THE RELATIONSHIP BETWEEN FOREIGN DIRECT INVESTMENT AND TERTIARY EDUCATION IN DEVELOPING COUNTRIES

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ABSTRACT

Foreign Direct Investment (FDI) is widely believed to play a key role in economic development. Existing research suggests that FDI may be positively related to technology transfer, industrial productivity, and overall economic growth. As such, substantial amounts of FDI have flowed into developing countries in recent decades. In this study, I hypothesize that inward FDI contributes to the demand for skilled labor in host countries, which may in turn increase investments in human capital. Specifically, I study the relationship between inward FDI and tertiary education enrollment in developing countries for the period between 2001 to 2015. Although not generally statistically significant, I find some evidence of a positive relationship between FDI inflows and tertiary education enrollment in developing countries. Additionally, I find statistically significant differences in the relationship between FDI inflows and tertiary education enrollment between low-income and middle-income countries. While FDI is negatively related to tertiary education enrollment in low-income countries, this relationship is positive in middle-income countries.

I would like to express my gratitude to my thesis advisor Adam Thomas for his valuable guidance and constant encouragement.

This paper is dedicated to my family for their love and support during these two years of school.

Many thanks,
Poonam Ravindranath

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INTRODUCTION

Human capital has long been linked to economic growth and development, (Barro, 1991; Mankiw et al., 1992; Asteriou & G.M, 2001; Seren, 2001). As a result, for decades, development agendas have centered on primary and secondary education systems across developing countries (Kruss et al. 2015). In recent years, however, a growing body of literature focused specifically on tertiary education (i.e., higher education) finds significant and positive linkages between participation in tertiary education and economic development through the formulation of human capital (Tilak, 2003; Kruss et al. 2015).

In the past, several studies found that the rate of return on investments in education was highest for primary education (Psacharopoulos, 1973; 1985; 1994). In a reversal of these trends, however, recent research has shown that the rate of return on investments in education is currently highest for tertiary education. Specifically, recent evidence suggests that completion of tertiary education is associated with a 14% increase in earnings, which is significantly higher than the estimated rate of return for primary or secondary education (Montenegro & Patrinos, 2014). Participation in tertiary education is also associated with improvements in non-market outcomes; it is positively related with socioeconomic indicators such as family health, infant mortality and household asset management (McMahon, 2009; McMahon & Oketch, 2013). Furthermore, tertiary education plays a crucial role in helping students to accumulate the human capital necessary to participate in a rapidly evolving technology-based economy (Yusuf et al., 2009). In light of these considerations, international organizations and governments are now refocusing their efforts on initiatives to expand and improve access to tertiary education in developing countries.

Enrollments in tertiary education have increased steadily around the world, with global enrollment rates rising from 18 percent in 1995 to over 35 percent in 2015 (World Bank, 2017). Participation rates among some countries in Europe, Latin America, the Caribbean and East Asia have now exceeded 50 percent.[1] However, despite a near-doubling of worldwide tertiary education enrollment in the past two decades, enrollment rates remain low among middle- and low-income countries, at 7 percent and 33 percent respectively (World Bank, 2017).

In light of recent research demonstrating the benefits associated with participation in tertiary education (McMahon, 1999; McMahon and Oketch, 2013, Montenegro & Patrinos, 2014), policy-makers are now keen to understand the mechanisms through which tertiary education outcomes may be improved in developing countries. The linkage between foreign direct investment (FDI) and tertiary education is of particular consequence, as inward FDI's impact on skilled labor may hold the key to boosting tertiary education outcomes in host counties.

Although developing countries continue to undertake policy reforms to open domestic markets to foreign direct investment, questions remain as to FDI's ability to spur human capital development.[2] This study investigates the relationship between FDI inflows and human capital, using tertiary education enrollment as a proxy, in developing countries over the time period spanning from 2001 to 2015. The results provide some, although inconclusive, evidence of a positive relationship between FDI and tertiary education enrollment in developing countries. I also find evidence of variations in the relationship

[1] For example, South Korea, Finland and France have participation rates exceeding 85% (World Bank, 2017).

[2] For example, China and India made sweeping reforms in 1979 and 1991 to open up their economies to foreign inflows and outflows (Arnold et al., 2012; Sun et al. 2002).

between FDI and tertiary education enrollment between countries of different income levels. In low-income countries, FDI inflows are negatively related to tertiary education enrollment, while the relationship of interest is positive in middle-income countries.

BACKGROUND

According to the United Nations Conference on Trade and Development (UNCTAD), FDI is defined as an investment made by an entity in one economy towards the establishment of a long-term business relationship and resulting in the partial or complete ownership of a business entity in another economy (UNCTAD, 2007).

Historically, FDI has been viewed with suspicion among developing countries (Balasubramanyam, 2002). Since the mid-1980s, however, governments across the developing world have executed significant policy reforms to attract FDI (Gastanga et al., 1998). Government-led measures include investments in education, improvements in physical infrastructure capabilities, provision of tax benefits and the easing of regulatory frameworks (Mallampally & Sauvant, 1999). As a consequence, FDI inflows to developing countries have increased rapidly, with global FDI inflows increasing from $208 billion in 1990 to $1.75 trillion in 2016 (UNCTAD, 2017).

The type and amount of FDI that countries receive is related to a variety of factors, including business objectives, policy and economic factors (Mallampally & Sauvant, 1999). Most FDI flows to developing countries have been aimed at the extraction of resources and increasing the market share of multinational enterprises (MNEs) in host countries (UNCTAD, 1998). FDI in developing countries has also been aimed at reducing production costs by capitalizing on low labor and resource costs (UNCTAD, 1998).

Recent years have seen an increase in FDI inflows to developing countries (UNCTAD, 2015). In fact, FDI now constitutes the largest source of external private finance among developing countries (UNCTAD, 2017). This growth in FDI inflows has inevitably fostered questions as to its role in spurring economic growth and development

in middle- and low-income countries. The effects of FDI have been studied with respect to various outcomes in host countries: economic growth (Zhang, 2001; World Bank, 2002), technology spillovers (Smarzynska, 2002; Bwayla, 2006) and human development (Sharma & Gani, 2004; Reiter & Steensma, 2010).

FDI is positively related to economic growth through increases in capital, investments in production capabilities, technology spillovers and knowledge transfer (Caves, 1974; Findlay, 1978; Borensztein et al., 1998; De Mello, 1999). Studies also find that FDI's correlation with economic growth is conditioned by factors such as countries' human capital levels (Borensztein et al., 1998; Bengoa & Sanchez-Robles, 2003; Li and Liu, 2005), income levels (Blomström et al., 1994), trade openness (Balasubramanyam et al., 1996; Zhang, 2001) and political stability (Solomon, 2011).

There is far less research examining the link between FDI inflows and welfare measures like the Human Development Index (HDI) in developing countries. Some studies observe a positive association between FDI inflows and human development levels (as measured by HDI) in developing countries (Sharma & Gani, 2004; Reiter & Steensma, 2010; Lehnert et al., 2013e). Others find that FDI flows correlate negatively with human development rates in developing countries (Kosack & Tobin, 2006).

