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Original Research Article

Impact of Economic Infrastructure and Inward Foreign Direct Investment on Economic Development: Evidence from Developing Countries

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Abstract: This study examined if inward foreign direct investment (to be referred to as FDI henceforth) and economic infrastructural in a country interact insofar as economic development is concerned. The study classified 95 developing countries selected based on data availability by geographical region. Secondary data from 1998 to 2020 was used and regression analysis performed on panel data set spanning for 23 years using E-views. Eleven equations were tested for robustness and results analyzed. The study found that FDI inflows and economic infrastructure individually increase gross domestic product per capita growth. This study also used a distributed-lag model and showed that economic infrastructure and inward FDI interact with a lag. The study established that last period's economic infrastructure and inward FDI interact. This, positively and significantly, increase current gross domestic product per capita. Unambiguously therefore, this paper concluded that economic infrastructure is the main transmission mechanism through which FDI influences the host country's economic development. Good economic infrastructure increases productivity of investment and therefore promotes FDI inflows. Consequently, gross domestic product per capita increases. This, *ceteris paribus*, raises global welfare. Physical domestic investment is exogenous in this paper's modelling and can be endogenous in a second equation. The paper therefore used instrumental variables (IV) through a stronger method of 2SEGLS (Two Stages Estimated Generalized Least Square) and showed the implicit "second" estimated equation of physical domestic investment. The empirical finding from this autoregressive model showed that inward FDI could be crowding out domestic investment in developing countries.

JEL Classification: F21 and F23.

Keywords: Foreign Direct Investment, multinational corporations, Economic Infrastructure, Crowding Out, Economic Growth, Economic Development, Developing Countries.

1. INTRODUCTION

The rapidly globalizing and increasingly competitive world economy dictates that the performance of countries, best measured in terms of per capita income (as a proxy for growth and welfare) must be determined significantly by the links they establish with the rest of the global economy. The major link is engendered through multinational corporations (MNCs) that embark on global production, along with trade flows, technology and capital (Bloomstrong, 1990). Foreign direct investment mode of involvement by MNCs in global production creates opportunities for economies to strengthen their capacities to produce and expand the markets for their products, and to adopt their economies to changing conditions (Noorbakhsh & Youssef, 2001; Dunning, 1981).

The powers driving MNC systems to heighten their competitiveness have important implications for the host countries' economic performance. To the extent that these firms set out their tangible and intangible resources that increase the capacity of an economy to produce a greater quantity or improved quality of goods and services, the performance of the country will be affected positively (Aitken & Harrison, 1998; Tsai, 1994). The deployment of these assets by MNCs through economic infrastructure of the host economies strengthens the resource base of countries

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and their capacity to produce. Developing host countries are then able to reach and expand markets for their products and even restructure their economies to improve their overall economic performance.

Physical capital, research and development capacity, technological knowhow, trade links, skilled human resources and efficient organizational and managerial practices are imperative for the effectiveness of MNCs. Given these resources, good economic infrastructure help improve the economic performance of the countries that are host to them (Bougheas & Mamuneas, 2002; Cohen & Paul, 2004; Limao & Nuno, 2001). MNCs systems generate these resources and disseminate them throughout their cross-border corporate networks in the daily course of their business operations. A huge amount of the international availability of these resources can be attributed to the undertakings of MNCs.

Aitken & Harrison (1998), argue that collaborative contracts between MNCs and host firms can boost the competitiveness firms involved, by taking up technological knowhow obtained from the foreign subsidiaries. As far as manufacture technology is concerned, backward linkages with MNCs are imperative means of gaining new or cutting- edge technology by indigenous producers. Indeed, according to Durham (2004), international production can enhance the efficiency of host economy's firms through spillovers, externalities and competition effects provided that the volume and development level of economic infrastructure is good enough to tap fully the benefits. Moreover, FDI also acts as a catalyst for investment by domestic firms in a host country by signaling investment opportunities (Schmitz, 1999).

Vital organizational and managerial practices are disseminated as domestic firms imitate the practices of foreign affiliates that compete with them or that they consider better managed. Aitken & Harrison (1998), claim that the very existence of foreign affiliates of a MNC is sufficient to performance as a catalyst for improvement in management style, as appear to have been the case with the general embracing of quality control practices. The adoption by many companies in developing countries of ISO standards, beheld as a mark of quality and global competitiveness, is a case in fact. It is to the benefits of a host country that FDIs through MNCs provides a bundle of wealth-creating assets that become available directly for use in production activities and hence can enhance the economic performance of developing economies. Although the wealth-creating assets that are part and parcel of FDI may be assimilated separately provided that sufficient infrastructure is in place, it is precisely because it comes as a package that FDI is increasingly welcomed by all countries (Kravis & Lipsey 1982; Justman, 1995; Li & Liu, 2005).

