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Determinants of Economic Growth in Latin America

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ABSTRACT. This paper aims to identify the factors that are most important in promoting economic growth in Latin America.[2] It uses panel data for 17 countries over a 15-year period. Low levels of corruption, high levels of internet access, low levels of FDI, and high net energy imports are statistically significant in increasing GDP per capita in Latin America. Surprisingly, education is found to be statistically insignificant for economic growth.

I. Introduction

Various organizations work to develop Latin American communities. Some are more successful than others in promoting economic growth.[3] Organizations fund micro-loans, encourage infrastructure, or enhance the human capital stock by leading development programs for young children, primary and secondary educational programs for adolescents, and programs on sustainable agriculture for adults (Instituto de Desarollo y Medio Ambiente, 2010; CEPAD, 2005). In addition to external groups' projects, local and national governments try to induce growth through policy decisions, such as offering subsidies to incoming Foreign Direct Investment (FDI)[4]. The variation in annual growth rates among Latin American countries indicates that some factors may have a greater effect than others in promoting long-term economic growth in the region.

This study examines several determinants of economic growth to determine the most significant factors in Latin America. The variables include FDI, indices for economic freedom and corruption, primary and secondary education enrollment as proxies for different intensities of human capital, and the inflation rate as a proxy for the quality of policy. While previous research has used the rate of mainland telephone access[5] as a proxy for available infrastructure, this study measures infrastructure by internet access per hundred people. Additionally, the model incorporates the annual net energy imports of each country, in oil equivalents, to measure how oil affects growth.

The variables are examined in a fixed-effects regression model over a 15-year period in 17 Latin American countries to determine the variables that are most closely linked to economic growth. Increasing

openness and internet access help increase growth. Countries that import more oil are found to have more growth. Decreasing FDI, corruption, and inflation rates are also correlated with an increase in economic growth. Education, both primary and secondary, is statistically insignificant. Further tests dispel the concern about multicoliniarity between oil and corruption in the model.

II. Literature Review

Robert Barro (1996) finds that a country's legal structure, international openness, inflation rate, fertility rate, investment, and educational enrollment are all factors that affect economic growth. Various studies have examined the effect of these variables on economic growth, but none focus on Latin America in the last decade. Perhaps not all factors promote growth equally in all countries. The best approach for the world's 100 poorest countries or for East Asia may not be the best approach for Latin America. To test this idea, the widely-recognized factors of economic growth are incorporated in this study with minor modifications. This analysis includes measures for FDI, openness, corruption, education, infrastructure, inflation, and net energy imports.

Although fertility rates have decreased drastically in the last 50 years, the change over the last decade has not been noteworthy. Over the last 50 years, the rate fell by an average of 3.7 children per woman. From 1995 to 2009, the average fertility rate in Latin American countries fell by just 0.2 children per woman. Some of the decrease in fertility rates may be explained by the increase in secondary education enrollment over the period. Perhaps a woman delays giving birth to pursue an education, and once she is has attained an education, she has more incentive to work at a paying job than to raise children. Because the change in fertility rates over the last 15 years was so small and the change may be attributed to changes in education, fertility rates were excluded from the final model.

Globalization has allowed a freer flow of technology and has increased FDI. Borensztein et al. (1998) explain that FDI benefits a host country through additional employment opportunities and the transmission of technology and knowledge. FDI may also have a spillover effect for local industry in the host country, as it may reduce the cost of training new hires who already have a basic understanding of industry processes (Hanson, 2001). The benefits create an incentive to subsidize FDI.

FDI may sometimes have a negative effect on a host country (Hanson, 2001; Borensztein et al., 1998). Foreign firms may redistribute income away from the low and middle classes, edge out domestic firms, and lower the host country's welfare as a whole. If this is the case, Hanson (2001) notes that the optimal policy toward FDI may, in fact, be a tax. Borensztein et al. (1998) and Harrison (1996) agree that FDI enhances economic growth only when a country has a minimum threshold of human capital. If human capital does not meet the threshold, the net effect of FDI may be negative in the host country.

Openness is measured as the ratio of the absolute value of exports plus the absolute value of imports to GDP, the proportion of a country's economy that is tied to the international market (Barro, 2001 and Al Nassar, 2007). Harrison (1996) and Barro (2001) find that, in poor countries, greater openness is associated with higher productivity growth and greater returns to human capital. If the increase in productivity arises because workers specialize in the industry in which they have a comparative advantage, then openness enhances efficiency and productivity via specialization and trade.

One concern, however, is Latin America's dependence on particular export markets. The United States makes up 17 percent of Peru's export market (U.S. Department of State, 2010). When such a substantial part of a country's economy is tied to a single international trade partner, the exporting country may be harshly affected when its trading partner, the United States, is hit by a recession. For example, the 2008 recession caused a substantial loss of exports. In addition, the recession coincided with a rise in commodity prices. Because Latin America imports many commodities, the rise exacerbated poverty in the region (The Economist, 2011).

