm externality captures the effect the average level of human capital has on the economy as a whole.

In the models mentioned above Human capital improves the productivity of labor inputs in production. However, a branch of growth theory has focused on endogenizing technological progress via the impact of human capital on knowledge creation. An important feature of these models is that knowledge is a public good which generates international, inter-regional, inter-temporal, or inter-sectoral externalities, (Gemmell, 1996).

Romer (1990) constructs a model whereby investments in research and development generates new goods/designs which in turn leads to investments in physical capital and thus growth. Externalities arise because these new goods/designs may be used as intermediaries elsewhere in the economy thus providing the avenue for knowledge accumulation economy wide. The creation of these new goods/designs depends on the stock, as well as growth of human capital.

Aghion and Hewett (1992) developed an endogenous growth model in which knowledge is accumulated via vertical integration. Innovations create new intermediate goods which improves the productivity of final goods output, while making obsolete old innovations. This they called creative destruction. Growth results exclusively from technological progress due to competition among firms that generate innovations. This competition is motivated by monopoly profits for the innovators. The average and the variance of the growth rates are increasing functions of the size of the innovations, the size of the skilled labor force, and the productivity of the labor force, (Aghion and Howitt, 1992, p.323).

Jones (1996) proposed a model similar to Mankiw, Romer, and Weil's (1992) model. However Jones' (1996) model incorporates human capital both as an input into the production function and as an input into the creation of new ideas, (that is, new intermediate goods). Investment in education is therefore important to the development of intermediate goods. Final goods output depends on the ability of workers to use these new ideas, however, ideas are modeled as partly non-rivalrous because once new ideas are created it spills over to other firms but these firms must now invest in education in order to be able to apply these new ideas. Jones (1996) further argues that the productivity of skilled labor depends on the existing stock of ideas, and thus the productivity of future workers benefit from the skill acquired by current workers due to the production of new ideas. Therefore, knowledge in Jones' (1996) model has an inter-temporal spillover aspect to it, (Gemmell, 1996).

Barro (1991) models human capital as having international externalities. He argues that technologically backward countries may be able to catch-up on "best practice" technology if they have a larger stock of educated workers. Therefore, higher levels of human capital can improve productivity and thus economic growth. This happens because higher levels of education facilitate the absorption of foreign technology thus reducing the "knowledge gap" between the technology "leading" and technology "lagging" countries.

The importance of technological progress to economic growth is recognized in both the neoclassical and endogenous growth models. However due to the effects of diminishing returns to the factors of production within the Solow model, long run growth was left to exogenous technological advances, that is, the model could not explain sustained growth in output. The new growth models sort to address this issue by endogenizing technological progress. Within this context the importance of human capital was of paramount importance. Education, (that is, human capital) was seen as the foundation of knowledge creation which is the basis for the advancement of technology. An important feature of these models is that knowledge is a public good which can generate international, inter-regional, inter-sectoral, or inter-temporal externalities which counter the effects of the diminishing returns to physical capital and labor. However an adequate level of education is needed to generate and absorb this new technology.

Part III of this research will examine the problems encountered by researchers when doing analyses on human capital and economic growth. This section will examine both the empirical issues and the measurement issues pertaining to human capital. Part IV looks at factors that may lead to a dynamic relationship between FDI and human capital accumulation. Part V develops the theoretical model. The theoretical works of Galor and Tsiddon (1997) and Monge-Naranjo (2002) will be used to examine our hypothesis. Part VI develops the empirical model. The principal estimator will be the first difference GMM estimator. Part VII will examine the limitations of this research. Part VIII will explain the reasons for the selection of our explanatory variables. Part IX will look at the regression results. Part X will analyze various regressions using various measures of schooling and different explanatory variables to test the robustness of the previous results. Finally, Part XI will give a summary of the results and the policy implications of our analysis.

III) Human Capital: Empirical and Measurement issues.

Economic theory teaches us that human capital should have a positive impact on economic growth via its effect on productivity, knowledge accumulation and spillovers. However, while some empirical evidence supports this view, others find no such relation. There is a vast literature pertaining to the impact of human capital on economic growth[3], and the reasons given for the lack of empirical support are varied[4]. However, there are two very important concepts which can lead to contradictory empirical results in these regressions. First, is the issue of the "level effect" of human capital versus the "rate effect" of human capital. This problem relates to how we model human capital into our growth regression. Some studies model human capital as an input into the production function (this is called the level effect). Other studies model human capital as a determinant of technical progress, (this is called the growth effect). Subsequently, the measure of human capital used in regression models depends on what effect researchers are trying to measure. For growth effects, it is the level of human capital that is required. However for level effects, it is the accumulation of human capital variable that matters[5]. Second, is problem of inaccurate, incomplete, or generally poor quality data which, (it is argued), leads to inconclusive results. This is a problem relating to measurement issues at both the national and international levels.

Most empirical studies use various measures of education to proxy for human capital. This research will not focus on whether or not education is the best proxy for

[3] See for example,Nelson and Phelps (1966); Kyriacou (1991); Mankiw, Romer, and Weil (1992); Benhabib and Spiegel (1994); Barro and Sala-i-Martin (1995);Gemmell (1996); Pritchett (1996); and Krueger and Lindahl (2002).

[4] Some of these issues are expressed in the above literature and are related to equation specification, type of estimator, panel vs cross-section, level effects vs rate effects of human capital, convergence vs non-convergence, macro vs micro foundation, and data measurement issues.

[5] For example Nelson and Phelps (1966) argues that the stock of human capital is the important variable, while Lucas (1988) contends that the accumulation of human capital is what matters for growth.

human capital. Instead, the focus will be on reviewing various empirical results in chronological order as it relates to the "level" versus "rate" effects of human capital, and reviewing various issues relating to the measurement of education.

Empirical Issues.

Kyriacou (1991) concludes that it as the level of human capital, not its' growth rate that matters for economic growth. Kyriacou (1991) cites two reasons why this is possible. First, the output elasticity of human capital is positively related to the level of human capital. There exist threshold levels of human capital beyond which investments in education become more productive, (p.12). Second, the level of human capital is a proxy for the growth of technology, and thus constitutes an omitted variable problem in regressions that use human capital growth rates. Kyriacou (1991) concludes that the growth rate of human capital has no effect on the growth rate of output.

Mankiw, Romer and Weil (1992) extended the Solow model to include human capital and examined whether this specification could better describe the observed international variation in the standard of living. The growth rate of human capital had a positive and statistically significant impact on economic growth, (p.142). The augmented Solow model gives an accurate description of the cross-country variations in incomes because it eliminated the omitted variable bias by including the human capital variable in the model, (Mankiw, Romer, and Weil, 1992).

Benhabib and Spiegel (1994), indicate that when human capital is treated as an ordinary input into the production function it had no effect on economic growth. Alternatively, they argue that when human capital is introduced in a model in which it affects the growth of total factor productivity, then positive results are obtained between human capital stocks in levels and the growth in per capita income.

Judson (1995) analyzed the effects of human capital on growth by using an extended version of the Solow model similar to that of Mankiw, Romer, and Weil's (1992) model. Judson (1995) also used new measures of human capital in the analysis and concluded that human capital "cannot be ignored in growth decompositions", (p.40). Human capital accounts for about 10% of per capita GDP growth and belongs in the production function as an input. Furthermore, Judson (1995) argues that none of the relationships predicted by new growth theories about human capital and growth hold.

Barro and Sala-i-Martin (1995,) used a cross-sectional growth regression to do a comprehensive examination of the determinations of economic growth in a cross-section of countries. They found that higher levels of human capital will allow a country to grow faster. To achieve this result they added a multiplicative education-initial income term to their regression. They contend that this result depends on a nation's ability to absorb and imitate technology and thus education must be of an adequate level. This result was also repeated when Barro and Sala-i-Martin (1995) found evidence to support Nelson and Phelps'(1966) contention that growth is driven by the stock of human capital through its effect on a country's ability to innovate or catch up. Barro and Sala-i-Martin (1995) study also found that higher initial male educational attainment at the secondary and tertiary levels has a positive impact on growth, however female educational attainment at similar levels was inversely related to output growth.

Bils and Klenow (1998) further argue that even though Barro (1991), and others find strong positive correlation between initial school enrollment and the subsequent growth in per capita income across countries their evidence suggests otherwise. They contend their evidence suggest that the correlation runs from expected growth to schooling, and this relation was able to explain Barro's coefficient on education and growth.

Freire-Seren (1999) also used an augmented neoclassical growth model and endogenized the human capital variable to test the impact of growth on human capital and the impact of human capital on growth. Simultaneous equations were used to construction the regression equations. Both the level and growth rate of human capital are important for economic growth. Therefore human capital contributes as an input factor and as a determinant to overall technological improvements, (Freire-Seren, 1999).

Pritchett (1999) argues how "on average" cross-country regressions show no relation between education and output growth. In fact he argues that in many studies the relationship between human capital and growth is negative[6]. Even though the micro evidence shows some relationship between education and higher wages, this evidence is less conclusive at the aggregate level. These macro results are not due to measurement errors or the variables used[7] as others contend, (Pritchett, 1999).

Cohen and Soto (2001) devised a new data set on human capital whereby they minimized the extrapolations of the data, and kept the data as close as possible to those available directly from national censuses. Their results conclude that education does have a positive impact on growth and that the level of education is correlated with the level of output and the growth of education is correlated with the growth of output. However there are no human capital externalities either in physical or human capital.

---

[6] See Pritchett (1999), p.12, for various studies supporting this view.
[7] Pritchett (1999) did criticize the use of enrollment rates as proxies for the stock of education or the steady state level of education, and the method of regressing growth variables on level variables.

Kruger and Lindahl (2001) found evidence to support the argument that both the change and the initial level of education are positively correlated with economic growth. This evidence supports using either the level or growth rate of human capital.

Bassanini and Scarpetta (2001), found a positive and significant impact of human capital accumulation to output per capita in OECD countries. They contend that these results support endogenous growth models, with constant returns to scale to broad human and physical capital. However they found that the evolution of human capital over time was not statistically correlated to output growth.

Portella, Alessie, and Teuling (2003) used panel data to analyze the impact of human capital and found that when the errors in measurement associated the human capital variable is accounted for both the level and the change in education were relevant to the growth of output.

The literature on human capital and economic growth is vast and varied. The purpose of this expose` was simple to review the concepts of the "level" and the "rate" effect of human capital by looking at the research in a chronological order. There is evidence to support both effects however the evidence is not conclusive because the results are usually in favor of one effect while rejecting the other or the results may reject the correlation completely. Pritchett (1999) for example rejects the standard arguments[8] as to why there is an overall lack of evidence at the macro level to support the view that human capital is positively related to output growth. While he acknowledges that education is productive, he does identify three reasons why the evidence was not observed. First, while education did create human capital in some countries, it did not do so for other countries because the level of education in those countries was too low to

[8] See footnote 3 on page 13.

begin with[9]. Second, the supply of education in some countries was greater than the demand for education. This meant that the returns to education were falling, and thus its productivity[10]. Finally, the institutional environment in some countries may be distorted too such an extent that human capital accumulation can actually lower growth. This happen when conditions in the economy lead to rent seeking and directly unproductive activities by newly acquired human capital[11].

Many reasons are given for the lack of consistent evidence on the impact of human capital on economic growth. However the following literature will focus on the measurement problems which plague the construction of education data. Most empirical work use education data to proxy for human capital. This research will do the same thus it is imperative that we examine look at the measurement issue.

Measurement Issues.

The United Nations Educational, Scientific and Cultural Organization (UNESCO), and various national census surveys are the major sources of educational data. The methodologies used by researchers to construct an educational data series are based on the perpetual inventory method (PIM), interpolation, extrapolation, and some subjective estimation, (De La Fuente and Domenech, 2000).

Portela, et al (2003) compared data constructed from the PIM with data obtained from national censuses and surveys and concluded the PIM consistently underestimated the observed levels. On average the PIM underestimates the observed results by about one-fifth of a school year every five year period, (Portela, et al, 2003, p.8). They

[9] Pritchett (1999), page 25-28.
[10] Pritchett (1999), page 28-32.
[11] Pritchett (1999), page 32-37.

conclude that data constructed form PIM contains a systematic error which causes counter-intuitive results when human capital is regressed on output growth. However when these errors are controlled for the results from the growth regressions improve, (Portela et al, 2003).

De La Fuente and Domenech (2000) suggest that there are a number of problems which plague the construction of education data and it is these problems which have led to the discouraging results observed in the literature on human capital and growth. For example, there are sharp breaks in the time series data which indicates there are problems involved in measuring and collecting the data. Other problems encountered in the construction of education data include deficiency in data, differences in the classification of various educational levels, computational mistakes, and the reliability of the test statistic, (De La Fuente and Domenech, 2000, p. 9-12).These problems have led to the counter-intuitive results that are observed in the recent growth literature. Panel data shows the worst results because when human capital stocks are measured with error their first difference will be even less accurate, (De La Fuente and Domenech, 2000).

Behrman and Rosenweig (1994) also highlights the problems of data comparability, data gaps, and data collection which exist within the educational flow and stock data used in empirical work. Comparability problems arise with school enrollment rates (flow data), because the same data may be measured in different ways across countries, within countries, or overtime. For example, school enrollment rates are quite possible starting figures and since different countries have different starting ages, cross-country comparisons based on enrollment rates may be misleading. Additionally, for many developing countries the difference between net and gross enrollment rates varies considerably while for others this is not so. Yet some studies use gross enrollment rates in lieu of net enrollment rates for some countries. This substitution will seriously affect the empirical results because the data is not directly comparable. Also, school officials change the way they report attendance, the rate of non-repeaters, and grade repeaters over time, both within and across countries, (Behrman and Rosenweig, 1994).

Comparability problems also exist with the data on literacy rates (stock data), because literacy is defined differently across countries and over time. Also in many African countries literacy measures are based on very limited information, (Behrman and Rosenweig, 1994, p. 153). They conclude that literacy rates as an indicator of educational stock is more suited for lower income countries because these rates represent only the basic dimensions of education, which is the ability to read and write.

