DOES FOREIGN DIRECT INVESTMENT AFFECT THE GROWTH RATE IN DEVELOPING COUNTRIES? THE EMPIRICAL EVIDENCE FOR THE PERIOD 1970-2004

by

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ABSTRACT

This paper examines whether foreign direct investment (FDI) affects economic growth in developing countries within the standard neoclassical growth framework, based on data for 127 developing countries over the period 1970-2004. Both Ordinary Least Squares (OLS) and dynamic panel data estimation with fixed effects are used to assess this relationship. The results suggest that FDI does have direct positive effects on economic growth, and the effects of FDI are not contingent on the "absorptive capacity" of recipient countries.

Keywords: foreign direct investment; economic growth; development; developing countries

To my parents

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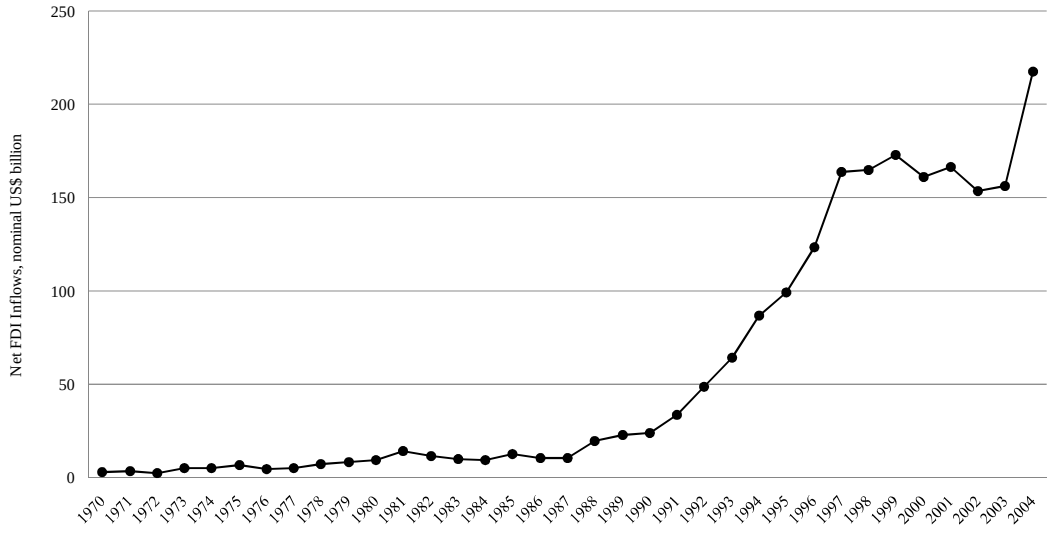
1 Introduction

Foreign direct investment (FDI) has emerged as an important source of external resources flows to developing countries. It rose from an annual rate of nominal US$2.9 billion in 1970 to US$9.0 billion in 1980 and US$23.8 billion in 1990 before surging to over US$217.3 billion in 2004. Figure 1 provides information on net FDI inflows to developing countries from1970 to 2004.

Figure 1: Net FDI inflows to developing countries, 1970-2004



Source: Figure constructed from data in World Bank's World Development Indicators

FDI involves much more than the simple transfer of capital. It also includes advanced production technology, management experience, entrepreneurial abilities that can be transferred to developing countries by the process of learning by doing, and spillovers.

Because accumulation of capital and the process of learning by doing have long been recognized as important sources of economic growth, FDI is often viewed in theory as an engine of growth. But what does the empirical evidence suggest about the relationship between FDI and the growth rate in developing countries? Unfortunately, the impact of FDI on growth remains more contentious in empirical than in theoretical studies.

There have been quite a number of empirical studies analyzing the impact of FDI on economic growth so far. However, the results are varied as different analytical techniques and data samples are adopted. Carkovic and Levine (2002) analyze cross-sectional and panel data of 72 countries over the period 1960-1995 using both the Ordinary-Least-Squares (OLS) and the Generalized-Method-of-Moments (GMM) under the identifying assumption that the independent variables are weakly exogenous. They find FDI inflows do not exert an independent influence on economic growth. According to Carkovic and Levine, their results are robust to different alternative estimation procedures, different information set and sample, and alternative database of FDI being used. Borensztein et al. (1998) analyzes panel data of 69 developing countries over the period 1970-1989 using SUR. Specifically, their setup includes two equations - in the first equation, the dependent variable is the average growth rate of real GDP per capita of 1970-1979. In the second equation, the dependent variable is the average growth rate of real GDP per capita of 1980-1989. Similarly, the independent variables include FDI and other possible growth determinants to the corresponding time period in each equation. The two-equation system is then estimated by SUR, which allows for different error variances in each equation and for the correlation of the errors across the two equations. They find that FDI

has a positive effect on economic growth only when the host country has a minimum threshold stock of human capital to fully exploit the advanced technologies embodied in FDI.[1] Durham (2004) analyzes cross-sectional data of 80 countries over the period 1979-1998 using OLS. He finds that lagged FDI does not have direct, unmitigated positive effects on growth, but the effect of FDI is contingent on the "absorptive capacity" of host countries in particular with respect to financial development which will increase the potential for spillover effects of FDI.[2] Batten and Vo (2009) analyze panel data of 79 countries over the period of 1980-2003 using both country fixed effects and GMM under the identifying assumption that the independent variables are weakly exogenous. They find that FDI has a stronger positive impact on economic growth in countries with a higher level of education attainment, openness to international trade and stock market development, and a lower rate of population growth and levels of country risk. The findings above, however, have been challenged by other work. Oliva and Rivera-Batiz (2002) analyze panel data of 119 developing countries over the period 1970-1994. They estimate a system of growth, FDI, and schooling equation using Three-Stage-Least-Squares (3SLS). Specifically, growth is estimated as a function of variables treated as endogenous (FDI and schooling) and other variables that are treated as exogenous. The three-equation system is then estimated simultaneously assuming that the errors from the three equations are dependent. They find that the growth effect of FDI is positive, and estimated growth effect of FDI is several times higher than the estimated growth effect of

[1] See among others Nelson and Phelps (1966), and Benhabib and Spiegel (1994).
[2] As revealed by Alfaro et al. (2009), there are several plausible reasons to expect that financial markets might complement the spillover effects of FDI. First, the successful acquisition of new technologies introduced by foreign firms will generally involve a process of reorganization and reinvestment by their domestic competitors. To the extent that this process is financed from domestic sources, efficient financial markets will enhance the competitive response of the domestic industry. Second, well-developed financial markets also enable other domestic firms and entrepreneurs to capitalize on linkages with new multinationals.

the domestic fixed capital. But they cannot detect a statistically significant effect from the interaction between FDI and human capital. Butkiewicz and Yanikkaya (2008) analyze panel data of 114 countries over the period of 1970-1997 using SUR. Specifically, their setup includes two equations - in the first equation, the dependent variable is the average growth rate of real GDP per capita of 1980-1989 less that of 1970-1979. In the second equation, the dependent variable is the average growth rate of real GDP per capita of 1990-1997 less that of 1980-1989. Similarly, the independent variables including FDI and other possible growth determinants are derived by taking the same approach. The two-equation system is then estimated by SUR, which allows for the correlation of the errors across the two equations. They find that FDI has a direct positive effect on growth regardless of the level of economic or political development.