FDI is also considered to be a key channel for technology transfer to developing countries (UNCTAD, 2014). Theory suggests that FDI introduces new technologies to firms in host countries, which is later diffused locally through interactions between foreign-invested firms and domestic firms (Caves, 1974; Markusen & Venables, 1999). Additionally, the introduction of technology facilitates the training and skill development of employees, who are then conduits for technology transfer when they join other firms

(UNCTAD, 2014). Technology transfer through FDI has been observed in developing countries such as China, India and Bangladesh (Rhee & Belot, 1989; Kathuria, 2000, Liu, 2002).

In the following section, I elaborate on the relationship between FDI and human capital formation. Specifically, I discuss the theoretical models of, and summarize the empirical evidence on, the link between FDI inflows and tertiary education outcomes - a measure of human capital – in host countries.

LITERATURE REVIEW

While there is ample research on the relationship between FDI and economic growth, there are few studies on the relationship between FDI and human capital (Gittens, 2006). What little research exists, has produced mixed results on the relationship between FDI inflows and human capital outcomes such as educational participation and educational attainment (Gittens, 2006; Mughal & Vechiu 2009; Egger et al., 2010; Zhuang, 2017). Gittens (2006) finds a positive linkage between FDI inflows and primary school enrollments in developing countries. The evidence on the relationship between inward FDI and secondary school outcomes is mixed (Gittens & Pilgrim, 2013; Checchi et al, 2007). Gittens & Pilgrim (2013) find a positive association between FDI inflows and secondary school enrollment in developing countries. In contrast, Checchi et al. (2007) find FDI inflows to be negatively correlated with secondary school enrollment in developing countries.

Theoretical Relationship Between FDI and Tertiary Education

FDI inflows can raise the demand for skilled labor, as MNE operations require higher-order skills among employees (Feenstra & Hanson, 1997). When MNEs operate in science, technology and business-related sectors, they offer appealing job opportunities in the host country (Blomström & Kokko, 2002). To acquire the skills required by these jobs, individuals in host countries may make investments in tertiary education (Lehnert et al., 2013). Research has also shown that students are capable of making reasonable predictions regarding the financial benefits associated with participation in tertiary education (Webbink & Hartog, 2004; Topel 1997). In light of this, it can be argued that individuals may respond to the incentives provided by FDI-based employment opportunities by participating in tertiary education.

Empirical Evidence

The existing empirical literature on the subject of FDI and tertiary education, while limited, shows mixed results. In a panel data analysis spanning developing 79 developing countries, Mughal & Vechiu (2010), and Zhuang (2017) find evidence of a negative relationship between FDI and enrollments in tertiary education. In contrast, Egger et al. (2010) study a cross-section of countries and find that post-secondary educational attainment is positively related to FDI inflows. Gittens & Pilgrim (2013) conduct panel data analysis on data averaged over five-year time periods between 1970 to 2010. Their study also finds a positive association between FDI inflows and enrollments in tertiary education. Zhuang (2017) produces conflicting results when he disaggregates FDI inflows by source. Aggregated FDI inflows are negatively linked to tertiary schooling rates, whereas FDI inflows originating from developed countries (i.e., OECD nations) were positively associated with tertiary schooling rates (Zhuang, 2017).

As the existing literature has such contrasting results, it is necessary for further research on this topic, to provide a clearer understanding on the linkages between FDI and tertiary education. This paper contributes to the literature by analyzing, what is, the most recent data on FDI inflows and tertiary education enrollments in the period between 2001 to 2015.

CONCEPTUAL FRAMEWORK

In this paper, I hypothesize that FDI inflows boost the demand for skilled labor, which prompts individuals to make investments in human capital. Specifically, as shown in figure 1, I expect a country's enrollments in tertiary education, the primary outcome of interest in this study, to be influenced by FDI inflows and policy factors, as well as economic, political and demographic characteristics.

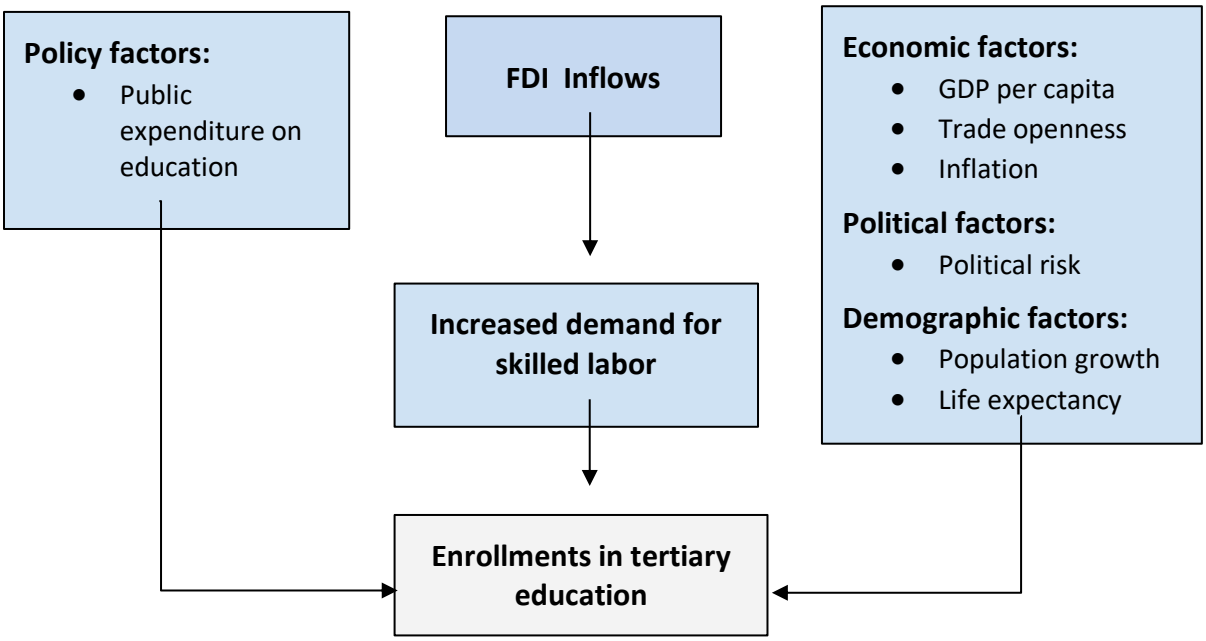

Figure 1. Conceptual Framework

FDI Inflows

As outlined in the previous section, FDI inflows may increase the demand for skilled labor in host countries (Blomström & Kokko, 1998), which can plausibly induce individuals to make investments in education (Lehnert et al., 2013). Because MNEs often require higher-order skills, one can expect these investments to lead to higher post-secondary education enrollments. Additionally, unlike primary and secondary education – which are compulsory across most developing countries (World Bank, 2013) – tertiary

education is voluntary and can better capture responses to these individual incentives to invest in human capital (Mughal & Vechiu, 2011). Hence, I predict that tertiary education enrollments will be positively influenced by increases in FDI inflow.

