THE DEVELOPMENT DICHOTOMY

FDI & Economic Growth in Developed versus Developing Economies

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ECONOMETRICS

ABSTRACT

In light of the growing importance of globalization, this study examines whether foreign direct investment truly impacts economic growth and if that impact is different between developing versus developed countries. Many of the factors shown to be significant in previous papers, such as the enhancement of human capital, are found equally critical within this study. Where past works used incomplete and less nuanced variables in order to categorize human capital and economic freedom, this study seeks a deeper approach through its use of the Human Development Index and Economic Freedom Index. Panel data on 80 different countries (20 developed and 60 developing) between 1990 and 2017 is used to understand the interplay between FDI, HDI, and economic freedom. The results of this empirical analysis confirm that FDI, HDI, and economic freedom are all significant contributors to growth in developing economies. Most of all, this study reveals a powerful dichotomy in the interaction of variables between developed and developing economies.

PART I

INTRODUCTION

With the growth of globalization and integration of the world economy, studying the effects of national relationships has become increasingly paramount to gaining a clearer picture of economic growth and prosperity. One of the major indicators of the growth of globalization is foreign direct investment (FDI), especially as multinational corporations (MSCs) seek expansion and diversification oversees.[1] Based on World Bank data, global FDI inflows grew by 600 percent between 1990 and 2000, from $196 billion to $1,460 billion. After declining until 2003, FDI again skyrocketed to $3,103 billion in 2007. Since 2007, however, FDI inflows have been steadily decreasing amongst both developed countries (DCs) and developing, or less-developed, countries (LDCs). Meanwhile, GDP growth rates have also shown a declining trend during the same period, especially for LDCs. As a result of this trend, it is the aim of this study to analyze the relationship between GDP growth and FDI inflows.

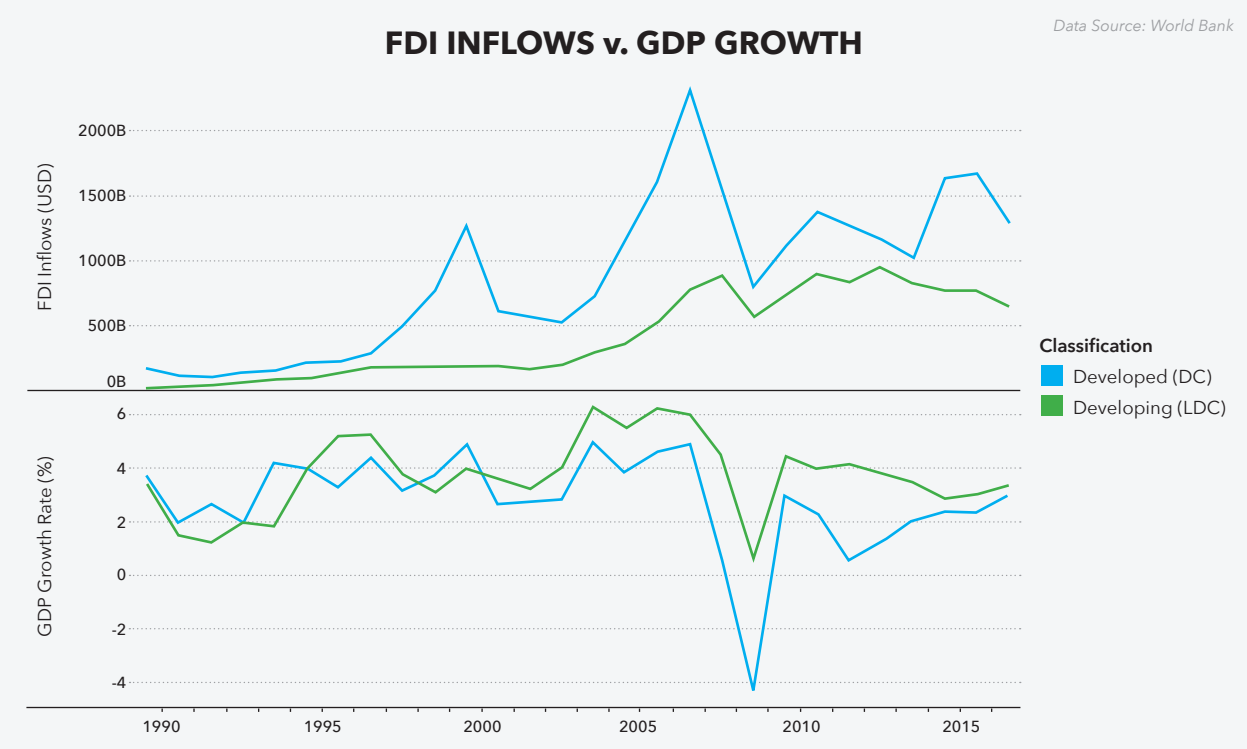
FDI plays a major role in the diffusion of technology by enhancing both human and non-financial capital assets in host countries. New training methods, industrial machinery, manufacturing techniques, managerial processes, and computer technology are just a few of the imports that FDI can bring to any host country. As a result of these imports, FDI inflows force many externalities and creates a spillover effect in each country. The extent of such spillover and its positive economic effects depend heavily upon the individual nation. However, it is rather intuitive that the impact of FDI's spillover effects on developed countries (DCs) will be substantially different than on developing countries (LDCs). Developed nations already have access to capital, generate growth from internal investment, and experience high levels of human development. By contrast, developing nations lack the same economic freedom and human development due to individual circumstances that have stunted national growth.

