A Study on the Nexus between Infrastructure, Foreign Direct Investment, and Economic Growth- The Case of African Countries Using Panel Threshold Model

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**Abstract**

The paper investigates the non-linear functional role of Infrastructure on Foreign Direct Investment (FDI) inflows and the subsequent impact of FDI inflows on Economic growth within African countries. Employing Panel Threshold Models, we also explore the potential of Infrastructural Absorptive Capacity to stimulate the FDI-Growth Nexus. The study leverages data from 23 African countries spanning 2008–2019. To measure infrastructure quality, we construct a composite Infrastructure Index via Principal Component Analysis (PCA), incorporating seven key components: land, sea, and air transport infrastructure, electrification, internet usage, mobile phone subscriptions, and fixed telephone lines. Our results indicate that infrastructure plays a critical role in attracting FDI, with its positive effect being most pronounced in countries with initially low levels of infrastructure. Additionally, in the context of economic growth, infrastructure serves as a key absorptive factor, enabling countries in both low- and high-infrastructure regimes to amplify the developmental impact of FDI inflows.

**Keywords:** Infrastructure, Foreign Direct Investment, Economic Growth, Threshold Model, Africa

JEL CLASSIFICATIONS— F2 C24 H54

# 1 Introduction

After experiencing almost two successive decades of positive growth, Africa faced the aftermath of the global financial and economic crisis of 2008-2009 and this led to a significant drop in growth rates. Given the prime role of FDI- promoting the environment in achieving its previous positive growth, the Economic Report by the United Nations Economic Commission for Africa listed Foreign Direct Investment inflows to be the key to solving Africa’s economic crisis. Various studies have advocated FDI inflows as the solution for the lack of financial resources, technology and skills in the African community. As the FDI framework improves, potential investors have been swayed from the negative image of the continent as a region under civil unrest and economic stagnation to a continent that has untapped potential investment opportunities to offer.

As the importance of FDI inflows as a catalyst of economic growth and development is recognized, various academic papers have also attempted to study the classical and non- classical determinants/ motivators of FDI inflows. Amongst them, an adequate supply of infrastructure has been perceived to be a necessary stimulant of FDI Inflows. The role of infrastructure has been studied in different regions and time periods. Whilst most of the academic evidence have established a positive contribution of infrastructure development to FDI inflows, productivity and growth like Asiedu (2002, 2006) and Sekkat and Veganzones- Varoudakis (2004), few have failed to establish a significant relationship, for example, Quazi (2005). Some of the reasons attributed for the insignificant link has been recognised as the usage of a singular component as proxy for infrastructure, biased definition of the variable as well as the infrastructure development stage being different for each region. Another aspect of the study of infrastructure has been its productivity to Economic growth. Studies have shown that its productivity is dependent on the degree of concentration. As such, the beneficial effect of infrastructure is dependent on the construction of the networks and once the optimal level of infrastructure is reached, its effect will diminish or become null. Studies have also argued that good sufficient infrastructure is not only a motivator of FDI inflows but also a pre- requisite for positive spillovers of FDI inflows on growth.

The objectives of the study are:

1. To estimate if there is an impact of infrastructure on FDI and if there exists a level of Infrastructure that is needed to attract more FDI.
2. To determine if FDI, contingent on the existing level of infrastructure, exerts an impact on the economic growth of Africa.

Given the outlined objectives, the paper is organized as follows: section 2 presents the literature review. Section 3 furnishes the data and methodology. Section 4 consists of the empirical results and the interpretation. Section 5 finally provides the conclusions and policy recommendations based on the theoretical understanding and the empirical results.