There are other factors that affect growth. Mauro's (1995) 67-country study concludes that a one standard deviation decrease in the level of corruption is associated with a 1.3 percentage point increase in the annual growth rate. Corruption may stem from many sources, such as a fragmented population (Mauro, 1995). Countries with citizens of dissimilar backgrounds, customs, and cultures may face interethnic conflict. The leader of a fragmented country may implement policy that benefits his ethnic, social, or political group.

Historically, corruption in Latin America has been associated with extreme inflation rates. Barro's (1996) 100-country study indicates that a 10 percent increase in the annual inflation rate, a rate that is not

uncommon in Latin American countries, lowers economic growth by 0.3 percentage points per year. If high, erratic inflation persists over time, economic growth could slow considerably.

Others suggest that natural resource availability may contribute to corruption. Sachs and Warner (1995) find a statistically significant, inverse relationship between natural resource abundance and economic growth. The phenomenon has been deemed the "curse of oil" (Thompson, 2007). Sachs and Warner (1995), however, note that the effect of oil abundance on corruption may not be identical to the effect it has on welfare. Oil abundance may enhance social welfare, even if it does not stimulate growth.

ZhiDong (2003) explores this effect in China. He finds that China's boom in economic growth raised the country's energy use above self-sufficiency and caused the country to become a major energy importer. Although the boom corresponded with huge environmental and health concerns, the corruption index increased, indicating less corruption.

Resource abundance may lead to rent-seeking and corruption, which may reduce growth (Thompson, 2007; Sachs and Warner, 1995). The underlying assumption is that the oil industry brings money to poor countries. This creates an incentive to seek part of the windfall rather than develop productive enterprises.

The resource curse is related to the "Dutch disease" (Collier, 2007). Resource abundance, such as oil reserves, causes an increase in a country's exports. The inflow of foreign currency causes the domestic currency to appreciate, making the country's other exports relatively more expensive in the international market. When the country's products are more expensive, the international demand for the country's exports will fall. The reduced demand for exports will slow or inhibit growth, even if the non-oil exports would have otherwise stimulated growth.

Despite the negative stigma, Rose-Ackerman (1978) warns that eliminating corruption is not the optimal solution from an economic standpoint. The cost of eliminating corruption would be so high that it would outweigh the benefit of a corruption-free society. The tradeoff indicates that some level of corruption, however small, is efficient. Yet, Latin America is known for high, inefficient levels of corruption. The goal is not to eliminate corruption in Latin America, only to reduce corruption to a more efficient level. High levels of corruption distort growth and economic opportunities. Countries with high levels of corruption have low growth rates.

Instability is also a concern in developing countries. Unstable governments spend less on education than other countries (Mauro, 1995). Low education expenditures mean that nearly 90 percent of Mexico's education funds go toward teachers' wages, leaving little for building construction and maintenance, computers, or other educational infrastructure (Hanson, 2010). The lack of investment in education creates a self-perpetuating spiral of low human capital accumulation. Human capital facilitates the absorption of new skills and technologies. Thus, a lack of human capital inhibits a country's ability to learn new skills, use technology, and attract FDI. More generally, a lack of education limits economic opportunities.

Al Nassar (2007) notes that a worker's level of education is a good measure of his human capital and that human capital is directly related to workers' productivity. Barro (1999) finds that an additional year of schooling increases a country's growth rate by 0.7 percent per year. This indicates that an educated workforce is better able to absorb technologies in the workplace. Because education has positive externalities to society, the return on education expenditures may greatly surpass the cost of the initial investment.

Infrastructure also affects growth. If a country has basic infrastructure, it may be easier to operate a successful business in the area. The number of telephone lines is statistically significant in Al Nassar's (2007) model of the determinants of FDI in Latin American and Asian countries. He suggests that a country is more attractive to multinational corporations when the country promotes stability, education, and standard infrastructure.

Multinational corporations respond to safety and economic conditions in host countries. The Economist (2011) cited Wal-Mart's recent move of its Central American operations from Guatemala to Costa Rica as a response to security concerns. The murder rate in Guatemala has doubled in less than a decade, rising from 26 intentional homicides per 100,000 citizens in 2000 to 52 intentional homicides per 100,000 in 2009 (OCAVI, 2010). Guatemala has the fourth highest murder rate in the world, behind El Salvador, Honduras, and Jamaica (OCAVI, 2009). Wal-Mart's move was partly based on higher insurance premiums caused by insecurity in Guatemala (The Economist, 2011).

Although the rate of intentional homicides could have been a significant variable in the model, no organization stores this data for all the countries in the sample, and the countries that do have data on

homicides have sporadic data sets for the 1995-2009 period. In recent years, The World Bank (2010) has published statistics on intentional homicides per 100,000 people from four different sources: government police sources, international police sources, international public health sources, and from the United Nations Crime Trends Survey.