Policy Factors

Governments often frame policies around, and invest significant resources in, efforts to improve their primary and secondary schooling outcomes. These policies are aimed not only at attracting foreign investment, but also at spurring long-run economic growth (Romer, 1986). As such, public expenditure on primary and secondary education can play a role in preparing students to participate in tertiary education (Bergh & Fink, 2006). Resources may also be invested towards the subsidization and expansion of access to tertiary education. Thus, I expect tertiary education enrollments to rise with increases in public expenditure in education.

Economic Factors

I follow the practice of Lehnert et al. (2013) by controlling for a country's economic well-being via its per capita gross domestic product (GDP) and trade openness. Both factors are indicative of a country's economic environment and can be related to its ability to finance investments in human capital. Previous research has found that per capita income is positively related to education outcomes (Reiter & Steensma, 2010; Zhuang, 2017). Similarly, research has found trade openness to be associated positively with growth and human development outcomes (Glick & Moreno, 1996; Rodrik, 1999). Hence, per capita GDP and trade openness are both likely to be positively related to enrollments in tertiary education.

I also control for a country's economic risk and volatility via its inflation rate (Kosack & Tobin, 2006). Moreover, higher prices may hamper peoples' ability to afford tertiary education (Mughal & Vechiu, 2011). Hence, I expect higher inflation rates to have a negative relationship with tertiary education enrollments.

Institutional Factors

I also include a measure of a country's political or institutional risk, which may be inversely related to a country's attractiveness for FDI investment (Donaubauer et al., 2014) as well as its ability to make improvements to its human capital. Therefore, I expect higher risk ratings to be associated with reduced enrollments in tertiary education.

Demographic Factors

Finally, I control for the rapidly changing demographic characteristics of developing countries. Holding the number of households constant, a rise in population growth rates may result in larger household sizes. An increase in household size may impose financial constraints that reduce households' investments in education (Mughal & Vechiu, 2011). On the other hand, a rise in life expectancy may lead parents to have fewer children and invest more in the education of household members (Soares, 2005; Tamura, 2006).

DATA AND METHODS

I conduct a cross-country panel data analysis using data on 130 developing countries over the time period 2001-2015. I choose to study this set of countries for two reasons: First, in recent years, developing countries have received a higher share of FDI than developed (i.e., high-income) countries (UNCTAD, 2015). Second, in the past two decades, developing countries have witnessed substantial improvements in socioeconomic metrics such as life expectancy and primary school enrollments (World Development Indicators, 2017). It is possible that, over my period of analysis, FDI inflows were partly responsible for these improvements. As such, my sample consists of countries that are classified by the World Bank on the basis of per capita gross national income (GNI) as low-income, lower-middle and upper-middle income countries.

The dependent variable, tertiary education enrollment, is measured as the gross enrollment ratio of the total enrollment in tertiary education to the total population of the 18-23 age group following the completion of high school or secondary education (Chapman & Chien, 2014). Data for this variable come from UNESCO's Statistics Division. The key independent variable, FDI, is measured as the ratio of FDI inflows to GDP. I draw data for this variable from UNCTAD's Statistics Division.

As outlined in the previous section, I control for policy, economic, institutional and demographic variables in my empirical model. I proxy for education policy through public education expenditures, measured as a percentage of total government expenditure. I obtain data for this variable from the World Bank's Development Indicator Database.

As is common across the human capital literature, I include two macroeconomic controls – per capita GDP and trade openness – in my analysis (Kosack and Tobin, 2006;

Lehnert et al. 2013). Both variables are representative of a country's overall economic wealth and consequent ability to make investments in education, which may boost tertiary education enrollments. I also proxy for economic risk and price fluctuations via a country's inflation rate. Data for all the macroeconomic variables come from the World Bank's Development Indicator Database.

My model also controls for the PRS Group's International Country Risk Guide's (ICRG) measure of government and socioeconomic stability. Apart from being related to a government's ability to provide education services and household willingness to invest in education, ICRG's risk rating also accounts for the strength of political and economic institutions that help countries to realize the benefits associated with FDI (Alfaro et al., 2004).

Finally, I control for a country's demographic characteristics via measures of life expectancy rates at birth and the population growth rate, both of which may be associated with human capital outcomes (Bloom et al., 2003). Data for these two demographic variables are also sourced from the World Bank's Development Indicator Database.

Empirical Strategy

I estimate the relationship between FDI inflows and tertiary education enrollment through multivariate regression analysis. I incorporate fixed effects specifications into my analysis in order to control for a subset of the unmeasured characteristics that are not explicitly controlled for in my model. I use country fixed effects to capture country-specific characteristics, such as natural resource endowments, that do not vary over time but may be related to FDI inflows. I also employ year fixed effects to control for time-varying characteristics that are common across all countries included in my sample and may be

related to FDI inflows and tertiary education enrollments – for instance, events such as the global economic crisis of 2008, which may have negatively influenced FDI inflows to developing countries as well as the take-up of tertiary education. The model estimated is as follows:

$$\textbf{Tertiary Enrollment}_{it} = \beta_0 + \beta_1 FDI\ Inflows_{it} + \beta_2 Public\ expenditure_{it} + \beta_3 GDP\ per\ capita_{it} + \beta_4 Trade\ openness_{it} + \beta_5 Inflation_{it} + \beta_6 Country\ risk_{it} + \beta_7 Life\ expectancy_{it} + \beta_8 Population\ growth_{it} + \delta_i + \gamma_t + \epsilon_{it}$$

where i represents each FDI host country, t represents each year, δ_i represents the dummy variables for each country, γ_t represents the dummy variables for each year, and ϵ_{it} is the error term. In the table below, I summarize the variable definitions and sources for all the variables included in my analysis.

Table 1: Variable Definitions and Sources

Variable	Variable Definition	Source
Dependent Variable		
Tertiary education Enrollment	Gross enrollment ratio (GER) for tertiary education (continuous variable) The total enrollment in tertiary education, irrespective of age, expressed as a percentage of the total population of the age group (18-23 years).	UNESCO Statistics Division
Key Independent Variable		
FDI inflows	FDI Inflows (continuous variable) An investment made by an entity in one country towards the establishment of a long-term business relationship and resulting in the partial or complete ownership of a business in another country (UNCTAD, 2007)	UNCTAD Statistics Division
Policy Variable		
Public expenditure on education	Public expenditure on education as % of total government expenditure (continuous variable) Total government expenditure on education sector, expressed as a percentage of total government expenditure on all sectors.	World Bank Development Indicators Database
Macroeconomic Variables		
GDP per capita	Real GDP per capita (continuous variable) The logged value of a country's average per-capita GDP in constant 2010 U.S dollars at purchasing-power-parity.	World Bank Development Indicators Database
Trade openness	Trade Openness (continuous variable) The ratio between the total value of net trade flows and the GDP in constant 2010 U.S dollars at purchasing-power-parity.	World Bank Development Indicators Database
Inflation	Annual Inflation growth (continuous variable) The rate of growth in Consumer Price Index (CPI) over a given year.	World Bank Development Indicators Database
Political Variable		
Country risk	Political Risk (continuous variable) A measure of a country's political stability as compared to other countries, this measure accounts for the risk associated with ten key components, including government stability, socioeconomic conditions, corruption and religious tension. The rating ranges from a high of 100 (least risk) to a low of 0 (highest risk).	International Country Risk Guide (ICRG)

Table 1: (Contd.)