# 2 Literature Review

Given Dunning (1993)’s horizontal and vertical motivator of FDI, studies have shown that FDI exerts more influence on vertical FDI as it assists in reducing transport costs and improves productivity as a whole. Khadaroo and Seetanah (2008) estimated that better infrastructure increases accessibility and reduces transport costs for investors. Erenberg (1993) concurred with the notion of vertical motivator of FDI and argued that insufficient infrastructure would render Multinational Enterprises (MNEs) operationally inefficient, leading to wasteful resource utilization in their network-building endeavors. Kok and Ersoy (2009) examination of FDI determinants for developing nations asserted that infrastructure, proxied by the number of telephone lines, stands out as a positive and the most significant determinant of FDI. Asiedu (2002), Demirhan and Masca (2008) and Moosa and Cordak (2006) have also corroborated the positive correlation between infrastructure (measured by telephone lines per 1000 inhabitants) and FDI inflows. Studies have also been conducted to estimate the role of Infrastructure on FDI inflows for different regions. Loree and Guisinger (1995) for the USA, Sekkat and Veganzones-Varoudakis (2004) for the Middle East and North Africa (MENA), and Cheng and Kwan (2000) for China, have all studied the link and concluded the existence of a positive relationship. Quazi (2005), on the other hand, could not estimate a significant relationship between FDI inflows and infrastructure for the Asian case.

Many empirical studies have found a positive relationship between FDI and economic growth . Nair- Reichert and Weinhold (2001) and Li and Liu (2005) studied the effects of FDI on growth and revealed a significant and positive relationship. Academic researchers used different methodologies to study the impact. For example, Emin (2011) used the Johansen cointegration technique and suggested a positive link between the two variables. On the other hand, Sylwester (2005) used the ordinary least squares, seemingly unrelated, and three-stage least squares regression, and concluded similar results for 29 developing countries. Chowdhury and Mavrotas (2006) focused on the causal relationship between FDI and economic growth and deduced a unidirectional relationship between Economic growth and FDI in Chile but a directional link for Thailand and Malaysia for the period 1969 to 2000. Despite evidence supporting a positive link, some studies have reported an insignificant relationship. Adams (2009) studied panel data for Sub-Saharan Africa from 1990 to 2003, and Herzer and Klasen (2008) investigated 28 developing countries, both failing to find sufficient evidence for the long-term and short-term effects of FDI on Economic growth.

Given the mixed evidence on the role of FDI as an engine of growth, researchers have delved into a country’s absorptive capacity, a factor that may shape FDI’s positive spillovers on growth. In essence, the efficacy of FDI is contingent upon certain pre-existing conditions. A seminal study by Borensztein et al. (1998) first addressed the notion that FDI’s impact on growth is conditional on the presence of specific prerequisites. Their research emphasized the significance of an educated workforce, arguing that without it, FDI struggles to enhance economic growth. Building on this, Balasubramanyan et al. (1996) and Kohpaiboon (2002) explored the conditioning of

FDI on trade openness, revealing that augmenting a country’s engagement in global trade positively influences the impact of FDI on growth. Additionally, Fu (2008) studied the impact of FDI on the development of regional innovation capabilities for China and revealed that FDI and regional innovation capacity are positively related wherein the magnitude of the effect mainly depends on the innovation-complementary assets in the host regions. Ogundipe et al. (2020), on the other hand, used the GMM estimation method, conditioned FDI to infrastructure to deduce if its absorptive capacity stimulates the FDI- Growth relationship in the ECOWAS region for the period 1995 to 2017. The evidence concluded that when FDI has been conditioned to the existing level of physical infrastructure, its effectiveness as an engine of growth declines. The results supported Nguyen et al. (2009) argument that recipient developing countries can only benefit from FDI if a sufficient level of Physical infrastructure is available.

# 3 Data and Methodology

## Model 1

The data collection for this study comprises a panel of 23 African countries (Appendix 1), and secondary data was gathered for the period spanning 2008-2019. The factors influencing Foreign Direct Investment (FDI) were determined based on various theoretical and empirical frameworks relevant to Africa, including Khadaroo and Seetanah (2009), Asiedu (2002), and Kurul (2017).