There is great discrepancy between the numbers reported by each source, likely stemming from differences in classifying a death as an intentional homicide. In 2004, The World Bank (2010) reported Bolivia's intentional homicide rate from government and police sources as 41.6 intentional homicides per 100,000 people, while the international public health sources reported just 3.72 intentional homicides per 100,000 people. The lack of clear and consistent data pulled the intentional homicide rate outside the scope of this project, but it may be an important variable to consider in future studies.

Hanson (2010) claims that a country's growth depends on more than just violence, political stability, the quality of policy, or the available infrastructure. For example, Mexico's growth may be stunted because Mexico's export industry competes with China's export industry. Argentina, Brazil, and Chile produce goods that China imports, leading to greater success in their export sectors (Hanson, 2010). Kehoe and Ruhl (2010) propose that a producer experiences faster growth when he lags behind the industry leader. When a producer is closer to the industry leader, growth slows. Perhaps Mexico's expansion in the 1950s-1980s pulled Mexico's industry relatively close to an industry leader in China. If industry in Mexico and China is now more similar, it may explain Mexico's relatively slow growth in recent decades (Kehoe and Ruhl, 2010).

While current research provides a base of information on the effects of various factors on economic growth, the literature does not isolate Latin America over the last decade. The most-significant factors for economic growth may be different in Latin America than in other regions or a new significant factor may have recently emerged. This study builds on existing literature by narrowing the focus to recent trends in Latin America. The results could be used by organizations that promote growth in Latin American or used by policy makers in Latin America.

III. Data and Methodology

Data was collected for 1995-2009 for 17 Latin American countries. The

Transparency Index, used as a proxy for the level of corruption, comes from Transparency International (2010). The Index of Economic Freedom comes from the Heritage Foundation (2010). The remaining variables were collected from The World Bank (2010) and the CIA World Factbook (2010). The data set was run in the following regression equation:

$$GROWTH = \beta_0 + \beta_1 OPEN + \beta_2 FDI + \beta_3 FREE + \beta_4 CORR + \beta_5 INFL + \beta_6 INT + \beta_7 EGY + \beta_8 PRIMEDU + \beta_9 SECEDU + \varepsilon$$

OPEN is a measure of openness to the international economy, measured as the ratio of the absolute value of exports plus the absolute value of imports to a country's GDP. Openness increases specialization and, hence, productivity. Therefore, the coefficient on OPEN is expected to be positive.

FDI is a measure of a country's net inflows of FDI in a given year[6]. Despite the potential adverse effects, the majority of jobs created by FDI require low-skilled labor. Many Latin Americans are active in the informal labor market because there are few low-skilled jobs available, and they lack the education necessary to obtain and excel at more-skilled positions. Bringing low-skill positions to an area abundant in low-skilled labor may lead to a more productive workforce. For this reason, the expected coefficient for FDI is positive.

FREE is a measure of economic freedom. Scores range from zero to 100 to indicate whether a country has no economic freedom or full economic freedom, respectively. The index accounts for factors such as ease of starting a business, banking efficiency, protection of private property, and workers' rights. Business owners, property owners, and workers with more rights have an incentive to be more productive. The expected coefficient for FREE is positive.

CORR uses Transparency International's Transparency Index to measure the amount of perceived corruption in a country in a given year. Transparency International assigns a rating based on frequency and size of bribes in the public and political sectors. Scores range from zero to 10, zero indicating the highest prevalence of corruption and 10 indicating the country is free from corruption. Because high levels of corruption reduce incentives to be productive, corruption may inhibit efficient growth. A higher corruption index indicates a lower level of corruption, so the expected coefficient of CORR is positive.

PRIMEDU represents the gross percentage of the population enrolled in primary education, regardless of a student's age, out of the cohort of traditional primary students. Gross percentage was selected over net percentage as gross percentage accounts for non-traditional students who return to school. Regardless of a student's age, a primary education may enhance his level of human capital. Additional human capital allows a worker to perform a larger variety of tasks and be more productive. Therefore, the expected coefficient on PRIMEDU is positive.

Similarly, SECEDU represents the gross percentage of the population enrolled in secondary education, regardless of a student's age, out of the population of the age group corresponding with a traditional secondary education. Again, gross percentage was selected to account for non-traditional students. The expected coefficient of SECEDU is positive.

Literacy rates, like fertility rates, remained nearly constant over the period. Had the literacy rate been more volatile across time and space, it would have been tested in the model in place of the primary and secondary education variables.

INFL represents inflation, the rate of change in the consumer price index from one year to the next. Inflation is a proxy for monetary policy management and is problematic in Latin America. High, erratic inflation has plagued the region over time, indicating poor policy decisions. Latin America's low real GDP per capita is exacerbated by instances of hyperinflation. In 1987, Nicaragua saw hyperinflation of 13,109 percent (CIA World Factbook, 2010). With such an astronomical inflation rate, prices increase so rapidly that money essentially holds no value. In periods of hyperinflation, the population may resort to a barter system.