Demographic Variables		
Life expectancy	Life Expectancy at birth in years (continuous variable) The average number of years that an infant would live if the mortality rate at time of birth were to persist over time.	World Bank Development Indicators Database
Population growth	Population growth in percentage (continuous variable) The annual growth in a country's population from the previous year to the current year.	World Bank Development Indicators Database

DESCRIPTIVE STATISTICS

Descriptive statistics for my dependent variable, key independent variable and control variables are presented in Table 2.[3] The average enrollment in tertiary education is 26.6 percent, with a standard deviation of around 21 percent, which indicates significant variation across the developing countries in my sample. The minimum value of .4 percent (Malawi, 2003) and a maximum of around 90 percent (Belarus, 2013) also speak to the considerable variation in enrollment levels across developing countries. There is also wide variation in my key independent variable, with FDI inflows ranging from a minimum of 0.6 million USD (Cameroon, 2010) to a maximum of about 96 billion USD (Brazil, 2011). Over the period of study, the average FDI inflow to developing countries is 4.2 billion USD.

Table 2 also shows significant variation in terms of the control variables included in my sample. Public expenditure on education is on average around 4% of host country GDP, but ranges from 1% (Gambia, 2004) to 10% (Timor-Leste, 2009). GDP per capita is on average US $3,735, which is significantly lower than the global average of $14,838.[4] The average country risk rating is 61.8, which implies moderate to high political risk.[5] The global average, however, is around 71, indicating that political conditions among countries in my sample are less desirable than that of high-income countries.[6] On the other hand, the mean life expectancy of 66.8 years and population growth of 1.3 percent for developing

[3] Several variables in my sample – including the dependent, key independent and control variables – had missing data in the time period spanning between 2001 to 2015. I employed a combination of linear interpolation and backwards extrapolation to fill in the missing values.

[4] The global mean of GDP per capita, amounting to $18,687, was calculated by the author.

[5] ICRG's Country Political Risk Rating scale is as follows: 0% - 49.0%: Very High Risk; 50% - 59.9%: High Risk; 60% - 69.9%: Moderate Risk; 70% - 79.9%: Low Risk; 80.% and upward: Very Low Risk (Howell, 2011).

[6] The global mean was calculated by the author.

countries in my sample are not very different from the global means of 72 years and 1.2 percent, respectively. [7] However, the values for life expectancy range from 39 (Sierra Leone, 2001) to 79 years (Costa Rica, 2015), indicating substantial variation across countries.

Table 2. Descriptive Statistics for Dependent, Key Independent and Control Variables

Variable	Mean	Std. Dev.	Min.	Max.
Tertiary Education Enrollments	26.6	21.4	.4	91.1
Key Independent Variable				
FDI Inflows (millions of USD)	4,214	9,333	0.55	96,152
Policy Variable				
Public Expenditure on Education (% GDP)	4.2	1.6	1.1	10.6
Economic Variables				
GDP per capita (in USD)	3,735.7	3,126.4	278	14,687.9
Trade Openness (trade-to-GDP ratio)	73.9	31.5	20.9	210.3
Inflation (%)	6.0	5.4	-5.3	59.2
Political Variable				
Country Risk (scale 0-100)	61.8	7.6	37.5	79
Demographic Variables				
Life Expectancy	66.8	7.8	39.6	79.6
Population Growth (%)	1.5	1.2	-2.1	7.1
N = 738				

Differences exist in my data not only between different countries but also over time. As shown in Figure 2, despite fluctuations, average enrollments in tertiary education rose over my period of study, from about 19 percent in 2001 to about 33 percent in 2015. The distribution of these changes indicates that, while most countries increased their enrollments over time, some countries may have improved at much higher rates than others (see Figure 3).

[7] The global means were calculated by the author.