An important interrogation concerning FDI is whether the investment takes place at the expense of domestic investment in the host developing economies. If the build-up of foreign affiliates' assets is financed through cross-border flows of capital and if raising this capital involves the crowding out of host economies investment, then FDI would affect domestic capital formation adversely (Choe, 2003; Calderon *et al.,* 2015). Indeed, this paper tests this empirically.

In industrialized economies, changes in the standard of living depend primarily on the development of new technology and the accumulation of capital stock – roughly explained (Romer, 1987; Barro & Sala-i-Martin, 1996; Bleaney, 1996). In developing economies on the other hand, the development of a well-functioning economic infrastructure is more important than the development of new technology, because the latter can be imported customarily from MNCs. Infrastructure development is one of the major determinants of economic development, particularly in developing economies. Direct investment in infrastructure generates; (i) production facilities and thus stimulates economic activities; (ii) reduced transaction costs and trade costs hence improving competitiveness and (iii) employment opportunities to the poor through opening up of the hinterland (Canning & Bennathan, 2000; Arrow & Kurz, 1970; Baharumshah & Thanoon, 2005). Access to numerous resources and markets provided by MNCs, and its effects on the economic performance of countries, can produce–in interaction with economic infrastructure, performance-enhancing effects that go well beyond the sum of the individual effects. Specifically, FDI and infrastructure interact to improve a country's ability to restructure its economy which, in turn, leads to higher productivity and income thereby ameliorating poverty, ignorance and diseases (World Bank, 1994).

Development economists have (Munnell, 1992; Komires & Xun, 2003) stressed that physical infrastructure is a precondition for industrialization and economic development. Physical infrastructure in general consists of two parts; (i) economic infrastructure such as telecommunications, roads, irrigation and electricity, and (ii) social infrastructure, such as water supply, sewage systems, hospitals and school facilities. Clarke & Scott (2003) emphasize that most of the studies on macroeconomic impact suggest that infrastructure does contribute towards increased output, income, employment and more importantly, quality of life.

Although issues of the impact of FDI on the host country's growth have been addressed in previous literature, contribution to this issue where FDI interact with economic infrastructure and countries are geographically classified is rather limited. This study assesses the performance-enhancing effect of the interaction between economic infrastructure and FDI on

economic growth and development that goes beyond the sum of the individual effects in 95 developing countries.

The paper contributes to the literature in the following aspects: Firstly, the study considers a broader time period (1998 - 2020) in comparison to previous works. Secondly, the study covers the largest set of explanatory variables including the traditional variables used in the growth model (labour, human capital, domestic investment, and FDI) as well as economic infrastructure and the geographical classification dummies. Thirdly, it is the first time interaction of FDI with economic infrastructure is used to examine whether infrastructure is the main transmission mechanism through which FDI affects growth and development via the interaction term. Fourthly, the paper uses the instrumental variables (IV) through a stronger method of the 2SEGLS (two stages estimated generalized least square) estimation and show the implicit "second" estimated equation of investment. Finally, this paper uses the panel regression analysis to extract consistent and efficient estimates of the effects of economic infrastructure and FDI inflows on economic growth instead of using time-series or cross-sectional methods as other past works.

The paper is organized as follows: Section II reviews theoretical and empirical evidence on the effect of economic infrastructure and FDI on economic growth. Section III provides the model specification and methodology and data applied for the empirical study. Section IV discusses the empirical results and interpretations. Conclusions are presented in the final part.

2. LITERATURE REVIEW

2.1 Inward Foreign Direct Investment and Economic Development

Numerous studies analyze the impact of FDI on economic growth of the host countries (Athukorala, 2003; Borensztein & Lee, 1998; Balasubramanyam, 1996). The theoretical foundation for the empirical investigation on FDI and growth originates from either neoclassical or endogenous growth models. Neoclassical growth models hypothesizes that FDI is customarily assumed to add to capital stock of the host country. Given diminishing returns to physical capital where technological change is taken to be exogenous, FDI has no permanent effect on the rate of growth of the economy. In this case FDI affects income level through the accumulation of capital stock in the economy but does not affect the growth in the long-run.

In new endogenous growth models there are various transmission mechanism through which FDI permanently impacts on the growth rate in the long run. Just like in the neoclassical models, FDI can impact output directly by raising the stock of capital. However, this change is probably small in magnitude because of perfect substitutability assumption. The new endogenous growth models have long-run growth as a determined by technological progress and human capital augmentation. The main transmission mechanism through which FDI can increase the growth rate is by raising production and productivity through technology transfer, productivity spillovers and externalities (Solow, 1957; DeMello, 1997).

FDI is a composite bundle of capital stock, technological know-how and can improve the current stock of knowledge in the host economy through labour training, skill acquisition and dissemination and through the creation of alternative organizational and managerial practices. Technology generates opportunity and allows creation of new jobs, raise productivity and bring effective service (World Bank, 2019). Empirically, impact of FDI on economic growth remains terribly ambiguous. While some research find a positive effect of FDI on economic growth, others get negative relationship between the two variables. Borensztein *et al.*, (1998), run regressions using a cross-sectional data on FDI flows from developed economies and conclude that whether FDI increases economic growth through the magnitude of its impact depends positively on the level of human capital available in the host country. This level of human capital is reflective of the absorptive capacity of the host country to new advanced technology.