While hyperinflation has not been as extreme in the last 15 years, inflation in Latin America is still far from moderate. High inflation rates reduce incentives to work and save, reducing the incentive for workers to be productive. Therefore, the coefficient for INFL is expected to be negative.

INT is the percent of residents with internet access, a proxy for a country's level of infrastructure. The more infrastructure available, the more technology a local company can incorporate into its business, making production more efficient. Due to widespread cellphone use, land line telephones may not provide an accurate picture of a country's infrastructure. For this reason, this study measures infrastructure as the rate of internet access per 100 people. The variable INT is expected to have a positive coefficient.

EGY measures a country's net energy imports, estimated as energy use less energy production, both in barrel of oil equivalents. A positive value indicates that the country is a net importer of energy products; a negative value indicates that the country is a net energy exporter. Figure 1 shows which countries in this study are net energy exporters and which are net energy importers.

Net Exporting Countries	*Net Importing Countries*
Argentina	Brazil
Bolivia	Chile
Colombia	Costa Rica
Ecuador	Dominican Republic
Mexico	Guatemala
Paraguay	Honduras
Venezuela	Nicaragua
	Panama
	Peru
	Uruguay

Figure 1. Net Exporting and Net Importing Countries

The oil industry is highly profitable, meaning the more oil a country exports, the greater the potential financial inflows to the country. Although one may expect EGY to have a positive coefficient, empirical research over Asian countries has found the contrary.[7] The result may hold in Latin America, as well. A negative relationship between oil and growth may come from rent-seeking behavior or may be a symptom of the Dutch disease. For this reason, net energy imports, EGY, is expected to have a positive coefficient; the more oil a country imports, the greater its expected economic growth.

Because this is a cross-country study, the data set is likely imperfect. Countries may use different data collection techniques or use slightly different definitions for various indicators. The problem is not unique to this study (Harrison, 1996). Though imperfect, the data are the best that is currently available. Therefore, the results are as reliable as possible. Until standardized international data collection methods and indicator definitions are adopted, it will not be possible to have perfect data.

The lack of data availability is another weakness of this study. Some

of the data were missing, and some potentially valuable variables are immeasurable. For example, the amount of violence associated with regime changes or government overthrows could provide more insight into the stability of a government and the public perception of a country's political system.

Another immeasurable variable that could have been significant in the model is the volume of drug trafficking in Latin America. It is estimated that 350 tons of cocaine pass through Guatemala annually (The Economist, 2011). Cocaine sales, however, are not recorded as formal market transactions, so there is no way to monitor the flow accurately.

Drug trafficking may be related to corruption or violence in a country, and it may be damaging to economic growth. Alternatively, the drug market could provide an alternative to formal employment in the market. It may be very profitable. The revenue associated with drug trafficking in Latin America could actually stimulate growth. Again, as no index is available to measure violence associated with regime changes or the volume of drug trafficking, the current data set is as comprehensive as possible.

In April 2011, Uruguay legalized cultivation and possession of marijuana for personal use (Gil, 2011). Uruguay is known for its liberal policies and is expected to fully legalize marijuana, including commercialization, in the near future. This will be an important issue to monitor in future studies. Legalization and taxation of marijuana could bring in additional tax revenue for Latin American governments. The revenue could be used to support education, public health and safety services, or growth and development projects in the area.

IV. Results and Interpretations

Table I shows summary statistics for the variables used in the final regression. The average annual growth reported over the period was 2.01 percent. On average, 111.95 percent of the primary school population was enrolled in primary school, while only 71.23 percent of the secondary school population was enrolled in secondary school. Both measures account for non-traditional students, explaining why the mean value for primary education and the maximum values for both primary and secondary education are over 100 percent. Yet, there was much variation between countries, particularly in secondary education.

The mean number of internet users was 8.67 per hundred people. The

rate increased over time in all countries. The average annual inflation rate for the sample was just over 11 percent but varied greatly between countries and over time, ranging from -1 percent to 100 percent. Corruption had an average index of 3.49 but varied greatly between countries, ranging from 1.50 to 7.94 across the sample. On average, Latin American countries are net energy exporters. Each country's status as an oil importer or an oil exporter stayed constant across the entire period.

TABLE I–Summary Statistics

Summary Statistics, using the observations 1:01 - 17:15
(missing values were skipped)
Number of observations: 118

Variable	*Mean*	*Std. Dev.*	*Minimum*	*Maximum*
GROWTH	2.0100	3.8411	-11.7400	16.2400
OPEN	0.5517	0.2848	0.1205	1.6153
FDI	3,563,670,000	6,722,920,000	-4,939,000,000	45,058,200,000
FREE	62.0302	6.8413	39.9000	78.6000
CORR	3.4893	1.4016	1.5000	7.9400
INFL	11.1072	13.0615	-1.0000	100.0000
INT	8.66878	9.61496	0.00000	40.2000
EGY	-20.7109	100.6790	-325.5510	81.6123
PRMEDU	111.9550	9.5076	88.1306	154.6170
SECEDU	71.2308	17.1055	20.0000	109.0000

The regression results are presented in Table II. Both primary education and secondary education were statistically insignificant. Despite statistical insignificance, it is worth noting that the coefficients on both variables were negative. While this was not the expected result, it may explain much about the educational system in Latin America. Perhaps the educational quality is not strong enough to provide a

sufficient base of human capital. Further tests should be conducted to determine whether it may be worthwhile to invest more in educational programs.