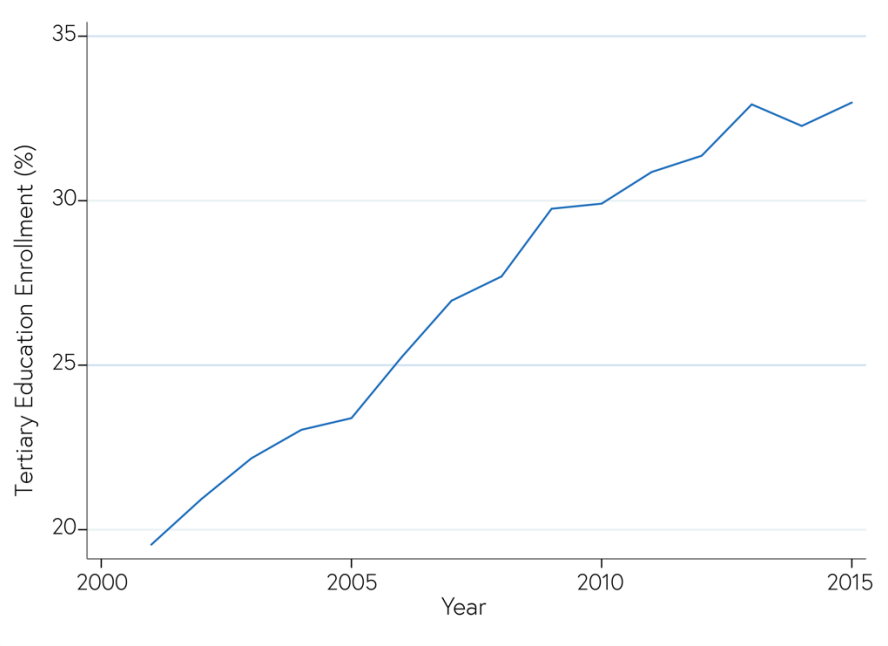

Figure 2. Average Enrollment in Tertiary Education between 2001-2015

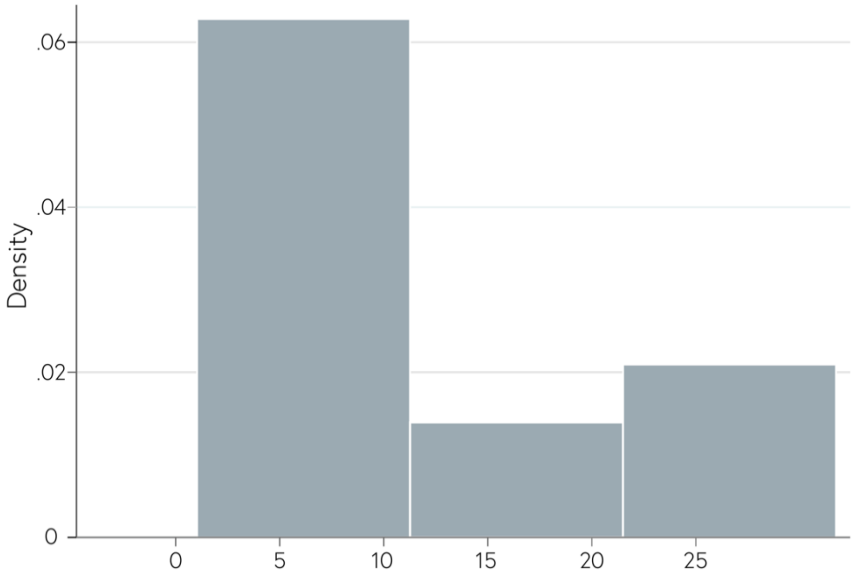

Figure 3. Change in Tertiary Education Enrollments between 2001-2015

REGRESSION RESULTS

I estimate my empirical model using two commonly employed measures of FDI inflows (Neumeyer & Spess, 2005; Kerner, 2009; Mughal & Vechiu, 2010; Zhuang, 2017). I first measure my key independent variable as the ratio of FDI inflows to a country's GDP. Though this measure is frequently used in studies of FDI and human capital (Mughal & Vechiu, 2010; Zhuang, 2017), fluctuations in a country's GDP may mask the variation in FDI flows (Neumeyer & Spess, 2005).[8] Therefore, I also employ a measure of net absolute FDI inflows as an alternate key independent variable (Neumeyer & Spess, 2005; Kerner, 2009). I follow common practice in the FDI literature by logging absolute FDI inflows to account for skewness in the distribution and year-on-year fluctuations in this variable (Neumeyer & Spess, 2005; Kerner, 2009).

It is plausible that FDI-induced demand for skilled labor, and subsequent take-up of tertiary education, may not be immediate. To account for this, as well as for the likely endogenous relationship between FDI and tertiary education, I lag the two aforementioned measures of FDI in most of my models. Instead of choosing an arbitrary time period to lag my key independent variable, I employ lags of between one and five years and present results for the same.[9] To reduce omitted variable bias in my regressions, I include policy, economic, institutional and demographic controls. I further reduce bias by including country and year fixed effects to control for fixed time-variant and time-invariant differences between states and across years, respectively. The addition of country and year

[8] My model does not include GDP as a control variable. I use GDP per capita – GDP divided by population size – as a control in my model. Though the main model does not include population size as a control, I carried out additional regressions with population size included. In these regressions, the coefficient of the key independent variable does not vary materially with respect to its magnitude or significance.

[9] In a supplementary set of analyses, I conduct regressions with FDI lagged for 6- and 7-year time periods. In these regressions, I find that the magnitude and significance of the coefficient of interest decreases.

fixed effects, however, significantly reduces the explanatory potential of my key independent and control variables. As it happens, I find an r-squared of 0.95 when I regress my dependent variable, tertiary enrollment, on country and year dummies. I estimate a total of twelve models and report the coefficient and robust standard error of my key independent variable in Table 3. Due to the considerable number of models that I estimate, I only report the coefficient and robust standard error of my key independent variable in Table 3. I report the complete regression results in Appendices 1-2.

The results in Table 3 show some evidence of a positive relationship between my key independent variable – whether FDI ratio or logged FDI - and tertiary education enrollment. In general, when I use FDI ratios in the model, I find the relationship of interest to be positive but statistically insignificant. A one unit increase in the FDI ratio, lagged over two years, is associated with a 0.07 percentage point increase in tertiary education enrollment. When this model is estimated using logged FDI as the key independent variable, the relationship between FDI and tertiary education enrollment is positive and generally statistically significant. For example, a one percent increase in FDI inflows, lagged over two years, is correlated with a 0.006 percentage point increase in tertiary education enrollment. These results are in contrast to the findings of Mughal & Vechiu (2011) and Zhuang (2017), who find a negative relationship between FDI inflows and tertiary education enrollment.

In regressions using FDI ratio, the size of the coefficient of interest varies when additional years of lag are employed. As shown in Table 4, these changes do not follow any particular trend. However, in the logged FDI regressions, the size and significance of the coefficient increases with each additional year of lag. This result is not too surprising

as it may be reasonable to expect longer periods of time before host countries accrue the benefits of inward FDI. As pointed out by the World Bank (2013), delays in bureaucratic processing and regulation compliance, among other reasons, may lower the ability of foreign investors to set up fully operational enterprises in host countries within the year in which the transfer of funds has taken place. Such delays imply that FDI-induced demand for skilled labor may not be immediate in host countries. This could explain increases in the magnitude of the coefficient of interest when additional years of lag are employed for the logged FDI variable.

Table 3: Regression Results of FDI Inflow on Tertiary Education Enrollment

Dependent Variable: Tertiary Education Enrollment (in percentage points)		
Key Independent Variable	**FDI ratio**	**Log (FDI)**
Not Lagged	0.0665	0.201
	(0.0691)	(0.302)
Lagged (1 year)	0.0554	0.378
	(0.0535)	(0.295)
Lagged (2 years)	0.0719	0.660**
	(0.05)	(0.303)
Lagged (3 years)	0.0741	0.827**
	(0.0476)	(0.337)
Lagged (4 years)	0.0835*	1.119***
	(0.0471)	(0.336)
Lagged (5 years)	0.0282	1.156***
	(0.0385)	(0.36)
N = 738		

Robust standard errors in parenthesis
* p < 0.10, ** p < 0.05, *** p < 0.001

Note: The model includes policy, economic, institutional and demographic controls, as well as country and year fixed effects. Complete results are presented in Appendices 1-2.

My sample consists of developing countries that are classified by the World Bank on the basis of per capita gross national income (GNI) as low-income, lower-middle and upper-middle income countries. To analyze potential differences in the relationship between FDI and tertiary education in countries with different income characteristics, I construct models in which I interact dummies reflecting a country's income classification with FDI inflow. These interaction terms are in addition to the list of controls already included in the model specification used in Table 4. Because I use two different measures of FDI and a variety of lags, I once again estimate twelve models. In Table 5, I report the coefficient and robust standard error for my key independent variable and for these interaction terms. For each model, I also conduct a set of joint significance tests and report these results. As before, I only report the coefficients and robust standard errors for my key independent variable in Table 4. I report complete regression results in Appendices 3-4.

Surprisingly, I find FDI ratio to be negatively associated with tertiary education enrollment in low-income countries. In contrast, I find the relationship of interest to be positive in lower-middle and upper-middle income countries. For example, a one unit increase in FDI ratio is associated with a 0.196 percentage point decrease in tertiary enrollment in low-income countries, but with a 0.067 (-0.196 + 0.263 = 0.067) and 0.169 (-0.196 + 0.365 = 0.169) percentage point increase in tertiary education enrollment in lower-middle and upper-middle income countries, respectively.

The results are similar when logged FDI inflows are employed as the key independent variable in the regressions. In low-income countries, a one percent increase in FDI inflows, lagged by 2 years, is associated with a 0.012 percentage point decrease in tertiary education enrollment. On the other hand, a one percent increase in FDI inflows,

lagged by two years, is related to a 0.001 (-0.01207 + 0.01347 = 0.0014) and 0.022 (-0.01207 + 0.03469 = 0.0226) percentage point increase in tertiary education enrollment in lower-middle and upper-middle income countries, respectively. I find these coefficients to be jointly significant.