To measure FDI inflows, we used FDI as a percentage of Gross Domestic Product (GDP). Data for this variable was sourced from the United Nations Conference on Trade and Development (UNCTAD). To study the determinants of FDI inflows, we delved into institutional factors, which encompass dimensions such as protection of Property rights and intellectual property, judicial independence, transparency, and organized crime. According to Buchanan et al. (2012), poor institutions deter foreign investors, may act as an additional tax for them, and as such, increase the cost of doing business. Mengistu and Adhikary (2011) suggested that foreign investors are less willing to invest in countries with low institutional quality wherein corruption, and bureaucracy discourage further investments. The figures are extracted from the annual Global Competitiveness Reports.

Human Capital is also considered to be a key instrument for Foreign Direct Investment. Foreign investors are not only motivated by the cost of labor but also by the quality of labor since it determines the former’s adoption of technology and therefore also affects their productivity. To proxy for human capital, we use the Gross Secondary Enrollment Rate provided by the Annual Global Competitiveness Reports and respective national statistical reports. Another factor which is considered to be a major determinant of FDI inflows is the market size. Market size represents a business’ demand for their product and therefore, is an essential element for investors. Scaperlanda and Mauer (1969) concluded that market size has a threshold impact on FDI where it exerts a positive influence once it reaches the level that allows the presence of economies of scale and the optimal use of resources. To emphasize the pivotal role of market size in influencing investors’ decisions, we utilize Real per Capita GDP. Data on market size has been drawn from the World Bank National Account. Chronic and rising inflation also signals macroeconomic instability in a country and therefore, empirical studies from Demirhan and Masca (2008) concluded a negative relationship between FDI inflows and inflation. We use the annual percentage change in the Consumer Price Index to proxy for inflation and data for this variable is sourced from the World Bank National Account.

Lastly, Various empirical studies by Hufbauer et al. (1994), Chakraborty and Nunnenkamp (2006), and Asiedu (2002) concluded a positive relationship between FDI inflows and a country’s trade openness. Following the existing literature, we use Trade as a percentage of Gross Domestic Product to proxy for Trade openness. Data for openness has been drawn from the World Bank National Account. Acting as the regime-dependent threshold variable, the infrastructure index was meticulously constructed, encompassing seven broad categories: Road Infrastructure, Sea Infrastructure, Air Infrastructure, Electrification, Internet, Mobile Phone Subscriptions, and Fixed Telephone Lines. To construct the Infrastructure Index, we use data published in the annual Global Competitiveness Reports by the World Economic Forum. As given in Appendix 3, Road Infrastructure, Sea Infrastructure, and Air Infrastructure are proxied by the quality of roads, port infrastructure, and air transport infrastructure respectively. Electrification is proxied by the percentage of the population having access to electricity. Finally, the Internet, Mobile Phone Subscriptions, and Fixed Telephone Lines are proxied by the number of people using the Internet and having a mobile phone subscription and fixed telephone lines per 100 population. Given the high multicollinearity existing between the variables, and the weakness in using only one component of Infrastructure as an indicator, we follow Loree and Guisinger (1995) and Kumar (2001) and use the above seven components of Infrastructure to construct a composite infrastructure index by employing Principal Component Analysis (PCA).

Our empirical approach to the study of Infrastructure and FDI is based on the framework of the endogenous growth models, previously tested by Barro (1990), Romer (1994) and the Panel threshold model regression function. After testing and concluding the non-linearity of the variables as well as the failure of holding linearity and normality assumptions, we use Hansen’s (1999) Fixed Effect Threshold model (Static Panel Threshold Model) to study the impact of Infrastructure as a threshold variable on FDI, based on the static and dynamic Panel threshold regression, takes the following form:

lfdi*it* = *µi*+*α′Xit*+*β′* infraindex*it I*(infraindex*it ≤ γ*)+*β′* infraindex*it I*(infraindex*it > γ*)+*ϵit*

1 2

(1)

where lfdi*it* is the dependent variable, *Xit* is a set of regime-independent explanatory variables, and infraindex*it* refers to the regime-dependent variable that divides the sample into two regimes.