TABLE II
Fixed-Effects Model, using 118 observations,
Dependent variable: GROWTH,
Robust (HAC) standard errors

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
CONST***	30.2743	6.15407	4.9194	<0.00001
OPEN***	3.41193	1.2402	2.7511	0.00715
FDI***	-6.31E-11	1.44E-11	-4.3829	0.00003
FREEDOM***	-0.450277	0.0478209	-9.4159	<0.00001
CORRUPTION***	1.51913	0.250676	6.0601	<0.00001
INFL**	-0.0701981	0.0343935	-2.0410	0.04411
INTERNET***	0.0907323	0.0313998	2.8896	0.00481
NETEGY***	0.0163722	0.00610832	2.6803	0.00872
PRIMEDU	-0.0463765	0.0533501	-0.8693	0.38695
SECEDU	-0.0214386	0.0229201	-0.9354	0.35205

***Denotes a 99% confidence level
** Denotes a 95% confidence level

High enrollment in education may reduce GDP if the commitment to education pulls potential workers out of the labor force. Education has an opportunity cost of decreased work time, causing a temporary decrease in GDP. In poor areas, many families cannot afford to send children to school. Those families that do send children to school may face financial difficulty by both the monetary costs of sending children to school and the opportunity cost of losing a work-hand. Further investment could reduce the opportunity cost of education. Investment may enhance the

quality of education, invert the coefficient on primary and secondary education in the model, and make the variables statistically significant.

Many countries have found investment in education to be worthwhile. In 1995, the Brazilian Government implemented "Bolsa Família," an initiative to increase health and education standards for children in Brazil (The World Bank, 2010). Low-to-moderate-income families with children are offered a monthly stipend ranging from five to 33 US dollars. While this may sound like insufficient compensation, funds go to families with a monthly income below 17 US dollars (low-income families) or from 17-34 US dollars (middle-income). In return, a family must pledge to keep its children in school and to take its children to regular medical checkups.

The program extends to 11 million families, totaling more than 46 million Brazilians. 94 percent of the funds target the poorest 40 percent of Brazil's population (The World Bank, 2010). In the last 15 years, Bolsa Família has reduced Brazil's poverty and inequality and appears to have broken into the intergenerational education cycle, reducing future poverty (The World Bank, 2010). The data indicate that Bolsa Família has had a larger effect on secondary enrollment rates than on primary enrollment rates in Brazil. In 1985[8], the gross secondary enrollment rate in Brazil was 51 percent; in 2005, there was a 106 gross percent enrollment rate (The World Bank, 2010).

The positive results have earned international support for Brazil's Bolsa Família program and have sparked similar initiatives in other countries. In 2004, The World Bank approved a 572.2 million dollar loan for the Bolsa Família project. Nearly 20 countries have created variations of the program, including Chile and Mexico. The programs are still young. Because there is a lag on the return on investment in education, it will be important to monitor the long-term effects of Bolsa Família and similar programs into the future.

FDI was found to be statistically significant at the one percent confidence level and had one of several perverse signs in the regression results. FDI was found to be negatively related to economic growth. This likely indicates that, as Borensztein et al. (1998) and Harrison (1996) suggested, human capital in the region is not strong enough to support the incoming technologies of FDI. Because increasing FDI restricts economic growth, it is not worthwhile for Latin American countries to permit or subsidize incoming FDI. Rather, the efficient solution may be to tax incoming FDI, as suggested by Hanson (2001). Because this is not

an intuitive result, this result may have important implications for policy surrounding FDI in Latin America.

The final perverse result is the index for economic freedom. Economic freedom was expected to have a positive coefficient. The actual coefficient from the regression model was negative and significant at the one percent confidence level. This may be another connection with the low level of human capital in the region. Perhaps the level of economic freedom has not crossed a critical threshold or the human capital stock is "too low" to efficiently use economic freedoms.

Alternatively, the result may indicate a problem with the subjectivity of the index. The assigned values may be inconsistent across space and time and may inaccurately capture the level of economic freedom in a country. The result may indicate the need to create a better measure of economic freedom for future research.

The results on the remaining variables were as expected. Openness, corruption, net energy imports, and internet use each had the expected coefficient and were statistically significant at the one percent confidence level. Inflation had the expected negative coefficient and was significant at the five percent confidence level.