In sum, I find the association between logged FDI inflows and tertiary education enrollment in developing countries to be positive and statistically significant. However, this relationship is generally statistically insignificant in models employing FDI ratio as the key independent variable. The regression results from my subgroup analyses reveal statistically significant differences in the relationship between FDI and tertiary education in low-income and middle-income countries. In low-income countries, FDI inflows are negatively related to tertiary education enrollment. In contrast, I find this relationship to be positive in lower-middle and upper-middle income countries. In the following section, I explore the policy implications of these results and outline potential avenues for future research.

Table 4: Subgroup Regression Results of FDI Inflows on Tertiary Education Enrollment

Dependent Variable: Tertiary Education Enrollment (in percentage points)			
$Tertiary\ Enrollment_{it} = \beta_0 + \beta_1\ FDI\ Inflows_{it} + \beta_2\ FDI\ Inflows * Lower{-}Middle\ Income_{it} + \beta_3\ FDI\ Inflows * Upper - Middle\ Income_{it} + \beta_4\ Controls_{it} + \delta_i + \gamma_t + \epsilon_{it}$			
Key Independent Variable	**Coefficient**	**FDI ratio**	**Log (FDI)**
Not lagged	β_1	-0.0840	-1.481***
		(0.0599)	(0.555)
	β_2	0.218**	1.498***
		(0.0828)	(0.512)
	$\beta_2 + \beta_1 = 0$	0.0294	0.9595
	β_3	0.282**	2.915***
		(0.131)	(0.904)
	$\beta_3 + \beta_1 = 0$	0.1004	0.0176
Lagged (1 year)	β_1	-0.0853	-1.607***
		(0.0674)	(0.562)
	β_2	0.210**	1.649***
		(0.103)	0.9043
	$\beta_2 + \beta_1 = 0$	0.133	0.0081
	β_3	0.254**	3.472***
		(0.117)	(0.984)
	$\beta_3 + \beta_1 = 0$	0.1003	0.0052
Lagged (2 year)	β_1	-0.196**	-1.207**
		(0.0886)	(0.468)
	β_2	0.263**	1.347***
		(0.110)	(0.478)
	$\beta_2 + \beta_1 = 0$	0.0446	0.6947
	β_3	0.365***	3.469***
		(0.135)	(0.896)
	$\beta_3 + \beta_1 = 0$	0.0296	0.0006
Lagged (3 year)	β_1	-0.213*	-1.063*
		(0.107)	(0.540)
	β_2	0.233*	1.208**
		(0.126)	(0.571)
	$\beta_2 + \beta_1 = 0$	0.1219	0.6937
	β_3	0.382***	3.478***
		(0.137)	(0.910)
	$\beta_3 + \beta_1 = 0$	0.0247	0.0002

Table 4: (Contd.)

Lagged (4 year)	β_1	-0.203	-0.680
		(0.133)	(0.519)
	β_2	0.167	0.897
		(0.161)	(0.571)
	$\beta_2 + \beta_1 = 0$	0.3169	0.6183
	β_3	0.382**	3.317***
		(0.158)	(0.874)
	$\beta_3 + \beta_1 = 0$	0.0482	0.0001
Lagged (5 year)	β_1	-0.0607	-0.606
		(0.0735)	(0.465)
	β_2	-0.0151	0.685
		(0.136)	(0.531)
	$\beta_2 + \beta_1 = 0$	0.6365	0.8499
	β_3	0.191*	3.245***
		(0.111)	(0.829)
	$\beta_3 + \beta_1 = 0$	0.2316	0.0001
N = 738			

Robust standard errors in parenthesis
* p < 0.10, ** p < 0.05, *** p < 0.001

Note: The model includes policy, economic, institutional and demographic controls, as well as country and year fixed effects. Complete results are presented in Appendices 3-4.

DISCUSSION

With vast increases in FDI flows to developing countries over the past few decades (UNCTAD, 2017), policymakers are keen to understand FDI's relationship with human capital in host countries. The existing evidence on the relationship between inward FDI and human capital outcomes in host countries is both limited and mixed (Egger et al., 2010; Mughal & Vechiu 2010; Gittens & Pilgrim, 2013; Zhuang, 2017). This study estimates the relationship between FDI and tertiary education using two different measures of FDI: the FDI ratio and logged FDI. Although the regression results suggest that FDI ratio and logged FDI are positively correlated to tertiary education enrollment, the relationship is statistically significant only when logged FDI, lagged between two and five years, is employed as the key independent variable in my model.

Unlike previous research, this study also conducts subgroup analyses to explore potential differences in the relationship between FDI and tertiary education enrollment between countries of different income levels. Here, I surprisingly find FDI ratio and logged FDI to be negatively related to tertiary education enrollment in low-income countries. In contrast, the relationship of interest is positive in lower-middle and upper-middle income countries. Model misspecification may lie at the root of these results. Alternatively, it is plausible that FDI inflows to low-income countries provide a disincentive to invest in tertiary education. Jacob & Sasso (2015) suggest that FDI flows to low-income countries are primarily directed towards low-skilled manufacturing sectors. Under such circumstances, individuals in low-income countries may reduce investments in tertiary education. In contrast, middle-income countries - which have relatively higher human capital levels to begin with - attract FDI in high-skilled manufacturing and services sectors

(Ouedraogo and Marlet, 2018), which may in turn induce individuals to invest more in tertiary education.

This study is subject to several limitations. One key limitation arises from the endogenous relationship between FDI and human capital in host countries. Mughal & Vechiu (2011), Gittens & Pilgrim (2013) and Zhuang (2017) argue that there is a two-way relationship between FDI inflows and human capital. As hypothesized in this paper, FDI inflows increase employment opportunities that may raise investments in tertiary education. On the other hand, foreign investors are increasingly drawn to locations that can provide skilled labor (Pfeffermann & Madarassy, 1992; Noorbaksh et al., 2001). Indeed, empirical studies have shown that an increase in host countries' human capital levels may boost FDI inflows (Dunning & Narula, 1996; Hanson, 1996; Noorbaksh et al., 2001).

Zhuang (2017) employs an instrumental variable approach to tackle this endogeneity problem, instrumenting for FDI inflows through primary schooling and tertiary schooling levels at the beginning of the period of study, the initial level of FDI inflow levels, and changes in public education expenditure. However, it is likely that these instruments are directly related to tertiary education outcomes, independent of any impacts they may have on FDI, thereby violating the 'exclusion restriction' mandated by the instrumental variable approach. Indeed, other researchers have acknowledged the difficulty in finding suitable instruments for FDI inflows (Mughal & Vechiu, 2011). Therefore, to overcome this issue of endogeneity, I use a lagged value of FDI inflows in most of my regression analyses. However, economists have shown that the use of lagged variables may be an inadequate approach to tackle endogeneity bias (Bellemare et al., 2015).