Missing data are usually handled by interpolation and projections. However, these estimates are not usually based on empirical observations taken in the year to which such numbers refer (Behrman and Rosenweig, 1994). The poorer developing countries suffer from too much missing data, and it appears that these data gaps are systematically related to level of development (Behrman and Rosenweig, 1994).

The issue of how education data is collected in some countries is important to the reliability of regression results. Behrman and Rosenweig (1994) contend that the instruments used by national agencies to collect data on education are flawed, and this makes the data unreliable.

Cohen and Soto (2000) have argued that there are errors in the measurement of human capital at the theoretical and empirical levels. There is no consensus at the theoretical level as to how human capital should be proxied. The method of using schooling data to proxy for human capital or constructing human capital through some law of motion creates inconsistent estimates, (Cohen and Soto, 2000, p. 9). Also empirical results are ambiguous due to the poor quality of the data, (see also De La Fuente and Domenech, 2000), and the log-log approach method used in many studies on human capital and growth, (Cohen and Soto, 2000).

The literature shows there are many problems associated with the construction of the data series on education, but most empirical analyses use these constructed series as a basis for human capital data. This has led to inconsistent results when growth is regressed on human capital. Additionally, the way the human capital variable is modeled in the equation can affect the regression results.

IV) Foundation for the Analysis of FDI and Human Capital Accumulation

FDI and the accumulation of human capital.

FDI is seen as a major avenue for the transfer of technology from the leading countries to the follower countries because Multinational Enterprises (MNEs), tend to be very knowledge-intensive firms, (Benhabib and Speigel 1994; Borensztein, De Gregorio, and Lee 1998; Xu 2000; Slaughter 2002;). It is this technological content of MNEs that can help explain the relationship between FDI and the accumulation of human capital in developing countries, (Slaughter 2002). Furthermore Stijns (2001) argues that if FDI inflows translate itself into higher human capital stocks then FDI can have a permanent effect on a country's income per capita[12]. This effect should be all the more important to development if human capital is the key to the adoption of foreign technology. This effect will also matter more since education is seen as the key to the mitigation of income inequality and the advancement of democracy[13], (Stijns 2001). Sen (1999) contends that in developing countries the marginal social returns of education for growth are considered sizable at the human capital level. Finally higher human capital stocks per capita will be required if technological knowledge is to be accessed successfully, (Evans 1998).

The possibility that FDI may have an impact on the accumulation of human capital has been suggested by some authors. However in analyzing the various avenues given in the literature by which FDI may have a positive effect on the accumulation of

[12] Aghion and Howitt (1992) contend that human capital is necessary for the discovery of new technology thus the stock of human capital is permanently related to the growth rate of output

[13] Aghion, et al (1999), suggest that education creates better conditions for good governance, improved health, and increases in income equality. Barro (1997, 2001) also suggest that education increases democracy.

human capital in developing countries I will use a demand and supply framework, (see Slaughter 2002; and Willem te Velde 2003). On the demand side, the literature suggests three channels by which FDI may positively affect the accumulation of human capital. They are technology transfer, spillovers, and physical capital investment (Slaughter 2002). On the supply side the process is less well known and documented but FDI can affect human capital development via its effect on general education, and official and informal on-the-job training, (Slaughter 2002).

The Transfer of Technology and Human Capital Accumulation:

Slaughter (2002) argues that the transfer of technology from MNCs to host country affiliates boost the demand for more skilled within the host firms. He argues that the evidence of technology transfer leading to skill upgrading can be deduced from examining three indicators. The first is wage increases in host affiliates. The implication is that technology transfers will lead to the increase in the demand for skilled labor which in turn will increase the wage rate for skilled labor. Slaughter (2002) estimated the effect of MNCs on skill upgrading by regressing the wage-bill shares on MNEs' presence in various host affiliate firms. He used a country-industry-year panel data set consisting of 951 observations. He found a positive relation between the wage-bill shares and the presence of MNEs in host firms in developing countries. Willem te Velde (2003) studied individual wages in the manufacturing industry in five African countries in the early 1990's. He found that on average foreign ownership is associated with a 20-40% increase in individual wages conditioned on age, tenure, and education. However, this is halved to 8-23% if taken into account the fact that foreign owned firms are larger and locate in high wage sectors. Aitken et al (1997, 1999) also finds that establishments owned by MNE's in Mexico and Venezuela pay higher wages than do domestically owned firms.

The second indicator which shows that technology is transferred to host affiliates, (which ultimately leads to an increase in the demand for skilled labor) is the increase in Research and Development (R&D). Slaughter (2002) contends that in 1982 host affiliates of U.S. owned companies performed 6.4% of worldwide R&D; by 1994 that share rose to 11.5%. "If one role of R&D is to facilitate technology transfer, then this rising share suggest rising technology transfer", (Slaughter 2002).

The third indicator which shows that technology is transferred to host affiliates, (which ultimately leads to an increase in the demand for skilled labor) is labor-demand mix of host affiliates. Slaughter (2002) contends that U.S. owned host affiliates in developing countries has seen an increase in the employed of skilled labor while at the same time the share of less skilled labor has fallen. Berman et al (1998), and Haskel and Slaughter (2002), report that there is a rising within-affiliate relative employment of more skilled workers in both developed and developing countries.

Slaughter (2002) agrees that "taken together this evidence on affiliate wage, R&D, and skill-mix is all consistent with the idea that affiliates stimulate demand for more skilled workers thanks to technology transfer".

Galor and Moav (1998) also conclude that technological progress, (which we can assume results from technology transfer) raises the returns to skills, both ability and education. Consequently, this increase in the returns to skills induces an increase in the supply of educated workers. Lichtenberg (1992) finds evidence which suggest that the reward to ability is higher in the presence of technological progress. He finds that industries with new technology pay higher wages to workers with given educational ability than do industries with outdated technology. Bartel and Sicherman (1999) find that there is an education premium associated with technological change and that this is as a result of an increase in the demand for the innate ability or other unobservable characteristics of more educated workers. Furthermore, Bartel and Lichtenberg (1987) show that individuals respond positively to changes in the incentives to in vest in human capital. Also, Foster and Rosenzweig (1996) find that during the green revolution in India school enrollment rates responded positively to the higher rates of return to human capital that resulted from this technological revolution. Schultz (1964) also contends that technological progress itself raises the returns to human capital. He examined the agricultural sector and argued that when technology is constant for a long time farmers' children would learn to use resources more efficiently by direct observation. However as technology progresses the knowledge gained from previous generations will be useless and trial and error, (which with static technology was efficient) will be inefficient with new technology. He concludes then that new technology will create a demand for the ability to analyze and evaluate new production possibilities which will raise the returns to education. Schultz (1975) cites a wide range of evidence in support of this theory.

Borenszein, De Gregorio, and Lee (1998) conclude that "FDI is a vehicle for the adoption of new technology, and therefore, the training required to prepare the labor force to work with new technologies suggest that there may also be an effect of FDI on human capital accumulation". Monge-Naranjo (2002), hypothesized that FDI speeds up the accumulation of general human capital. He used an Overlapping Generations Model (OLG), to show that FDI alters the incentives for the accumulation of general human capital by changing the dynamical structure of the economy. Galor and Tssidon (1997), who also used OLG models, states that the amount of real resources invested in human capital are positively related to the level of technology. Since FDI brings with it technological improvements, we may expect to witness increase investments in human capital as a result of FDI activities. Galor and Tsiddon (1997), further contend that technical progress increases the rate of return on investments in human capital and consequently stimulates further investments in human capital. Bils and Klenow (1998) contend that anticipated growth and technology driven growth can induce more schooling by raising the effective rate of return on investments in schooling. It has been suggested in the literature that technology driven growth in developing countries is an expected outcome of FDI activities. In this research I will view all technological progress as a byproduct of FDI activities. Thus we can expect to see an increase in schooling due to the activities of FDI in developing countries. Note too that the assumption is that foreign direct investment activities are a by product MNEs' activities.

Spillovers and the Accumulation of Human Capital:

Slaughter (2002) contends the idea that interaction among firms can generate spillovers dates back to Marshall (1920). The implication is that technological knowledge from the host affiliates will spill over to domestic firms, improving their productivity and thus their demand for skilled labor. The literature focuses on FDI as the main conduit by which technology is transferred to developing countries. Therefore to measure if spillover is taking place the literature focuses on the effect of FDI on total factor productivity (TFP) in local firms. Slaughter (2002) further argues that spillovers can happen in any of three ways. The first is the demonstration effect, whereby local firms adopt technologies introduced by MNEs through reverse engineering or imitation. Second, spillovers can happen via labor turnover when workers who were trained by or previously employed by MNEs' affiliates transfer their technological knowledge to local firms by switching employers or by starting their own business. Third, spillovers can happen when MNEs transfer technology to firms that are potential suppliers of intermediate goods or buyers of their own product. This is called vertical linkage.

There are a number of studies estimating direct productivity spillovers for developing countries but these tend to produce mixed results, (Blomstrom, et al 1999). Blomstrom and Persson (1993), Blomstrom (1986), and Kokko (1994) find evidence of FDI spillovers in Mexico. However, Haddad and Harrison (1993) find limited evidence of spillovers in Morocco. In fact, they found FDI to be negatively related to TFP. Meanwhile, Aiken and Harrison (1999) find no evidence to suggest that FDI improves the productivity of local firms in Venezuela. Here too, FDI was negatively related to TFP. However, Slaughter (2002) argues that a lack of spillovers is not necessarily a bad thing in the light of the stronger evidence on the role of within-firm technology transfer and physical capital accumulation in the development of human capital in developing countries.

Investments in Physical Capital and the Accumulation of Human Capital:

Investment in physical capital which is related to new technology is another link that connects FDI with human capital development, (Slaughter 2002). The implication is that new technology will be embodied in new capital goods, (Blomstrom, Globerman, and Kokko 1999) and thus the demand for skilled labor will increase with the acquisition of new capital goods. Slaughter (2002) gives evidence which suggest that the coincidence of host affiliates capital deepening and the shifting of relative employment towards more skilled workers is consistent with capital skill complementing technology transfer. Hammermesh (1993) gives a survey of empirical work which supports the contention that capital investments stimulate firms' demand for more skilled labor. Furthermore, Borenzstein, De Gregorio, and Lee (1995) point out that the training required to prepare the host affiliates labor force to work with new technology suggest that there may be an effect of FDI on the accumulation of human capital. Borenzstein, De Gregorio and Lee (1995) used panel data in a test of 69 developing countries and found that FDI has a "crowding-in" effect on domestic investment thus facilitating the expansion of domestic firms. FDI actually leads to more domestic investment.

FDI, General Education and Human Capital Accumulation:

Willem te Velde (2002) contends the involvement of MNEs in general education is threefold. First he presents evidence which shows that MNEs engage in voluntary spending on general education in the name of "corporate social responsibility", in many countries. He gives evidence of large Transnational corporation, (TNCs) such as Shell, BP-Amoco, ExxonMobil, and Rio Tinto spending millions of dollars vocational training, and formal education in both developed and developing countries. Second, he contends that there are strategic asset-seeking TNCs that set up general education centers that are sometimes open to outsiders. Such TNCs hope to develop projects using the skills and knowledge in the host countries. He cites examples of Sharp, Oki, STMicroelectronics, Ericsson Cyberlab, and Philips who all set up learning centers in Asia, (Willem te Velde, 2002, pg.12, box no.2). Third, he explains that business schools such as Harvard, London Business School, and the Stockholm School of Economics have become international companies by setting up campuses abroad, especially in developing countries. Slaughter (2002) suggest that MNEs lend support to local educational institutions in developing countries and in so doing affect the accumulation of human capital.

FDI, Official Training and Human capital Development:

Slaughter (2002) and Willem te Velde (2002) recognize that FDI can affect the development of human capital in developing countries via its effect on official training. Willem te Velde (2002) gives evidence that TNCs offer worker training in developing countries but that this is more likely to occur where the work force is large, and highly educated, and where the TNCs invest in R&D and are export oriented.

Slaughter (2002) contends that in the long run MNEs can improve the national supply of skilled labor in developing countries indirectly via its effect on the macro economy. He contends that MNEs can supply a steady stream of income which can boost fiscal policy thus providing a way for governments to increase their spending on education. Furthermore, FDI provides capital investment stability which can inhibit brain drain, (no evidence has been found on this) and contribute to the general equilibrium incentive of individuals in host countries to acquire skills through education and/or training, (Slaughter 2002).

In conclusion, studies have looked at the effects of FDI and human capital on economic growth and TFP. Thought the results are mixed, the general consensus is that both FDI and human capital positively affect economic growth and TFP. Some avenues through which FDI affects economic growth are via technology upgrading, and technology spillover. However, authors such as Xu (2000), Benhabib and Speigel (1994), and Borensztein, De Gregorio, and Lee (1998) argue that even though FDI promotes technology transfer, the higher productivity in the host country only holds when a minimal level of educational attainment is achieved. They refer to this as the threshold level. The reasoning being that some level technical ability is needed in order to promote the new technology. Can FDI itself contribute to increasing this threshold level? The purpose of this research is to examine whether or not FDI contributes to the accumulation of human capital in developing countries by changing the dynamics of the economy thereby raising the rate of returns to schooling via the transfer of technology, spillovers and its effect on general education and training. If, as in many poorer developing nations, the level of educational attainment is below the threshold level needed for the transfer of technology, then FDI (along with host policies) can play a major role in reversing such deficiencies if its' effects on human capital accumulation is positive. If this relationship between FDI and human capital exist, then even the poorest of countries may eventually realize productivity gains through FDI activities.

The impact of FDI on the accumulation of human capital in developing countries is scarcely covered the literature. However, the possibility that FDI increases the level of human capital in the recipient country can be deduced from selected works on FDI, human capital, and their effects on productivity and economic growth. Much of the literature assumes that FDI is the major avenue for the transfer of technology from the developed to the developing world. It is argued in the literature that human capital determines the level, type, and efficiency of FDI, while FDI is believed to, in turn; affect the level of technology and human capital in developing nations. This research will attempt to address the empirical deficiency in the empirical literature on FDI and human capital accumulation.