The study by Balasubramanyan *et al.*, (1996) finds that FDI improves economic growth if the recipient country has adopted trade openness policies. They demonstrate that FDI is of paramount important for economic growth and assists in export-promoting than in import-substituting countries. Zhang, (2001(a)) examined the effect of FDI on economic growth in China under the theory presented in Barro & Salai-I-Martin (1995) and gets comparable outcome as Balasubramanyan *et al.*, (1996). Zhang, (2001) maintains that FDI affects China's economic growth directly by raising productivity, promoting exports, positive externalities and diffusion of technology. Lopez-Calva & Rodriguez-Clare (2000) argue that global investments in Costa Rica raise economic growth by creating large-enough spillover benefits for the domestic economy like generating new training programs in universities and colleges and attracting new suppliers. Noorbakhsh *et al.*, (2001) elucidate that FDI is positively correlated with economic growth but host countries require human capital, macroeconomic stability and trade openness in order to benefit from FDI.

Applying panel data regression analysis, Baharumshah & Thanoon (2005) find positive impact of FDI on economic growth in East Asia economies in both short and long run. Convincingly, they assert that the positive effect of FDI on growth was higher than domestic savings in support of the postulate that FDI

inflows are by far more productive than domestic investment. On the other hand, their paper concludes that the spillover effect of knowledge embodied in FDI might increase domestic productivity and therefore promote growth. Examining on Sri Lanka, Athukorala (2003) finds no robust relationship between FDI and economic growth using data of eight countries from 1979-1998. Durham (2004) is unsuccessful in identifying a positive relationship between FDI and economic growth.

2.2 Economic Infrastructure and Economic Development

There have been numerous academic interests on the effect of infrastructure on economic growth, productivity and welfare. Much of this work is closely linked to a literature concerned with the macroeconomic role of productive public expenditure. Arrow & Kurz (1970) pioneered the formal analysis of the effects of public capital on output and welfare under alternative financing schemes. In their framework, public capital is an input in an economy's aggregate production function, in the context of a Ramsey model with long-run growth exogenously determined. The endogenous growth version of this basic set up was developed first by Barro (1990) who assumed that the government's contribution to current production of goods and services is driven by its flow of productive expenditure to include both public and private capital stock accumulation. This gives a clear insight of the existence of the interaction nature between infrastructure and FDI on economic growth.

Empirical survey on the influence of infrastructure on economic growth took off relatively recently following the seminal work of Aschauer (1989) but it has boomed over the last two decades. Numerous papers have been devoted to examine the effect of infrastructure on growth, productivity, poverty alleviation and other development outcomes, employing a variety of data and empirical methodologies. According to Komires *et al.,* (2003) the benefits of infrastructure development for poverty reduction are manifested through two major mechanisms: (i) the impact of income distribution (the direct channel) and (ii) via the effect on economic growth (the indirect channel). The "income distribution effect of infrastructure" brings about increased employment and higher earnings prospects for the poor as a result of growth in the non-agricultural sectors of the economy and by improving productivity in both the agricultural and non-agricultural sectors. Shah (1992) adds that through multiplier effects, these productivity and employment gains drive the economic growth process further leading to the so called "infrastructure growth effect."

Komires *et al.,* (2003) examined effect of infrastructural for poor people. Precisely, the impact of physical and social infrastructure on living standards and poverty. The authors' aim is to provide empirical evidence for the implication of improved urban infrastructure for the poor. The study unequivocally finds infrastructural development leads to poverty reduction.

Extensive empirical literature exists on the impact of infrastructure on economic growth, but with mixed result. Several gaps including data availability on infrastructure, measurements of infrastructure spending and its efficiency and potential reverse causation in which higher economic growth generates an increase in public capital spending. Cannock (2001) assesses the causal relationship among telecommunications infrastructure, financial development and economic growth in Peru. The author's findings reveal that there is causality, in a Granger sense, among the variables, both in short- and long- run. Asiedu (2002) examines the effect of telecommunications infrastructure in Sub-Saharan Africa. The author's results show that development of telecommunications infrastructure fosters economic growth in Sub-Saharan Africa. Numerous micro studies have concluded that development of infrastructure is an indispensable component of poverty alleviation (Arrow & Kurz, 1970).

Physical infrastructure (Calderon *et al.,* 2015) has for many decades been theorized as central in promoting economic growth. The essence of capital investment for raising productivity was particularly predominant during the 1950s to 1970s and continues to be a focus of institutions like World Bank and World Economic Forum. Economic infrastructure affects output productivity by decreasing production costs and enables domestic and foreign firms capture economies of scale that come from market expansion possibilities. Theories of economic geography which examine spatial dimensions of economic development, finds that a major factor that determine a region's development is its access to economic infrastructure because such infrastructure allows products to be distributed at lower costs to various regional and global market places. Transportation infrastructure reduces transportation costs, connect places, and enhance mobility of factors of production. Production costs are also minimized by general public infrastructure other than roads such as gas pipelines, electricity, water supply, drainage and sewer systems, bridges, harbors, river transportation systems just to mention a few (World Bank, 1994; Janseen, 2000; Aloui *et al.,* 2020).