In the past, numerous studies on the effects of FDI on economic growth have yielded mixed results. However, many of these studies have sought to analyze both developed and developing economies together. Based on the endogenous theory of economic growth, such analysis seems futile, as each group of countries has very different capacities for change depending upon their 'absorptive capacity'—or their ability to utilize FDI effectively given the circumstances of their economic development. In other words, developing countries with higher levels of economic freedom and more enhanced

1 See Busse and Groizard (2005)

human capital are likely to yield more economic growth when supplemented with FDI. For this reason, in order to truly understand the effects of FDI on economic growth, one must account for the integral endogenous variables of human development and economic freedom.

This study seeks to analyze the impact of FDI on GDP in both developing and developed nations to discover where the discrepancy lies in its power to produce economic growth between the two subsets. Where this analysis departs from previous studies is in its choice of variables for measurement. In order to account for numerous factors that impact the advancement of human capital, most studies utilize educational variables. However, this analysis seeks a far more nuanced approach by utilizing the United Nation's Human Development Index (HDI) instead, which takes into consideration life expectancy, education, and income per capita as measures of individual prosperity. Meanwhile, rather than using the typical measure for trade openness, the Heritage Foundation's ratings for Trade Freedom within its Economic Freedom Index will be analyzed for deeper insight. This variable takes into consideration national policy as well as imports and exports' share of GDP. The core hypothesis of this study is that FDI will play a major role in the growth of GDP in developing nations (LDCs), while it will be negligible in that of developed nations (DCs). If this hypothesis is true, it supports the case that global economic growth hinges upon further emphasis on globalization through FDI in developing nations.



PART II

LITERATURE REVIEW

Because of the massive impact of globalization over the past three decades, numerous studies on foreign direct investment have been conducted in order to unearth its potential for inspiring growth. The results of these studies are best characterized as mixed; however, it is important to note that each study is on very different subsets of nations and time periods.

Perhaps one of the most impactful pieces of literature on the power of FDI is the work of Borensztein et al. (1998), who analyzed data from 69 different countries between 1970 and 1989 to find the relationship between FDI and per capita GDP growth. Ultimately, Borensztein reveals that the impact of FDI depends heavily upon the level of human capital within the host country. For countries with very low levels of human capital, he finds that the direct effect of FDI is negative, while his main regression results point to a positive overall effect. Borensztein's work indicates the importance of endogenous variables like human development in improving the effects of FDI on national economies.

In order to understand the causal relationship between FDI and economic growth, Kumar and Pradhan (2002) analyzed panel data on 107 different countries. Their regression analysis reveals that while FDI and economic growth have a positive relationship, in many cases the direction of causality is not prominent. In fact, a number of observations even reveal that FDI is impacted by economic growth rather than the other way around. Such a finding is intuitive, as one might expect multinational corporations looking to expand to be interested in nations with higher levels of growth. Similar to Kumar and Pradhan's research, Chowdhury and Mavrotas (2005) used the Toda-Yamamoto test on lagged variables of FDI and GDP to discover that GDP causes FDI in Chile. However, they found strong evidence of bi-directionality in both Malaysia and Thailand. As a result, it seems appropriate to assume that the relationship between GDP and FDI depends on the individual nation.

In order to understand the spillover of FDI more accurately, Sabina Silajdzic and Eldin Mehic (2015) looked at the impact of research and development expenditure as well as human capital in interacting with FDI in the CEE-10 countries. Using a Granger causality test, they indicate that FDI does impact economic growth in these countries. In addition, their results show that R&D expenditures significantly

impact growth performance, signaling the importance of innovation in making FDI more effective in the host country—another example of endogenous variables increasing absorptive capacity.

Many other studies have found FDI to hold a negative impact on economic growth, but only under certain circumstances. DeMello (1999) analyzed fifteen OECD countries against seventeen non-OECD countries to find that FDI caused some positive growth for OECD nations and some negative growth for non-OECD nations. This may also be an indication of the importance of endogenous variables, as non-OECD nations tend to be less developed in human capital, infrastructure, and technology—making FDI less powerful in generating economic growth. Such a conclusion would confirm Borensztein's results that a certain level of human capital is necessary before the effect of FDI can be felt. This same conclusion is echoed by Karbasi et al. (2005), who found that the positive effect of FDI is enhanced by human capital and sound macroeconomic policies.

The work of Blonigen and Wang (2004) found that pooling developed and developing countries together tends to skew data. On average, FDI positively effects developing countries, while developed countries have little to no impact. It is important to note that Blonigen and Wang find that the majority of FDI inflows are between developed nations, specifically the 'Triad' of the United States, Japan, and the European Union. Over ten years later, the makeup is quite similar, as the countries with the highest levels of FDI between 2012 and 2017 were the United States, the European Union, and China (which is categorized as undeveloped but emerging). The developing nations with the highest FDI inflows during the same period consist of Brazil, the British Virgin Islands, India, and Russia. According to Blonigen and Wang, the share of FDI inflows to developing countries (LCDs) between 1993 and 1998 accounted for 35 percent of total FDI inflows. That share has now grown to 38 percent between 2012 and 2017. While FDI itself has been declining, the share of FDI inflows to developing countries is on the rise. The aim of this study is to discover whether these inflows play any role in impacting developing economies as opposed to developed economies while accounting for two major endogenous variables—economic freedom and human development.