V) **Theoretical Foundations of the Empirical Equation.**

The Theoretical model of Galor and Tsiddon (1997) will be relied upon to develop the theoretical base for the empirical model used in this research. Their work will provide the foundation for which I will test the hypothesis about the effects of FDI on Human capital formation in developing countries. The works of Mongo-Naranjo (2002) and Borensztein et al. (1998) will also be relied upon to advance the theoretical model. After which, an empirical equation will be developed to assess empirically the stated hypothesis. The variables to be included in the empirical equation will also be based on the information provided in the literature on FDI, human capital, and economic growth.

Galor and Tsiddon (1997) consider a small open overlapping generations economy that operates in a perfectly competitive world in which economic activity extends over an infinite discrete time. Their model analyzes the interaction between the distribution of human capital, technological progress, and economic growth. The model demonstrates how the evolutionary pattern of the distributions of human capital, income, and economic growth are determined simultaneously by the interplay between a local home environment externality and a global technological externality.

The home environment externality states that an individual's level of human capital is an increasing function of the parental level of human capital. This observation has been supported in the literature[14]. Parents have a duel effect on the incentive of their children to invest in human capital, (Galor and Tsiddon, 1997). The first effect works directly via a home environment. This effect facilitates better schooling for a given level of investment in human capital. Secondly, parents affect the level of their child's human

[14] Galor, and Tsiddon (1997) cite Coleman et al. (1966), and Becker and Tomes (1986) as supporting this observation.

capital investment indirectly by the contribution they make to the average level of human capital in the society. Galor and Tsiddon (1997) further argue that an individual's incentive to invest in human capital may differ due to differences in their parental level of human capital.

The global technological externality states that technological progress, that is, the rate of adoption of new technology, is positively related to the average level of human capital in the economy. This observation has also been supported empirically[15].

The theoretical model will argue that this increase in the average level of human capital, called technological progress in this model, brings about a qualitative change in the dynamical system that governs the economy. Multiple locally steady state equilibria and polarization are eliminated and the rate of return on investments in human capital for the children's generation increases. This consequently stimulates further investments in human capital.

The Model.

The Production of Goods

A neoclassical production function with constant returns to scale and endogenous technological progress is used. The output produced at time t, Y_t, is

$$(1) \qquad \mathbf{Y_t = F(K_t, \lambda_t H_t) \equiv \lambda_t\, H_t\, f(k_t): \qquad k_t \equiv K_t/(\lambda_t H_t),}$$

Where K_t and H_t are the quantities of capital and efficiency labor employed in production at time t. λ_t is the technology coefficient at time t.

[15] Galor and Tsiddon (1997) cite Schultz (1975) as one author who supports this observation.

Technological Progress

In Galor and Tsiddon's (1997) model technological progress is endogenous and advances with the average level of human capital of the previous generation, ht. λ_{t+1} is the level of technology which is employed at time t+1 in the production of goods. The technology equation is as follows

(2) $$\lambda_{t+1} = \max [\, \lambda(h_t); \lambda_t \,]$$

Investments in Human Capital.

Efficiency labor, h^i_{t+1}, is the outcome of an individual's investment in human capital in the preceding period. Individuals may differ in their parental level of human capital, and thus in the efficacy of their own investment in education,(Galor and Tsiddon, 1997). An individual of generation t, who has parents with h^i_t units of human capital, invest x^i_t units of real resources and one unit of their labor at time t in the formation of human capital. The following equation constitutes the individual's labor supply in the second period of life.

(3) $$h^i_{t+1} = Ø\,(h^i_t, x^i_t).$$

The labor supply equation captures the home environment externality. For a given level of technology, and under certain assumptions[16], x^i_t can be written as a single valued function of h^i_t.

$$(4) \qquad \mathbf{x^i_t = \varepsilon\,(h^i_t;\ \lambda_{t+1}).}$$

Given equations 3 and 4, the evolution of the investment in each dynasty is governed by the following dynamic equation,

$$(5) \qquad \mathbf{h^i_{t+1} = \psi\,(h^i_t;\ \lambda_{t+1}).}$$

The Evolution of Human Capital across Dynasties: Threshold Externalities and Endogenous Technological Progress.

The model also assumes that technological progress is characterize by the threshold externality[17] form whereby the level of technology is stationary at a level λ^1 as long as the human capital is below some threshold level $\hat{h}$. However, once $\hat{h}$ is reached the level of technology jumps to λ^2 and remains at this level as long as the level of h_t remains above $\hat{h}$. Namely,

$$(6) \qquad \lambda_{t+1} = \lambda(h_t) = \begin{cases} \lambda^1 \text{ if } h_t < \hat{h};\ \lambda^2 \text{ if } h_t \geq \hat{h} \end{cases}$$

[16] See pg. 97 and 99 in Galor and Tsiddon (1997).

[17] Many authors, for example Xu (2000) and Borensztein et al. (1998), argue that human capital must reach some threshold level in order for technology transfer to be successful. Thus this assumption by Galor and Tsiddon (1997) is useful for our purposes.

The assumption was further made that if at time 0, ht < $\hat{h}$, then given equations 5 and 6 we get the following equation,

(7) $$\mathbf{h^i_{t+1} = \psi\, (h^i_t;\, \lambda^1)}$$

Equation 7 describes the evolution of human capital within each dynasty at time 0. Despite the assumption of positive and diminishing returns to factors of production, $\psi\, (h^i_t;\, \lambda^1)$ may be concave, convex, or alternating between the two, depending on the degree of complementary between x^i_t and h^i_t[18], (Galor and Tsiddon, 1997).

In figure 1 (see page 75), there exist a technology level,λ^1 such that the system is characterized by multiple locally stable steady state equilibria. The points of intersection $h^a\, (\lambda^1)$ and $h^c\, (\lambda^1)$ are stable, while $h^b\, (\lambda^1)$ is unstable. The level of human capital at $h^b(\lambda^1)$ determines the decomposition of dynasties that gravitate towards the high skill level, h^c (λ^1), and those that gravitate towards the low skill level, $h^a\, (\lambda^1)$. As long as the level of technology remains unchanged at λ^1 the decomposition of dynasties remain polarize and stationary within each group, (Galor and Tsiddon, 1997).

The assumption was further made that if at some time t > 0, the average level of human capital exceeds the threshold level $\hat{h}$, then the technology level will increase from λ^1 to λ^2. The equation which describes the evolution of human capital within each dynasty from time t > 0 becomes,

(8) $$\mathbf{h^i_{t+1} = \psi\, (h^i_t;\, \lambda^2\,)}$$

---

[18] See page 100 in Galor and Tsiddon (1997) for conditions under which this holds

Figure 2, (see page 75) shows how this technological progress eliminates the low and stable steady state equilibrium and generates a dynamical system that is characterized by a unique and globally stable steady state. The returns to the optimal investment in human capital increases as the wage rate per efficiency unit of labor increases throughout the economy as a whole,(Galor and Tsiddon, 1997). The interaction between dynasties whereby, increases in the level of human capital of the parents' generation increases the technological content, which subsequently increases investments in human capital of future generations, is the theoretical base for this research.

Technological advancement brought about by the increase in the average level of human capital in the society led to a change in the dynamical system in this model. This result is not unique however. Monge-Naranjo (2002) developed a similar model in which technological advances were the outcome of FDI. This in turn led a dynamical change in the economy and further increases in investments in general human capital due to increases in the rates of returns on such investments. In fact Monge-Naranjo (2002) suggests "looking for the effects of FDI on the host economy in their implications for human capital of future workers – and not the productivity of contemporaneous local firms". Stokey (1991), also analyzed a model whereby the decisions about human capital accumulation affect the rate of growth. Within that context, it was argued that international trade affects growth by affecting the incentives for schooling or other investments in human capital. Slaughter (2002) examined the effects of multinationals from the United States and found that they had a positive effect on skill upgrading in developing countries. Nelson and Phelps (1987) analyzed the effects of human capital on technological diffusion and found that the rate of return to education is greater the more technologically progressive the economy. Borensztein et al. (1998) introduced FDI as the main conduit by which technological progress is transferred to developing countries. They concluded that FDI may be an important factor in the accumulation of human capital. However, there is inconclusive evidence in the literature on whether or not technological progress and spillovers (leading to productivity gains and human capital formation), via FDI inflows are being realized in developing countries.

The Theoretical Argument of Research.

In Galor and Tsiddon's (1997) model increases in the average level of human capital led to technological advances which then led to further increases in the accumulation of future generations' human capital. However the assumption of this research is that technological advances are brought about by the inflow of FDI. This then leads to increases in human capital accumulation. The idea that FDI can be a major source of technological transfer because of its technological content is pervasive in the literature. Borensztein et al. (1998) modeled FDI as being a major conduit by which technological advances are possible for developing countries. As stated before Monge-Naranjo (2002) also modeled foreign firms as having a technological content that leads to the accumulation of human capital in developing countries.

The argument that technological advances can lead to increases in the accumulation of human capital can be discovered in the works of the above mentioned authors[19].

[19] The literature review of this research explains the arguments involved in the relationship between technological advances and human capital accumulation.

In this research a basic level of human capital development is needed in order to attract FDI[20]. This inflow of FDI into developing countries leads to some level of technological progress. The higher level of technology brought about by the inflows of FDI leads to dynamical changes in the economy which increases the rate of returns on investments in human capital for future generations thus leading to increases in human capital formation[21]. Galor and Tsiddon (1997), and Monge-Naranjo (2002), argue that increases in the level of technology cause a dynamical change in the structure of the economy, leading to an increase in the optimal level of investment in human capital throughout the economy. "Given that young workers foresee that, as long as it is in their best interest, foreign organizations will always invest in the country, then their returns to human capital investment is insured", (Monge-Naranjo, 2002).

As the economy becomes more developed, both Galor and Tsiddon (1997), and Monge-Naranjo (2002), postulate some level of convergence in human capital. Thus as the economy becomes more advance FDI should become relatively less important.

[20] This is called the threshold level in the growth literature. See for example Xu (2000).
[21] School enrollment variables may be the most appropriate variables to use in the regression equations.

VI) The Empirical Method.

The regression equation in this research is motivated by the work done previously on growth. Theory dictates that we incorporate a time dimension in our analysis because FDI is expected to have an effect on the level of human capital of future generations. Hence our analysis will employ panel estimation in order to take advantage of both the time series and cross-sectional nature of our research.

There does not exists a consensus theoretical framework to guide empirical work on human capital accumulation in developing countries, or for that matter growth in income per capita, (Levine and Renelt, 1991, 1992). However a common feature of most cross-country growth regressions is that the explanatory variables are entered independently and linearly, (Levine and Renelt, 1992). I will follow this trend here.

Two empirical models will be used to analyze the impact of FDI on the accumulation of human capital. The first will be a simple ordinary least squares (OLS) regression, (see for example Carkovic and Levine, 2002) using panel data[22]. The second regression will be based on a dynamic panel procedure with data averaged over five year periods, so that there will be six possible observations per country over the 1970-2000 period.

The basic OLS equation takes the form:

$$\mathbf{H_i = \alpha + \beta FDI_i + \beta' Z_i + \varepsilon_i} \quad (9)$$

Hi represents the human capital variable. FDI is a measure of the inflows of FDI by MNC,s into developing countries, and is measured as a percentage of gross domestic

[22] This technique produces inconsistent results and is only used for comparison purposes.

product in order to control for large country effects,(Noorbakhsh and Paloni, 2001). Z_{it} is a vector containing other variables that we theorize to have an effect on the accumulation of human capital.

The regression equation based on the dynamic panel procedure will be based on the following equation:

$$(10) \qquad \mathbf{H_{it} = \alpha + \lambda H_{it-1} + \beta FDI_{it} + \beta' Z_{it} + \eta_i + \varepsilon_{it}.}$$

Where as before, the dependent variable, H_{it}, is a measure of human capital. The common intercept term is α. H_{it-1} is a measure of the previous level of human capital. This is supposed to reflect the parental level of human capital. FDI_{it} is a measure as before. Z_{it} is a vector containing other variables that have an effect on the accumulation of human capital. Additional explanatory variables will be used as a test of robustness and sensitivity, (see for example, Levine and Renault, 1992 and Carkovic and Levine 2002). This conditioning set will be based on a set of variables which help determine the level of human capital in the economy. The literature on the determinants of human capital and economic growth will help determine which variables are selected. η_i is a common fixed effect term, and ε_{it} is a white-noise error term. The primary concern of this research is the partial correlation coefficient, β**.** The subscripts i and t represents country and time periods, respectively.

The literature tells us that there are many advantages of using the panel approach procedure[23] over the cross-country approach using the OLS estimator. Carkovic and Levine (2002) for example argue that panel procedures allows for the control of country

[23] This is pooled cross-section and time series data.

specific effects. In cross-country growth regressions, unobserved country-specific becomes part of the error term and this may bias the coefficient estimates. However, the panel estimator can control for these unobserved effects by differencing the data. The panel estimator can also control for the potential endogeneity of all the explanatory variables. Many of the growth regressions use explanatory variables that may themselves depend on growth. In this research we contend that human capital accumulation depends on FDI, but it has been argued convincingly that FDI inflow is also a function of human capital development. Thus there is an endogeneity problem with the regression equation. The OLS coefficients are biases whenever lagged levels of the dependent variable are used as an explanatory variable. However the panel estimator accounts explicitly for this bias. Another advantage of the panel estimator over the cross-country approach is that the panel estimator can allow the researcher to exploit the time-series nature of the variables under consideration.

As stated above, the major concerns of most cross-country growth regressions are that they do not address the problems of endogeneity, measurement errors, and omitted variables,(see Bond, et al 2001, and Carkovic and Levine, 2002). The Least Squares Dummy Variable (LSVD), though designed for the fixed effects panel approached, has been proved to be biased when the regression equation contains a lagged dependent variable as an explanatory variable, (Judson and Owen, 1996). One prominent way to address these problems has been through first-differenced generalized method of moments estimates applied to dynamic panel data (GMM), (see Caselli,et al 1996, Carkovic and Levine, 2002,).