2.3 Economic Infrastructure, Inward Foreign Direct Investment and Economic Development

In developing economies, agricultural sector is the backbone of development, linkages to, and with other activities in the economy are the driving belts and perform the actual work. The far-reaching these linkages, the larger the effect. The scope of the linkages is related to the level and quality of economic

infrastructure. Transportation and communication infrastructure have a positive effect on agricultural incomes because they reduce transaction costs and increase the availability of inputs to agriculture. Moreover, higher incomes in agricultural sector translate into effective demand for goods and services produced by other sectors. Benefits from this increased demand depends highly on tradability of goods produced. This is largely determined by infrastructure. The better the infrastructure (Bougheas, *et al.*, 2002; Ng'ang'a, 2022), the higher the tradability of goods. This will generate an increase in agricultural income and will translate into demand for goods produced elsewhere, for instance, in urban areas.

Well-functioning economic infrastructure and FDI inflows particularly in rural area have positive impact on agriculture and other activities because they boost technology implementation and degree of specialization among geographical areas. FDI helps in generating technology that will ultimately lead in processing of agricultural raw material and thus increases value added in agricultural exports. This raises incomes, increases standard of living and assist in poverty alleviation. Impact of higher incomes on other sectors apart from agriculture in the rural area is at least higher if the demand for goods and services is almost same as what is locally produced. It is probable with no supply chain constraints and if non-tradability of goods is low given the availability of good infrastructure. The more these conditions are fulfilled, the higher the linkages to the local community. In developing economies, the proportions of goods that are considered non-tradable is relatively high, largely due to the poor infrastructure. Exogenous growth in agricultural income triggered by embracing new technology from FDI or improvement in global prices of exported goods have significant demand-led growth effects on the economy (Limao & Venables, 2001). Good infrastructure permits the transfer of modern technology through FDI. This modernizes agriculture and manufacturing industries and thus create jobs, increase income and lead to higher economic growth and poverty reduction.

3. MODEL SPECIFICATION AND METHODOLOGY

Following Levine & Zervos (1993) and Levine & Renelt (1992), I run a cross-country growth regression of the form:

$$g^y = \beta_i \boldsymbol{I} + \beta_m \boldsymbol{M} + \beta_z \boldsymbol{Z} + \mu \qquad (1)$$

Where, g^y is per capita GDP growth rate, *I* is a vector of variables always included in the regression. *M* is the variable of interest and *Z* is a vector of variables chosen from a pool of variables identified by past studies as potentially explanatory variables for growth. Given the complimentary nature between economic infrastructure and FDI inflows and the methods of estimation i.e. using both dummy variables and fixed effect models the paper augments the above equation as follows;

$$g_{it}^y = \beta'_i I_{it} + \beta_m M_{it} + \beta'_z Z_{it} + \lambda'_i d_{it} + \varepsilon_{it} \qquad (2)$$

$$g_{it}^y = \beta'_i \boldsymbol{I_{it}} + \beta_m \boldsymbol{M_{it}} + \beta'_z \boldsymbol{Z_{it}} + \lambda_i + \varepsilon_{it} \qquad (3)$$

Where the dependent variable g_{it}^y, is gross domestic product per capita growth, annual %. *I* is a vector of variables always included in the regression. *M* is the interaction term which is the variable of interest. In my case, the interaction term is $Ln(INFR_{it})$* $Ln(FDI_{it})$, where, $Ln(INFR_{it})$ is a measure of infrastructural development i.e. telephone mainlines per 1,000 people; $Ln(FDI_{it})$, is net foreign direct investment inflows expressed as a percentage of GDP. **Z** is a vector of control variables, i.e., a set of g_{it}^y determinants other than $Ln(INFR_{it})$*$Ln(FDI_{it})$ chosen from a pool of variables identified by past studies as potentially explanatory variables for growth. The d_{it} is a dummy variable which takes the value of one for individual i and zero otherwise. λ_i in equation (2) is treated as an unknown parameter to be estimated, this is a common fixed effect term, identical across countries, in the same geographical category. Additionally, ε is a white noise error tem; λ_i in equation (3), fixed effects regression, differs from λ_i in equation (1) in that the individual effect term λ_i, though constant across time, is now modeled as specific to the individual country i rather than being identical across countries as defined in equation (2). Equation (3) therefore is the fixed effects model (regression), where differences between countries, being fixed across time, can be viewed as parametric shifts of the regression function.

