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THEORY OF FOREIGN DIRECT INVESTMENT AND CORRUPTION

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ABSTRACT

In this study a theoretical model is developed to show that there is some level of corruption in the host countries that can be tolerated by foreign investors. Foreign firms will enter a foreign market only if it has some compensating advantages over the local firms since these foreign firms are inherently disadvantaged in the foreign market. These compensating advantages include the ownership and location advantages of transnational corporations. It is expected that these advantages play a role in the investment decision of investors. The theory tries to explore how corruption impact on the ability of these transnational corporations to exploit these advantages. The study deploys the firm production function, individual firm behavior in producer theory and game theory to analyze the decision of a foreign investor in the choice of a country for investment taking into consideration the quality of institutions in the country. The theory postulates that above certain level of corruption, corruption plays the role of "sand in the wheels of commerce" and below this level, corruption plays the role of "greasing the wheels of commerce". This implies that corruption is expected to have a positive impact on FDI at high level of institutional quality and a negative impact at low level of institutional quality. This level of corruption is referred to as Corruption Tolerable Level of Investment.

Keywords: Corruption, Foreign direct investment, Corruption tolerable level of investment.

JEL: F18, F23, F20, F30.

Contribution/ Originality

The paper contributes the first logical analysis of threshold of corruption that is likely to influence the decision of foreign investors in the choice of a country for investment. This threshold of corruption is referred in the theoretical framework analyzed as Corruption Tolerable Level of Investment (CTLI).

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1. INTRODUCTION

Direct foreign investment is defined as an investment in which the investor sets up a subsidiary in the foreign country or acquires a substantial controlling interest in the foreign firm.Companies that engage in direct foreign investment are referred in literature as multinational enterprises (MNE). International trade economists have tried to use theory to explain foreign direct invest (Markusen *et al.*, 1995). The first attempt to explain FDI was Ricardo's theory of comparative advantage but has been criticized because it is based on two countries, two products and a perfect mobility of factors at local level (Denisia, 2010). Due to the failure of Ricardo's comparative advantage theory to explain the rising share of FDI, other models such as portfolio theory were used. Because the portfolio theory could not explain the direct investments, it also failed. (Denisia, 2010). Mundell (1957) also tried to explain FDI but Mundell's model could not explain international production through FDI, because foreign investment incorporated were either portfolio investment or short term investment (Denisia, 2010). Production cycle theory developed by Vernon (1966) explains that in the first stage of the production cycle, manufacturers have an advantage by possessing new technologies and as the product develops so also the technology becomes known. Cushman (1985) analyzed the influence of uncertainty as a factor of FDI and posited that real exchange rate increase stimulated FDI. The internalization theory by Buckley and Casson (1976) demonstrate that transnational companies organize their internal activities so as to develop specific advantages, which can to be exploited. In the assertion of FDI at firm level, (Hymer, 1976) recognized that FDI is a firm-level strategy decision rather than a capital-market financial decision and posits that FDI take place only if the benefits of exploiting firm-specific advantages outweigh the relative costs of the operations abroad. The eclectic theory developed by Dunning (1988) is a mix of three different theories of direct foreign investments; namely the ownership advantage, location advantage and internalization (O-L-I) which MNEs tend to exploit in the foreign economy to reduce their transaction cost.

Both economic theory and empirical studies support the notion that FDI inflow is conducted in anticipation of future profits. Because of various inherent disadvantages of setting up MNEs operations abroad, MNEs will enter a foreign market only if it has some compensating advantages over the local firms which make their venture profitable. The MNEs should be able to exploit some special advantage such as lower cost due to economics of scale or superior technology they own (Markusen *et al.*, 1995). Mwilima (2003) also argued that a strong policy and regulatory regime as well as appropriate institutions are important in attracting FDI inflow.

North (1990) defines institutions as 'rules of the game in society' or 'human-devised constraints that shape human interaction'. Literature has shown that returns on investments reduce and capital accumulation also decreases due to poor institutional arrangements which translate into corruption and poor enforcement of laws. (Mauro, 1995; Brunetti *et al.*, 1997; Lambsdorff, 1999; Wei, 2000a). Most research on the effect of institutional quality on FDI inflow reveal that countries that have weak institutions, in particular, high corruption and an unreliable legal system tend to receive less FDI (Gastanaga *et al.*, 1998; Wei, 2000b). Corruption has been argued by economists to have two sides with respect to entrepreneur activities. On the one side, some authors have

suggested that corruption might enhance entrepreneur activities. Dreher and Gassebner (2013) posit that corruption may be a means to achieve certain benefits by making easier work in the official economy. For example getting a license to operate, overcoming cumbersome bureaucratic regulations and winning a contract from a public authority among others. In support of the 'grease the wheels' hypothesis, Dreher and Gassebner (2013) finds that at maximum level of regulation, corruption significantly increases entrepreneurial activity and as such, corruption might be viewed as being beneficial rather than harmful. Malfunctioning government institutions have been contended to constitute a severe impediment to investment, entrepreneurship, and innovation by many economists on the other side (Mauro, 1995). Kaufmann and Wei (2000) posit that multinational firms paying more bribes also spend more time negotiating with foreign officials which works against the 'grease the wheels' hypothesis. Studies by Dal Bo and Rossi (2007) and Yan and Oum (2011) show that corruption really leads to low efficiency levels. Research has also revealed that poor institutions (corruption) prevent the use of technologies available to firms (Tebaldi and Elmslie, 2008) and also limit the efficiency gains from current innovation (Matthews, 1986). All these findings seem to support the "sand in the wheels of commerce" hypothesis.