The basic idea is to take first-difference of the original regression equation so as to remove the unobserved time-invariant country-specific effects. The right hand side variables in the first-difference equation are then instrumented using the levels of the original series lagged two periods or more, under the assumption that the time-varying disturbances in the original levels equations are not serially correlated.

To eliminate country-specific effects, I took first-differences of equation (10) and obtained the following:

$$(11) \quad \mathbf{H_{i,t} - H_{i,t-1} = \lambda(H_{i,t-1} - H_{i,t-2}) + \beta'(FDI_{i,t} - FDI_{i,t-1}) + \beta'(Z_{i,t} - Z_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1})}.$$

The new error term $\varepsilon_{i,t} - \varepsilon_{i,t-1}$ is now correlated with the lagged dependent variable, $H_{i,t-1} - H_{i,t-2}$. The use of instruments are now required to deal with problem of serial correlation and the possibility of the endogeneity of the explanatory variables (Carkovic and Levine, 2002).

Bond, et al (2001) argues that there are important advantages that the first-difference GMM estimator has over other methods for dynamic panel data models. Firstly, the estimates will be no longer biased by any omitted variables that are constant over time. Secondly, the use of instruments allows parameters to be estimated consistently in models which include endogenous right hand side variables. In the above equation factors that affect the accumulation of human capital may also affect the right hand side variables. Finally, the use of instruments potentially allows consistent estimation even when measurement errors are present.

VII) Limitations of Research.

A serious drawback with the first-difference GMM estimator is that large finite sample biases can occur when instrumental variables are weak. Instruments are weak when lagged levels do not make good instruments. This occurs when time series are persistent and the number of time series observations are small (Bond, et al, 2001, and Carkovic and Levine, 2002). Traditionally, series based on growth indicators such as Gross Domestic Product are viewed to be persistent. Another drawback is when the fixed effect term has a large variance. This drawback also creates weak instruments. The first-difference GMM estimator was used despite these potential setbacks.

When Levine and Renelt (1992) examined the robustness of cross-country growth regressions they found that all the variables included in the growth regressions were sensitive to the particular conditioning set used. They conclude that the relationship between growth and almost every particular macroeconomic indicator is fragile. They reasoned that national policies are complex and thus the focus should be on the interaction between policies and not on the independent effects of any particular policy. Carkovic and Levine (2002) conclude that macroeconomic variables are fragile in cross-country growth regressions, and the statistical significance of each variable depends on the conditioning set and the econometric specification of the model. Notwithstanding the above argument, this research will proceed using the techniques and methods used in the existing literature on human capital and economic growth.

VIII) <u>Selection of variables.</u>

The level of income has a positive and significant effect on the process of human capital development, (Freire-Seren, 1999). Many studies agree that economic growth leads to higher rates of human capital accumulation. Bils and Klenow (1998) give strong evidence that technology driven growth leads to higher rates of human capital accumulation. Another important explanatory variable is government spending on education. Judson (1995) argues that government spending is a good indicator of education's value. Levine and Renelt (1992) contend that most cross-country growth regressions include fiscal policy indicators in the conditioning set as a way to measure the effects of policy on the variable of interest. To measure the government's effect on the variable of interest in this research I will use the variable public spending on education.

Other variables identified by other studies as providing conditions for improvements in human capital development include, Fertility rates, and the general health system of the country (Pitt and Rosenzweig, 1990). To capture some of these effects I will use a life expectancy variable. Becker (1962) identifies a number of ways in which to invest in human capital besides schooling and they include medical care, vitamin consumption. It is hoped that the life expectancy variable will capture some of these effects. Becker (1962) further argued that information about the economic system impacts on the development of human capital. While, FDI itself may proxy for the variable about information on the economic system, a pertinent variable for economic system information may be the degree of openness of the economy. This variable can be found in many studies relating to economic growth, international trade, and FDI. Levine and Renelt (1992) conclude that most studies include variables that measure the overall size of the economy. I will use population growth estimates to control for country size and the availability of a human capital pool.

This research will examine human capital variables at all levels, based on education measures as obtained by Barro and Lee (2001), and the WDI (2004). My main focus will be on the indicator of human capital identified as school enrollment. Primary school enrollment is seen as the foundation for the development of general human capital, (Monge-Naranjo, 2002). According to Levine and Renelt (1992) secondary school enrollment may be preferable to other measures of human capital based on schooling because many countries have reached the upper bound for these other measures. The secondary school enrollment variable can be rationalized as a reflection of a flow of investment in human capital, (Noorbakhsh and Paloni, 2001).It also helps to capture the threshold level[24]. The tertiary level education variable captures high level technical and managerial skills, (Noorbakhsh and Paloni, 2001). Therefore my primary human capital variables will be school enrollment at the primary, secondary, and tertiary levels. All school enrollment variables are taken from the World Development Indicators 2004. I will also use other measures of human capital as a test of robustness. These variables were taken from Barro and Lee's (2001) data set on human capital and include the following; 1) average years of primary schooling in the total population over 15 years old, 2) the average years of secondary schooling in the total population over 15 years old; 3) the percentage of higher school attained in the total population over 15 years old; 4) educational attainment of the total population aged 15 and over.

---

[24] Borensztein et al. (1998) argue that .45 years of secondary school education is necessary to benefit from an infusion of foreign technology.

The main explanatory variables will be the dependent variable lagged one period so as to capture the parental level of human capital, FDI, gross domestic product per capita growth measured as an annual percent, openness in constant prices, and public spending on education measured as a percentage of gross domestic product. As a test of robustness I will include in my information set the variable life expectancy at birth and population growth rates. All explanatory variables were taken from the World Development Indicators (2004) data set.

The empirical literature on cross-country economic growth contains a myriad of explanatory variables and there is no consensus on which to include and which to exclude in empirical regressions. Levine and Renelt (1992) contend that no macroeconomic variable is robustly correlated with economic growth, however one can find some econometric specification that will allow for some correlation economic growth and the myriad of explanatory variables used in cross-country growth regressions. They further contend that fiscal policy variables are more strongly correlated with the efficiency of the resource allocation than with the accumulation of physical capital. In this research FDI will measure the effects of resource allocation. The argument for this is two-fold. First, the literature suggests that FDI inflows increases competition among firms in the host countries and thus stimulates economic growth. This aspect of FDI can be viewed as increasing efficiency in resource allocation. Firms that are not competitive become obsolete and resources are channeled to more competitive endeavors. Second, FDI has a technological content and this can improve efficiency in resource allocation. Additionally, it is very problematic to do a cross-country comparison fiscal policy variables but it may be a lot easier to compare FDI inflows between countries since these inflows usually come from OECD countries where the data more reliable.

Levine and Renelt (1992) further contend that trade and price distortion variables enhance economic growth through its' effect on the accumulation of resources and not necessarily on the efficiency of resource allocation. The effects of resource accumulation on human capital can be measured by the growth in income. All these indicators will be considered in the analysis.

IX) **Regression results.**

This section will begin the analysis by looking at the full sample of developing countries. This will be followed by an investigation into the effects of FDI on human capital accumulation in different regions. The regions covered will be Asia, Latin America and the Caribbean, and Africa. Easter Europe and the former communist countries were ignored due to the unreliability of the data[25]. To address the issue of the robustness of these regression results I will include additional explanatory variables to examine if these regression results are sensitive to the inclusion of other variables. The additional variables are those which are commonly used in the growth literature. The primary explanatory variables are human capital lagged one period, FDI, and gross domestic product per capita growth (annual %), (gpc). The additional explanatory variables are trade in goods as a percentage of gdp (tra), school expenditure total as a percentage of gdp (sxp), life expectancy at birth in total years (lex)[26], and the consumer price index with a base year of 1995 (cpi).

Full Sample of Developing Countries: primary school enrollment.

As a preliminary analysis I first examined the effects of FDI, and the lagged dependent variable primary school enrollment on the accumulation of human capital. Column 1 in table 1 shows that while FDI has a positive and statistically significant effect on human capital, the parental level of education, (as measured by the lagged dependent variable) has no impact on future education. Column 2 in table 1 represents the main

[25] The exclusion of Eastern Europe and the former communist countries is a method used throughout the growth literature.
[26] This variable is measured in natural log form and averaged over 5 year intervals.

regression. It shows that FDI has a positive impact on the accumulation of human capital as measured by primary school enrollment but the initial level of human capital again shows no impact on future growth of human capital. The effect of FDI on human capital is positive and statistically significant for four out of the six regressions therefore one must question the validity of these results. When school expenditure and life expectancy are included in the regression FDI is no longer statistically significant even though its' sign remains positive. However, when the consumer price index variable is included FDI again becomes significant. A more troubling result is that the initial level of human capital is not statistically significant in any of the regressions and it also has the wrong sign in one, (see column 4). Also, it has the wrong sign in three out of 5 regressions. Columns 1, 3, and 5 all show this variable as having a negative effect on human capital accumulation, however theory suggest that economic growth should increase the need for human capital. In columns 2 and 3 the growth variable has the wrong sign and it is also statistically significant.

All the other explanatory variables are statistically insignificant. However, in a many cross-country growth regressions most macroeconomic variables show no correlation due to errors in measurement and econometric specification. Alternatively, there could be other forces driving these results. For example, combining Africa with Asia and to a certain extent Latin America may be erroneous. Even though they are all considered developing countries, the level of economic prudence and political stability in Asia and to a certain extent Latin America affords more FDI inflows. The nature of these economies makes it difficult to compare economic indicators. This research will attempt to address this issue by examining the effects of FDI on human capital by regions. It is hoped that this analysis will then shed some light which region is driving these results.

Asia: primary school enrollment.

Table 2 shows the impact of FDI inflows on the accumulation of human capital in the Asian region. FDI has a positive and statistically significant effect on primary school enrollment. The coefficients remain significant to the inclusion of additional explanatory variables. However, indicators such as trade in goods and school expenditure have a negative but statistically insignificant impact on primary schooling. Theory suggests that these variables should have a positive effect on education. Trade in goods fuels development due to its' technological content, which in turn can lead to human capital development through reverse engineering. However, this process relies on the level of economic development, and the technological content of the product. Thus, for lesser developed countries this avenue may not be possible. The gains from trade could be static and not dynamic in nature in lesser developed countries. Theory suggests that school expenditure is also expected to increase school enrollment. However, it can be argued that some school expenditure may be channeled to activities that do not increase the productive capacity of people. The literature argues that religious spending may fall into this category.

Latin America and the Caribbean: primary school enrollment.

Table 3 shows the impact of FDI on primary school enrollment in the Latin American and Caribbean region. These results too demonstrate the positive effect of FDI on human capital. However in columns 4 and 5 the coefficients become statistically insignificant. In columns 1, 2, and 3 the level of significance of the FDI coefficient varies form 1 to 5 percent. It is reasonable to question the robustness of these results; however the direction of the impact of the coefficients adheres to the theory and argument of this research.

Africa: primary school enrollment.

Table 4 shows the results when primary school enrolment is regressed on the same information set. The primary regression in column two shows that FDI has no impact on human capital. Even though the co-efficient on the FDI variable is positive, it is statistically insignificant and changes sign as the information set is increased. The economic growth variable, becomes positive and significant when secondary schools spending and life expectancy variables are included in the regression, (column 3 and 4). In column three, the initial level of primary school enrolment is negatively correlated with the future level of primary school enrolment. This goes counter to theory, because the parental level of human capital is expected to have a positive effect on future school enrolment.

School enrolment, can be viewed as an investment in human capital development, however in regions where subsistence economic activities takes precedence, parents may focus less on human capital development and more on economic survival. Column three also shows that spending on education has a negative and statistically significant impact on primary school enrolment. This also goes counter to theory.

Overall, the results from the regression on Africa are discouraging. The primary explanatory variables are for the most part statistically insignificant and change signs as the pool of explanatory variables is increased. This regressions show a lack of robustness.

It may be unwise to compare the data on Africa with the date from Asia and Latin America and the Caribbean. Generally, the literature suggests, that the data from Africa is less liable than those from other regions. Another problem is that the African region has a lot more observations than any other region in this study, causing Africa to act as an outlier, this effects may skew the results of these regressions.

Full sample: secondary school enrolment

Table 5 shows the results of FDI and secondary school enrolment in developing schools and countries. FDI has a positive impact on the accumulation of human capital. The coefficients are all positive and vary between 1% to 5% level of significance. This regression is robust to the inclusion of additional explanatory variables. The trade variable has a positive impact on human capital however it is only significant in the regression that includes the entire information set. The more troubling result is that the coefficient and the growth indicator changes sign from positive to negative, (however it is statistically insignificant).

Africa: Secondary School Enrolment

Table 6 shows the results of the impact of FDI on secondary education in Africa. The FDI coefficient is insignificant in every region, and changes sign in some regressions. Regressions relating to the African region lack robustness.

Latin America and the Caribbean: Secondary School enrolment

Table 7 shows that FDI has a positive impact on secondary school enrolment in Latin America, however as the pool of explanatory variables expand, the coefficient goes from being statistically significant to being statistically insignificant. The overall direction of the impact though remains positive.

Asia: Secondary school enrolment

Table 8 shows that all variables, (except trade in column 5) enter with a positive sign in regressions where secondary schools enrolment is the dependent variable. In the primary regression in column 2, only the initial level of school enrolment is insignificant. But as more explanatory variables are added it looses its significance, (see columns 4 and 5). FDI has a positive sign in all regressions but is not statistically significant in any, and this goes counter to the argument of this research.

Since 1960, secondary education in Asia has expanded rapidly in response to the increasing demand for skilled workers, economic growth, and new private sector demands. According to the World Bank (2002) report, almost all countries in the Asian region have experienced substantial growth in secondary school enrolment during the 1990's. However, the 1990's have also seen economic crises in this region. Therefore, any reasonable conclusion about the effects of FDI on secondary school enrolment, should take into account the adverse effects of these economic prices on the entire process of human capital development.

Full Sample: Tertiary school enrollment

Table 9 shows the results of the regressions of tertiary school enrolment on the same information set. In all regressions, the initial level of tertiary school enrolment is positively and significantly correlated with the subsequent levels of tertiary school enrollment, and the level of significance remains at 0.01. However no other explanatory variable is significantly correlated to tertiary school enrolment. FDI which is our primary explanatory indicator, actually changes sign as we expand our information set. This variable exhibits a lack of robustness, and is sensitive to changes in the information set.