In this section, I use panel data sets for the 95 developing countries on gross domestic product per capita growth (GDP per capita growth annual %). Applying panel method is better to control for heterogeneity of exogenous variables, exploit the time-series variation in the data and account for unobserved country-specific effects. Moreover, panel technique provides more edifying data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency.

Infrastructure ($INFR$), the telephone mainlines per 1,000 people and foreign direct investment (FDI) net inflows as % of GDP are used to assess the effects of the interaction of infrastructural development and FDI net inflows on gross domestic product per capita growth. This is done after controlling for physical capital (INV) i.e. gross capital formation as a % of GDP; male secondary school enrollment (SEC) i.e. % of the gross. Since the purpose of this paper is to examine if foreign direct investment (FDI) and the level of infrastructural development in a country interact insofar as the process of economic growth is concerned the study focuses on these.

Choosing telephone systems as a method to measure infrastructure compromise numerous benefits above other methods. Firstly, they are likely to have more direct effects on production costs than are other indicators. Various studies (Cannock, 2001) have shown that production is facilitated by the existence of good telecommunications network. Secondly, they are more appropriate for my purposes than are broader indicators like public capital which encompass government buildings, schools, hospitals and in some instances military capital. Thirdly, they are less vulnerable to comparability problems across countries than are other measures which could be because of differences in national accounting practices and valuation methods, including exchange rates conversions. Lastly, for many countries they are available than other measures. This makes estimation viable. The number of telephone mainlines however, have one weakness: they may not account for quality differences across countries, which are likely to affect productivity.

The Data Sources

This study used annual secondary data from various sources, spanning from 1998 to 2020. The data were obtained from the World Development Indicators (2020) CD-ROM and assorted World Development Reports. Several diagnostics tests were done prior to actual analysis to avoid reporting spurious results. Countries were classified into five geographical areas as shown in table I below.

Table I: World Classification by Geographical Region

EAST ASIA AND THE PACIFIC: (EAP: 11 COUNTRIES)				
Cambodia	Fiji	Korea (Rep)	Malaysia	Philippines
China	Indonesia	Lao PDR	Papua New Guinea	Thailand
Vietnam				
LATIN AMERICA AND THE CARIBBEAN: (LAC: 29 COUNTRIES):				
Argentina	Colombia	Grenada	Mexico	St. Lucia
Barbados	Costa Rica	Guatemala	Nicaragua	St. Vincent and the Grenadines
Belize	Dominica	Guyana	Panama	Trinidad and Tobago
Bolivia	Dominican Republic	Haiti	Paraguay	Uruguay
Brazil	Ecuador	Honduras	Peru	Venezuela, RB
Chile	El Salvador	Jamaica	St. Kitts and Nevis	
MIDDLE EAST AND NORTH AFRICA: (MENA: 8 COUNTRIES)				
Algeria	Egypt Arab Republic	Iran, Islamic Republic	Jordan	Lebanon
Morocco	Syrian, Arab Republic	Tunisia		
SOUTH ASIA: (SAS: 5 COUNTRIES)				
Bangladesh	India	Nepal	Pakistan	Sri Lanka
SUB-SAHARAN AFRICA: (SSA: 41 COUNTRIES)				
Angola	Comoros	Guinea	Mozambique	Tanzania
Benin	Congo (Dem. Rep.)	Guinea-Bissau	Niger	Togo
Botswana	Congo (Rep)	Kenya	Nigeria	Uganda
Burkina Faso	Cote d'Ivoire	Lesotho	Rwanda	Zambia
Burundi	Equatorial Guinea	Madagascar	Senegal	Zimbabwe
Cameroon	Ethiopia	Malawi	Seychelles	
Cape Verde	Gabon	Mali	Sierra Leone	
Central African Republic	Gambia (The)	Mauritania	South Africa	
Chad	Ghana	Mauritius	Swaziland	

4. EMPIRICAL RESULTS AND INTERPRETATION

Following the standard practice in the empirical literature on the determinants of growth, this paper uses the multiple regression models. The variables included in the model are guided by the theoretical model considerations and empirical literature discussed. The model is estimated using panel data (i.e., pooled cross-sectional and time series data) for 95 developing countries for the period 1998 to 2020. At the diagnostic test stage, I undertook the Hausman Test, which favored the Fixed Effects Model (FEM) over the Randfom Effects Model (FEM) to investigate the issue at hand. The White Heteroscedasticity procedure was used to correct for heteroscedasticity.

The dependent variable is the natural logarithm of gross domestic product per capita growth, $Ln(g_{it}^{y})$, annual %, for the years 1998-2020 for the 95 developing countries in the sample.