The above literature review suggests that the impact of FDI on economic growth is far from conclusive. The divergent conclusions from these six recent cross-country studies are derived mainly for the 1970s and the 1980s, and a portion of 1990s. There is a need for further empirical research on more recent data. Following the established practice (see Mankiw et al.1992, Balasubramanyam et al. 1999), this paper adopts a standard neoclassical growth framework for analyzing the effect of FDI on growth of national income along with other factors of productions. First, given the shortcomings of previous studies (i.e. small sample size, do not fully control country-specific effects and period-specific effects, and the inclusion of lagged dependent variable in the growth regression), this investigation uses a larger sample, which consists of all developing countries (depending on the availability of data, a number of developing countries may be excluded)

and longer period (1970-2004) to avoid the threat of sample selection bias. Second, two econometric methods will be used to assess the relationship between FDI and economic growth rate. One is the pure cross sectional, OLS analysis with data averaged over 1970-2004. The other is the dynamic panel data estimation with fixed effects with a five-year average over 1970-2004. Third, the instrumental variable technique is used in the panel estimation to account for the biases induced by including the lagged dependent variable in the growth regression. Finally, as human capital, physical infrastructure, legal institution, and openness to trade are identified in the literature to be important determinants to economic growth, this paper includes these parameters and interaction terms of FDI with these parameters to test whether the effect of FDI is contingent on the "absorptive capacity" of host countries.

The structure of the paper is as follows. Section 2 introduces the standard neoclassical growth framework. Section 3 describes the data used in the empirical analysis. Section 4 reports the empirical results. Conclusions are offered in section 5.

2 The Model

2.1 Theoretical Framework

The effect of FDI on economic growth is analyzed in the standard neoclassical growth framework. The neoclassical growth framework makes it possible to decompose the changes in output into the contributions of factor accumulations. Assume a Cobb-Douglas production function, an aggregate output (Y) is a function of technology (A), physical capital (K) and labor (L) such as

(1) $$Y(t) = A(t)[K(t)]^{\alpha}[L(t)]^{\gamma}$$

The model can be expanded to include other variables that may have effect on Y.
A standard approach is to treat FDI as ordinary input in the production function.

(2) $$Y(t) = A(t)[K(t)]^{\alpha}[FDI(t)]^{\beta}[L(t)]^{\gamma}$$

The notation is standard: Y is real Gross Domestic Product (GDP), K is the stock of domestic capital, FDI is the stock of foreign direct investment, L is the stock labor force, and A is the level of technology.

Taking logs of function (2) to get function (3)

(3) $$ln[Y(t)] = ln[A(t)] + \alpha \ln[K(t)] + \beta ln[FDI(t)] + \gamma ln[L(t)]$$

Then differentiating function (3) with respect to time to get the function (4)

(4) $$GY = a + \alpha(GK) + \beta(GFDI) + \gamma(GL)$$

The notation is standard: GY is the growth rate of real GDP, a is the growth rate of technology, (GK) is the growth rate of domestic capital, (GFDI) is the growth rate of FDI, (GL) is the growth rate of labor force, α is the output elasticity of domestic capital, β is the output elasticity of FDI, and γ is the output elasticity of labor force. Alternatively, parameters of α, β, γ can be seen as the partial derivatives of the growth rate of real GDP with respect to the growth rate of domestic capital, FDI, and labor force. Estimation of the capital growth rate is often viewed as unreliable because of lack of information on the initial capital stock and the rate of depreciation for developing countries. Because of data constraints and the skepticism about estimation of growth rate of capital, this paper follows the precedent set in numerous previous studies by approximating the growth rate of the capital stock by the share of investment in GDP, and the growth rate of FDI by the share of FDI in GDP[3] (see Mankiw et al.1992, Levine and Renelt 1992, Collins and Bosworth 1996, Balasubramanyam et al. 1999, among others).

[3] As revealed by Collins and Bosworth (1996), most cross-national growth studies have relied upon the investment rate to measure capital accumulation. The change in the capital stock is given by ΔK=I-dK, where d is a measure of the geometric rate of depreciation. Dividing through K and assuming a steady-state constant value (γ) for the inverse of the capital-output ratio allows the rate of change of capital (k) to be measured by the investment rate (i=I/Y): k=iγ-d.

Many scholars, including Benhabib and Spiegel (1994), suspect the accuracy of labor growth rate would vary broadly across developing countries. In particular, workers in the traditional agriculture sector may or may not be recorded as members of the labor force. Moreover, as the data on the growth rate of labor force are scarce, thus we use the growth rate of population (GPOP) to approximate the growth rate of labor force.

Initial GDP per capita ($YPC_{initial}$) measured in logarithms is included in our study for two reasons. First, it is crucial to control for preexisting economic condition in the recipient countries in any kind of attempts to explore the true relationship of FDI and economic growth. Second, to account for the conditional convergence hypothesis, which is, countries with low real GDP per capita possess more potential for faster growth rates than countries with high real GDP per capita while holding the other explanatory variables constant.

Then function (5) yields as the augmented model in the econometric analysis,

$$(5) \qquad GY = a + \delta ln(YPC_{initial}) + \alpha(\frac{I}{GDP}) + \beta(\frac{FDI}{GDP}) + \gamma(GPOP) + \theta X + \varepsilon$$

The group of variables X comprises the control variables that are identified as the determinants of economic growth. Without implications, the group of X includes the stock of human capital, the quality of legal institutions, the level of physical infrastructure, trade openness, and interaction terms of FDI with these variables. In

addition, the inflation rate, a proxy for macroeconomic instability, is also a component of X. ε is the error term.

According to neoclassical growth theory, the sign of parameter **δ** is expected to be negative, and parameters α and γ are expected to have positive signs. Since this analysis aims to test the hypothesis whether FDI has any effect on economic growth in developing countries, in the econometric analysis which follows, the parameter β - the output elasticity FDI will be our primary interest. To examine whether the effect of FDI on economic growth is contingent on the "absorptive capacity", the value and statistical significance of each coefficient of interactive terms will also be reported.

2.2 Econometric Methods

Two econometric methods will be employed in this paper.

i. Ordinary Least Squares (OLS) with White's heteroskedasticity-consistent standard error & covariance estimation method in the cross-sectional study.
ii. Dynamic panel data estimation with fixed effects and cluster robust errors in the analysis of panel data.