PART III

DATA

In order to measure economic growth, the natural log of GDP in constant USD is used as the dependent variable. Panel data was collected for 80 different countries between 1990 and 2017 from various sources. To determine which countries would be involved in the model, the International Monetary Fund's definitions of advanced economies and emerging/developing economies were used to separate developed countries (DCs) and developing countries (LCDs) respectively. Each group (DCs and LCDs) were then divided by continent and the ten countries with the highest GDP in constant USD as of 2017 per continent were chosen. It is important to note that on many continents there are less than ten or even zero DCs. For this reason, the final model includes 60 developing nations (LCDs) and 20 developed nations (DCs), all listed below.

COUNTRIES BY CLASSIFICATION

According to the International Monetary Fund

DEVELOPED (DC)

North America	South America	Europe	Asia	Africa	Oceania
Canada		Austria	Hong Kong		Australia
United States		Belgium	Israel		New Zealand
		France	Japan		
		Germany	Macao		
		Italy	Singapore		
		Netherlands	South Korea		
		Spain			
		Sweden			
		Switzerland			
		United Kingdom			

DEVELOPING (LDC)

North America	South America	Europe	Asia	Africa	Oceania
Costa Rica	Argentina	Azerbaijan	China	Algeria	American Samoa
Cuba	Bolivia	Belarus	India	Angola	Fiji
Dominican Republic	Brazil	Bosnia & Herzegovina	Indonesia	Egypt	Guam
El Salvador	Chile	Bulgaria	Iran	Ethiopia	Micronesia
Guatemala	Columbia	Croatia	Malaysia	Ghana	N. Mariana Islands
Honduras	Ecuador	Hungary	Russia	Kenya	Papua New Guinea
Jamaica	Guyana	Poland	Saudi Arabia	Morocco	Samoa
Mexico	Paraguay	Romania	Thailand	Nigeria	Solomon Islands
Panama	Peru	Serbia	Turkey	South Africa	Tonga
Trinidad & Tobago	Uruguay	Ukraine	UAE	Sudan	Vanuatu

The variables used within the model were chosen based on previous similar models in order to account for the endogenous effects of individual countries. The key independent variables of interest are FDI inflows, HDI score, and selected scores from the Economic Freedom Index. Additional variables were chosen to control for natural GDP growth over time, all listed below.

FDI

Source: World Bank

A one year lag of Foreign Direct Investment inflows as a Balance of Payments measured in billions of US dollars. The lag was chosen for accuracy, as the previous year's FDI will better explain current year GDP growth.

HDI

Source: United Nations Development Programme

The Human Development Index gives a more nuanced approach to measuring human capital. It is measured from 0 to 1, with a higher number indicating higher levels of development. Collected since 1990, it is itself a conglomeration of three indices—the education index, life expectancy index, and GNI index. As a result, it takes into account education quality, life expectancy, and Gross National Income as measure of human development and capital.

TRADE

Source: The Heritage Foundation

Three separate measures from The Heritage Foundation's Economic Freedom Index are used. The Trade Freedom Index operates as a proxy measurement for Trade Openness. The Trade Freedom Index is measured on a scale of 0 to 100, with the higher score indicating more freedom. It takes into consideration trade policies, tariffs, and share of imports and exports. A limitation of this data is that it has only been measured since 1995 and omits some of the countries within this model.

PROP

Source: The Heritage Foundation

Also part of the Economic Freedom Index, the Property Rights Index serves as a measure of the risk of foreign investment. It is measured on a scale of 0 to 100, with 100 indicating the most freedom.

TAX

Source: The Heritage Foundation

The last variable from the Economic Freedom Index, the Tax Burden Index measures the negative impact of high tax policies on businesses and individuals. It is also measured on a scale of 0 to 100, with 100 indicating the most freedom.

INF

Source: World Bank

Inflation measured a percentage change in the Consumer Price Index is used to account for price changes and their natural effect on GDP.

POP

Source: World Bank

The total population of each country measured in millions of people.

YR

Because a pooled OLS regression will be used on panel data, it is important that the model control for the effect of time on GDP growth. For this reason, a time variable is added in years from 1990 to 2017.

SA, AF, AS, EU, OC

Geographic Intercept Dummy Variables

Five dummy variables were made to examine the impact of the location. South America, Africa, Asia, Europe, and Oceania are each their own dummy variable, with the base continent as North America.

LDC

Developing Intercept Dummy Variable

LDC is a dummy variable that indicates if a country is developing or not, used in the aggregate model.

FDI*LDC

Developing FDI Slope Dummy Variable

FDI*LDC is a slope dummy variable meant to describe the difference in growth caused by FDI in developing versus developed countries, used in the aggregate regression.