Moreover, although I control for economic, policy, institutional and demographic characteristics, as well as country and year fixed effects, the results of this study may be subject to omitted variable bias. For instance, this study omits a measure of the accessibility of tertiary education institutions which is likely to be positively associated with tertiary education enrollment and FDI inflows. Hence, the omission of this characteristic is likely to bias my estimates in the upward direction. Another characteristic not included in my analyses is the cost of tertiary education which may be negatively related to the outcome variable. Countries with high tertiary education costs may also be less attractive to foreign investors. Therefore, the exclusion of tertiary education cost is likely to positively bias my results. In sum, the omission of these two factors may exaggerate the relationship between tertiary education enrollment and FDI inflows.

Additionally, this study is limited by the use of aggregated FDI inflow as the sole measure of inward FDI in developing countries. Although FDI is usually measured as a composite monetary figure, the quality and type of inward FDI varies substantially over time and across countries (UNCTAD, 2006). FDI quality - which is a measure of FDI's ability to boost skills, transfer technology, and increase jobs in the host economy (UNCTAD, 2006) - is likely to capture the skill requirements of employment opportunities provided by FDI in host countries. Hence, I expect the relationship of interest to vary by the quality of FDI inflows in host countries. FDI inflows can also be disaggregated on the basis on investor motivations and business operations. Dunning (1998) categorizes FDI into resource-seeking, efficiency-seeking, market-seeking and strategic-asset-seeking. According to previous research, efficiency-seeking FDI is highly sought after and related to skills transfer, technology spillovers and productivity benefits in recipient nations

(Hornberger et al., 2011). In contrast, resource-seeking investments have been associated with mixed outcomes in host countries (USAID, 2007). As there is currently little available data on such disaggregated FDI, researchers have used aggregated FDI measures in their studies. However, as and when these data become available, future researchers can shed more light on the relationship between FDI and tertiary education by separating FDI into meaningful components.

Researchers may also wish to explore the role of domestic investment, as an alternative to FDI, in enhancing human capital outcomes in host countries. Developing countries often have to choose between the promotion of foreign investment and domestic investment (Görg & Greenaway, 2004). It is not necessarily clear that FDI plays a superior role in providing high-skilled employment opportunities. Therefore, further research on the relationship between domestic investment and tertiary education can help policymakers to make informed decisions regarding the promotion of one form of investment over the other.

Overall, this study does not find a clear association between FDI and tertiary education enrollment in developing countries. However, my results indicate that there may be differences in the relationship between FDI and tertiary education in developing countries with different income characteristics. While the relationship between FDI and tertiary education enrollment is negative among low-income countries, for middle-income countries the relationship is positive. These results suggest that further research is required to help developing countries frame policies that allow the benefits of FDI to be reflected in tertiary education outcomes.

APPENDIX: DATA TABLES

Table 5: Regression Results of FDI ratio on Tertiary Education Enrollment

Dependent Variable: Tertiary Education Enrollment						
Key Independent Variable: FDI ratio (lagged 0-5 years)						
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	0.0665					
	(0.0691)					
FDI (lagged 1 year)		0.0554				
		(0.0535)				
FDI (lagged 2 year)			0.0719			
			(0.0500)			
FDI (lagged 3 year)				0.0741		
				(0.0476)		
FDI (lagged 4 year)					0.0835*	
					(0.0471)	
FDI (lagged 5 year)						0.0282
						(0.0385)
Public Education	0.752	0.735	0.722	0.724	0.735	0.745
Expenditure	(0.460)	(0.459)	(0.462)	(0.461)	(0.460)	(0.459)
GDP per capita	8.376	8.072	7.899	7.721	7.574	7.742
	(5.499)	(5.813)	(5.985)	(6.128)	(6.175)	(6.186)
Trade Openness	0.0254	0.0286	0.0279	0.0280	0.0288	0.0267
	(0.0285)	(0.0287)	(0.0286)	(0.0286)	(0.0289)	(0.0307)
Inflation	-0.0436	-0.0446	-0.0457	-0.0467	-0.0471	-0.0437
	(0.0780)	(0.0779)	(0.0779)	(0.0781)	(0.0782)	(0.0777)
Life Expectancy	-1.611***	-1.611***	-1.605***	-1.600***	-1.594***	-1.579***
	(0.316)	(0.318)	(0.317)	(0.316)	(0.313)	(0.313)
Population growth	-0.209	-0.235	-0.317	-0.383	-0.420	-0.419
	(0.938)	(0.946)	(0.923)	(0.923)	(0.925)	(0.949)
Country Risk	-0.0672	-0.0613	-0.0621	-0.0572	-0.0529	-0.0516
	(0.111)	(0.111)	(0.111)	(0.111)	(0.112)	(0.112)
Constant	59.67	61.49	62.58	63.41	63.85	61.81
	(48.60)	(50.89)	(52.03)	(53.03)	(53.23)	(53.21)
Observations	738	738	738	738	738	738
R-squared	0.566	0.565	0.565	0.565	0.566	0.564

Robust standard errors in parenthesis
* p < 0.10, ** p < 0.05, *** p < 0.001

Table 6: Regression Results of Logged FDI Inflows on Tertiary Education Enrollment

Dependent Variable: Tertiary Education Enrollment						
Key Independent Variable: Logged FDI (lagged 0-5 years)						
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	0.201					
	(0.302)					
FDI (lagged 1 year)		0.378				
		(0.295)				
FDI (lagged 2 year)			0.660**			
			(0.303)			
FDI (lagged 3 year)				0.827**		
				(0.337)		
FDI (lagged 4 year)					1.119***	
					(0.336)	
FDI (lagged 5 year)						1.156***
						(0.360)
Public Education	0.757	0.749	0.716	0.721	0.758*	0.774*
Expenditure	(0.463)	(0.460)	(0.461)	(0.456)	(0.448)	(0.442)
GDP per capita	7.603	7.301	6.916	6.745	6.852	7.306
	(6.080)	(5.956)	(5.760)	(5.738)	(5.678)	(5.774)
Trade Openness	0.0290	0.0288	0.0292	0.0294	0.0258	0.0219
	(0.0290)	(0.0290)	(0.0287)	(0.0286)	(0.0281)	(0.0279)
Inflation	-0.0437	-0.0428	-0.0457	-0.0485	-0.0474	-0.0409
	(0.0774)	(0.0768)	(0.0747)	(0.0736)	(0.0724)	(0.0725)
Life Expectancy	-1.608***	-1.617***	-1.637***	-1.654***	-1.681***	-1.684***
	(0.318)	(0.319)	(0.320)	(0.322)	(0.317)	(0.314)
Population growth	-0.270	-0.271	-0.377	-0.453	-0.556	-0.777
	(0.948)	(0.940)	(0.920)	(0.905)	(0.863)	(0.822)
Country Risk	-0.0588	-0.0562	-0.0577	-0.0477	-0.0330	-0.0276
	(0.111)	(0.111)	(0.110)	(0.109)	(0.105)	(0.101)
Constant	63.62	65.32	68.30	69.27	67.77	65.03
	(52.32)	(51.47)	(50.15)	(49.94)	(49.03)	(49.42)
Observations	738	738	738	738	738	738
R-squared	0.564	0.565	0.570	0.574	0.582	0.584