The motivation for using panel data estimation with fixed effect is it allows us to exploit the time-series nature of the relationship between FDI and economic growth. As any unobserved country or time-specific variable(s) could become a part of the error term, the OLS estimators of the regression coefficients and standard errors could suffer from the omitted variables bias problem. Moreover, since the assumption of $\varepsilon_{i\,t}$ is independent and

identically distributed that is often violated, the routine procedure is to estimate cluster standard errors in fixed effects panel models.[4] Therefore, we allow errors to be correlated between observations within each country, but are not correlated between observations across countries. Furthermore, the inclusion of ln(initial income per capita) in the equation makes function (5) a dynamic panel data model. To see this, consider the function (5) within the context of panel data,

$$GY_{i\,t} = a_{i\,t} + \delta ln(YPC)_{i\,t-1} + \alpha\left(\frac{I}{GDP}\right)_{i\,t} + \beta\left(\frac{FDI}{GDP}\right)_{i\,t} + \gamma(GPOP)_{i\,t} + \theta X_{i\,t} + \varepsilon_{i\,t}$$

Since population growth (GPOP) enters on the right hand side of the equation, the function (5) can also be explicitly regarded as growth equation for GDP per capita if we subtract population growth (GPOP) from both sides of the equation. Given the growth rate of GDP per capita is approximately equal to $\ln(YPC)_{i\,t} - \ln(YPC)_{i\,t-1}$, therefore, function (5) takes the form as,

$$ln(YPC)_{i\,t} - ln(YPC)_{i\,t-1} = a_{i\,t} + \delta ln(YPC)_{i\,t-1} + \alpha\left(\frac{I}{GDP}\right)_{i\,t} + \beta\left(\frac{FDI}{GDP}\right)_{i\,t} + (\gamma - 1)(GPOP)_{i\,t} + \theta X_{i\,t} + \varepsilon_{i\,t}$$

As $\ln(YPC)_{i\,t-1}$ appear on both sides of the equation, therefore, function (5) is a dynamic panel data model in which one of the explanatory variables $\ln(YPC)_{i\,t-1}$ is directly related to the lagged dependent variable $[\ln(YPC)_{i\,t-1} - \ln(YPC)_{i\,t-2}]$. For such models, the

[4] Arellano (1987), Wooldridge (2002), Kezdi (2004), and Arai (2009).

estimates from the conventional estimation techniques (such as OLS, fixed effects, and random effects) will be biased and inconsistent as the strict exogeneity assumption is not satisfied. In this study, we attempt to solve the problem caused by lagged dependent variables in a fixed effect model by a simple approach, that is to estimate the first difference model using instrumental variable methods. Specifically, the steps we take to estimate coefficients in the dynamic panel data are:

i. Take first differences of equation (5) to eliminate the country-specific effects
ii. Since $\Delta \ln(YPC)_{i\,t-1}$ are correlated with $\Delta\, \varepsilon_{i\,t}$ by construction, we estimate coefficients using $\Delta \ln(YPC)_{i\,t-2}$ as an instrumental variable for $\Delta \ln(YPC)_{i\,t-1}$ by two least stage least squares (2SLS) under the assumption that the initial income per capita is weakly exogenous (i.e. initial income per capita is uncorrelated with future realizations of the error term)
iii. Use time dummies to account for period-specific effects
iv. Control for group effects by applying cluster robust standard errors to estimate consistent standard errors

3 The Data

The dataset consists of 127 developing countries over the period of 1970-2004. Based on the classification by World Bank, developing countries are those that had a gross national income (GNI) per capita in 2005 of less than $10,725. However, many variables are missing for several countries so that the number of observations varies with the number of variables included. Unless otherwise stated, all the data are collected from *World Development Indicators* (*WDI Online)*, which are available from the World Bank's website (http://publications.worldbank.org/WDI/). In the pure cross sectional data estimation, all variables are transformed by computing averages over the 35-year period. In the panel data estimation, variables are transformed by computing 5-year average for the following reasons. First, the human capital and the quality of legal institution variables are only available at such intervals. Second, annual data are too noisy due to business cycle fluctuations, terms of trade fluctuations, and data quality problems (especially in developing countries). So that there are seven possible observations per country for the period of 1970-2004, representing the average over 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1999, and 2000-2004.

The dependent variable (GY) is annual percentage growth rate of real GDP. I / GDP is defined as gross fixed capital formation as a percentage of GDP. FDI / GDP is defined as net FDI inflows as a percentage of GDP. GPOP is the growth rate of population.

Initial income per capita ($YPC_{initial}$) is measured in terms of constant 2000 US dollars. In the pure cross sectional data analysis, it is defined as real GDP per capita in 1970. In the panel data estimation, it is the first year of the 5-year period. For example, it is the real GDP per capita in 1970, 1975, 1980, 1985, 1990, 1995, and 2000.

It is difficult to define a variable that represents the stock of human capital. In some studies, it is approximated by the literacy rates or enrollment rates. However, the problem with using literacy rates is that limited data are available across developing countries during 1970-2004. Thus, it would substantially reduce our sample size. The problem with using enrollment rates is that they tend to be unreliable, as the available data are mainly gross figures that over count school repeaters. According to Barro and Lee (2001), either school enrollment ratios or literacy rates does not adequately measure the aggregate stock of human capital available contemporaneously as an input to production. In this paper, human capital is measured as the average of years of schooling for the population aged 15 and over and is taken directly from the dataset constructed by Barro and Lee (2001).[5] As explained in their paper, these data begin with census and survey information on schooling of the adult population, then fill in missing census and survey observations by using gross enrollment rates (after the adjustment for repeaters). This measure reflects the inflows of new school graduates to existing educational stocks more accurately than the usual gross or net enrollment ratios. Thus, the educational attainment provides good measures of the human capital stock and has been used in many of previous studies (see

[5] The data of educational attainment are available for the population aged 25 and over, and aged 15 and over. As much of the labor force in developing countries consists of younger persons, we choose to use the latter.

Benhabib and Spiegel 1994, Collins and Bosworth 1996, Borensztein et al. 1998, Kumar and Pradhan 2002, among others). This variable is available on a five year basis.

A growing literature argues that physical infrastructure can contribute to economic growth and create a favorable climate FDI. Telephone mainlines per 100 people are incorporated to measure the physical infrastructure of the host countries. Physical infrastructure is comprising of telecommunication, water and sanitation, transport and can be measured with different indicators. According to Bougheas et al. (2000), the adoption of telephone mainlines has advantages over other indicators. It has a more direct impact on production cost and is less susceptible to comparability problems across countries and available for a larger number of countries.

Levine and Zervos (1998) show well-developed financial markets can promote long-run economic growth. Furthermore, they argue that, since the stock market and banks are providing different bundles of financial services to the economy, degrees of financial development should be measured by measures of stock market development AND banking development. But data on stock market development is not available for most of developing countries before 1990s. Alternatively, as Levine (2002) suggests, a country's legal system is the primary determinant of its financial development, and the degree to which financial structure is bank-based or equity-based is not associated with growth. The rational is that without effective legal statutes and their enforcement, potential market participants will never invest in shares or deposit funds in banks. Therefore, the legal system importantly influences financial development and this in turn influences

economic growth. In this study, the measure of quality of institution is the legal structure and security of property rights index. The index has seven components: judicial independence, impartial courts, protection of property rights, military interference in rule of law and the political process, integrity of the legal system, legal enforcement of contracts, and regulatory restrictions on the sale of real property. The index ranges from 0 to 10 (a higher rate implies a better quality of legal institution) and is taken directly from Gwartney et al. (2008). This variable is available on a five year basis. The widely used International Country Risk Guide (ICRG) index from Political Risk Services (see Asiedu 2006, Alfaro et al. 2009, Batten and Vo 2009, among others) is not used in this paper, as it is only available from 1984. Thus, it would substantially reduce the sample size.

Empirical studies by Balasubramanyam et al. (1999) support the view that FDI in the presence of a liberal trade regime is likely to promote growth. Rather than using Balasubramanyam's classification of trade regimes as either export-promoting or import-substituting countries, this study follows the common practice of using the ratio of trade (the sum of exports and imports of goods and services) to GDP as a proxy for openness to trade.

In light of studies by Borensztein et al. (1998) and Makki and Somwaru (2004), the inflation rate (rate of price change in the economy as a whole) is used as a proxy for macroeconomic instability.