Table II: Empirical Results on Economic Development Impact of Economic Infrastructure and Inward Foreign Direct Investment

Regressors	Two-Stage Least Square Fixed Effects Regression Results				
	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (4)	Eq. (5)
Constant	-0.6515 (-0.9385)	-1.248 (-1.809)	0.1763 (0.1304)	-1.0475 (-1.515)	-0.462 (-0.7649)
Ln(SEC_{it})	0.409[b] (1.953)	0.5256[c] (2.4936)	0.3932[c] (1.82)	0.531[b] (2.513)	0.31127[c] (1.8254)
Ln(FDI_{it})	0.1912[a] (4.254)	0.177[a] (3.068)	-0.185 (-0.302)	0.1716[a] (3.0195)	0.1955[a] (4.339)
Ln($INFR_{it}$)	-0.0022 (-0.0366)	-0.046 (-0.762)	-0.404 (-0.592)	-0.0947[c] (-1.8213)	-0.0448 (-0.7065)
Ln(FDI_{it-1})		0.1325[a] (3.733)			
Ln($INFR_{it-1}$)		0.0179 (0.278)			
Ln($INFR_{it}$)*Ln(FDI_{it})			0.1938 (0.6193)		
Ln($INFR_{it-1}$)* Ln(FDI_{it-1})				0.046[a] (4.3839)	0.0409[a] (2.9978)
Ln(INV_{it})					0.0607 (0.9)
Ln(INV_{it-1})					-0.0053 (-2.2428)
N	86	88	86	88	86
Adjusted R^2	0.337	0.319	0.316	0.414	0.346
Standard Error of the Regression	0.8158	0.844	0.8286	0.844995	0.8102

Notes: Superscripts indicate levels of significance as follows: [a]1%, [b]5%, [c]10%. The t-Statistics are reported in parentheses.

The two stages estimated generalized least square estimation set out in table II relates to the entire set of 95 developing countries in the sample. Regressions 1 to 5 report results for the fixed effects model. These results show that the coefficient of $Ln(FDI_{it})$ is positive and statistically significant in equations 1, 2, 4 and 5. Interestingly, infrastructure is significant only in equation 4 and astonishingly negatively correlated with gross domestic product per capita growth. This negative result could be due to congestion and excludability of infrastructure in most developing countries. Further, the coefficient of interaction of the current infrastructure and FDI, (Ln($INFR_{it}$)*Ln(FDI_{it})), in equation 3 of Table II is insignificant albeit positive.

Equations 4 and 5 give new findings! The slope coefficients of the interaction term in the two distributed-lag equations are positively signed as expected and significantly different from zero. These two equations demonstrate that current growth in gross domestic product per capita is influenced by interaction of the last period's economic infrastructure and FDI inflows. This is actually, what we observe in reality. Development is sluggish. Once real progress is in place, global welfare will rise marginally. These are the results of this paper. All slope coefficients of the control variables are correctly signed as expected and significantly different from zero.

Equation five produces coefficients for investment results. They are negative for the lagged and positive for the level investment variables. Both are statistically insignificant. Investment results are inconclusive in this paper. Investment (INV) is exogenous in this model and can be endogenous in a second equation. Consequently, this paper also examines whether FDI crowds out domestic investment. The use of instrumental variables (IV) through a stronger method of the 2SEGLS and showing the implicit "second" estimated equation of investment is applied in table II. The following is the implicit "second" estimated autoregressive model that corresponds to eqn. 5 in the above table.

$$Ln(INV_{it}) = -0.4195 + 0.164Ln(SEC_{it}) + 0.0133Ln(FDI_{it}) - 0.0146Ln(INFR_{it}) -$$
$$\text{t = (-2.16) (2.86) (1.07) (-0.712)}$$

$$- 0.008Ln(INFR_{it-1}) * Ln(FDI_{it-1}) + 0.842Ln(INV_{it-1}) \qquad (4)$$
$$\text{(2.847) (64.43) Adjusted } R^2 = 0.818 \text{ N = 90}$$

From the above equation, the coefficient of $Ln(FDI_{it})$ is positive though statistically insignificant. The interaction term $Ln(INFR_{it})$×Ln(FDI_{it}) is negative and also statistically insignificant. Thus, whether FDI "crowds out" or "crowds in" domestic investment

cannot be determined in this fixed effects regression results. The results are inconclusive.

Because of statistical insignificances found in Table II relating to infrastructure and investment, the paper uses dummy variables to see if the level of growth rate of gross domestic product per capita is different geographically.

This paper models empirical equation of this study as follows;

$$Ln(g_{it}^{y}) = \alpha_1 + \alpha_2 D_{2it} + \alpha_3 D_{3it} + \alpha_4 D_{4it} + \alpha_5 D_{5it} + \beta_1 Ln(SEC_{it}) + \beta_2 Ln(FDI_{it}) + \beta_3 Ln(INFR_{it}) + \beta_4 Ln(INFR_{it-1}) * Ln(FDI_{it-1}) + \varepsilon_{it} \quad (5)$$

Where;
D_1 (not used): Middle East and North Africa
D_2: East Asia and the Pacific
D_3: Latin America and the Caribbean
D_4: South Asia
D_5: Sub-Saharan Africa