## Model 2

To ensure consistency with the preceding model, the dataset for the FDI-Growth model consists of a panel of the same 23 African countries, wherein secondary data was available for the period spanning 2008 to 2019. The selection of explanatory variables aligns with diverse theoretical and empirical frameworks tailored to the African context. Specifically, the studies by Alege and Ogundipe (2014) and Ogundipe et al. (2020), which were founded upon the Harrod-Domar growth model, served as foundational frameworks that posits FDI as a pivotal catalyst for economic growth. Adjustments to the explanatory variables were made to accommodate data availability specific to the African context. To assist in the interpretation, all the variables except Inflation and the proxy for infrastructural absorptive capacity have been transformed by taking their natural logarithmic forms. A detailed explanation for the dependent, regime-dependent,

and independent variables is given below as well as Appendix :

To proxy for growth, we utilize Real Gross Domestic Product in 2015 US prices, sourced from the World Bank National Account figures. Foreign Direct Investment as an engine for growth has been studied and concluded in numerous academic studies. While Ng (2007) has concluded an insignificant link between FDI and productivity, Sharma and Abekah (2008) have demonstrated a positive response of FDI inflows on growth. On the other hand, after concluding an insignificant relationship between FDI and growth, Durham (2000) argued that the negative/ negligible impact is due to a lack of sufficient absorptive capacity in terms of financial systems, per capita income, or human capital, that are necessary components for FDI positive spillovers to have an impact on growth. The data is drawn from the UNCTAD (United Nations Conference on Trade and Development) website. To study the impact of labor force, we utilize labor force participation rate as a proxy and the relevant data is drawn from the World Bank National Account. Empirical studies, including those by Dollar (1992) and Lipsey (2002), generally support the idea that more open economies experience faster growth. However, Rodriguez and Rodrik (2000) have refuted the past positive link between trade and economic growth and their study suggests that the link between average tariff rates is only slightly negative but mostly insignificant, and as such, different institutional indicators can lead to biased positive results. To proxy for Trade Openness, data on Trade as a percentage of GDP is drawn from the World Bank National Account. The size and quality of the labor force contribute to economic growth .Additionally, education, as a determinant, is proxied using the secondary enrollment rate, drawing data from the World Bank National Account, Global Competitive reports, and individual country statistical websites.

Following the pattern with the other explanatory variables, the relationship between inflation and economic growth also presents itself with diverse results. The majority of the studies by Kremer et al. (2013), Akgul and Ozdemir (2012) and Vinayagathasan (2013) have established a negative relationship between Inflation and growth above an estimated threshold and a negligible or positive relationship below the estimated threshold. In our study, to proxy for Inflation, we use the annual percentage change in the consumer price index which is drawn from the World Bank National Account. Appreciation and depreciation of a country’s exchange rate and its consequent impact on growth has been studied and, in his study, Rodrik (2008) established that a devaluation of real exchange rate contributes positively to growth while Easterly (2004) concluded that a high overvaluation of a currency will hurt growth. To proxy for the variable, we use the official exchange rate figures that are drawn from the World Bank National. Empirical studies related to resource-led growth have also successfully established the conclusion that countries with abundant natural resources grow less rapidly than countries having scarce natural resources. Sachs and Warner (1995)’s findings suggested a “Natural Resources Curse” where economies with abundant non-renewable resources hamper growth. According to Lane and Tornell (1996), resource-rich economies are more likely to experience extreme rent-seeking behavior than resource-poor economies. As such, the political environment is prompted to grab the rents earned by those resources and may end up inefficiently exhausting the public good. This leads to further impeding

the growth potential of resource-rich economies. To proxy for Natural resources, we use Natural resources rents, as a percentage of GDP which is sourced from the World Bank National figures. To examine the role of infrastructural absorptive capacity in stimulating FDI-induced growth for the African Countries, we employ an interactive model, wherein a new variable, fdi.infra, is introduced, utilizing a multiplicative method. This variable conditions FDI on the level of Infrastructural development for Africa, following the approach used by Yuko and Lu (2006) and Ogundipe et al. (2020). The Infrastructure Index created in the first model is utilized for this purpose.