The positive coefficient on openness indicates that the more active a country is in the international market, the greater growth the country experiences. This follows the theory of comparative advantage, indicating efficiency gains from international specialization and trade. Though this seems contradictory to the negative implications of the specialization and trade argument for FDI, the coefficient on openness may indicate that a country is only able to specialize up to a particular level or in certain industries. In the model, a one percent increase in the openness of a country's economy increases the annual growth rate by 3.4 percent. The relationship indicates the efficiency in building import and export markets and the importance of fostering international partnerships.

As expected, the coefficient on the corruption variable is negative. A more corrupt government is linked to lower economic growth. The result is consistent with other research[9]. A one point decrease in corruption, as measured by an increase in the Transparency Index, results in a 1.52 percent annual increase in economic growth. With Latin America's high levels of corruption, the fight against corruption could significantly raise GDP per capita in a short period.

Internet access per hundred people was used as a proxy for infrastructure, and, as expected, the coefficient was positive. The more

internet access in a country, the greater the expected annual growth rate. The findings were significant at the one percent confidence level and are consistent with the current literature[10]. A one percent increase in internet access increases annual growth by 0.09 percent.

Latin America had low internet access rates over the period. Though rates increased dramatically in the last decade, Latin America still lags far behind more-developed countries such as the United States, France, or Germany. In 2008, the United States, France, and Germany had an average internet access rate of 73 percent, while Latin America had an average rate of just 24 percent (The World Bank, 2010). As society becomes more dependent on global communications, Latin American countries will likely continue to see an increase in the number of internet users. Because internet access is statistically significant to economic growth, a Latin American government may find it profitable to lower the price of internet service. Reducing the costs could promote global communications, allow more-efficient production, and stimulate growth.

The positive coefficient on net energy imports is significant at the one percent confidence level and indicates that countries with a higher level of net oil imports are linked to higher levels of economic growth. The positive coefficient may indicate that oil-importing countries import energy to meet the demands of increased industrialization. Increased industrialization implies that urban areas are creating a higher level of output and are, thus, achieving growth.

Finally, inflation was significant at the five percent confidence level with the expected negative coefficient. The lower a country's inflation, the higher the annual growth rate. This, too, is consistent with current literature[11]. A one percent increase in inflation corresponds with a 0.07 percent decrease in economic growth. With a history of extraordinarily high inflation rates, this provides strong evidence that stability and responsibility in monetary policy can drastically affect growth rates in Latin America.

The most significant variables in the regression turned out to be openness, corruption, internet access, and low levels of FDI. Inflation was also significant. Although neither primary nor secondary education showed statistical significance, it is plausible that efforts to improve the quality of education may drastically change the results of the study. The adjusted R-squared for the regression was 0.4178. This is comparable to the results in existing growth literature[12]. The results indicate the factors that may be important to policy makers and various organizations working

to enhance economic growth in Latin American.

V. Additional Tests

Because the current literature links oil with corruption, this study includes an additional analysis to address the concern about multicoliniarity between the two variables. Figure 2 depicts a country's annual corruption index in relation to its net energy imports in each of the 15 years. A higher value of net energy imports represents a country with few oil sources. A higher corruption index indicates a country that is perceived as less corrupt. The trend-line shows that countries with negative net energy imports are more corrupt (have a lower corruption index rating). In other words, the more oil sources a country has, the more likely the country is to have higher levels of corruption.

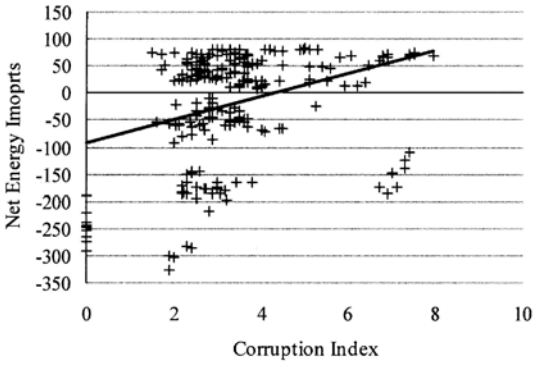

Figure 2. Corruption vs. Net Energy Imports

The data was run through a correlation matrix to test for multicoliniarity. The primary concern was correlation between corruption and net energy imports. The results in Table III show that no combination of variables is at significant risk for multicoliniarity[13]. This should be monitored in future studies using other data samples.