Table 1 provides descriptive sample statistics for the average variables in the cross sectional dataset. Tables 2 through 8 provide descriptive sample statistics for the 5-year averaged variables in the panel dataset.

Table 1 shows large cross-country variation over the period of 1970-2004. For example, the mean growth rate of real GDP for the sample is 3.4%, with a standard deviation of 2.6%. Equatorial Guinea has the highest growth rate (18.3%) among developing countries, followed by Botswana (10.4%), while Serbia has the lowest growth rate (-2.7%). In terms of FDI as a share of GDP, the mean for the sample is 3.0%, with a standard deviation of 4.8%. Armenia has the maximum value of FDI (39.8%), followed by Equatorial Guinea (29.6%), Nepal has the lowest value of FDI (-0.1%). Tables 2 to 8 show, in terms of 5-year periods, the variability over 5-year periods is even much larger than when using lower frequency data. For instance, Equatorial Guinea has the highest growth rate of real GDP over the period 1995-1999 (35.6%). Lebanon has the lowest growth rate of real GDP over the period 1985-1989 (-42.5%). Equatorial Guinea has the maximum value of FDI over the period 1995-1999 (111.3%), Togo has the minimum value of FDI over the period 1970-1974 (-7.9%).

Table 1: Descriptive sample statistics for the variables: average for 1970-2004

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	3.40	2.60	-2.66	18.28	127
Ln(initial income per capita)	6.62	1.04	4.80	8.80	82
Growth rate of population (%)	1.95	1.05	-0.32	4.72	127
Capital/GDP (%)	21.28	6.49	8.07	57.53	125
FDI/GDP (%)	3.02	4.75	0.08	39.80	127
Education (years)	4.71	2.59	0.60	9.79	91
Telephone lines per 100 people	6.09	6.99	0.07	30.14	127
(Exports+Imports)/GDP (%)	74.53	34.16	17.46	165.56	126
Inflation rate (%)	61.98	150.67	-0.04	1016.08	122
Legal system & property rights	4.63	1.11	2.18	7.16	87

Table 2: Descriptive sample statistics for the variables: average for 1970-1974

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	5.52	3.42	-0.94	19.88	82
Ln(initial income per capita)	6.62	1.04	4.80	8.80	82
Growth rate of population (%)	2.15	1.19	-4.37	6.18	125
Capital/GDP (%)	19.59	7.01	5.31	40.42	59
FDI/GDP (%)	1.47	2.79	-7.90	10.71	73
Education (years)	3.32	2.19	0.20	9.71	72
Telephone lines per 100 people	1.33	1.72	0.03	8.10	88
(Exports+Imports)/GDP (%)	53.52	30.06	7.21	136.02	78
Inflation rate (%)	13.31	23.99	2.59	198.72	69
Legal system & property rights	4.03	1.60	1.15	7.41	24

Table 3: Descriptive sample statistics for the variables: average for 1975-1979

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	4.60	3.43	-4.18	15.24	85
Ln(initial income per capita)	6.73	1.09	4.82	8.87	83
Growth rate of population (%)	2.18	1.29	-2.76	8.76	125
Capital/GDP (%)	22.73	7.86	6.10	47.68	72
FDI/GDP (%)	1.49	2.61	-2.88	17.45	83
Education (years)	3.53	2.26	0.09	9.69	75
Telephone lines per 100 people	2.45	2.94	0.05	12.74	108
(Exports+Imports)/GDP (%)	64.47	34.28	11.82	160.36	84
Inflation rate (%)	19.68	31.69	3.04	227.58	73
Legal system & property rights	3.55	1.13	1.15	5.62	24

Table 4: Descriptive sample statistics for the variables: average for 1980-1984

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	2.78	3.58	-6.03	14.34	100
Ln(initial income per capita)	6.83	1.08	4.91	8.96	95
Growth rate of population (%)	2.27	1.14	-0.69	6.71	126
Capital/GDP (%)	22.21	8.62	2.53	59.74	92
FDI/GDP (%)	1.05	1.63	-1.40	10.25	90
Education (years)	3.96	2.32	0.26	9.71	76
Telephone lines per 100 people	3.19	3.96	0.02	18.33	124
(Exports+Imports)/GDP (%)	66.08	36.89	9.11	169.70	95
Inflation rate (%)	25.93	49.47	3.63	351.97	82
Legal system & property rights	4.12	1.47	1.76	6.59	60

Table 5: Descriptive sample statistics for the variables: average for 1985-1989

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	2.86	5.25	-42.45	11.94	110
Ln(initial income per capita)	6.77	1.09	4.78	8.88	77
Growth rate of population (%)	2.14	1.23	-0.65	6.58	126
Capital/GDP (%)	20.74	7.61	5.60	50.80	102
FDI/GDP (%)	1.24	2.78	-5.28	22.36	101
Education (years)	4.33	2.30	0.49	9.77	77
Telephone lines per 100 people	4.29	5.28	0.03	21.47	125
(Exports+Imports)/GDP (%)	64.21	33.14	13.42	158.03	105
Inflation rate (%)	73.96	282.56	-5.53	2414.35	94
Legal system & property rights	4.29	1.39	1.67	7.25	76

Table 6: Descriptive sample statistics for the variables: average for 1990-1994

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	0.67	7.25	-31.02	17.34	125
Ln(initial income per capita)	6.88	1.10	4.87	8.99	123
Growth rate of population (%)	1.79	1.45	-4.80	5.69	127
Capital/GDP (%)	20.75	7.64	6.66	55.21	121
FDI/GDP (%)	2.76	10.09	-0.99	109.63	123
Education (years)	5.10	2.64	0.65	10.50	88
Telephone lines per 100 people	6.14	7.47	0.04	35.59	127
(Exports+Imports)/GDP (%)	72.84	36.15	14.38	226.87	123
Inflation rate (%)	253.94	881.02	1.11	6424.99	110
Legal system & property rights	4.51	1.45	1.95	7.25	76

Table 7: Descriptive sample statistics for the variables: average for 1995-1999

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	4.07	4.83	-5.74	35.59	126
Ln(initial income per capita)	6.80	1.17	4.03	9.12	126
Growth rate of population (%)	1.69	1.35	-1.51	6.78	127
Capital/GDP (%)	21.57	9.12	5.79	86.79	123
FDI/GDP (%)	4.32	10.43	-4.17	111.30	126
Education (years)	5.24	2.50	0.76	11.23	78
Telephone lines per 100 people	8.83	10.11	0.04	45.42	127
(Exports+Imports)/GDP (%)	78.95	39.36	16.58	224.21	126
Inflation rate (%)	35.65	142.24	0.76	1478.31	116
Legal system & property rights	5.05	1.10	2.22	7.60	87

Table 8: Descriptive sample statistics for the variables: average for 2000-2004

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size
Growth rate of real GDP (%)	4.36	3.65	-5.84	28.32	127
Ln(initial income per capita)	6.91	1.19	4.44	9.30	126
Growth rate of population (%)	1.52	1.20	-1.36	4.13	127
Capital/GDP (%)	21.00	6.87	7.82	53.97	124
FDI/GDP (%)	3.94	4.25	-0.81	23.79	126
Education (years)	5.49	2.52	0.84	11.41	78
Telephone lines per 100 people	11.06	11.88	0.02	53.01	127
(Exports+Imports)/GDP (%)	84.81	39.10	26.02	205.54	126
Inflation rate (%)	11.84	28.13	-0.04	197.34	119
Legal system & property rights	4.94	1.23	1.98	7.22	87

4 The Results

The purpose of this research is to estimate the effects of FDI on economic growth in developing countries for the period 1970-2004, after controlling for other growth determinants and preexisting economic conditions. Furthermore, we want to examine whether the effect of FDI on growth depends on the stock of human capital, the level of physical infrastructure, the quality of legal institutions, and trade openness. In this section, the econometric results for this paper are presented.