LIST OF VARIABLES

Variable	Anticipated Sign	Number of Observations	Description	Source
LN_GDP	N/A	2215	Dependent Variable: the natural log of GDP measured in current USD.	The World Bank
FDI	+	2119	One year lag of Foreign Direct Investment inflows, measured in billions of current USD.	The World Bank
HDI	+	2114	Human Development Index (scale 0-1). Proxy measure for human capital.	The United Nations Development Programme
TRADE	+	1742	Trade Freedom score in the Economic Freedom Index. Measured from 0-100. 100 = most free.	The Heritage Foundation
PROP	+	1739	Property Rights score in the Economic Freedom Index. Measured from 0-100. 100 = most rights.	The Heritage Foundation
TAX	+	1742	Tax Burden score in the Economic Freedom Index. Measured from 0-100. 100 = least burden.	The Heritage Foundation
INF	–	2059	Inflation measured at percent change in CPI.	The World Bank
POP	+	2268	Population in millions.	The World Bank
YR	+	2349	Year, measured 1990 to 2017. Meant to account of growth over time in OLS.	N/A
SA	–	2349	South America (dummy variable)	N/A
AF	–	2349	Africa (dummy variable)	N/A
AS	–	2349	Asia (dummy variable)	N/A
EU	+	2349	Europe (dummy variable)	N/A
OC	–	2349	Oceania (dummy variable)	N/A
LDC	–	2349	Dummy variable for developing countries 1 = Developing; 0 = Developed	N/A
FDI*LDC	+	2349	FDI inflow for developing countries	N/A

PART IV

MODEL

The core hypothesis of this paper is simple: the effect of FDI on economic growth (measured by GDP) is negligible in developed economies, but significant in the growth of developing economies. In order to test this hypothesis, three models are offered: a developed (DC) model, developing (LDC) model, and an aggregate model. The aggregate model will add the LDC and FDI*LDC variables in order to account for the different GDP growth and effects of FDI on developing economies. For each sample, a pooled ordinary least squares technique is used, producing the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots \beta_n X_n + \varepsilon$$

The best models as developed by the OLS on panel data are as follows:

REGRESSION MODELS

Using Ordinary Least Squares Technique

DEVELOPED (DC)

$$\textbf{LN\_GDP} = \beta_0 + \beta_1 FDI + \beta_2 HDI + \beta_3 TRADE + \beta_4 PROP + \beta_5 TAX + \beta_6 INF + \beta_7 POP + \beta_8 YR + \beta_9 SA + \beta_{10} AF + \beta_{11} AS + \beta_{12} EU + \beta_{13} OC + \varepsilon$$

DEVELOPED (DC)

$$\textbf{LN\_GDP} = \beta_0 + \beta_1 FDI + \beta_2 HDI + \beta_3 TRADE + \beta_4 PROP + \beta_5 TAX + \beta_6 INF + \beta_7 POP + \beta_8 YR + \beta_9 SA + \beta_{10} AF + \beta_{11} AS + \beta_{12} EU + \beta_{13} OC + \varepsilon$$

AGGREGATE

$$\textbf{LN\_GDP} = \beta_0 + \beta_1 FDI + \beta_1 FDI{*}LDC + LDC + \beta_2 HDI + \beta_3 TRADE + \beta_4 PROP + \beta_5 TAX + \beta_6 INF + \beta_7 POP + \beta_8 YR + \beta_9 SA + \beta_{10} AF + \beta_{11} AS + \beta_{12} EU + \beta_{13} OC + \varepsilon$$

The pooled OLS method yielded a model with strong results: high adjusted R-squared, low VIF values, and a majority of variables with statistical significance. However, it did not pass all assumption testing. Errors were correlated as revealed by its failure of the Durbin-Watson Test, with the scores for each model below 1. This revealed a negative error correlation, invalidating the model. As a result, the ordinary least squares regression was repeated using the AUTOREG procedure to rectify any autocorrelation. The same regression analysis with autoregressive errors corrected the correlated errors and DW Statistic with new parameter estimates.

PART V

EMPIRICAL RESULTS

POOLED OLS REGRESSION

	DEVELOPED (DC)		DEVELOPING (LDC)		AGGREGATE	
Variable	**Parameter**	**VIF**	**Parameter**	**VIF**	**Parameter**	**VIF**
INTERCEPT	−75.34560***	0	−43.03740***	0	−11.93002	0
	(14.6692)		(14.6250)		(12.2960)	
FDI	−0.00061527	1.62659	0.01294***	1.96070	0.00422***	1.52306
	(0.000443)		(0.001831)		(0.000715)	
HDI	0.44259	3.46907	3.80921***	2.42129	5.76599***	4.12405
	(1.4507)		(0.4066)		(0.4128)	
TRADE	−0.02992***	1.98945	0.00931***	2.40282	0.01214***	2.81453
	(0.007234)		(0.003604)		(0.003603)	
PROP	−0.00958***	1.59306	0.00429**	1.28322	0.00089955	3.11571
	(0.003514)		(0.002163)		(0.002131)	
TAX	0.00417	2.32007	−0.00211	1.41113	−0.01150***	2.12232
	(0.002723)		(0.003438)		(0.002871)	
INF	−0.02022	1.10908	−0.00040330	1.08358	−0.00045260	1.06792
	(0.0178)		(0.000757)		(0.000805)	
POP	0.01580***	2.12282	0.00185***	2.68077	0.00336***	2.43601
	(0.000599)		(0.000214)		(0.000216)	
YR	0.01580***	3.51873	0.03178***	2.40404	0.001669***	2.04493
	(0.007803)		(0.007423)		(0.006247)	
SA	-	-	0.35599***	1.65409	0.15285	1.64451
			(0.1054)		(0.1098)	
AF	-	-	1.47421***	2.35090	1.48560***	2.29004
			(0.1281)		(0.1324)	
AS	−0.25726*	4.43413	1.94834***	2.07563	0.84528***	2.20011
	(0.1324)		(0.1163)		(0.1055)	
EU	0.47772***	5.39745	0.28585**	1.95506	-0.06932	2.62955
	(0.1275)		(0.1150)		(0.1036)	
OC	−0.24096	2.64499	−2.79158***	1.49738	−2.15341***	1.55134
	(0.1488)		(0.1439)		(0.1292)	
LDC	-	-	-	-	−1.28789***	4.56175
					(0.1364)	
FDI*LDC	-	-	-	-	0.00393*	2.08428
					(0.002009)	
Adj. R-Square	0.7863		0.7091		0.7131	
F-Value	152.90		207.15		261.59	
Durbin-Watson	0.120		0.150		0.149	
Observations	455		1119		1574	
Countries	20		60		80	