FDI inflows into developing countries are seen as less technologically advanced than FDI inflows into industrial countries. Thus an argument can be made that the level of tertiary education in developing countries does not depend on FDI inflows but instead depends on more esoteric activities.

Asia: Tertiary school enrolment

Table 10 shows that the impact of FDI on tertiary school enrollment is positively and statistically significant even when we expand our control variables. The level of significance, remains at 1% except in column five when it falls to 5%. The growth in per-capita output, remains statistically significant throughout, but has a negative impact on tertiary school enrolment.

The FDI coefficient has a positive impact on school enrolment at all levels in the Asian region, except at the secondary level where this impact is statistically insignificant. However at the primary and tertiary levels, the coefficient is statistically significant and robust to the inclusion of additional explanatory variables.

Latin America and the Caribbean: Tertiary Education

The results of the regressions pertaining to Latin America and the Caribbean are shown in table 11. The FDI coefficient which is the variable of interest, alternate in sign and significantly impacts tertiary education only in the primary regression, (see column 2). When the regression is expanded to include the entire set of explanatory variables, the FDI coefficient becomes negative. However it remains statistically insignificant. The initial school enrollment variable has a positive impact on future levels of school enrollment, and is statistically significant only in columns 1 and 2. As the information set is expanded the coefficient on this explanatory variable alternates in sign. This result goes counter to theory. In column 4 the trade, school expenditure, and expectancy variables are all statistically significant but the trade and school expenditure variables impact tertiary education negatively. These results go counter to the argument in this research.

Africa: tertiary school enrollment.

Table 12 shows the results of the regressions as conducted in the African region. These results are somewhat counter intuitive. FDI has a negative impact on tertiary education in all regressions at the 0.01 level. However, the coefficient on the initial level of tertiary education is statistically significant and has a magnitude greater than one which suggests a unit root problem. This problem compromises the GMM estimator by making the instruments invalid.

The results from our analysis are mixed. 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. In Latin America and the Caribbean, FDI enhances the development of human capital at all levels[27] however the level of statistical significance is not upheld in all regressions. The level of significance diminishes as more explanatory are added to the regression in regressions at all levels of school enrollment.

FDI has no impact on primary and secondary school enrolments in Africa. The coefficients are not robust and alternate in sign as we expand our information set. These regressions are very unstable therefore no firm conclusions can be drawn from any analysis based on data drawn from the African region. A more troubling result in the analysis is that FDI has a negative and statistically significant impact on tertiary school enrolment. This result goes counter to the argument of this research. However, the growth literature suggests that tertiary education in developing in countries may not be a function of FDI inflows because these inflows have less technological content. Still it is perplexing why FDI inflows should impact tertiary school enrolment in a negative way.

FDI has a positive and statistically significant impact on primary and secondary school enrolment when the full sample of developing countries is used.[28] However FDI has no impact on tertiary school enrolment in developing countries. Even though the FDI

[27] Only in table 2 column 5 does FDI have a negative impact on school enrolment (tertiary), but the coefficient is statistically equal to zero.
[28] This footnote is only in columns 3 and 4 of table 1 and are the coefficients statistically insignificant

coefficient alternates in sign, it is statistically insignificant. This result is expected because the literature suggests that tertiary education is not a perquisite for FDI inflows

X) Additional test of robustness.

This research further examined the robustness of the findings by changing some of the explanatory variables. In tables 13, 14, and 15 we drop the trade variable and the school expenditure variable. These variables were replaced with the variables openness in constant prices, and public spending on education, respectively. Regressions were also analyzed using the OLS, TSLS, and GMM estimators.

Table 13 shows that FDI has a positive impact on human capital, as measured by the variable secondary school enrollment, in the OLS and GMM estimators. The effect is positive, just as theory predicted, and is statistically significant, at the 1% level when the GMM estimator is used. In the OLS estimator the significance level falls to ten percent. However, in the TSLS regression the FDI variable has the wrong theoretical sign, but the coefficient is statistically insignificant. The previous regressions were done without the control variable life expectancy. When this variable is added as a test of robustness, the FDI variable remains statistically significant in both the OLS and GMM estimators, and it remained insignificant in the TSLS regression. In all regressions the initial level of human capital has a positive impact on future levels of human capital. It is statistically significant at the ten percent level in the OLS and TSLS regressions but in the GMM regression the statistical significance falls to ten percent. In the regressions without the control variable life expectancy, public spending on education also has a positive impact on the level of human capital in the TSLS and GMM regressions. However, when the variable life expectancy is included the variable public spending changes sign in the GMM regression and it becomes insignificant. This would suggest that this variable is fragile. However in the OLS regression that includes the life expectancy variable, public spending remains significant at the one percent level. Income growth as measured by the variable GDP per capita growth is significant only in the GMM estimate, however it has the wrong theoretical sign. However, Bils and Klenow (1998), argue that it is expected growth which drives school.

Table 14 examines the impact of the same set of explanatory variables on human capital as measured by primary school enrollment. The analysis shows FDI has a positive impact on the level of human capital only when the GMM estimator is used. The statistical significance of the coefficient is robust to small changes in the information set. In all regression models the correlation between the previous levels of human capital and futures levels of human capital remains significant to the expansion of the information set. Public spending, which was hypothesized to have a positive impact on human capital accumulation is statistical insignificant in the TSLS and OLS regressions. However, it has the wrong theoretical sign in the GMM estimator, and that coefficient turns out to be statistically significant. Even though output growth has the wrong sign, that is, it is negative when a positive sign was expected, the coefficient is insignificant.

Table 15 examines the effect on the dependent variable human capital as measured by school enrollment at the tertiary level. FDI has no effect on the accumulation of human capital in any regression. In the TSLS and GMM estimates it has a negative sign. Only in the OLS regressions is the coefficient positive, however, as in all the regressions it is insignificant.

Openness has a positive impact on the accumulation of human capital only at the tertiary level, and only when using OLS and TSLS. This coefficient is robust to small changes in the information set, (see table 15). The only variable that was robust to all regression specification was the initial level of the dependent variable.

FDI had a positive impact on the accumulation of human capital at the primary and secondary school enrollment levels when the more efficient GMM estimator is used. The literature argues that in developing countries the level of primary and secondary schooling is more important for development than the level of tertiary education. This argument is based on endowments and resource inflows. The results of this research demonstrate that the above arguments are plausible.

Further tests of the robustness of the results were conducted using different schooling variables to measure human capital. The population growth rate was also included as an additional variable in the information set. Table 16 shows the results when the average years of primary schooling in the total population is the dependent variable. The coefficient on the FDI term is positive and statistically significant except for column 3, where it's statistically equal to zero. This occurs when the population growth is included in the regression.

Table 17 shows the impact of FDI on the average years of secondary schooling in the total population. The coefficients on the FDI variable are statistically insignificant except for column 2 where the significance level is 0.10 level. This demonstrates that the variable is fragile. The initial schooling variable remains positive and statistically significant at the 0.01 level even when additional explanatory variables are included in the regressions.

Table 18 shows that FDI has a positive impact in regressions where educational attainment of the total population over15 years is the explanatory variable. However only in column 1 is the coefficient statistically significant, in columns 2 and 3 the coefficients become statistically equivalent to zero as more explanatory variables are added. The initial level of schooling remains positive and significant at the 0.01 level. The other explanatory variables are all statistically insignificant. The results on the other explanatory variables go counter to theory but these results were not totally unexpected because Levine and Renelt (1992) demonstrate that most macroeconomic variables show no correlation with growth.

Table 19 shows that FDI has a positive impact on the percentage of higher school attainment in the total population over 15 years old. However, only in column 2 is the FDI coefficient significant, (0.10 level). Output growth has a coefficient that changes sign as more variables are added to the regression. This coefficient too is unstable. All other explanatory variables have positive but statistically insignificant coefficients.

Our analyses demonstrated a lack of robustness to the inclusion of additional explanatory variables. The regression analyses also proved to be sensitive to changes in the measurement of the schooling variable. These results are prevalent in the growth literature. Many reasons are usually given for such outcomes they include measurement errors, econometric and model specification, and a general lack of cohesion in theoretical reasoning. In this research we used the GMM estimator to conduct our analyses. The literature views this method as preferable to other methods when conducting cross-country growth regressions. But problems still plague this estimator, for example when the data suffers from unit root problems instrumental variables become inconsistent. However, the results from our analyses were not totally disappointing. FDI was shown to have a positive and statistically significant impact on the level of primary and secondary school enrollment in developing countries. These results conformed to our argument that FDI affects the accumulation of human capital in developing countries. The literature suggests, and our results confirm that the effects of FDI will be felt at the lower levels of schooling. Exports from and imports into developing countries require less technological knowledge therefore FDI inflows into these regions are viewed as having a lower technologic content. Therefore the literature suggests that it is more important to develop human capital at the lower levels than at the tertiary level.

XI) Conclusions.

The motivation for this research is based on the notion that if FDI inflows translate into higher human capital stocks then FDI can have a permanent effect on a country's income per capita, (despite the lack of correlation found in many cross-country regressions). Romer (1986), Lucas (1988) and Robelo (1991) have argued that human capital externalities can generate sustained long run growth, and Romer (1990) and Aghion and Howitt (1992) contend that the stock of human capital is important to the development of new technology. A preliminary conclusion of this research is that FDI improves the development of human capital and in this way it acts as a catalyst for future growth. This research contends that FDI should be part of the growth process in developing countries. Globalization brings with it foreign technology and thus dictates that every economy improves its level of human capital if the adaptation of this technology and sustained long run growth is to be realized. The idea that human capital is the key to the adaptation of foreign technology and growth has been emphasized by many growth and development authors, (see for example Borenszein, De Gregorio, and Lee, 1995).

Also, education is seen as the key to the mitigation of income inequality, the advancement of democracy, and the increase in health and productivity, in economies (Stijns 2001, Aghion, et al, 1999, Barro, 1997, 2001, Sen 1999). The policy implications form this analysis is that FDI should be regarded as an important factor in the development programs of developing countries because of its dynamic effect on human capital which in turn promotes social and political development.

These preliminary results suggest that FDI has a positive impact on the accumulation of human capital in developing countries. However, these results are far from conclusive. When the sample was divided into different regions many observations were lost and this seriously compromised the validity of the results. No conclusions should be drawn from the results of regressions based on the sub-regions of Africa, Asia, and Latin America and the Caribbean because the samples were inadequate. We have seen that in some regions of the world FDI has a positive and significant effect on human capita development while in other regions the effect of FDI on human capital accumulation is not robust and is sensitive to the inclusion of different explanatory variables. We cannot conclude if this is due to the estimator, economic theory or the data quality and quantity.

Levine and Renelt (1992) have suggested looking at the interaction among policy variables as opposed to the independent influence of any particular variable when analyzing growth regressions. I will follow Levine and Renelt's (1992) argument and suggest that future research should look at the interaction of various policy variables and how these may affect the accumulation capital. Also, more efficient ways to measure human capital is needed. Human capital goes beyond just formal schooling. We must establish ways in which to the measure the impact of FDI on an individuals' productivity in the workplace. Better estimators may also improve upon the quality of the results. The GMM estimator is biased whenever the data contains a unit root and it has been suggested in the literature that a number of macroeconomic series contain unit roots.

References:

Aghion, P., Caoli, E., & Garcia-Penalosa, C. (1999). Inequality and Economic Growth: The Perspective of the New Growth Theories. Journal of Economic Literature, 37, 1651-1660.

Aghion, P., & Howitt, P. (1992). A Model of Growth Through Creative Destruction. Econometrica, 60, (March), 323-351.

Aitken, B., Gordon, H., H., & Harrison, A., E. (1997). Spillovers, Foreign Investment and Export Behaviour. Journal of International Economics, 43, 103-132.

Aitken, B., & Harrison, A. (1999). Do Domestic Firms Benefit from Foreign Investment? Evidence from Venezuela. American Economic Review, 89, No.3.

Arrow, K., J. (1962) The Economic Implications of Learning By Doing. Review of Economic Studies, 29, (June), 151-173.

Barro, R. (2001). Human Capital and Growth. The American Economic Review: Papers and Proceedings, 12-17.

Barro, R. (1997). The Determinants of Economic Growth, MIT Press, Cambridge, Massachusetts.

Barro, R., (1991). Economic Growth in a Cross Section of Countries. Quarterly Journal of Economics, 106 (2), 407-444.

Barro, R., J., & Lee, J. (2001). International Data on Educational Attainment: Updates and Implications. Oxford Economic Papers, 3, 541-563.

Barro, R., J., & Sala-I-Martin, X. (1999). Economic Growth. MIT Press, Cambridge, Massachusetts.

Bartel, A., N., & Lichtenberg, F., R. (1987). The Comparative Advantage of Educated Workers in Implementing New Technologies. Review of Economics and Statistics, 69, 1-11.

Bartel, A., N., & Sicherman, N. (1999). Technological Change and Wages: An Inter-Industry Analysis. Journal of Political Economy, 107 (2), 285-325.

Bassanini, A., & Scarpetta, S. (2001). Does Human Capital Matter for Growth in OECD Countries? Evidence from Pooled Mean-Group Estimates. OECD, Economics Department Working Paper No. 282.

Becker, G. (1962). Investment in Human Capital: A Theoretical Analysis. Journal of Political Economy, LXX, (Oct), 9-49.

Becker, G., & Tomes, N. (1986). Human Capital and the Rise and Fall of Families. Journal of Labor Economics. 4, S1-S39.

Behrman, R., J. & Rosenzweig (1994). Caveat Emptor: Cross-Country Data on Education and the Labor Force. Journal of Development Economics 44, 147-171.

Benhabib, J., & Spiegel, M., M. (1994). The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data. Journal of Monetary Economics, 34, 143-173.

Berman, E., Bound, J., & Machin, S. (1998). Implications of Skill-Biased Technological Change: International Evidence. Quarterly Journal of Economics, 1248-1280.