$D_2 = 1$	if East Asia and the Pacific
$= 0$	Otherwise
$D_3 = 1$	if Latin America and the Caribbean
$= 0$	otherwise
$D_4 = 1$	if South Asia
$= 0$	Otherwise
$D_5 = 1$	if Sub-Saharan Africa
$= 0$	otherwise

The above equation hypothesizes that g_{it}^{y} function in relation to the interaction term $Ln(INFR_{it-1}) * Ln(FDI_{it-1})$ has the same slope (β_4) but different intercepts. For instance, this paper assumes that the level of mean annual g_{it}^{y} of East Asia and the Pacific, Latin America and the Caribbean, South Asia, and Sub-Saharan Africa is different from that of Middle East and North African by α_2, α_3, α_4, and α_5 respectively. Notably is the fact that, as assumed in this study, the rate of change in the mean annual g_{it}^{y} as a result of $Ln(INFR_{it-1}) * Ln(FDI_{it-1})$ is the same for all regions.

In particular, I test the following hypotheses:

For α_2:	For α_3:	For α_4:	For α_5:
H_o: $\alpha_2 = 0$	H_o: $\alpha_3 = 0$	H_o: $\alpha_4 = 0$	H_o: $\alpha_5 = 0$

Or more compactly that:

$$H_0: \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$$

(That Middle East and North Africa, East Asia and the Pacific, Latin America and the Caribbean, South Asia and the Sub-Saharan Africa all share the same intercept and hence their levels of mean annual g_{it}^{y} are the same).

Estimated regression equations (dependent variable: g_{it}^{y}, is gross domestic product per capita growth, annual %). 2SEGLS estimation (cross-section weights).

Table III: World by Geographical Region Empirical Results on Economic Development Impact of Economic Infrastructure and Inward Foreign Direct Investment

Regressors	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (4)	Eq. (5)	Eq. (6)
Constant	1.826[a] (14.779)	-0.1256 (-0.295)	-0.143 (-0.287)	-0.219 (-0.409)	-0.5689 (-1.07)	-0.4247 (-0.8143)
D_2	-0.556[a] (-5.928)	-0.4508a (-4.78)	-0.43[a] (-4.368)	-0.432[a] (-4.413)	-0.383[a] (-3.444)	-0.42[a] (-3.468)
D_3	-0.369[a] (-4.335)	-0.2199b (-2.108)	-0.265[b] (-2.478)	-0.268[c] (-2.492)	-0.211[c] (-1.707)	-0.1184 (-1.04)
D_4	-0.462[a] (-5.041)	-0.311a (-3.24)	-0.358[a] (-3.453)	-0.357[a] (-3.421)	-0.289[a] (-2.785)	-0.235[a] (-2.57)
D_5	-0.220[a] (-4.984)	-0.218[a] (-5.28)	-0.1815 (-3.712)	-0.182[a] (-3.714)	-0.205[a] (-4.041)	-0.2021[a] (-3.47)
Ln(SEC_{it})		0.5093[a] (4.99)	0.5[a] (4.24)	0.4937[a] (4.273)	0.6297[a] (6.023)	0.581[a] (6.05)
Ln(FDI_{it})		0.166[a] (6.328)	0.177[a] (5.484)	0.223[a] (3.37)	0.176[a] (1.872)	0.166[c] (1.654)
Ln($INFR_{it}$)			-0.0376 (-1.006)	0.009 (0.108)	-0.1168 (-0.961)	-0.131 (-0.959)
Ln($INFR_{it}$)*Ln(FDI_{it})				-0.0216 (-0.740)	0.0011 (0.024)	0.0183 (0.385)
Ln($INFR_{it-1}$)*Ln(FDI_{it-1})					0.0446[a] (3.215)	0.011[b] (2.486)
Ln(INV_{it})		0.032 (0.610)				0.011 (0.1691)

Ln(INV_{it-1})		0.0037 (0.098)				0.0522
						(1.3)
N	95	86	91	89	87	88
Adjusted R^2	0.0589	0.14799	0.1376	0.137	0.293	0.1988
Standard Error of Regression	1.05	0.9476	0.9592	0.9596	0.9315	0.8993

Notes: Superscripts indicate levels of significance as follows: [a]1%, [b]5%, [c]10%. The t-Statistics are reported in parentheses.

The following is the implicit "second" equation corresponding to equation 2:-

$$Ln(INV_{it}) = -2.96 + 0.52D_2 - 1.524D_3 - 0.115D_4 - 0.148D_5 + 0.902Ln(SEC_{it}) +$$
$$t = (-5.82)\ (3.754)\ (-7.11)\ (-0.8113)\ (-3.37)\ (6.307)$$

$$0.07998Ln(FDI) \qquad (6)$$
$$(1.702)$$

Adjusted $R^2 = 0.1319$ N = 87

The $Ln(FDI_{it})$ is positive and statistically significant. Therefore, investment (INV) and FDI are statistically related. This elegant empirical conclusion shows that FDI could be crowding out domestic investment. FDI increases private investment less than one for one (The coefficient in this case is 0.07998). A coefficient equals to one indicate that FDI does not affect private domestic investment. A higher coefficient (greater than one) suggest that FDI actually stimulates or "crowds in" domestic investment. The estimated parameters in table III above, suggest that across the sample as a whole, increased infrastructural development leads to increase in FDI, which in turn triggers growth in GDP per capita. The most robust finding of these estimates is that the impact of FDI on economic growth is dependent on the infrastructure development in the host country. Infrastructure is the channel through which FDI influenced the growth rate of gross domestic product per capita. Amazingly, the paper finds that current GDP per capita growth is positively and significantly impacted by previous period's infrastructure and foreign direct investment inflows.