*Note: ***, **, and * indicate significance at the 1%, 5%, and 10% significance level respectively.*

The following models were created in order to correct for the correlated errors in the original pooled OLS models based on their DW statistics. Below are the corrected estimates.

OLS REGRESSION WITH AUTOREGRESSIVE ERRORS

	DEVELOPED (DC)	DEVELOPING (LDC)	AGGREGATE
Variable	**Parameter**	**Parameter**	**Parameter**
INTERCEPT	–10.7543	–73.5466***	–49.1944***
	(9.4586)	(7.0793)	(5.8263)
FDI	0.000120	0.001609**	0.0000482
	(0.0000934)	(0.000674)	(0.2725)
HDI	3.6601***	1.2363***	1.8564***
	(1.0768)	(0.2803)	(0.000828)
TRADE	0.002594	0.000967	0.001400*
	(0.002020)	(0.000856)	(0.000818)
PROP	–0.002043	0.002046**	0.001785**
	(0.001660)	(0.000851)	(0.001324)
TAX	0.000806	0.001725	–0.000040
	(0.001488)	(0.001553)	(0.000108)
INF	0.004526	–0.000159	–0.000193*
	(0.003583)	(0.000108)	(0.000219)
POP	0.0158***	0.001498***	0.002517***
	(0.001017)	(0.000230)	(0.002982)
YR	0.0168***	0.0482***	0.0379***
	(0.005126)	(0.003589)	(0.1510)
SA	-	0.1190	0.1647
		(0.1591)	(0.1775)
AF	-	0.9663***	1.0822***
		(0.1832)	(0.1501)
AS	–0.0514	1.7648***	0.7964***
	(0.2104)	(0.1718)	(0.1365)
EU	0.5416***	–0.438**	–0.3389**
	(0.1742)	(0.1767)	(0.1664)
OC	0.1198	–3.2177***	–2.7089***
	(0.2302)	(0.1852)	(<.0001)
LDC	-	-	–4.3067***
			(0.3275)
FDI*LDC	-	-	0.001613**
			(0.000693)
Adj. R-Square	0.9935	0.9919	0.9932
F-Value	-	-	-
Durbin-Watson	1.8171	1.9679	1.9788
Observations	455	1119	1574
Countries	20	60	80

*Note: ***, **, and * indicate significance at the 1%, 5%, and 10% significance level respectively.*

PART VI

DISCUSSION OF RESULTS

The results of the original pooled OLS regressions are all rather significant, with adjusted R-squared values over 0.70 for each model. In addition, all three models pass the F-Test, with F-statics of 152.9, 207.9, and 261.6 for the DC, LDC, and aggregate models respectively. It is also important to note that no variables exhibit significant amounts of multicollinearity. The only variable with a variance inflation factor (VIF) over 5 is the EU dummy variable in the DC model. Even so, the VIF is only at 5.35, well below the more realistic target of VIF of 10. As a result, there is no evidence of significant multicollinearity within the OLS models. Unfortunately, as previously noted, the Durbin-Watson statistics fell into the negative correlation region for each regression, invalidating all three models. Not to mention, the studentized residuals plots appear to have fan shaped errors, indicating that there is non-constant variance in the models (see appendix 3). For these reasons, the original OLS models are not accurate.

In order to correct for the correlated error terms, a second series of regressions was conducted using autoregressive errors. This resulted in significantly different parameter estimates for each variable, and three far more powerful models. The DC, LDC, and aggregate models each produce R-squared values of 0.994, 0.992, and 0.993 respectively. In addition, all three of the newly generated models pass the Durbin-Watson Test with the new DW statistics. It is likely that the original models were inaccurate due to using an ordinary least squares technique on country panel data. Because there are significant amounts of variation country to country, the data may be more accurately analyzed using a fixed effects technique. When running an OLS, the variance between individual countries calls for either autoregressive errors or panel corrected standard errors (PCSE). For these models, autoregressive errors seem to yield a worthy result. The implications of each variable's parameter estimates are explained in the following pages.