Bils, M., & Klenow, P., J. (1998). Does Schooling Cause Growth or the Other Way Around? NBER Working Paper, No. 6393 1-41.

Blomstrom, M. (1986). Foreign Investment and Productive Efficiency. The Case of Mexico. The Journal of Industrial Economics, 35.

Blomstrom, M., Globerman, S., & Kokko, A. (1999). The Determinants of Host Country Spillovers from Foreign direct Investment: Review and Synthesis of the Literature. SSE/EFI Working Paper Series in Economics and Finance No. 239, 2-31.

Blomstrom, M., & Kokko, A. (2001). FDI and Human Capital: A Research Agenda. Stockholm School of Economics, Technical Meeting, Series Paper No.5, 1-19.

Blomstrom, M., & Persson, H. (1993). Foreign Investment and Spillover Efficiency in an Underdeveloped Economy: Evidence from Mexican Manufacturing Industry. World Development, 11(6).

Bond, S.R., Hoeffler, A., & Temple, J. (2001). GMM Estimates of Empirical Growth Models. Centre for Economic Policy Research, Discussion Papers No. 3048, 1-33.

Borenzstein, E., De Gregorio., & Lee, J-W. (1998). How Does Foreign Direct Investment Affect Economic Growth? Journal of International Economics, Vol.45, Issue 1, June, 115-135.

Carkovic, M., & Levine, R. (2002). Does Foreign Direct Investment Accelerate Economic Growth? University of Minnesota.

Caselli, F., Esquivel, G., & Lefort, F. (1996). Reopening the Convergence Debate: A New Look at Cross-Country Growth Empirics'. Journal of Economic Growth, 1, 363-389.

Cohen, D., & Soto, M. (2001). Growth and Human Capital: Good, Data Good Results. OECD Development Centre, Technical Papers , No. 179, 3-42.

Coleman, J. S., et al. (1966). Equality of Educational opportunity. Washington D.C. :US, GPO.

Crafts, N. (2000). Globalization and Growth in the Twentieth Century. IMF Working Paper, (March) WP/00/44.

De La Fuente, A. & Ciccone, A. (2000) Human Capital in a Global and Knowledge Based Economy. CEPR.

De La Fuente, A. & Doménech, R. (2000). Human Capital in Growth Regressions: How Much Difference Does Data Quality Make? Centre for Economic Policy and Research, Discussion Paper no. 2466, 1-48.

De Mello, R., L., Jr. (1997). Foreign Direct Investment in Developing Countries and Growth: A Selective Survey. The Journal Development Studies, Vol. 34 no. 1, 1-34.

Evans, P., (1998). Using Panel Data to Evaluate Growth Theories. International Economic Review, 39, No.2,

Foster, ., & Rosenweig, M., R. (1996). Technical Change and Human Capital Returns and Investments: Evidence From the Green Revolution. American Economic Review, 86, 931-953.

Freire-Seren, M., J. (1999). Human Capital Accumulation and Economic Growth. Universitat Autonoma de Barcelona and Universidade de Vigo, WP, 435.99.

Galor, O., & Moav, O. (1998). Ability Biased Technological Transition, wage Inequality, and Economic Growth. JEL Classification: J 31, 011, 033, 040.

Galor, O., & Tsiddon, D. (1997). Technological Progress, Mobility, and Economic Growth. American Economic Review, 87, No.3, 363-382.

Galor, O., & Tsiddon, D. (1997). The Distribution of Human Capital and Economic Growth. Journal of Economic Growth, 2, 93-124.

Gemmel, N. (1996). Externalities to Higher Education. Paper Presented to Department for Education and Employment, Labor Market Workshop, London.

Haddad, M.,& Harrison, A. (1993). Are There Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco. Journal of Development Economics, 42, 51-74.

Hammermesh, D., S. (1993). Labor Demand. Princeton University Press, Princeton, New Jersey.

Haskel, J., & Slaughter, J., M. (2002). Does the Sector Bias of Skill-Biased Technological Explain Changing Skill Premia? European Economic Review.

Hausmann, R. (2000). Foreign Direct Investment: Good Cholesterol? Inter-American Development Bank, Working Paper 417.

Jones, I., C. (1996). Human Capital, Ideas, and Economic Growth. Department of Economics, Stanford University, 1-28.

Judson., R. A. (1995). Do Low Human Capital Coefficients Make Sense? A Puzzle and Some Answers. Mimeo, Federal Reserve Board, 1-72.

Judson., R. A., & Owen., A. L. (1996). Estimating Dynamic Panel Data Models: A Practical Guide for Macroeconomists. Mimeo, Federal Reserve Board of Governors, 1-21

Kokko, A. (1994). Technology Market Characteristics, and Spillovers. Journal of Development Economics, 43, 279-293.

Krueger, A., & Lindhal, M. (2001). Education for Growth: Why and for Whom? Journal of Economic Literature, 39(4), 1101-1136.

Kyriacou, G., A. (1991). Level and Growth Effects of Human Capital: A Cross-Country Study of the Convergence Hypothesis. C.V. Starr Center for Applied Economics, RR # 91-26. 1-29

Levine, R., & Renelt, D. (1992). A Sensitivity Analysis of Cross-Country Growth Regressions. American Economic Review, Vol. 82, No. 4. 942-963.

Lichtenberg, F. (1992). R and D Investments and International Productivity Differences. NBER, WP 1813.

Lucas, R., E., Jr. (1988). On The Mechanics of Economic Development. Journal of Monetary Economics 22, 2-42.

Mallampally, P., & Sauvant, K., P. (1999). Foreign Direct Investment in Developing Countries. Finance and Development, 36, No.1

Mankiw, G., N., & Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. The Quarterly Journal of Economics, 107(2), 407-437.

Mansfield, E., & Romeo, A. (1980). Technology Transfer to Overseas Subsidiaries by US-Based Firms. Quarterly Journal of Economics, 95 (4), 737-750.

Miyamoto, K. (2003). Human Capital Formation and Foreign Direct Investment in Developing Countries. OECD Development Centre, Technical Papers No.277.

Monge-Naranjo, A. (2002). Human Capital, Organizations, and Foreign Direct Investment. Northeastern University.

Nelson, R. R., & Phelps, S. E. (1966). Investment in Humans, Technological Diffusion, and Economic Growth. American Economic Association, 56(2), 69-75.

Noorbaskhsh, F., Paloni, A., & Youssef, A. (2001). Human Capital and FDI Inflows to Developing Countries: New Empirical Evidence. World Development, 29 (9), 1593-1610.

Pitt, M., & Rosenzweig M. (1990). Estimating the Intra-Household Incidence of Illness: Child Health and Gender Inequality in the Allocation of Time in Indonesia. International Economic Review, 969-989.

Portela, M., & Alessie, R., & Teulings, C. (2003). Measurement Errors in Growth Regression: Re-evaluating the Role of Education.

Pritchett, L. (1996). Where Has All the Education Gone? Policy Research Working Paper Services, 1581, The World Bank.

Rebelo, S., (1991). Long-Run Policy Analysis and Long-Run Growth. Journal of Political Economy, 99(3), 500-521.

Romer, P., (1986). Increasing Returns and Long Run Growth. Journal of Political Economy, 94, 1002-1037.

Romer, P. (1987). Growth Based on Increasing Returns Due to Specialization. American Economic Review Papers and Proceedings, 77(2): 56-72.

Romer, P. (1988). Human Capital and Growth: Theory and Evidence. NBER Working Paper No. 3173.

Romer,. P. (1990). Endogenous Technical Change. Journal of Political Economy. 98 (5), S71-S102.

Sala-I-Martin, X. (1996). The Classical Approach to Convergence Analysis'. Economic Journal, 106, 1019-1036.

Schultz, T. W. (1964). Transferring Traditional Agriculture, New Haven. Yale University Press.

Schultz, T. W. (1975). The Value of the Ability to Deal with Disequilibria. Journal of Economic Literature, 13, 827-846.

Sen., A. (1999). Development as Freedom. Oxford University Press, Oxford.

Slaughter, M. J. (2002). Does Inward Foreign Direct Investment Contribute to Skill Upgrading in Developing Countries? Prepared for New School University's CEPA conference, "Labor and the Globalization of Production".

Stijns., J-P. (2001). Natural Resource Abundance and Human Capital Accumulation. Mimeo, University of California at Berkeley, Department of Economics, 1-27.

Stokey, N. (1991). Human Capital, Product Quality, and Growth. The Quarterly Journal of Economics, 106(2), 587-616.

UNCTAD (1999). World Investment Report. UNCTAD, Geneva.

UNCTAD (2000). World Investment Report, UNCTAD, Geneva.

Willem Te Velde, D. (2003). Do Workers in Africa Get a Wage Premium if Employed in Firms Owned by Foreigners? Journal of African Economies, Vol.12, Issue1, 41-73.

World Bank (2002). World Economic Report.

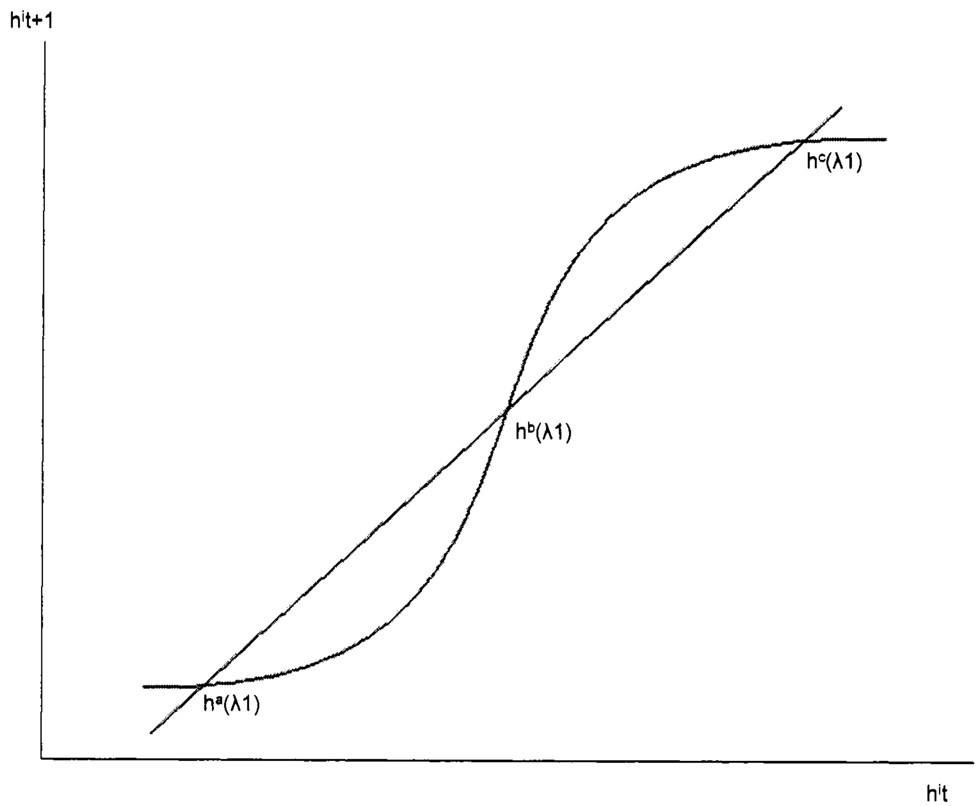
Xu, B. (2000) Multinational Enterprises, Technology Diffusion, and Host Country Productivity Growth. Journal of Development Economics, 62, 477-493.

Appendices

Countries Surveyed:

code	country
DZA	ALGERIA
BEN	BENIN
BWA	BOTSWANA
CMR	CAMEROON
CAF	CENTRAL AFRICAN REPUBLIC
COG	CONGO REPUBLIC
EGY	EGYPT
GMB	GAMBIA
GHA	GHANA
GNB	GUINEA BISSOU
KEN	KENYA
LSO	LESOTO
LBR	LIBERIA
MWI	MALAWI
MLI	MALI
MUS	MAURITIUS
MOZ	MOZAMBIQUE
NER	NIGER
RWA	RWANDA
SEN	SENEGAL
SLE	SIERRA LEONE
ZAF	SOUTY AFRICA
SND	SUDAN
SWZ	SWAZILAND
TZA	TANZANIA
TGO	TOGO
TUN	TUNISIA
UGA	UGANDA
ZAR	CONGO, DEM. REPUBLIC
ZMB	ZAMBIA
ZWE	ZIMBABWE
BRB	BARBADOS
CRI	COSTA RICO
DOM	DOMINICAN REPUBLIC
SLV	EL SALVADORE
GTM	GUATEMALA
HTI	HAITI
HND	HONDURAS
JAM	JAMAICA
MEX	MEXICO
NIC	NICARAGUA
PAN	PANAMA
TTO	TRINIDAD & TOBAGO
ARG	ARGENTINA