The statistical significance of the estimated $\hat{\alpha}_2$, $\hat{\alpha}_3$, $\hat{\alpha}_4$ and $\hat{\alpha}_5$ on the basis of traditional t-test need to be discussed. Equation 4 and 5 in Table III indicate that all the slope coefficients are statistically significant. Equation 6 in Table III however, shows that the slope coefficient of Latin America and the Caribbean is statistically insignificant. On the basis of these equations, this study rejects the null hypothesis. This means that the levels of mean annual g_{it}^{y} are not the same geographically given $Ln(INFR_{it-1})$*$Ln(FDI_{it-1})$ while controlling for other variables.

One can see that in the above table, the coefficients of $Ln(SEC_{it})$ are strongly positive and significantly different from zero in all equations. This is male secondary school enrolment as percent of the gross enrollment. I can explain these results by realizing that there is a strong link between education and living standard across developed and developing countries alike.

The quality of education is essential: high investment in schooling will lead to high productivity. Workers that are more educated may still receive higher wages because schooling signals to employers positive individual characteristics, such as ambition and motivation. These characteristics could have more effects on actual productivity if there are opportunities to take advantage of. If firms are subject to competitive pressures that stimulate technical progress and the demand for more skilled workers, the effective demand for education will be strong. Moreover, human capital may be applied to its most productive uses and especially if developing countries attract the required FDI inflows.

4.1 Motivation behind Mncs Seeking Funds from the Host Developing Countries

MNCs raise funds for expansion of their affiliates in countries where their subsidiary operates. There are approximately 450,000 foreign subsidiaries of MNCs globally. Foreign affiliate get financing either from its parent MNC or from external lenders and investors. For all the 54,000 MNCs globally in 2000, foreign affiliates had $21 trillion of financing available, but only $6 trillion of that funding was provided to FDI by the MNCs (Zhang, 2001a). Evidence for U.S.-based MNCs show that borrowing in the host countries provides more than half of the external funding.

Multinationals provides little of the affiliates' funding. The motive is a parent MNC's desires to lower business risks which its foreign activities are exposed. One risk is unanticipated variations in exchange rates, which can alter the value of its direct investments. Risk-reducing strategy for a MNC that has foreign-currency assets in its affiliates is to take on foreign-currency obligations as well by borrowing in foreign currencies that are used to fund the subsidiary. Another risk common in developing economies is the political risk. The likelihood that government of host country will amend policies in ways that detriment MNC. For instance, the possibility of expropriation or

nationalization of an affiliate by the host-country government.

5. CONCLUSION

This paper has examined if foreign direct investment (FDI) and the level of development of economic infrastructural in a country interact insofar as the process of economic growth and development is concerned. The paper has offered empirical evidence by utilizing panel data for 95 developing countries from 1998 to 2020 to test the robustness of the analysis. The interaction term between the lagged variables of infrastructure and FDI has been found to be positively correlated with gross domestic product per capita growth, annual % and is statistically significant in the distributed lag model. The paper concludes that good infrastructure increases the productivity of investment and hence stimulates FDI inflows. This interaction effect leads to economic growth and development in a country in the next period. The findings are robust in the sense that there exists a strong complementarity between infrastructure and inward foreign direct investment in developing countries. As noted elsewhere in this paper, several previous studies have examined the effects of numerous variables on GDP per capita growth. The uniqueness of this study is that it has unambiguously analyzed the enhancing and reciprocity nature of interaction effect between infrastructural development and FDI inflows on g_{it}^{y}. The coefficient of $Ln(g_{it}^{y})$ was seen, in this paper, to be invariably increasing infinitesimally as infrastructure gets better and FDI increases albeit in a distributed-lag model.

I conclude that, to the best of my knowledge, no empirical work has attempted to quantify the effect of interaction between economic infrastructure and FDI on economic growth in developing economies comprehensively as this study has accomplished. The results are robust in the sense that the effects of infrastructure and FDI inflows on economic growth are positive and statistically significant and this interaction operates in a lagged manner. Finally, the results of this paper suggest some directions for further research. It might be interesting to find out if there exists a minimum threshold stock of infrastructure below which FDI will not contribute to growth rate of GDP per capita. The question would be, "Does FDI requires the presence of a sufficient level of infrastructure in the host country?"

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