The estimated results using OLS are presented in Table 9. The estimated results using panel data estimation with fixed effects are presented in Table 10. Regressions 9.1 and 10.1 use a specification with explanatory variables of initial income per capita, population, and domestic fixed capital. In both regressions, all coefficients have the predicted signs based on neoclassical growth theory and are statistically significant at the 10% level, except for the coefficient of initial income per capita in 9.1 which is clearly insignificant. One thing to note is that the coefficient on population growth is positive and statistically significant, which is consistent with the growth theory if we keep in mind that the dependent variable is growth rate of real GDP, not growth rate of real GDP per capita. Thus, a high growth rate of real GDP is associated with a low initial income and high growth rates of population and domestic fixed capital, all of which are perfectly consistent with the growth theory.

Regression 9.2 and 10.2 extends 9.1 and 10.1 respectively to include human capital. Human capital enters significantly with a positive coefficient in almost all OLS regression, but enters insignificantly in all panel regressions. We use an alternative measure of human capital, such as the average of years of schooling for the population aged 25 and over, to test the robustness of our results. However, our results are not altered. Thus, our study finds no strong and consistent evidence for a significant role of human capital in economic growth for developing countries in this sample period. But this does not mean that human capital is unimportant. First, each worker may gain human capital not only from schools, but from work places also. Using educational attainment to measure human capital ignores the possibility of gaining human capital through working experience. Second, it does not take account of differences in the quality of schooling across countries. Third, the relationship between human capital and growth is complex and dynamic in nature and may not be adequately captured in non-lagged linear models.[6] Finally, perhaps the sample used in our regressions includes only developing countries.

Regressions 9.3 and 10.3 include FDI. Specification 9.3 shows that FDI has a negative impact on growth, after controlling for the initial income per capita, population, domestic fixed capital, and education. However, the coefficient is not statistically significant. Regression 10.3 reveals that FDI enters the growth regression significantly at the 5% level with the same controlling variables.

[6] Probably the estimation of nonlinear function form is not a promising solution in this context. Specifically, the nonlinear function form would involve higher order terms such as education squared, education cubic, FDI*education squared, and FDI*education cubic. This would inevitably reduce the degrees of freedom and likely cause multicollinearity problems.

As the coefficient on FDI may be subject to the omitted variables bias problem in regressions 9.3 and 10.3, regressions 9.4 to 9.7 and regressions 10.4 to 10.7 include addition variables proxying for the other important determinants of economic growth. Regressions 9.4 and 10.4 include variables that measure the level of physical infrastructure. Regressions 9.5 and 10.5 also control for the trade openness. In regressions 9.6 and 10.6, we also control for the quality of legal institutions (or can be seen as a proxy for the level of financial development). Regressions 9.7 and 10.7 also control for macroeconomic instability. And our main results are largely derived from regression 9.7 and 10.7 as those included variables are identified in the literature to be important determinants to economic growth.

The OLS regressions suggest that FDI does not have a positive growth effect as FDI fails to enter these growth regressions significantly at the 10% level.[7] Moreover, the coefficient of FDI is unstable in the OLS regressions, ranging from a negative 0.08 (regression 9.3) to a positive 0.58 (regression 9.8). This inconsistency casts some doubts on the credibility of estimated coefficient of FDI. Furthermore, it is not due to changes in sample. When the regressions are restricted to have the same number of observations, the coefficient of FDI remains unstable, as shown in Appendix Table 1. Given OLS analysis for cross sectional data is unable to control for country-specific effects and period-specific effects, thus the estimated coefficient of FDI in OLS regressions may suffer from omitted variables bias problem. The panel regression 10.7 shows that FDI has a positive

[7] We also try to estimate the coefficient of FDI in OLS regression 9.7 at the regional level for Africa, Asia, Europe, and Latin America, The results for the subsamples is largely consistent with those from the whole sample as FDI does not have a statistically significant growth effect in Africa, Asia, and Latin America. However, we are unable to estimate the coefficient of FDI for Europe as the sample size is less than the number of variables in OLS regression 9.7.

growth effect once we control for the stock of human capital, the level of physical infrastructure, the quality of legal institutions, trade openness, macroeconomic instability, and preexisting economic conditions.[8] And the coefficient of FDI (0.19) is positive and statistically significant at 10% level. It implies that a 1% increase in FDI / GDP is associated with 0.19% increase in the real GDP growth rate, with a 95% confidence interval of (-0.04, 0.42), while holding the other explanatory variables constant. For instance, raising a country's FDI / GDP from the 25th percentile (Guinea-Bissau, at 0.90%) to the median (Tunisia, at 1.94%) would raise real GDP growth by 0.20%, with a 95% confidence interval of (-0.04, 0.44). Thus, our analysis does support the view that FDI helps to promote economic growth in developing countries during 1970-2004.

Both OLS and panel data estimations suggest that growth of population and domestic capital have contributed to economic growth of sample countries as they enter into each regression significantly. And the magnitudes of the coefficients demonstrate the positive growth effects of population and domestic capital on real GDP. For example, the coefficient of the growth rate of population (1.02) is positive and statistically significant at 1% level in OLS regression 9.7. It implies that a 1% increase in population is associated with 1.02% increase in the real GDP growth rate, while holding the other explanatory variables constant. The panel regression 10.7 reports the magnitude of the corresponding coefficient as 1.52. In terms of the growth effect of domestic capital, the coefficient of the domestic capital (0.21) is positive and statistically significant at 1%

[8] We also try to estimate the coefficient of FDI in panel regression 10.7 at the regional level for Africa, Asia, and Latin America. FDI does not have a statistically significant growth effect in Asia, Europe, and Latin America but appears significant for Africa. Therefore, further analysis need to be done regarding the role of FDI in promoting growth at the regional level.

level in OLS regression 9.7. It implies that a rise in I / GDP by 1% is associated with 0.21% increase in the real GDP growth rate, while holding the other explanatory variables constant. The panel regression 10.7 reports the magnitude of the corresponding coefficient as 0.20. Our results are consistent with earlier work done Kumar and Pradhan (2002), who report that a 1% increase in population is associated with 1.41% increase in the real GDP growth rate; a rise in I / GDP by 1% is associated with 0.19% increase in the real GDP growth rate by utilizing the panel data estimation with fixed effects for 65 developing countries over the period of 1980-1999.

It is interesting to note that the coefficient of physical infrastructure has the predicted positive sign in both regressions 9.7 and 10.7, although the estimates are not statistically significant. Compared to the existing literature regarding the role of physical infrastructure on economic growth, the results in our study are not surprising. First, many developing countries do not have shortage of physical infrastructure but have to improve the effective use of physical infrastructure, as addressed by World Bank (1994). [9] Second, how the physical infrastructure is financed may have important consequences for economic growth.