BOL	BOLIVIA
BRA	BRAZIL
CHL	CHILE
COL	COLOMBIA
ECU	ECUADOR
GUY	GUYANA
PRY	PARAGUAY
PER	PERU
URY	URUGUAY
VEN	VENEZUELA
AFG	AFGHANISTAN
BHR	BAHRAIN
BGD	BANGLADESH
BUR	MYNAMAR
CHN	CHINA
HKG	HONG KONG
IND	INDIA
IDN	INDONESIA
IRN	IRAN
IRQ	IRAQ
ISR	ISRAEL
JOR	JORDAN
KOR	KOREA, REP.
MYS	MALAYSIA
NPL	NEPAL
PAK	PAKISTAN
PHL	PHILLIPINES
SGP	SINGAPORE
LKA	SRI LANKA
SYR	SYRIA
THA	THAILAND
TUR	TURKEY
FJI	FIJI
PNG	PAPAU NEW GUINEA


hⁱt+1
hᶜ(λ1)
hᵇ(λ1)
hᵃ(λ1)
hⁱt

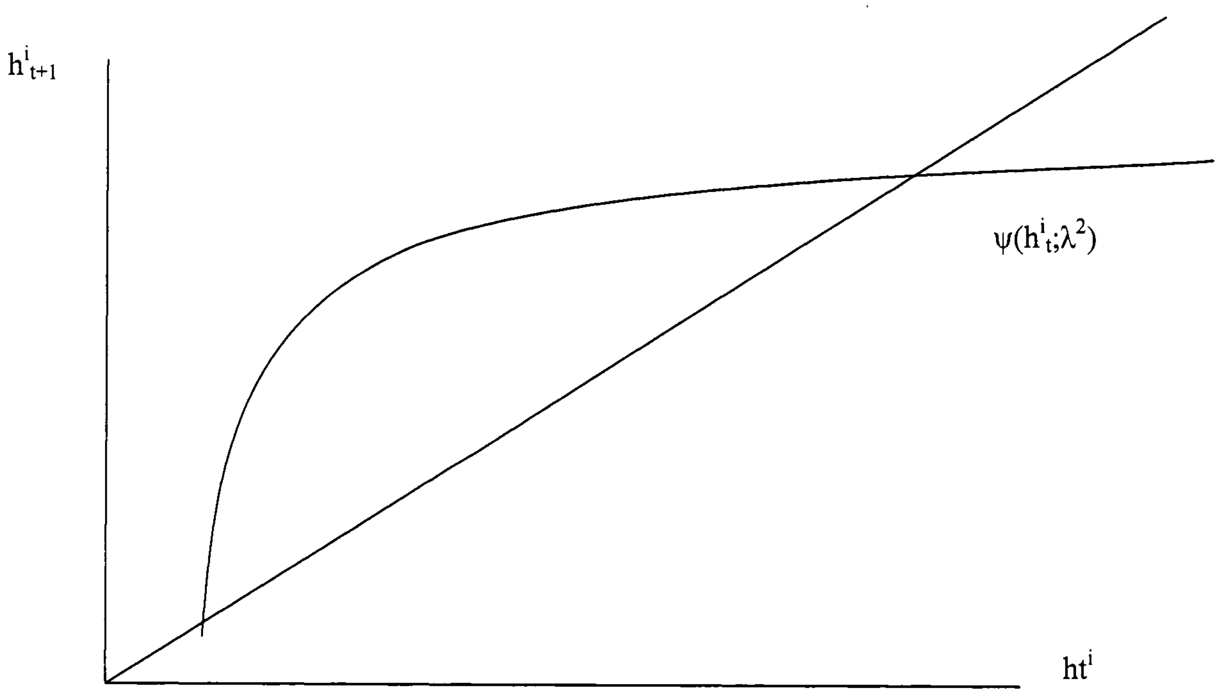

h^i_{t+1}
$\psi(h^i_t;\lambda^2)$
ht^i

Table 1
Full Sample
Fixed Effect Estimation: GMM
Dependent Variable = primary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM	(vi) GMM
primary school enrollment, (1 period lag)	0.43 (1.19)	0.42 (1.11)	0.28 (0.71)	-0.36 (-1.19)	0.39 (1.440	0.25 (0.81)
foreign direct investment, net inflows, (% of GDP)	2.09*** (2.67)	2.88*** (2.80)	3.07** (2.15)	1.62 (1.54)	1.58 (1.45)	3.27** (1.99)
GDP per capita growth, (annual %)		-1.39* (-1.80)	-1.74* (-1.80)	0.63 (0.72)	-0.15 (-0.25)	0.19 (0.26)
trade in goods (% of GDP)			-0.17 (-0.72)	0.10 (0.53)	-0.12 (-0.56)	-0.09 (-0.34)
school expenditure, total (% of GDP)				0.09 (0.15)	-0.20 (-0.31)	-0.58 (-0.70)
Ln (life expectancy at birth, total (years))					19.11 (0.47)	71.47 (1.44)
consumer price index (1995 = 100)						-1.63 (-1.22)
Number of observations	216	213	210	137	136	125
cross-sections	79	79	78	57	57	52

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 2
Asia
Fixed Effect Estimation: GMM
Dependent variable = primary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
primary school enrollment, (1 period lag)	0.01 (0.06)	0.48 (1.34)	-0.01 -0.04)	0.04 (0.10)	-0.09 (-0.23)
foreign direct investment, net inflows, (% of GDP)	4.31*** (2.92)	2.95* (1.87)	3.16*** (3.24)	2.56* (1.93)	2.91* (1.77)
GDP per capita growth, (annual %)	0.14 (0.33)	0.21 (0.46)	0.22 (0.63)	0.18 (0.27)	0.25 (0.46)
trade in goods (% of GDP)		-0.09 (-0.88)	-0.06 (-0.85)	-0.19 (-0.73)	-0.09 (-0.71)
school expenditure, total (% of GDP)			-0.52 (-1.02)	-0.88 (-0.78)	-0.91 (-0.85)
Ln (life expectancy at birth, total (years))				97.11 (0.97)	2.56 (0.01)
consumer price index (1995 = 100)					3.18 (0.23)
Number of observations	36	36	35	35	33
cross-sections	14	14	14	13	13

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 3
Latin America and the Caribbean
Fixed Effect Estimation: GMM
Dependent variable = primary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
primary school enrollment, (1 period lag)	0.05 (0.32)	0.58** (2.39)	0.46** (2.56)	0.47 (1.55)	-0.04 (-0.02)
foreign direct investment, net inflows, (% of GDP)	3.09*** (3.155)	1.92*** (4.04)	4.69*** (3.56)	6.11 (1.43)	5.70 (0.91)
GDP per capita growth, (annual %)	-1.21 (-2.43)	0.08 (0.23)	0.39 (0.25)	0.72 (0.36)	-1.42 (-0.48)
trade in goods (% GDP)		-0.10 (-1.23)	-0.24 (-0.45)	-0.12 (-0.26)	-0.40 (-0.86)
school expenditure Total, (% of GDP)			-1.34 (-0.85)	-1.82 (-0.76)	-3.74 (-0.71)
Ln (life expectancy at birth, total (years))				-124.1 (-0.52)	-42.86 (-0.04)
consumer price index (1995 = 100)					-0.20 (-0.02)
Number of observations	35	35	20	20	19
cross-sections	13	13	8	8	8

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 4
Africa
Fixed Effect Estimation: GMM
Dependent variable = primary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
primary school enrollment, (1 period lag)	-0.58 (-0.96)	-0.31 (-1.16)	-0.48** (-2.42)	0.09 (0.31)	-0.007 (-0.02)
foreign direct investment, net inflows, (% of GDP)	1.32 (0.52)	1.14 (0.51)	-0.62 (-0.43)	-3.10 (-1.05)	0.11 (0.08)
GDP per capita growth, (annual %)	-0.09 (-0.10)	-0.27 (-0.40)	1.10** (2.17)	1.53** (2.43)	0.57 (1.31)
trade in goods (% of GDP)		0.18 (0.63)	0.23 (0.84)	-0.20 (-0.82)	-0.22 (-0.77)
school expenditure, total (% of GDP)			-1.17*** (-3.26)	-1.38** -2.45)	-1.19*** (-4.24)
Ln (life expectancy at birth, total (years))				-47.05 (-0.94)	8.71 (0.29)
consumer price index (1995 = 100)					-0.78 (-0.78)
Number of observations	94	91	43	43	38
cross-sections	35	34	20	20	17

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year interval

Table 5
Full Sample
Fixed Effect Estimation: GMM
Dependent variable = secondary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
secondary school enrollment, (1 period lag)	0.78***	0.37	0.54*	0.73***	-0.07
	(2.79)	(1.12)	(1.75)	(3.40)	(-0.18)
foreign direct investment, net inflows, (% of GDP)	3.32**	3.68**	4.84***	2.73**	4.48***
	(2.43)	(2.55)	(2.63)	(2.54)	(2.98)
GDP per capita growth, (annual %)	-0.36	-0.19	0.95	0.18	-0.33
	(-0.41)	(-0.20)	(0.80)	(0.26)	(-0.26)
trade in goods (% of GDP)		0.37**	0.25	0.15	0.32**
		(3.09)	(1.38)	(1.00)	(2.01)
school expenditure, total (% of GDP)			0.41	0.11	0.15
			(0.54)	(0.21	(0.14)
Ln (life expectancy at birth, total (years))				59.96***	65.55*
				(2.96)	(1.77)
consumer price index (1995 = 100)					0.81
					(0.50)
Number of observations	204	201	133	132	121
cross-sections	78	77	57	57	52

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 6
Africa
Fixed Effect Estimation: GMM
Dependent variable = secondary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
secondary school enrollment, (1 period lag)	0.41***	0.06	0.86***	0.98***	0.76***
	(3.06)	(0.25)	(5.54)	(7.32)	(4.54)
foreign direct investment, net inflows, (% of GDP)	1.64**	0.48	-0.11	-0.04	0.16
	(2.30)	(0.91)	(-0.50)	(-0.28)	(1.26)
GDP per capita growth, (annual %)	0.36	0.90**	0.40**	0.13	0.11
	(0.91)	(2.15)	(2.59)	(0.78)	(0.47)
trade in goods (% of GDP)		0.37**	0.003	-0.04	-0.008
		(2.19)	(0.10)	(-0.59)	(-0.15)
school expenditure, total (% of GDP)			-0.38	-0.36	-0.24
			(-1.14)	(-1.47)	(-0.90)
Ln (life expectancy at birth, total (years))				9.05	15.63*
				(1.33)	(1.76)
consumer price index (1995 = 100)					-0.02
					(-0.07)
Number of observations	88	85	41	41	36
cross-sections	34	33	20	20	17

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 7
Latin America and the Caribbean
Fixed Effect Estimation: GMM
Dependent variable = secondary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
secondary school enrollment, (1 period lag)	1.67*** (5.92)	1.97*** (4.01)	0.67*** (2.95)	1.27** (2.38)	2.19 (0.19)
foreign direct investment, net inflows, (% of GDP)	1.60* (1.98)	1.32 (1.22)	5.12** (2.42)	7.63*** (3.16)	16.44 (0.22)
GDP per capita growth, (annual %)	-1.53*** (-4.21)	-1.61*** (-2.83)	-1.26 (-0.95)	0.39 (0.21)	1.48 (0.05)
trade in goods (% of GDP)		-0.13 (-1.36)	0.32** (2.58)	0.47*** (4.14)	1.42 (0.13)
school expenditure, total (% of GDP)			-1.40** (-2.17)	-1.30* (-1.80)	2.47 (0.08)
Ln (life expectancy at birth, total (years))				-389.01* (-1.89)	-2963.2 (-0.15)
consumer price index (1995 = 100)					15.58 (0.16)
Number of observations	35	35	20	20	19
cross-sections	13	13	8	8	8

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 8
Asia
Fixed Effect Estimation: GMM
Dependent variable = secondary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
secondary school enrollment, (1 period lag)	0.98***	0.84***	0.56***	0.21	0.43
	(11.05)	(6.57)	(3.46)	(0.64)	(0.98)
foreign direct investment, net inflows, (% of GDP)	1.87	1.20	1.00	0.57	0.12
	(1.33)	(1.36)	(0.87)	(0.51)	(0.12)
GDP per capita growth, (annual %)	0.54	0.68	1.11*	1.07	0.71
	(0.82)	(1.080	(1.90)	(1.41)	(0.89)
trade in goods (% of GDP)		0.06	0.46**	0.36	-0.006
		(0.46)	(2.25)	(1.52)	(-0.02)
school expenditure, total (% of GDP)			1.04	1.18*	0.86
			(1.53)	(1.72)	(1.39)
Ln (life expectancy at birth, total (years))				85.18	87.37
				(1.24)	(0.56)
consumer price index (1995 = 100)					2.35
					(0.27)
Number of observations	35	35	34	34	32
cross-sections	14	14	14	14	13

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 9
Full Sample
Fixed Effect Estimation: GMM
Dependent variable = tertiary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
tertiary school enrollment, (1 period lag)	0.81*** (4.06)	0.86*** (4.41)	1.23*** (6.14)	1.12*** (3.44)	0.91*** (2.79)
foreign direct investment, net inflows, (% of GDP)	0.81 (1.44)	0.57 (1.17)	-0.20 (-0.43)	0.01 (0.03)	0.44 (0.48)
GDP per capita growth, (annual %)	-0.24 (-0.73)	-0.30 (-0.80)	-0.05 (-0.20)	-0.12 (-0.48)	-0.20 (-0.46)
trade in goods (% of GDP)		0.07 (0.57)	-0.03 (-0.50)	-0.08 (-1.02)	-0.03 (-0.29)
school expenditure, total (% of GDP)			0.05 (0.27)	0.16 (0.74)	0.23 (0.79)
Ln (life expectancy at birth, total (years))				33.07 (0.85)	-13.82 (-0.28)
consumer price index (1995 = 100)					1.05 (1.35)
Number of observations	201	199	127	126	116
cross-sections	76	76	54	54	49

Notes: a) * significant at the 10% level. b) **significant at the 5 level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 10
Asia
Fixed Effect Estimation: GMM
Dependent variable = tertiary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
tertiary school enrollment, (1 period lag)	1.08***	1.10***	1.10***	1.11***	1.20***
	(11.65)	(13.37)	(11.62)	(11.15)	(3.41)
foreign direct investment, net inflows, (% of GDP)	3.15***	2.36***	2.15***	2.09***	1.35**
	(10.50)	(4.31)	(3.37)	(4.34)	(2.10)
GDP per capita growth, (annual %)	-1.63***	-1.49***	-1.41***	-1.17***	-0.76*
	(- 12.65)	(-9.97)	(-6.60)	(-4.56)	(-1.97)
trade in goods (% of GDP)		0.02	0.04	0.05*	0.03
		(0.98)	(1.63)	(1.82)	(0.79)
school expenditure, total (% of GDP)			0.01	0.26	0.19
			(0.63)	(1.62)	(0.44)
Ln (life expectancy at birth, total (years))				-17.51	-194.89
				(-0.97)	(-1.57)
consumer price index (1995 = 100)					13.04
					(1.58)
Number of observations	33	33	32	32	30
cross-sections	13	13	13	13	12