The model to study the impact of FDI inflows and Infrastructural absorptive capacity on growth, based on the Static Panel threshold regression, takes the following form:

lgdpco = *µi* + *α′Xit* + *β′* lfdi*it I*(lfdi*it ≤ λ*) + *β′* lfdi*it I*(lfdi*it > λ*) + *εit* (2)

*it* 1 2

lgdpco = *µi*+*α′Xit*+*β′* fdi.infra*it I*(fdi.infra*it*

*≤λ*)+*β′*fdi,infra*it I*(fdi.infra*it > λ*)+*εit*

*it* 1

2

(3)

where lgdpco*it* is the dependent variable, X*it* is a set of regime-independent explanatory variables and lfdi*it* and fdi.infra*it* refer to the regime-dependent variable that divides the sample into 2 regimes for each model.

# 4 Empirical Results and Interpretation

## Model 1

 Table 1: Static Panel Threshold Model

 **Variables Estimate**

lfdi

Estimated Threshold 0.113\*\*\* 95% Confidence Interval [0.093, 0.115]

infraindex

*β*1 (infraindex*it ≤ λ*) 0.382\*\* (0.176)

*β*2 (infraindex*it > λ*) -0.374\*\*\* (0.0990)

lins 2.976\*\*\*

(0.685)

lhc -0.0766

(0.305)

lms 1.336\*

(0.689)

inf -0.0103

(0.0113)

lopn 1.224\*\*\*

(0.343)

Constant -12.18\*\*

(5.816)

F-Test 40.95\*\*\*

Observations 276

Number of id 23

R-squared 0.208

Standard errors in parentheses

\*\*\* p*<*0.01, \*\* p*<*0.05, \* p*<*0.1

Table 1 illustrates the outcomes of the Static Panel Threshold Model concerning the Infrastructure Index and FDI inflows. The point estimate of the threshold, accompanied by its 95% confidence interval, denotes its significance. With a notable threshold of 0.113, the observations are effectively divided into two regimes—those possessing an infrastructure index below and above the threshold value. Consequently, this finding indicates a non-linear relationship between Infrastructure and FDI inflows. The role of Infrastructure as a determinant of FDI inflows is contingent upon the regime identified by their infrastructure index.

The coefficient for the lower regime, *β*1, exhibits a positive and highly significant trend, indicating that a marginal increase in infrastructure significantly enhances FDI inflows.

Conversely, the higher regime coefficient, *β*2, is negative and statistically significant, suggesting that once the infrastructure index surpasses the threshold value, it no longer

serves as a positive determinant of FDI inflows. This aligns with existing studies on infrastructural investment thresholds, implying that the positive effects of Infrastructure are more pronounced as network construction approaches a critical level, diminishing thereafter. These findings consistently support the concept of an ”optimal level of infrastructure” as argued by Candelon et al. (2013).

The impact of institutional quality (lins) on FDI inflows is positive and highly significant. Institutional factors predominantly reflect organized crime levels, transparency, and judicial independence in the countries. A positive relationship between institutional quality and FDI inflows suggests that countries with stronger regulations concerning property protection, lower crime rates, and greater transparency tend to attract higher FDI inflows. Another significant determinant of FDI inflows is Market Size (lms), which exhibits a positive relationship with FDI inflows. This implies that countries with larger markets, proxied by higher aggregate income, are more likely to attract increased FDI inflows. These results align with the findings related to the horizontal motivators of FDI. Lastly, Openness (lopn), proxied by trade as a percentage of GDP, demonstrates a positive and significant relationship with FDI inflows. This implies that more open countries tend to attract higher amounts of FDI inflows.

## Model 2

Model 2 of the study concentrates on FDI’s role as a catalyst for economic growth and subsequently assesses the potency of infrastructural absorptive capacity to stimulate FDI-induced growth in Africa. Table 2 presents the results of the static panel threshold model, with column 1 estimating the impact of FDI inflows on economic growth , and column 2 assessing the role of infrastructural absorptive capacity on growth.