Next, tolerance and variance inflation factors (VIF) were calculated. Each independent variable was put through an OLS regression against all other independent variables. From the regression results, the tolerance and VIF were calculated as follows:

$$\text{Tolerance}(\beta_i) = 1/\text{VIF} = 1-R_i^2$$
$$\text{VIF}(\beta_i) = 1/(1-R_i^2)$$

TABLE III–Coefficient Matrix

Correlation coefficients, using the observations 1:01 - 17:15
(missing values were skipped)
5% critical value (two-tailed) = 0.1229 for n = 255

OPEN	FDI	FREE	CORR	SECEDU	
1.0000	-0.3406	0.0478	-0.1270	-0.3647	**OPEN**
	1.0000	0.0319	0.1872	0.4235	**FDI**
		1.0000	0.6928	0.2558	**FREE**
			1.0000	0.4448	**CORR**
				1.0000	**SECEDU**

	INFL	INT	EGY	PRIMEDU	
	-0.0857	0.0007	0.2750	-0.1857	**OPEN**
	-0.1246	0.2314	0.0258	0.4911	**FDI**
	-0.3032	0.1260	0.3842	-0.0683	**FREE**
	-0.2237	0.3833	0.4465	-0.0749	**CORR**
	-0.2483	0.4909	0.1733	0.3555	**SECEDU**
	1.0000	-0.2216	-0.3717	-0.1559	**INFL**
		1.0000	0.1660	0.0522	**INT**
			1.0000	0.1643	**EGY**
				1.0000	**PRIMEDU**

A high tolerance, or a low VIF, indicates that multicoliniarity is not a concern between the variables. If the VIF reaches a value of approximately five, there may be a problem with the data set or potential multicoliniarity[14]. Table IV presents the results of the tolerance and VIF tests. Although multicoliniarity is not a concern in this study, future studies should run similar tests to be sure the data set is not at risk.

TABLE IV–Tolerance and VIF tests for MC

Dependent Variable	Independent Variables	Tolerance	VIF
OPEN	CONSTANT, FDI, FREE, CORR, SECEDU, INFL, INT, EGY, PRIMEDU	0.8483	1.1788
FDI	CONSTANT, FREE, CORR, SECEDU, INFL, INT, EGY, PRIMEDU, OPEN	0.8648	1.1563
FREE	CONSTANT, CORR, SECEDU, INFL, INT, EGY, PRIMEDU, OPEN FDI	0.6182	1.6176
CORR	CONSTANT, SECEDU, INFL, INT, EGY, PRIMEDU, OPEN, FDI, FREE	0.5065	1.9743
SECEDU	CONSTANT, INFL, INT, EGY, PRIMEDU, OPEN, FDI, FREE, CORR	0.6371	1.5696
INFL	CONSTANT, INT, EGY, PRIMEDU, OPEN, FDI, FREE, CORR, SECEDU	0.9723	1.0284
INT	CONSTANT, EGY, PRIMEDU, OPEN, FDI, FREE, CORR, SECEDU, INFL	0.7666	1.3044
EGY	CONSTANT, PRIMEDU, OPEN, FDI, FREE, CORR, SECEDU, INFL, INT	0.6748	1.4820
PRIMEDU	CONSTANT, OPEN, FDI, FREE, CORR, SECEDU, INFL, INT, EGY	0.6776	1.4757

VI. Concluding Remarks

This study indicates that openness, low levels of corruption, internet access, and high net energy imports are all positively and strongly related to the economic growth of countries in Latin America. FDI was negatively and strongly related to economic growth. These may be the most important factors in influencing economic growth in the region. Economic freedom showed a similar negative relationship with growth, though this is may indicate a problem with the subjectivity of the index and will require further research.

The inflation rate was negatively related to economic growth, though

at a slightly lower level of significance. This shows that the quality and stability of monetary policy is also important to economic growth in Latin American countries.

Primary education and secondary education were both statistically insignificant but negatively related to economic growth. The result may indicate that the quality of education in Latin America is extremely poor and prevents residents from acquiring a sufficient base of human capital. FDI also showed a negative relationship with economic growth; perhaps the Latin American workforce is unable to efficiently capitalize on FDI because the human capital stock of residents is below some minimum threshold.

The findings from this study have important policy implications as leaders in Latin America decide whether they should fund educational programs or whether they should tax or subsidize incoming FDI, for example. The results may help organizations and government officials create programs that specifically target relevant factors of economic growth in Latin America.

References

Al Nasser, Omar M. 2007. The Determinants of the U.S. Foreign Direct Investment: Does the Region Matter? *Global Economic Review* v.36, n.1: 37-51.

Barro, Robert J. 2001. Human Capital: Growth, History, and Policy. *American Economic Association Papers and Proceedings* v.91, n.2:12-17.

_____. 1999. Determinants of Economic Growth: Implications of the Global Evidence for Chile. *Cuadernos de Economia* v.36, n.107:443-478.

_____. 1996. Determinants of Economic Growth: A Cross-Country Empirical Study. *National Bureau of Economic Research*, Working Paper: 5698.

Borensztein, E., J. De Gregorio, and J-W. Lee. 1998. How Does Foreign Direct Investment Affect Economic Growth? *Journal of International Economics* 45: 115-135.

Central America: The Tormented Isthmus. (2011, April 14). The Economist. http://www.economist.com/node/18558254?fsrc=nlw|pub|04-20-2011|publishers. (Accessed April 20, 2011).

CIA World Factbook. 2010. Country Indicators. https://www.cia.gov/library/publications/the-world-factbook/. (Accessed January 21, 2011).