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 11
Latin America and the Caribbean
Fixed Effect Estimation: GMM
Dependent variable = tertiary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
tertiary school enrollment, (1 period lag)	0.85***	0.71***	0.29	-0.44	-0.09
	(6.77)	(3.91)	(.037)	(-0.66)	(-0.02)
foreign direct investment, net inflows, (% of GDP)	0.23	0.56*	1.73	0.30	-8.16
	(0.58)	(1.86)	(1.13)	(0.19)	(-0.30)
GDP per capita growth, (annual %)	-0.25	-0.15	0.27	-0.12	-2.63
	(-1.23)	(-1.31)	(0.39)	(-0.21)	(-0.33)
trade in goods (% of GDP)		-0.10**	-0.14	-0.39**	-0.64
		-2.25)	(-0.99)	(-2.57)	(-0.68)
school expenditure, total (% of GDP)			-0.11	-0.16**	-1.23
			(-0.79)	(-2.22)	(-0.39)
Ln (life expectancy at birth, total (years))				299.37*	1805.29
				(2.10)	(0.42)
consumer price index (1995 = 100)					-7.30
					(-0.36)
Number of observations	31	31	16	16	16
cross-sections	13	13	7	7	7

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 12
Africa
Fixed Effect Estimation: GMM
Dependent variable = tertiary school enrollment, (%gross)

	(i) GMM	(ii) GMM	(iii) GMM	(iv) GMM	(v) GMM
tertiary school enrollment, (1 period lag)	2.05*** (8.37)	1.94*** (14.45)	1.42*** (12.61)	1.41*** (12.93)	1.22*** (21.59)
foreign direct investment, net inflows, (% of GDP)	-2.28*** (-4.25)	-2.04*** (-7.85)	-0.72*** (-3.22)	-0.65*** (-2.84)	-0.66*** (-5.20)
GDP per capita growth, (annual %)	0.68** (2.29)	0.46*** (3.35)	0.10* (1.85)	0.01 (0.15)	0.11*** (4.20)
trade in goods (% of GDP)		0.04 (1.22)	-0.06* (-1.95)	-0.03 (-0.96)	-0.02 (-1.31)
school expenditure, total (% of GDP)			-0.18** (-2.26)	-0.07 (-0.79)	-0.11** (-2.10)
Ln (life expectancy at birth, total (years))				13.01** (2.17)	6.79* (1.89)
consumer price index (1995 = 100)					0.36 (1.20)
Number of observations	91	89	42	42	37
cross-sections	33	33	19	19	16

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression and it is taken at 5 year intervals

Table 13
Fixed effect estimation for OLS and GMM
Dependent variable = secondary school enrollment, (%gross)

	OLS	TSLS	GMM	OLS	TSLS	GMM
secondary school enrollment, (1 period lag)	0.73*** (13.73)	0.93*** (17.39)	0.66** (2.58)	0.71*** (13.27)	0.87*** (18.30)	1.44* (1.81)
foreign direct investment, net inflows, (% of GDP)	0.39* (1.85)	-0.23 (-0.16)	2.18*** (2.78)	0.37* (1.74)	-0.30 (-0.20)	4.17** (2.00)
GDP per capita growth, (annual %)	0.09 (0.52)	1.70 (1.522)	-1.12* (-1.94)	0.05 (0.32)	1.34 (1.26)	-2.84** (-2.15)
openness in constant prices	0.0006 (0.02)	0.007 (0.14)	0.07 (0.51)	0.01 (0.45)	0.01 (0.22)	-0.28 (-0.88)
public spending on education, (% of GDP)	2.24*** (4.37)	-0.06 (-0.10)	2.72* (1.69)	2.31*** (4.50)	-0.02 (-0.04)	-2.89 (-0.66)
constant	5.69* (0.06)	4.96** (2.39)		-26.33* (-1.68)	-59.39* (-1.75)	
life expectancy, (taken at 5yr. Intervals)				7.74** (2.08)	16.27* (1.89)	-0.64 (-0.02)
Number of observations	284	189	129	283	188	89
F-statistic	49.94			49.91		
R2 (adj.)	0.92	.89		0.94	0.89	
cross-sections	70	60	53	70	60	50

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression

Table 14
Fixed effect estimation for OLS and GMM
Dependent variable = Primary school enrollment, (%gross)

	OLS	TSLS	GMM	OLS	TSLS	GMM
Primary school enrollment, (1 period lag)	0.48*** (7.28)	0.83*** (14.62)	1.002* (1.81)	0.40*** (6.08)	0.78*** (12.94)	0.71* (1.76)
foreign direct investment, net inflows, (% of GDP)	0.30 (1.04)	-0.02 (-0.01)	2.65** (2.09)	0.16 (0.58)	-0.44 (-0.25)	1.99* (1.88)
GDP per capita growth, (annual %)	0.30 (1.26)	-1.19 (-0.87)	-1.27 (-1.30)	0.39 (1.61)	-1.02 (-0.77)	-1.23 (-1.46)
openness in constant prices	-0.005 (-0.15)	-0.003 (-0.049)	-0.03 (-0.19)	0.009 (0.26)	0.01 (0.17)	0.07 (0.54)
public spending on education, (% of GDP)	0.22 (0.31)	-0.02 (-0.03)	-5.99** -2.22	0.67 (0.98)	0.088 (0.12)	-4.53** -2.32
constant	49.06*** (7.04)	20.40*** (4.38)		-42.52** -2.05	-15.08 (-0.28)	
life expectancy, (taken at 5yr. Intervals)				23.52*** (4.66)	9.36 (0.66)	22.82 (1.34)
Number of observations	284	189	80	283	188	79
F-statistic	19.55			21.41		
R2 (adj.)	0.82	0.73		0.84	0.74	
cross-sections	70	60	49	70	60	48

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets.

Table 15
Fixed effect estimation for OLS and GMM
Dependent variable = Tertiary school enrollment, (%gross)

	OLS	TSLS	GMM	OLS	TSLS	GMM
tertiary school enrollment, (1 period lag)	0.85*** (18.75)	1.10*** (25.08)	1.05*** (7.26)	0.867*** (19.20)	1.15*** (23.34)	0.77*** (3.00)
foreign direct investment, net inflows, (% of GDP)	0.04 (0.50)	-0.04 (-0.05)	-0.10 (-0.31)	0.04 (0.56)	0.05 (0.06)	-0.40 (-0.86)
GDP per capita growth, (annual %)	-0.10 (-1.433)	1.15* (1.76)	-0.68*** (-4.39)	-0.17** (-2.28)	1.23* (1.65)	-0.18 (-0.41)
openness in constant prices	0.04*** (3.41)	0.01 (0.49)	0.14*** (3.5)	0.04*** (3.87)	0.01 (0.48)	0.19*** (2.76)
public spending on education, (% of GDP)	0.03 (0.15)	-0.08 (-0.27)	-1.09 (-1.4)	-0.01 (-0.08)	-0.10 (-0.33)	-0.64 (-0.60)
constant	0.46 (0.66)	-1.4 -1.19)		-2.04 (-0.37)	32.76 (1.18)	
life expectancy, (taken at 5yr. Intervals)				0.56 (0.37)	-8.51 (-1.21)	-15.05 (-1.08)
Number of observations	269	178	119	266	177	118
F-statistic	62.61			63.79		
R2 (adj.)	0.94	0.87		0.94	0.86	
cross-sections	70	59	51	70	59	51

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets.

Table 16
Full Sample
Fixed Effect Estimation for GMM
Dependent variable = average years of primary schooling in the total pop. over 15 years

Explanatory Variables	GMM	GMM	GMM
average years of primary schooling in the total population over 15 years	0.46*** (5.37)	0.56*** (3.09)	0.63** (2.02)
foreign direct investment, net inflows, (% of GDP)	0.048*** (3.01)	0.07* 1.70)	0.08 (1.49)
GDP per capita growth, (annual %)	0.01 (0.59)	0.07 (1.00)	0.08 (1.01)
public spending on education, (% of GDP)	-0.005 (-0.08)	-0.02 (-0.25)	-0.01 (-0.12)
openness in constant prices	-0.001 (-0.55)	-0.006 (-0.96)	-0.009 (-0.95)
life expectancy, (taken at 5yr. Intervals)		-0.54 (-0.89)	-0.73 (-0.90)
population growth rate			0.13 (0.36)
Number of observations	81	80	80
cross-sections	50	49	49

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression

Table 17
Full Sample
Fixed Effect Estimation for GMM
Dependent variable = average years of secondary schooling in total pop. Over 15 years

Explanatory Variables	GMM	GMM	GMM
average years of secondary schooling in total population over 15 years	0.99*** (7.13)	0.89*** (7.62)	1.05*** (3.17)
foreign direct investment, net inflows, (% of GDP)	0.02 (1.52)	0.02* (1.76)	0.03 (1.54)
GDP per capita growth, (annual %)	0.03** (2.16)	0.04** (2.21)	0.03* (1.93)
public spending on education, (% of GDP)	0.07** (2.07)	0.08** (2.26)	0.10* (1.96)
openness in constant prices	-0.007 (-1.78)	-0.006 (-1.44)	-0.008 (-1.36)
life expectancy, (taken at 5yr. Intervals)		0.07 (0.23)	0.03 (0.09)
population growth rate			0.08 (0.45)
Number of observations	130	129	129
cross-sections	54	54	54

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression

Table
18
Full Sample
Fixed Effect Estimation for GMM
Dependent variable = educational attainment of the total pop. over 15 years

Explanatory Variables	GMM	GMM	GMM
educational attainment of the total population over 15 years	0.61*** (7.04)	0.70*** (3.93)	0.92*** (2.15)
foreign direct investment, net inflows, (% of GDP)	0.08** (2.37)	0.11 (1.51)	0.16 (1.40)
GDP per capita growth, (annual %)	0.03 (0.77)	0.10 (0.94)	0.15 (0.88)
public spending on education, (% of GDP)	-0.02 (-0.25)	-0.08 (-0.54)	-0.08 (-0.35)
openness in constant prices	-0.003 (-0.60)	-0.01 (-0.79)	-0.02 (-0.94)
life expectancy, (taken at 5yr. Intervals)		-1.04 (-0.99)	1.16 (-0.95)
population growth rate			0.53 (0.60)
Number of observations	81	80	80
cross-sections	50	49	49

Notes: a) * significant at the 10% level. b) **significant at the 5% level c) ***significant at the one % level. d) t-statistic in brackets. e) life expectancy is in log difference form for GMM regression

Table
19
Fixed Effect Estimation for GMM
Dependent variable = percentage of higher school attainment in the total pop. over 15 years

Explanatory Variables	GMM	GMM	GMM
percentage of higher school attained in population over 15 years	0.77***	0.97***	1.04***
	(4.92)	(6.73)	(5.30)
foreign direct investment, net inflows, (% of GDP)	0.04	0.16*	0.12
	(0.44)	(1.85)	(0.99)
GDP per capita growth, (annual %)	0.11**	-0.04	-0.04
	(1.99)	(-0.48)	(-0.28)
public spending on education, (% of GDP)	0.35	0.30**	0.20
	(1.59)	(2.38)	(1.09)
openness in constant prices	0.04	0.01	0.002
	(1.47)	(0.39)	(0.070
life expectancy, (taken at 5yr. Intervals)		5.37	4.91
		(1.46)	(1.10)
population growth rate			0.29
			(0.56)
Number of observations	130	129	129
cross-sections	54	54	54

Notes: a) * significant at the 10% level. b) **significant at the 5% level
c) ***significant at the one % level. d) t-statistic in brackets.
e) life expectancy is in log difference form for GMM regression

Data Sources:

World Development Indicators:

foreign direct investment, net inflows (% of GDP)

School enrollment, primary (% gross)

School enrollment, secondary (% gross)

School enrollment, tertiary (% gross)

In (life expectancy at birth, total (years)). Taken at 5 year intervals

Openness in Constant Prices

GDP per capita growth (annual %)

Public spending on education, total (% of GDP)

Barro, R.J. and Lee's, J. (2001).

Average years of primary schooling in the total population over 15 years.

Average years of secondary schooling in the total population over 15 years.

The percentage of higher school attained in the total population over 15 years.

Educational attainment of the total population aged 15 and over.

Dexter Gittens

BA, University of the West Indies

MA, Hunter College

The Effects of Foreign Direct Investment on the Accumulation of Human Capital in Developing Countries: Are There Implications for Future Growth?

Dissertation directed by Salvatore, Dominick. PhD.

This research analyzed the impact of foreign direct investment, (FDI) on the accumulation of human capital in developing countries using the General Method of Moments (GMM) Difference Estimator. School enrollment estimates were used as a proxy for human capital. Panel data covering the period 1970 -2000 were constructed and five year averages were taken in order to minimize business cycle effects and control for the hypothesized dynamic effect of FDI on human capital development. Generally the results suggest that FDI has a positive effect on school enrollment rates at the primary and secondary levels. However no such correlation was found at the tertiary level. We tested the robustness and sensitivity of our results by using other measures of schooling to proxy for human capital, and using a different information set. The variables average years of primary schooling, average years of secondary schooling, educational attainment, and higher education in the population replaced school enrollment levels in the regressions. These regression coefficients were positive but statistically insignificant. Finally, we regressed school enrollment levels on a slightly different information set. FDI has a positive and statistically significant impact on school enrollment rates at the primary and secondary levels.

VITA

Dexter Darrell Gittens, the son of the late Victor and Ena Gittens, was born on September 2nd, 1960. In 1989, he received the Bachelor of Arts degree from the University of the West Indies, in Trinidad. He worked for the Central Statistical Office in Trinidad as a Field Interviewer, Statistical Assistant, and Statistician between the years 1888-1992.

In 1992, he migrated to the United States of America where he earned a Master of Arts degree in Economics from Hunter College in 1996. He tutored undergraduate students at Hunter College in Economics and Statistics, while studying for his MA. He was awarded a voucher for graduating at the top of his class in 1996.

He continued to tutor students in Economics upon graduation from Hunter College and also worked as a Mathematics teacher in the New York City public school system in 1998. He began working as an Adjunct Lecturer in Economics, Finance and Mathematics at Monroe College in 2004. He continues to work as an Adjunct Lecturer at Monroe College, while working towards his doctorial degree in Economics, under the mentorship of Dr. Dominick Salvatore.