The estimated threshold in column 1 shows that FDI experiences a non-linear relationship with growth, where it exhibits a significant and positive impact on growth in the upper regime but an insignificant relationship in the lower regime. However, once we condition FDI inflows to the existing availability of Infrastructure, signifying the infrastructure absorptive capacity of the recipient countries, the insignificant relationship evolves into a positive and significant one. This shows that with a sufficient level of infrastructure, recipient countries will be able to extend positive spillovers of FDI to both regimes irrespective of the level of FDI.

The behavior of the regime-independent variables on growth can be presented as follows. Firstly, labour force (llab), indicated by the labor force participation rate, emerges as a positive and statistically significant determinant of growth, implying that a larger labor force substantially contributes to positive growth.

On the other hand, Trade openness (lopn) has a negative impact on growth. The growth effect on trade has had mixed

 Table 2: Static Panel Threshold Model

| **Variables** | **(1) lgdpcu** | **(2) lgdpcu** |
| --- | --- | --- |
| **Threshold Variable***β*1 (Threshold Variable *≤ λ*) | 0.00607 | 0.0301\*\*\* |
| *β*2 (Threshold Variable *> λ*) | (0.0118)0.0175\* (0.0105) | (0.00535)0.00840\*\*\* (0.00300) |
| llablopn | 1.240\*\*\*(0.164)-0.24\*\*\* (0.0605) | 1.207\*\*\*(0.165)-0.199\*\*\* (0.0586) |
| lhc | 0.113\*\* | 0.0688 |
| inf | (0.0478)-0.00784\*\*\* (0.00198) | (0.0466)-0.00734\*\*\* (0.00191) |
| lex | -0.0790 | -0.192\*\*\* |
|  | (0.0491) | (0.0474) |
| lnresource | -0.0211 | -0.0155 |
|  | (0.0196) | (0.0191) |
| Constant | 0.216 | 1.050 |
|  | (1.305) | (1.364) |
| F-test | 177.23\*\*\* | 243.64\*\*\* |
| Observations | 276 | 276 |
| Number of id | 23 | 23 |
| R-squared | 0.569 | 0.601 |
| Standard errors in parentheses |  |  |
| \*\*\* p*<*0.01, \*\* p*<*0.05, \* p*<*0.1 |  |  |

reviews for African countries or developing countries in general. Joshua and Van Den Berg (2003) support the negative effect by commenting on the composition of trade. For example, African countries’ current export boom which is motivated by a capital intensive sector does not have much impact on sustainable growth because of its low gains in employment creation and a limited spillover effect on other sectors.

Our third regime-independent variable, inflation (inf) is negatively but significantly impacting growth in Africa. This shows that higher inflation harms the growth capacity of the economy. Furthermore, the exchange rate (lex) has a positive and significant influence on growth, indicating that an appreciation of the currency has a beneficial impact on growth.

# 5 Conclusions

The primary aim of this study was to examine the impact of infrastructure on FDI and estimate if infrastructural absorptive capacity has the ability to stimulate the FDI-Growth Nexus. We employed a static panel threshold model to estimate if the impact remains consistent across all regimes or if a structural break exists, offering insights into the mixed reviews found in our literature review. The overarching findings from our threshold models yield the following conclusions:

1. Model 1 shows evidence that there is a threshold impact of Infrastructure on FDI inflows for African countries. The result shows that the positive spillover of infrastructure is only significantly and positively motivating FDI inflows in the lower regime and once the “optimal level of infrastructure” is reached, the impact becomes negative.
2. In respect to the regime-independent variables in Model 1, We estimated a positive impact of institutional quality, market size, and openness on FDI inflows in both the static and dynamic panel threshold models.
3. From the FDI- Growth Model, we observe that the impact of FDI on growth has a structural break and FDI plays a more significant role in Growth in the upper regime while the lower regime has an insignificant impact.
4. Model 2 concludes that infrastructural absorptive capacity can stimulate the FDI- Growth Nexus in Africa. This shows that with a sufficient level of infrastructure, recipient countries will be able to extend positive spillovers of FDI to both regimes irrespective of the level of FDI inflows.
5. Finally, out of all the regime-independent variables in Model 2, we observed a positive impact of labor force on growth while openness, inflation, and exchange rate were found to be negatively related to growth in African countries.