Intercept & Year (YR)

In none of the models does the intercept term hold any explanatory power, as there is no situation in which the GDP of a nation might be zero. The year variable (YR) is statistically significant at the 1 percent level across all models, which is important in accounting for natural GDP growth over time. Based on the parameter estimates in the DC and LDC models, developed nations (DCs) experience a GDP growth rate of approximately 1.68 percent per year, while the GDP of developing nations (LDCs) grows by 4.82 percent per year. In the aggregate model, the GDP of all nations increases by approximately 3.79 percent each year. This is similar to the actual average growth rates between 2012 and 2017, which was 1.98 percent for developed nations, 3.49 percent for developing nations, and 3.2 percent worldwide. In comparing the findings of these models to actual statistics, they hold surprising accuracy, although with a slight bias toward higher growth rates for developing countries. This is likely due to the significantly larger sample size of LDCs.

Foreign Direct Investment (FDI)

The key variable for analysis in these models is foreign direct investment inflows (FDI). In the DC model, FDI holds no statistical significance, while in the LDC model, FDI is positive and statistically significant at the 5 percent level. This falls in line with the core hypothesis of this paper—FDI has little impact on increasing the GDP of developed countries, but is a significant factor in the growth of developing countries. The parameter estimate for FDI in the LDC model indicates that with every $1 billion in FDI inflows, there is a resulting 0.16 percent increase in GDP. This is a rather significant positive relationship, and demonstrates that FDI does in fact result in an increase in GDP for developing countries. While 0.16 percent may seem small, in a nation with the GDP of Brazil, $1 billion in FDI inflows would result in a $3.289 billion increase in GDP.

The aggregate model equally demonstrates the results of FDI seen within the DC and LDC models. The slope dummy variable FDI*LDC represents the increase in GDP as a result of FDI in developing countries (LDCs), while the FDI variable represents the impact on developed countries (DCs). FDI*LDC is statistically significant at the 5 percent level, again showing that $1 billion in FDI inflows results in a 0.16 percent increase in GDP for developing nations. Meanwhile, there is no statistical significance in the FDI variable, meaning that FDI does not play a major role in determining the GDP of developed

countries (DCs). These near identical findings between the separate DC and LDC models and the aggregate model lend credence to the overall accuracy of the variables chosen. Overall, these models demonstrate that there exists a dichotomy in the effect of FDI between developing and developed nations. Developing nations experience significant growth as a result of FDI, while the impact on developed nations is negligible.

Human Development (HDI)

Across all models, the Human Development Index score (HDI) is statistically significant at the 1 percent level. This indicates the importance of the enhancement of human capital in boosting economic output. It is critical to note that because HDI is measured from 0 to 1, its parameter estimates are significantly larger than the other variables. A single unit increase in HDI score is 0.01. As a result, if a country were to increase its HDI score by 0.01, the resulting GDP increase would be 3.6 percent for DCs, 1.2 percent for LDCs, and 1.8 percent in the aggregate model. This is quite significant, and yields credence to the theory that endogenous variables are major determinants of economic growth.

It is interesting that HDI yields lower GDP growth potential in developing countries. This may be due to the fact that an increase in human capital–through education, health, and national income–must be simultaneously met with job growth to stimulate GDP. Otherwise, a developing nation might have highly skilled workers, but no viable opportunities for them. By contrast, developed nations are more likely to meet an increase in human capital with an increase in jobs through domestic investment. Overall, it is clear that human capital enhancement is a powerful determinant of GDP for any nation.

Freedom Index Variables (PROP, TRADE, and TAX)

Of the Freedom Index variables, none prove to be universally significant across all three models. However, property rights (PROP) are significant in both the LDC and aggregate models at the 5 percent level. Based on the parameter estimates, a unit increase in the Freedom Index Property Rights score can grow GDP by 0.2 percent for developing countries and 0.3 percent all countries in aggregate. This serves as an indication that property rights are important for spurring innovation in developing countries. Trade freedom (TRADE) is statistically significant in the aggregate model, but only at the 10 percent level, making it negligible. Meanwhile, tax burden (TAX) holds no significance in any of the models.

Inflation

Inflation proves to not be a significant factor any of the models, which is quite interesting, as inflation normally holds a strong countercyclical relationship with GDP. It is possible that this effect is crowded out by the other control variables.

Population (POP)

In all three models, population (POP) is statistically significant at the 1 percent level. With every additional one million people, there is an expected GDP increase of 1.6 percent for developed countries, 0.15 percent for developing countries, and 0.25 percent in aggregate. This is rather intuitive, as many of the largest countries by population produce the most GDP globally. Population has less of an impact on GDP for developing economies. This may be due to the fact that population growth in developing nations usually does not keep pace with job growth, resulting in less overall economic impact. Such is the case with developing nations like Pakistan, where population growth is out-pacing job vacancies. For this reason, it is reasonable that population would play less of a role in growing GDP in developing versus developed countries.