Robust standard errors in parenthesis
* p < 0.10, ** p < 0.05, *** p < 0.001

Table 7: Regression Results of FDI ratio on Tertiary Education Enrollment (with Interaction Terms)

Dependent Variable: Tertiary Education Enrollment						
Key Independent Variable: FDI ratio (lagged 0-5 years)						
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	-0.0840					
	(0.0599)					
FDI (lagged 1 year)		-0.0853				
		(0.0674)				
FDI (lagged 2 year)			-0.196**			
			(0.0886)			
FDI (lagged 3 year)				-0.213*		
				(0.107)		
FDI (lagged 4 year)					-0.203	
					(0.133)	
FDI (lagged 5 year)						-0.0607
						(0.0735)
Public Education	0.783*	0.740	0.731	0.725	0.741	0.725
Expenditure	(0.462)	(0.460)	(0.461)	(0.458)	(0.452)	(0.454)
GDP per capita	9.864*	8.723	7.659	6.925	6.871	7.305
	(5.057)	(5.439)	(5.681)	(5.899)	(6.002)	(6.106)
Trade Openness	0.0231	0.0216	0.0257	0.0281	0.0273	0.0342
	(0.0283)	(0.0292)	(0.0284)	(0.0283)	(0.0295)	(0.0337)
Inflation	-0.0469	-0.0495	-0.0556	-0.0558	-0.0503	-0.0471
	(0.0778)	(0.0774)	(0.0776)	(0.0776)	(0.0777)	(0.0777)
Life Expectancy	-1.518***	-1.544***	-1.526***	-1.524***	-1.529***	-1.579***
	(0.296)	(0.304)	(0.305)	(0.310)	(0.310)	(0.314)
Population growth	-0.290	-0.381	-0.420	-0.519	-0.690	-0.593
	(0.910)	(0.883)	(0.886)	(0.900)	(0.894)	(0.966)
Country Risk	-0.0733	-0.0745	-0.0719	-0.0636	-0.0534	-0.0495
	(0.110)	(0.111)	(0.111)	(0.111)	(0.111)	(0.111)
FDI * Lower-middle	0.218**					
Income	(0.0828)					
FDI * Upper-middle	0.282**					
Income	(0.131)					
FDI (lagged 1 year) *		0.210**				
Lower-middle Income		(0.103)				
FDI (lagged 1 year) *		0.254**				
Upper-middle Income		(0.117)				
FDI (lagged 2 year) *			0.263**			
Lower-middle Income			(0.110)			
FDI (lagged 2 year) *			0.365***			
Upper-middle Income			(0.135)			
FDI (lagged 3 year) *				0.233*		
Lower-middle Income				(0.126)		
FDI (lagged 3 year) *				0.382***		
Upper-middle Income				(0.137)		
FDI (lagged 4 year) *					0.167	
Lower-middle Income					(0.161)	
FDI (lagged 4 year) *					0.382**	

Table 7: (Contd.)

	(1)	(2)	(3)	(4)	(5)	(6)
Upper-middle Income					(0.158)	
FDI (lagged 5 year) *						-0.0151
Lower-middle Income						(0.136)
FDI (lagged 5 year) *						0.191*
Upper-middle Income						(0.111)
Constant	42.85	53.74	60.28	65.22	65.52	64.68
	(43.67)	(47.56)	(49.79)	(51.77)	(52.55)	(53.31)
Observations	738	738	738	738	738	738
R-squared	0.575	0.572	0.572	0.571	0.571	0.568

Robust standard errors in parenthesis
* p < 0.10, ** p < 0.05, *** p < 0.001

Table 8: Regression Results of Logged FDI Inflows on Tertiary Education Enrollment (with Interaction Terms)

Dependent Variable: Tertiary Education Enrollment						
Key Independent Variable: Logged FDI (lagged 0-5 years)						
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	-1.481***					
	(0.555)					
FDI (lagged 1 year)		-1.607***				
		(0.562)				
FDI (lagged 2 year)			-1.207**			
			(0.468)			
FDI (lagged 3 year)				-1.063*		
				(0.540)		
FDI (lagged 4 year)					-0.680	
					(0.519)	
FDI (lagged 5 year)						-0.606
						(0.465)
Public Education	0.872*	0.852*	0.827*	0.817*	0.792*	0.749*
Expenditure	(0.451)	(0.433)	(0.429)	(0.422)	(0.414)	(0.410)
GDP per capita	6.116	5.034	4.525	4.208	4.747	5.522
	(5.071)	(4.697)	(4.635)	(4.830)	(4.955)	(5.276)
Trade Openness	0.0346	0.0336	0.0317	0.0323	0.0334	0.0309
	(0.0286)	(0.0289)	(0.0283)	(0.0284)	(0.0280)	(0.0277)
Inflation	-0.0305	-0.0277	-0.0416	-0.0486	-0.0554	-0.0414
	(0.0711)	(0.0683)	(0.0618)	(0.0607)	(0.0603)	(0.0585)
Life Expectancy	-1.188***	-1.139***	-1.182***	-1.210***	-1.340***	-1.382***
	(0.309)	(0.310)	(0.305)	(0.323)	(0.304)	(0.297)
Population growth	-0.357	-0.580	-0.800	-0.928	-1.126	-1.318*
	(0.926)	(0.880)	(0.843)	(0.821)	(0.760)	(0.764)
Country Risk	-0.0724	-0.0650	-0.0591	-0.0423	-0.0184	0.00159
	(0.106)	(0.103)	(0.0982)	(0.0975)	(0.0929)	(0.0878)
FDI * Lower-middle	1.498***					
Income	(0.512)					
FDI * Upper-middle	2.915***					
Income	(0.904)					
FDI (lagged 1 year) *		1.649***				
Lower-middle income		(0.521)				
FDI (lagged 1 year) *		3.472***				
Upper-middle Income		(0.984)				
FDI (lagged 2 year) *			1.347***			
Lower-middle Income			(0.478)			
FDI (lagged 2 year) *			3.469***			
Upper-middle Income			(0.896)			
FDI (lagged 3 year) *				1.208**		
Lower-middle Income				(0.571)		
FDI (lagged 3 year) *				3.478***		
Upper-middle Income				(0.910)		
FDI (lagged 4 year) *					0.897	
Lower-middle Income					(0.571)	

Table 8: (Contd.)

	(1)	(2)	(3)	(4)	(5)	(6)
FDI (lagged 4 year) *					3.317***	
Upper-middle Income					(0.874)	
FDI (lagged 5 year) *						0.685
Lower-middle Income						(0.531)
FDI (lagged 5 year) *						3.245***
Upper-middle Income						(0.829)
Constant	45.87	49.79	54.65	57.34	59.49	56.24
	(46.06)	(43.46)	(42.74)	(43.55)	(43.62)	(45.76)
Observations	738	738	738	738	738	738
R-squared	0.582	0.595	0.608	0.614	0.624	0.629

Robust standard errors in parenthesis
* p < 0.10, ** p < 0.05, *** p < 0.001

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