# 6 Appendix

## Appendix 1

Table 3: List of countries considered in the sample

**East Africa Central Africa South Africa West Africa North Africa**

| Burundi | Cameroon | Botswana | Gambia | Tunisia |
| --- | --- | --- | --- | --- |
| Ethiopia | Chad | Lesotho | Ghana | Algeria |
| Kenya |  | Namibia | Mali | Morocco |
| Malawi |  | South Africa | Nigeria |  |
| Mauritius |  |  | Senegal |  |
| Mozambique |  |  |  |  |
| Tanzania |  |  |  |  |
| Uganda |  |  |  |  |
| Zambia |  |  |  |  |

## Appendix 2

 Table 4: Model 1 - Variable Description

**Variable Description Proxy Sources lfdi** Log of FDI inflows FDI Inflows at constant price World Bank

**Infraindex** Infrastructure Index Infrastructure Index

constructed with PCA

Annual Global Competitive reports for components of Infrastructure and then Principal Component Analysis to create the composite Index

**lins** Log of Institutional Factors

Institutional factors Annual Global Competitive reports

**lhc** Log of Human Capital

Gross Secondary Enrolment Rate

Annual Global Competitive reports and each country’s statistical website

**lms** Log of Market Size GDP Per Capita at constant

Price in US$

**inf** Inflation Annual Percentage change in Consumer Price Index

**lopn** Log of Openness Trade as a percentage of

GDP

World Bank World Bank World Bank

## Appendix 3

 Table 5: Components of Infrastructure

### Infrastructural Factors Description Proxy Sources



**Road Infrastructure** Quality of Roads Road Quality Index World Bank Reports

**Sea Infrastructure** Efficiency of Seaport Services

**Air Infrastructure** Efficiency of Air Transport Services

**Electrification** Availability of Electricity Supply

**Internet** Internet Users per 100 Population

**Mobile Phone Subscription** Mobile Telephone

Subscriptions per 100 Population

**Fixed Telephone Lines** Fixed Telephone

Lines per 100 Population

Port Efficiency Score World Bank Reports Airport Efficiency Index World Bank Reports

Electricity Access Rate International Energy Agency

(IEA)

Internet Penetration Rate World Bank Mobile Subscription Rate World Bank

Fixed Line Penetration Rate World Bank



## Appendix 4

 Table 6: Model 1 - Summary Statistics

| **Variable** | **Obs** | **Mean** | **Std. Dev** | **Min** | **Max** |
| --- | --- | --- | --- | --- | --- |
| **lfdi** | 276 | 6.229 | 1.888 | -3.865 | 9.604 |
| **lins** | 276 | 1.362 | 0.174 | 0.908 | 1.691 |
| **lhc** | 276 | 3.849 | 0.504 | 1.808 | 4.708 |
| **lms** | 276 | 7.310 | 0.934 | 5.568 | 9.302 |
| **inf** | 276 | 6.723 | 6.141 | -16.860 | 44.357 |
| **lopn** | 276 | 4.121 | 0.424 | 3.037 | 5.082 |
| **infraindex** | 276 | 0.437 | 0.246 | 0.000 | 1.000 |

## Appendix 5

 Table 7: Model 1- Correlation Analysis

| **Variable** | **lfdi** | **lins** | **lhc** | **lms** | **inf** | **lopn** | **infraindex** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **lfdi** | 1.0000 |  |  |  |  |  |  |
| **lins** | 0.1990\*\*\* | 1.0000 |  |  |  |  |  |
| **lhc** | 0.1099\* | 0.5791\*\*\* | 1.0000 |  |  |  |  |
| **lms** | 0.3118\*\*\* | 0.5727\*\*\* | 0.7973\*\*\* | 1.0000 |  |  |  |
| **inf** | 0.0807 | -0.0046 | -0.1881\*\* | -0.2319\*\*\* | 1.0000 |  |  |
| **lopn** | 0.0256 | 0.2942\*\*\* | 0.3185\*\*\* | 0.4181\*\*\* | -0.2082\*\*\* | 1.0000 |  |
| **infraindex** | 0.0911 | 0.4430\*\*\* | 0.7620\*\*\* | 0.6813\*\*\* | -0.3426\*\*\* | 0.3034\*\*\* | 1.0000 |