Geographic Dummy Variables

The dummy variables used to account for geographic location proved surprisingly significant predictors of GDP in the LDC and aggregate models. Africa (AF), Asia (AS), Europe (EU), and Oceania (OC) were all statistically significant at the 1 percent level. Using developing North American countries as the base, African countries show 96 percent higher GDP and Asian countries show 176 percent higher GDP. Meanwhile, European nations have 34 percent lower GDP; Oceanian countries have a staggering 321 percent lower GDP; and South American has no statistically significant difference in GDP from North America. The results are quite similar, though less pronounced, in the aggregate model.

The estimates of the geographical dummy variables appear intuitive. The developing nations in North America consist of numerous Latin American countries and a string of islands, all of which have generally lower GDPs compared to the world. Oceania is made up of a large number of small island countries, so it seems logical that it would have a drastically lower GDP than North America. It is interesting that the developing European nations, which include Poland, Romania, and Hungary, have 34 percent lower GDPs than the developing North American countries like Mexico and Cuba.

The EU variable was the only notable geographical dummy variable in the DC model, significant at the 1 percent level. Its parameter estimate demonstrates that European countries have 54.16 percent higher GDP than North American countries. This may be a statistical anomaly, as only two North American countries were used in the data set—the United States and Canada. However, it may also be a testament to the fact that European nations tend to be closer together and more open to trade amongst one another, causing for higher GDP for the continent on a country to country basis. South America and Africa were not included in this model, as there are no developed nations within either continent.

Developing Countries (LDC)

The LDC dummy variable in the aggregate model is meant to account for the natural difference in GDP between developing and developed nations. Statistically significant at 1 percent, this variable's estimate is quite telling. According to the model, developing countries (LDCs) tend to have 430 percent lower GDP than developed countries (DCs). While this difference is rather large, it seems rather logical.

SUMMARY OF ANALYSIS

Outcomes of the Pooled OLS with Autoregressive Errors

FDI has a significant impact *on developing economies but no major impact on developed economies.*

Human capital enhancement *is a major growth factor for economic output, but yields a larger impact on the GDP of developed economies rather than developing.*

Property Rights *are a significant contributor to economic growth in developing countries.*

Population *is a strong determinant of GDP, especially for developed countries.*

Geographic location *makes a major difference in GDP outcomes for developing countries. The continents listed from highest to lowest GDP for developing countries are Asia, Africa, North America, Europe & Oceania.*

PART VII

CONCLUDING REMARKS

The results of this study have major implications on the determining factors for growth and development in countries across the globe. The vast majority of nations are still classified as developing and require significant improvements in industrialization, education, healthcare, infrastructure, and economic freedom before their economic potential can be realized. Based on these models, FDI remains a powerful catalyst for development diffusion. The hypothesis of this paper is confirmed: Foreign direct investment is a major contributor to economic growth in developing countries, but the evidence of its ability to boost growth in developed countries is scarce. Such findings necessitate the continued push for globalization in order to improve international standards, further the world economy, and enhance the human condition.

Foreign direct investment, human capital, property rights, population, and geographic location are all strong predictors of economic growth. Higher levels of freedom, increased human development, more minds to create, and robust investment capital all yield more prosperous economies. While this is not an exhaustive analysis of the factors that impact GDP and interact with foreign direct investment, it is rather telling of the differences between developed and developing nations. In the future, it is critical that studies make this distinction and even separate economies further by region or country. Variations in the impact of foreign direct investment hinge upon the individual country and its endogenous variables at play. At the very least, more control variables are necessary to capture the individual host country's response to foreign direct investment. As with most studies on FDI and macroeconomic variations, more data and increased granularity are needed to truly unpack the effects of FDI, human capital development, and economic freedom worldwide. At the very least, this study confirms the positive correlation between FDI and economic growth present in developing economies. Even more, it exposes the gap in FDI's explanatory power between developing and developed countries—evidence of the existence of a development dichotomy.

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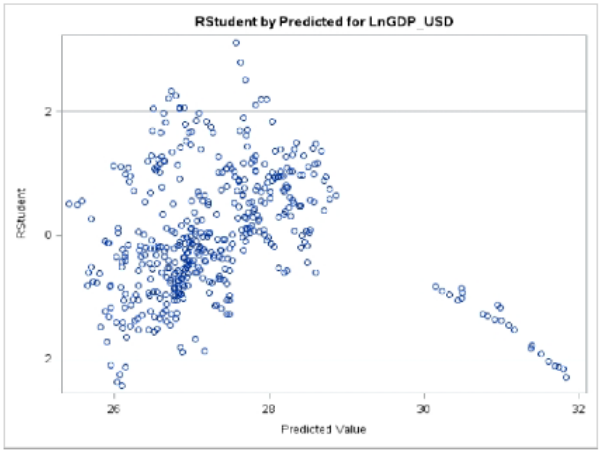
APPENDIX

(1) It is assumed that all independent variables are measured without error.

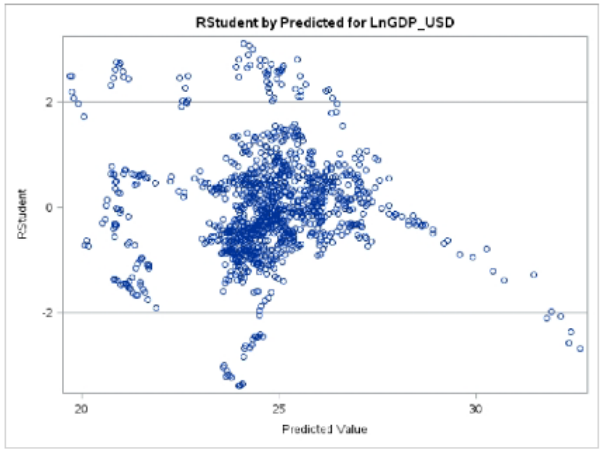
(2) Based on the plots below, the mean error for all three models appears to be zero.