The coefficient on initial income per capita is negative and statistically significant at 10% level in every OLS and panel regression. Therefore, the empirical evidence strongly supports the hypothesis of conditional convergence that has been reported in previous

[9]As revealed in World Development Report by World Bank (1994), developing countries invest $200 billion a year in new infrastructure – 4 per cent of their national output and a fifth of their total investment; however, these investments in infrastructure have not had the development impact expected. Therefore, it is essential to improve the effectiveness of investments and the efficiency of service provision.

studies, such as Barro (1991), Mankiw et al. (1992), Knack and Keefer (1995), among others.

In all OLS regressions, the estimate of coefficient on trade openness is having an unexpected (negative) sign and statistically significant. In contrast, all regressions for the panel data report the estimated coefficient for trade openness is positive and statistically significant. There is a growing consensus in empirical studies that openness to trade increase economic growth. For example, an empirical study by Frankel and Romer (1999) estimates that increasing the ratio of trade to GDP by one percent raises per-capita income by between 0.86 and 2.96 per cent. Numbers of recent studies published in the 1990s and afterward reach similar conclusions, though the estimated size and statistical significance of the effects differ. For a comprehensive survey of the empirical literature on trade and growth see Giles and Williams (2000). Greater openness to international trade has a positive effect on real income is consistent with economic theories of international trade. Trade facilitates more efficient allocation of resources and production of goods and services by shifting production to countries that have comparative advantages. We suspect the trade openness may be correlated with country-specific effects and period-specific effects and thus the estimated coefficient of trade openness in OLS regressions may indeed suffer from omitted variables bias problem. Therefore, we focus on the panel data estimation on the coefficient in regression 10.7. The coefficient of trade openness in regression 10.7 is 0.06. It implies that an increase in the share of percentage point is associated with an increase of 0.06% in the real GDP growth rate.

The quality of legal institutions is statistically insignificant with positive sign into regression 9.7 and 10.7. Therefore, we conclude that the quality of legal institution does not help to explain the economic growth in developing countries during 1970-2004. Oliva and Rivera-Batiz (2002) find that better political institutions encourage growth; however, these results are not always statistically significant. Our results are consistent with their conclusions.

The estimated coefficient on inflation is negative and statistically significant in all OLS and panel data regressions. Therefore, we conclude that there is an adverse effect of inflation on the economic growth for developing countries during 1970-2004.

To assess whether the effect of FDI on economic growth depends on the stock of human capital, the level of physical infrastructure, the quality of legal institutions, and trade openness, from regressions 9.8 and 10.8, the interactions of FDI with these parameters are included. In this way, we can test jointly whether FDI affect growth by itself or through the interaction terms.

To test the hypothesis of contribution of FDI to economic growth is enhanced by its interaction with the stock of human capital in host countries, we introduce the interaction term of FDI*Education. The coefficient of interaction term of FDI*Education never enters growth regressions significantly at any meaningful level. Thus, there is no evidence to support Borenstein's findings.

In Hermes and Lensink's (2003) paper, they argue the financial system enhances the efficient allocation of resources and in this sense it improves the absorptive capacity of a country with respect to FDI inflows, thus a more developed system may contribute to the process of technological diffusion associated with FDI. Since we use the quality of legal institution as a proxy for the financial market development, we include the interaction term of FDI*legal institution into our regressions. The evidence in favor of complementarities between FDI and financial market development is lacking. In OLS regressions, the coefficient of interaction term is negative in regression 9.9 while it is positive in regression 9.12. Neither of them has achieved statistically significant. In panel date regression 10.9 and 10.12, the coefficient of interaction term is positive and insignificant.

The interaction term of FDI*Telephone allow us to identify whether there is a link between FDI and the level of physical infrastructure. The OLS regressions 9.10 and 9.12 and panel regressions 10.10 and 10.12 never demonstrated a significant coefficient on the interaction term. Therefore, our study find the growth effect of FDI does not depend on the level of physical infrastructures in developing countries during 1970-2004. Balasubramanyam et al. (1999) find evidence supporting the view that FDI in the presence of a liberal trade regime is likely to promote growth. However, we cannot find the evidence suggesting that FDI can increase the growth rate by interacting with the country's openness to trade.

Moreover, all of these interaction terms fails to enter the growth regression individually (as indicated by t-test) or jointly with FDI (as indicated by F-test) in terms of statistical significance. Furthermore, including interaction terms of FDI*Education, FDI*Telephone, FDI*legal institution, and FDI*Trade openness does not raise the R-squared and thus does not improve the overall performance of the estimation. In sum, we conclude that FDI does have direct positive effects on economic growth, and the effect of FDI are not contingent on the "absorptive capacity" for developing countries during 1970-2004.

Table 9: Foreign direct investment and economic growth in developing countries: 1970-2004 (cross-sectional)

Dependent Variable: Growth rate of real GDP	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	9.1	9.11	9.12
Intercept	0.21	1.53	1.54	2.60	2.67*	0.52	1.29	1.67	0.99	1.70	1.29	1.84
	(1.67)	(1.64)	(1.66)	(1.58)	(1.56)	(2.31)	(2.25)	(2.17)	(2.40)	(2.14)	(2.27)	(2.44)
Ln(initial income per capita)	-0.30	-0.74***	-0.71***	-0.95***	-0.96***	-0.94***	-0.97***	-1.02***	-0.99***	-1.01***	-0.97***	-1.02***
	(0.20)	(0.24)	(0.25)	(0.25)	(0.24)	(0.24)	(0.22)	(0.21)	(0.21)	(0.20)	(0.22)	(0.21
Population growth	0.48*	0.69**	0.65**	0.88***	0.92***	0.89***	1.02***	0.93***	1.02***	0.96***	1.02***	0.93***
	(0.25)	(0.33)	(0.32)	(0.31)	(0.29)	(0.31)	(0.28)	(0.29)	(0.29)	(0.29)	(0.29)	(0.31)
Capital/GDP	0.22***	0.20***	0.20***	0.19***	0.21***	0.23***	0.21***	0.20***	0.21***	0.20***	0.21***	0.20***
	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Education		0.35**	0.34**	0.23	0.24	0.23*	0.32***	0.40***	0.32***	0.32***	0.32***	0.39**
		(0.15)	(0.15)	(0.16)	(0.16)	(0.13)	(0.11)	(0.13)	(0.11)	(0.12)	(0.11)	(0.19)
FDI/GDP			-0.08	-0.06	0.01	0.07	0.23	0.58	0.51	0.41	0.22	0.44
			(0.05)	(0.05)	(0.06)	(0.18)	(0.18)	(0.46)	(0.79)	(0.29)	(0.31)	(1.13)
Telephone per 100 people				0.11**	0.11***	0.07	0.07	0.08*	0.07	0.10**	0.07	0.08
				(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.07)
Trade openness					-0.01	-0.01*	-0.02***	-0.02***	-0.02***	-0.02***	-0.02*	-0.02*
					(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Legal system and property rights						0.49*	0.36	0.35	0.46	0.36	0.36	0.33
						(0.27)	(0.28)	(0.27)	(0.33)	(0.28)	(0.28)	(0.37)
Inflation							-0.003**	-0.003**	-0.003**	-0.003**	-0.003**	-0.003**
							(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
FDI*Education								-0.07				-0.06
								(0.07)				(0.15)
FDI*Legal system and property rights									-0.06			0.02
									(0.15)			(0.22)
FDI*Telephone per 100 people										-0.02		-0.004
										(0.02)		(0.06)
FDI*Trade openness											0.0001	0.001
											(0.003)	(0.004)
F-statsitics and p-values on joint hypothesis								0.99	0.85	1.02	0.78	0.37
all FDI variables & interactions								(0.38)	(0.43)	(0.37)	(0.46)	(0.87)
R-squared	0.41	0.49	0.50	0.54	0.55	0.62	0.65	0.66	0.66	0.66	0.65	0.66
Observations	81	71	71	71	71	63	63	63	63	63	63	63

Standard errors are given in parentheses under the coefficients, and p-values are given in parentheses under the F-statistics. Individual coefficients are statistically significant at the *10% level, **5% level, or ***1% level.