Table 8: \*\*\* p *<* 0.01, \*\* p *<* 0.05, \* p *<* 0.1

## Appendix 6

 Table 9: Model 1 - Variable Description

### Variable Description Proxy Sources

lgdpco Gross Domestic Product

lfdi Log of FDI inflows

Gross Domestic Product at current price

FDI inflows as a percentage of GDP

World Bank

UNCTAD

llab Labour Force Labour Force

participation

World Development Indicators database

lopn Log of openness

lhc Log of Education

Trade as a

percentage of GDP

Secondary Enrollment Rate

World Bank

World Bank, Global Competitive Reports, and each country’s statistical website

inf Inflation Annual Percentage change in Consumer Price Index

World Bank

lex Log of Exchange Rate

lnresourceLog of

Natural Resources

fdi.infra Infrastructure

Absorptive Capacity

Official Exchange Rate

Total natural resources rents (% of GDP)

Interactive term to condition FDI (FDI in

constant price) to existing level of infrastructure (index)

International Monetary Fund, International Financial Statistics

World Bank

UNCTAD and Global Competitive Repor

## Appendix 7

Table 10: Model 2 - Summary Statistics

| **Variable** | **Obs** | **Mean** | **Std. dev** | **Min** | **Max** |
| --- | --- | --- | --- | --- | --- |
| **lgdpcu** | 276 | 10.119 | 1.453 | 7.114 | 13.261 |
| **llab** | 276 | 8.704 | 1.299 | 6.315 | 11.118 |
| **lopn** | 276 | 4.121 | 0.424 | 3.037 | 5.082 |
| **lhc** | 276 | 3.841 | 0.504 | 1.808 | 4.708 |
| **inf** | 276 | 6.723 | 6.1401 | -16.860 | 44.357 |
| **lex** | 276 | 4.179 | 2.165 | 0.051 | 8.223 |
| **lnresource** | 276 | 1.650 | 1.454 | -6.050 | 3.524 |
| **lnfdico** | 276 | 6.229 | 1.888 | -3.865 | 9.604 |
| **infraindex** | 276 | 0.437 | 0.246 | 0.000 | 1.000 |

## Appendix 8

Table 11: Model 2 - Correlation Analysis

| **Variable** | **lgdpcu llab** | **lopn lhc** | **inf lex lnresourclnefdico infraindex** |
| --- | --- | --- | --- |
| **lgdpcu** | 1.000 |  |  |
| **llab** | 0.739*∗∗∗* 1.000 |  |  |

**lopn** -0.255*∗∗*-*∗*0.599*∗∗∗* 1.000

**lhc** 0.388*∗∗∗*-0.247*∗∗*0*∗*.318*∗∗∗* 1.000

**inf** 0.047 0.281*∗∗∗*-0.282*∗∗*-*∗*0.188*∗∗∗* 1.000

**lex** -0.122*∗∗*0.249*∗∗∗*-0.606*∗∗*-*∗*0.599*∗∗∗*-0.049 1.000

**lnresource** 0.098*∗∗* 0.495*∗∗∗*-0.339*∗∗*-*∗*0.462*∗∗*0*∗*.229*∗∗∗*0.207*∗∗∗* 1.000

**lnfdico** 0.714*∗∗∗*0.544*∗∗∗* 0.025 0.109 0.080 -0.262*∗∗∗*0.109*∗* 1.000

**infraindex**0.254*∗∗∗*-0.227*∗∗*0*∗*.303*∗∗∗*0.762*∗∗∗*-0.342*∗∗*-*∗*0.402*∗∗*-*∗*0.447*∗∗∗* 0.091 1.000

Table 12: \*\*\* p *<* 0.01, \*\* p*<* 0.05, \* p *<* 0.1

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