(3) There is a slight fan shape detected in each plot. However, transforming Y is not an option, as it is already a natural log in all three models. Therefore, it may be considered that the original OLS models violate this assumption.

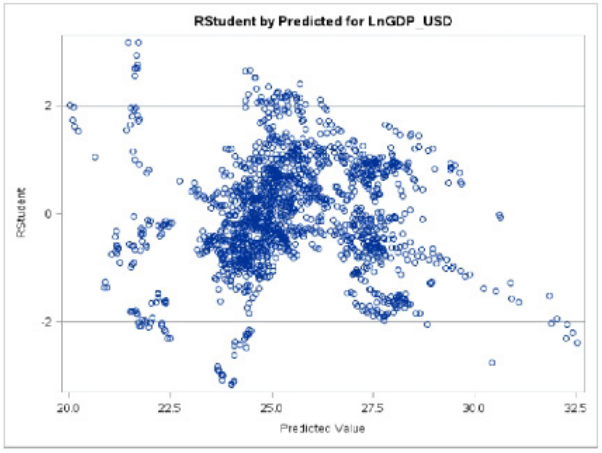
DEVELOPED (DCs)



DEVELOPING (LDCs)



AGGREGATE



(4) The Durbin-Watson statistics indicate that the original OLS models all have negatively correlated errors. For this reason, a second model was developed using autoregressive errors. See above)

DEVELOPED

Durbin-Watson D	0.120
Number of Observations	455
1st Order Autocorrelation	0.934

DEVELOPING

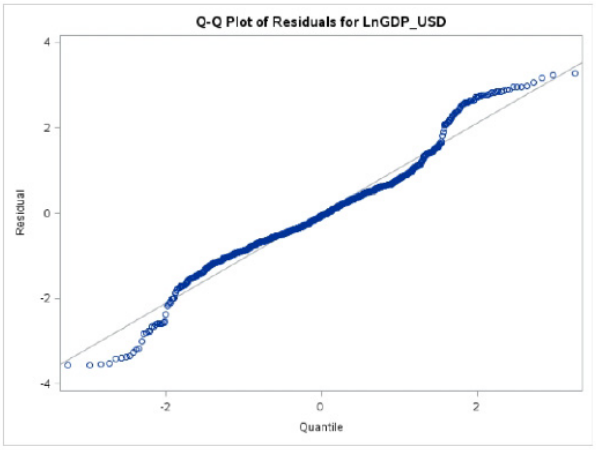
Durbin-Watson D	0.150
Number of Observations	1119
1st Order Autocorrelation	0.925

AGGREGATE

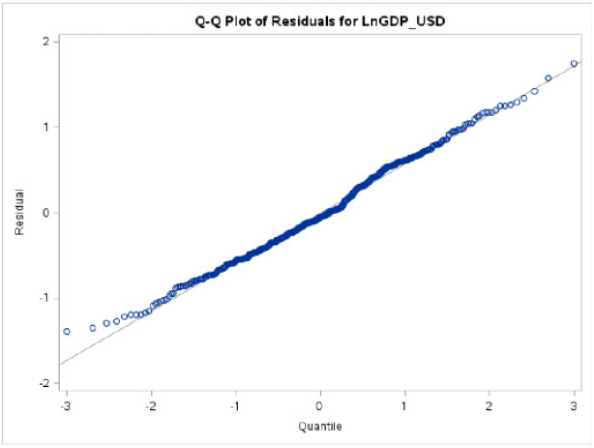
Durbin-Watson D	0.149
Number of Observations	1574
1st Order Autocorrelation	0.925

(5) The Normal Probability (Q-Q) plots demonstrate that the lines pass through point [0;0] and have an approximate 45° angle for each model. As a result, errors are evenly distributed.

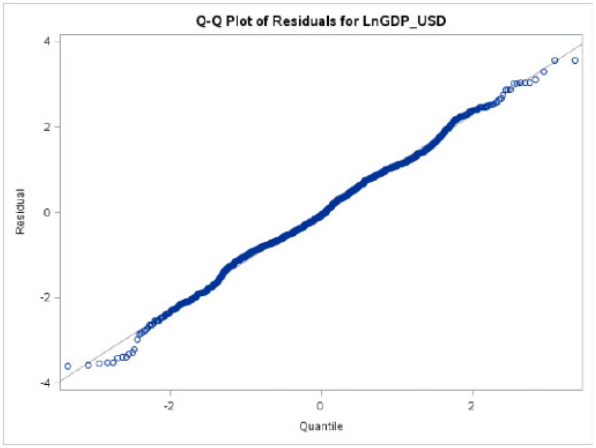
DEVELOPED (DCs)



DEVELOPING (LDCs)



AGGREGATE



The Development Dichotomy

Jordan Dunn

4.29.19

ECONOMETRICS