Collier, Paul. *The Bottom Billion: Why the Poorest Countries are Failing and What Can be Done About It.* New York: Oxford University Press, 2007.

Gil, Valeria. 2011. "Permitirán Hasta 8 Plantas de Marihuana." El País. April 11. http://www.elpais.com.uy/11/04/19/pnacio_561056.asp. (Accessed April 27, 2011).

Hanson, Gordon H. 2010. Why Isn't Mexico Rich? *Journal of Economic Literature* 48: 987-1004.

_____. 2001. Should Countries Promote Foreign Direct Investment? G-24 Discussion Paper 9, United Nations Conference on Trade and Development.

Harrison, Ann. 1996. Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries. *Journal of Development Economics* 48: 419-447.

Instituto de Desarrollo y Medio Ambiente, Peru. 2010. "Directivos del IDMA." http://www.idmaperu.org/. (Accessed January 30, 2011).

Jones, Charles I. 1998. Introduction to Economic Growth. New York: W. W. Norton and Company, Inc.

Kehoe, Timothy J. and Kim J. Ruhl. 2010. Why Have Economic Reforms in Mexico Not Generated Growth? *Journal of Economic Literature* 48: 1005-1027.

Mauro, Paolo. 1995. Corruption and Growth. *The Quarterly Journal of Economics* v.110, n. 3: 681-712.

Observatorio Centroamericano Sobre Violencia (OCAVI). 2010. Número de Victimas y Tasas de Homicidios Dolosos. http://www.octavi.com. (Accessed April 20, 2011).

Ramanathan, Ramu. 2002. "More on Multicoliniarity." http://econ.ucsd.edu/~rramanat/MoreonMC.pdf. (Accessed February 19, 2011).

Rose-Ackerman, Susan. Corruption: A Study in Political Economy (New York, NY: Academic Press, 1978.

Sachs, Jeffery D. and Andrew M. Warner. 1995. Natural Resource Abundance and Economic Growth. *National Bureau of Economic Research Working Paper Series: 5398.*

Saint-Germain, Michelle A. 1997. "Multiple Regression." http://www.csulb.edu/~msaintg/ppa696/696regmx.htm. (Accessed February 19, 2011).

The Council of Protestant Churches of Nicaragua (CEPAD). 2005. http://www.cepad.org.ni/eng/index2.html. (Accessed January 21, 2011).

The Heritage Foundation. 2010. Index of Economic Freedom. http://www.heritage.org/index/. (Accessed January 31, 2011).

The World Bank. 2010 Economic Indicators. http://data.worldbank.org/data-catalog. (Accessed January 31, 2011).

Thompson, Christopher. 2007. "'Curse of Oil' Sees Corruption Soar in Nigeria." *The Independent*. January 31. http://www.independent.co.uk/news/world/africa/curse-of-oil-sees-corruption-soar-in-nigeria-434405.html. (Accessed February 12, 2011).

Transparency International. 2010. Transparency Index. http://www.transparency.org/. (Accessed January 31, 2011).

U.S. Department of State. 2010. "Background Note: Peru." http://www.state.gov/r/pa/ei/bgn/ 35762.htm. (Accessed April 20, 2011).

ZhiDong, Li. 2003. Energy and Environmental Problems behind China's High Economic Growth: A Comprehensive Study of Medium- and Long-term Problems, Measures and International Cooperation. *The Institute of Energy Economics*, Japan. http://eneken.ieej.or.jp/en/data/pdf/188.pdf. (Accessed February 10, 2011).

Endnotes

1. I would like to thank Dr. Ken Brown of the University of Northern Iowa (UNI) Department of Economics for his help and guidance. Any errors that remain are strictly my own.

2. The countries included in this study are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.
3. As in the existing literature, this paper defines economic growth as the annual percentage change in GDP per capita.
4. The World Bank (2010) defines FDI as foreign investment that establishes a long-term interest in or management control over an enterprise. This may include the purchase of shares of a foreign enterprise, reinvesting earnings of a foreign-owned enterprise in the enterprise's home country, and parent enterprises' loans to foreign affiliates.
5. See Al Nassar, 2007.
6. FDI is measured in US Dollars.
7. See ZhiDong (2003).
8. 1985 is used for comparison as it is the last year for which secondary education rates were reported before the Bolsa Família program was implemented in 1995.
9. See Barro (2001), Mauro (2005), Thompson (2007), Sachs and Warner (1995), and Rose-Ackerman (1978).
10. See Al Nassar (2007).
11. See Barro (2001).
12. Barro's (1996) growth studies have found an adjusted R-squared ranging from 0.42-0.67; Mauro's (1995) growth studies have found an adjusted R-squared ranging from 0.44-0.66.
13. Saint-Germain (1997) says that absolute values of less than 0.75 in the correlation matrix are not multicoliniar.
14. Information on conducting tolerance and VIF tests come from a session with Dr. Ken Brown of the UNI Economics Department and an online summary by Ramu Ramanathan (2002) of the University of California, San Diego Economics Department.