Table 10: Foreign direct investment and economic growth in developing countries: 1970-2004 (panel with 5-year average)

Dependent Variable: Growth rate of real GDP													
Effects Specification: cross-section fixed and period fixed													
			10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	10.10	10.11	10.12
Intercept			0.15	-1.32**	-1.42***	-1.35**	-1.41***	-0.46	-0.25	-0.21	-0.25	-0.23	-0.25	-0.18
			(0.87)	(0.52)	(0.51)	(0.54)	(0.53)	(0.68)	(0.66)	(0.65)	(0.67)	(0.69)	(0.66)	(0.67)
Ln(initial income per capita)			-24.41**	-7.98**	-7.20*	-8.12*	-9.01*	-10.66*	-10.37*	-10.33*	-10.39*	-10.48*	-10.34*	-10.50*
			(10.17)	(3.69)	(3.66)	(4.76)	(4.78)	(5.78)	(5.60)	(5.65)	(5.62)	(5.77)	(5.64)	(5.87)
Population growth			1.93***	1.75***	1.74***	1.74***	1.74***	1.36**	1.52***	1.53***	1.52***	1.53***	1.52***	1.53***
			(0.21)	(0.26)	(0.28)	(0.27)	(0.28)	(0.53)	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)
Capital/GDP			0.26***	0.23***	0.20***	0.20***	0.17***	0.21***	0.20***	0.20***	0.20***	0.20***	0.20***	0.20***
			(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Education				0.09	0.10	0.09	0.23	-0.29	-0.39	-0.44	-0.38	-0.40	-0.40	-0.45
				(0.40)	(0.39)	(0.39)	(0.39)	(0.46)	(0.45)	(0.46)	(0.44)	(0.44)	(0.45)	(0.46)
FDI/GDP					0.18**	0.18**	0.13*	0.06	0.19*	0.15	0.19	0.23*	0.17	0.19
					(0.08)	(0.08)	(0.07)	(0.15)	(0.11)	(0.13)	(0.12)	(0.13)	(0.12)	(0.18)
Telephone per 100 people						0.07	0.06	0.10	0.08	0.08	0.08	0.09	0.08	0.10
						(0.10)	(0.10)	(0.13)	(0.13)	(0.12)	(0.13)	(0.15)	(0.13)	(0.15)
Trade openness							0.05***	0.06***	0.06***	0.06***	0.06***	0.06***	0.06***	0.06***
							(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Legal system and property rights								0.19	0.17	0.17	0.16	0.17	0.18	0.16
								(0.18)	(0.18)	(0.18)	(0.18)	(0.17)	(0.18)	(0.17)
Inflation									-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
									(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
FDI*Education										0.11				0.06
										(0.18)				(0.21)
FDI*Legal system and property rights											0.02			0.03
											(0.08)			(0.08)
FDI*Telephone per 100 people												-0.02		-0.02
												(0.03)		(0.04)
FDI*Trade openness													0.002	0.003
													(0.004)	(0.004)
F-statsitics and p-values on joint hypothesis										1.70	1.43	1.71	1.49	1.10
all FDI variables & interactions										(0.19)	(0.25)	(0.19)	(0.23)	(0.37)
R-squared			0.22	0.46	0.45	0.46	0.49	0.42	0.45	0.45	0.45	0.45	0.45	0.45
Observations			449	334	330	328	328	263	249	249	249	249	249	249

Standard errors are given in parentheses under the coefficients, and p-values are given in parentheses under the F-statistics. Individual coefficients are statistically significant at the *10% level, **5% level, or ***1% level.

5 Conclusion

This empirical study investigates the impact of FDI on economic growth in developing countries using a sample of 127 countries for the period 1970-2004. After resolving country-specific effects, period-specific effects, and inclusion of lagged dependent variables plaguing previous empirical studies, we find that FDI does have clear positive effects on economic growth. Moreover, the effect does not depend on the stock of human capital, the level of physical infrastructure, the quality of legal institutions, and trade openness.

However, our results should be viewed with some caution as we do not control for the potential endogeneity of all explanatory variables. For example, it also seems plausible that FDI may be attracted to countries characterized by high growth rates, thus, FDI is endogenous. Therefore, our study may suffer from endogeneity problem. However, this is a general problem in analysis of economic growth since many of the determinants are affected by economic growth.[10]

Finally, the policy implications of this study are relatively straightforward - developing countries should ease restrictions on FDI, and offer tax incentives and subsidies to attract FDI.

[10] For example, investment in domestic capital is often thought to be related to expected growth.

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Appendices

Appendix 1: List of sample countries

Albania	Gabon	Oman
Algeria	Gambia, The	Pakistan
Angola	Georgia	Panama
Argentina	Ghana	Papua New Guinea
Armenia	Grenada	Paraguay
Azerbaijan	Guatemala	Peru
Bangladesh	Guinea	Philippines
Barbados	Guinea-Bissau	Poland
Belarus	Guyana	Romania
Belize	Haiti	Russian Federation
Benin	Honduras	Rwanda
Bolivia	Hungary	Sao Tome and Principe
Botswana	India	Senegal
Brazil	Indonesia	Serbia and Montenegro
Bulgaria	Iran, Islamic Rep.	Seychelles
Burkina Faso	Jamaica	Sierra Leone
Burundi	Jordan	Slovak Republic
Cambodia	Kazakhstan	Solomon Islands
Cameroon	Kenya	South Africa
Cape Verde	Kyrgyz Republic	Sri Lanka
Central African Republic	Lao PDR	Sudan
Chad	Latvia	Swaziland
Chile	Lebanon	Syrian Arab Republic
China	Lesotho	Tajikistan
Colombia	Liberia	Tanzania
Comoros	Lithuania	Thailand
Congo, DR	Macedonia, FYR	Togo
Congo, Rep.	Madagascar	Tonga
Costa Rica	Malawi	Trinidad and Tobago
Cote d'Ivoire	Malaysia	Tunisia
Croatia	Maldives	Turkey
Czech Republic	Mali	Uganda
Djibouti	Mauritania	Ukraine
Dominica	Mauritius	Uruguay
Dominican Republic	Mexico	Vanuatu
Ecuador	Moldova	Venezuela, RB
Egypt, Arab Rep.	Mongolia	Vietnam
El Salvador	Morocco	Yemen, Rep.
Equatorial Guinea	Mozambique	Zambia
Eritrea	Nepal	Zimbabwe
Estonia	Nicaragua	Korea, Rep. (South Korea)*
Ethiopia	Niger	
Fiji	Nigeria	

*South Korea becomes a member of Organization for Economic Co-operation and Development (OECD) in 1996. To avoid the sample selection bias problem, South Korea is included in our study.

Appendix Table 1: Foreign direct investment and economic growth in developing countries: 1970-2004 (cross-sectional)[11]

Dependent Variable: Growth rate of real GDP												
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12
Intercept	0.89	1.24	1.24	2.19	2.73*	0.52	1.29	1.67	0.99	1.70	1.29	1.84
	(1.82)	(1.68)	(1.70)	(1.61)	(1.62)	(2.31)	(2.25)	(2.17)	(2.40)	(2.14)	(2.27)	(2.44)
Ln(initial income per capita)	-0.46**	-0.80***	-0.78***	-0.99***	-1.05***	-0.94***	-0.97***	-1.02***	-0.99***	-1.01***	-0.97***	-1.02***
	(0.20)	(0.23)	(0.25)	(0.26)	(0.24)	(0.24)	(0.22)	(0.21)	(0.21)	(0.20)	(0.22)	(0.21
Population growth	0.31	0.68*	0.64*	0.86**	0.92**	0.89***	1.02***	0.93***	1.02***	0.96***	1.02***	0.93***
	(0.32)	(0.36)	(0.36)	(0.36)	(0.35)	(0.31)	(0.28)	(0.29)	(0.29)	(0.29)	(0.29)	(0.31)
Capital/GDP	0.25***	0.24***	0.24***	0.23***	0.24***	0.23***	0.21***	0.20***	0.21***	0.20***	0.21***	0.20***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Education		0.34**	0.35**	0.24	0.23	0.23*	0.32***	0.40***	0.32***	0.32***	0.32***	0.39**
		(0.15)	(0.15)	(0.15)	(0.15)	(0.13)	(0.11)	(0.13)	(0.11)	(0.12)	(0.11)	(0.19)
FDI/GDP			-0.10	-0.04	0.22	0.07	0.23	0.58	0.51	0.41	0.22	0.44
			(0.16)	(0.15)	(0.16)	(0.18)	(0.18)	(0.46)	(0.79)	(0.29)	(0.31)	(1.13)
Telephone per 100 people				0.10**	0.12***	0.07	0.07	0.08*	0.07	0.10**	0.07	0.08
				(0.05)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.07)
Trade openness					-0.01**	-0.01*	-0.02***	-0.02***	-0.02***	-0.02***	-0.02*	-0.02*
					(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Legal system and property rights						0.49*	0.36	0.35	0.46	0.36	0.36	0.33
						(0.27)	(0.28)	(0.27)	(0.33)	(0.28)	(0.28)	(0.37)
Inflation							-0.003**	-0.003**	-0.003**	-0.003**	-0.003**	-0.003**
							(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
FDI*Education								-0.07				-0.06
								(0.07)				(0.15)
FDI*Legal system and property rights									-0.06			0.02
									(0.15)			(0.22)
FDI*Telephone per 100 people										-0.02		-0.004
										(0.02)		(0.06)
FDI*Trade openness											0.0001	0.001
											(0.003)	(0.004)
F-statsitics and p-values on joint hypothesis								0.99	0.85	1.02	0.78	0.37
all FDI variables & interactions								(0.38)	(0.43)	(0.37)	(0.46)	(0.87)
R-squared	0.45	0.52	0.52	0.55	0.57	0.62	0.65	0.66	0.66	0.66	0.65	0.66
Observations	63	63	63	63	63	63	63	63	63	63	63	63

Standard errors are given in parentheses under the coefficients, and p-values are given in parentheses under the F-statistics. Individual coefficients are statistically significant at the *10% level, **5% level, or ***1% level.

[11] The regressions are restricted to have the same number of observations.

Appendix Table 2: Foreign direct investment and economic growth in developing countries: 1970-2004 (panel with 5-year average)[12]

Dependent Variable: Growth rate of real GDP													
Effects Specification: cross-section fixed and period fixed													
			2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	2.11	2.12
Intercept			-0.23	-0.02	-0.20	-0.12	-0.01	-0.23	-0.25	-0.21	-0.25	-0.23	-0.25	-0.18
			(0.70)	(0.68)	(0.65)	(0.73)	(0.71)	(0.66)	(0.66)	(0.65)	(0.67)	(0.69)	(0.66)	(0.67)
Ln(initial income per capita)			-10.00**	-9.43**	-8.17**	-9.31	-11.45**	-10.91**	-10.37*	-10.33*	-10.39*	-10.48*	-10.34*	-10.50*
			(3.94)	(4.18)	(4.10)	(5.83)	(5.68)	(5.46)	(5.60)	(5.65)	(5.62)	(5.77)	(5.64)	(5.87)
Population growth			1.43***	1.42**	1.49**	1.47**	1.39**	1.39**	1.52***	1.53***	1.52***	1.53***	1.52***	1.53***
			(0.54)	(0.55)	(0.58)	(0.57)	(0.54)	(0.55)	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)
Capital/GDP			0.30***	0.29***	0.25***	0.26***	0.23***	0.22***	0.20***	0.20***	0.20***	0.20***	0.20***	0.20***
			(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Education				-0.36	-0.37	-0.36	-0.26	-0.34	-0.39	-0.44	-0.38	-0.40	-0.40	-0.45
				(0.50)	(0.49)	(0.50)	(0.48)	(0.45)	(0.45)	(0.46)	(0.44)	(0.44)	(0.45)	(0.46)
FDI/GDP					0.36***	0.34***	0.20*	0.20*	0.19*	0.15	0.19	0.23*	0.17	0.19
					(0.11)	(0.12)	(0.11)	(0.15)	(0.11)	(0.13)	(0.12)	(0.13)	(0.12)	(0.18)
Telephone per 100 people						0.08	0.10	0.09	0.08	0.08	0.08	0.09	0.08	0.10
						(0.13)	(0.13)	(0.12)	(0.13)	(0.12)	(0.13)	(0.15)	(0.13)	(0.15)
Trade openness							0.06***	0.07***	0.06***	0.06***	0.06***	0.06***	0.06***	0.06***
							(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Legal system and property rights								0.18	0.17	0.17	0.16	0.17	0.18	0.16
								(0.18)	(0.18)	(0.18)	(0.18)	(0.17)	(0.18)	(0.17)
Inflation									-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
									(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
FDI*Education										0.11				0.06
										(0.18)				(0.21)
FDI*Legal system and property rights											0.02			0.03
											(0.08)			(0.08)
FDI*Telephone per 100 people												-0.02		-0.02
												(0.03)		(0.04)
FDI*Trade openness													0.002	0.003
													(0.004)	(0.004)
F-statsitics and p-values on joint hypothesis										1.70	1.43	1.71	1.49	1.10
all FDI variables & interactions										(0.19)	(0.25)	(0.19)	(0.23)	(0.37)
R-squared			0.36	0.36	0.38	0.38	0.43	0.43	0.45	0.45	0.45	0.45	0.45	0.45
Observations			249	249	249	249	249	249	249	249	249	249	249	249

Standard errors are given in parentheses under the coefficients, and p-values are given in parentheses under the F-statistics. Individual coefficients are statistically significant at the *10% level, **5% level, or ***1% level.

[12] The regressions are restricted to have the same number of observations.