This study argues that corruption might be a means to achieve certain benefits which make investment in an official economy easier (especially in countries where bureaucratic regulations are cumbersome) but when corruption goes beyond to situations where there is malfunctioning of government institutions then corruption deters private investment. Corruption is seen as "greasing the wheels" at low levels and also seen as "sand in the wheels of commerce" at high levels. The motive of this paper is to develop a theoretical model that elucidate the impacts of the quality of institutions in an economy on the adoption of technology and capital productivity which will influence the decision of the investor to choose to invest in an economy. The theory postulates that above some level of corruption; referred to as Corruption Tolerable Level of Investment (CTLI) in this study, corruption plays the role of "sand in the wheels of commerce" and below this level, corruption plays the role of "greasing the wheels of commerce". The study contributes to existing literature on corruption by advocating with a simple theoretical model that there is some level of corruption that can be accommodated by foreign investors and beyond which the investors are no longer enthused to invest in those countries. The rest of the paper will review literature on eclectic theory developed by Dunning (1988) followed by literature on corruption and then develop the theory relating corruption to FDI.

1.1. Literature on Eclectic Paradigm of Dunning

The eclectic theory by Dunning (1988) is a combination of three different theories of foreign direct investments (O-L-I):

I. "O" from Ownership advantages:

These advantages are described as the specific benefits of the company or the property competences. Because a firm has control over its own specific advantages, the firm can use these advantages to earn a higher marginal profit or decrease marginal cost than its competitors in the foreign country (Dunning, 1973;1980;1988) as cited in Denisia (2010). Agarwal and Ramaswami

(1992) postulate that MNEs must possess superior assets and skills when moving operations to a foreign market in order to compensate for the extra cost and earn sufficient economic rents and become competitive. Resource-based view (RBV) which is an analytical tool to recognise a firm's resources and identify its O advantages proposes that companies can earn sustainable returns if they have superior resources (Óladóttir *et al.*, 2008).

II. "L" from Location:

The location advantages of these countries are key factors in determining who becomes a host country for the activities of the transnational corporations. The specific advantages of each country can be divided into three categories including economic benefits, political advantages and Social advantages. According to Óladóttir *et al.* (2008) locational advantages can result from structural market distortions such as government intervention, which affect costs and revenues. Institutions in the domestic country have the potential of attracting or otherwise foreign firms depending on whether with the existing institutions, the foreign firm can capitalize on its location advantage. North (1990) posits that the formal or informal constraints of the institutional framework can affect any strategic choice that a firm makes. Enforcement of property rights and contract laws is also an important feature of formal constraints (Williamson, 2000). North (1990) postulates that efficient markets are structured by stable institutions towards an economic exchange orientation, which implies low transaction cost and reduced uncertainty, and provides incentives for the players to compete through price and quality.

III. "I" from Internalization:

A firm must be able to use the ownership and location advantages it possess in collaboration with some factors outside the country of origin to be profitable (Dunning, 1973;1980;1988). Internalization theorists suggest that when the benefits of internalization outweigh its cost, FDI occurs (Fina and Rugman, 1996). Williamson (1985) posits that the governance structure that MNCs choose for a venture is driven by the desire to minimise transaction cost in that a rational company will choose market governance for its transactions if transaction costs are low.

Eclectic paradigm OLI shows that OLI parameters differ from firm to firm and the extent to which a firm can benefit from these OLI parameters depends on the economic, political and social characteristics of the host country. Therefore, the objectives and strategies adopted by the firms, the extent and pattern of production (Denisia, 2010) and the choice of a country to invest will be contingent on the challenges and opportunities existing in different countries.

1.2. Literature on Corruption and FDI Inflow

A classical economic theory of corruption perceives corruption as one way among others of allocating scarce resources, where the rational behaviour of market actors in respect to incentives and rents explicates corruption outcomes (Mishra, 2005). The new institutional economics extended the analysis of economic agency to ascertain the role of institutions, in addition to individuals, in producing corrupt transactions, opportunism and transactional costs (Lambsdorff *et al.*, 2004). Rose-Ackerman (2006) explains that corruption occurs where private wealth and public power overlap. It represents the illicit use of willingness to pay as a decision making criterion. In

most common transaction a private individual or firm makes a payment to a public official in return for a benefit.

Research on the consequences of corruption has taken a wider dimension with varied results being reported depending on the area of interest and focus of research. The discussion of effects of corruption can be considered as an entity having independent impacts on other social occurrences or variables (Andvig *et al.*, 2000) . The "grease the wheels" hypothesis on the effects of corruption on efficiency features prominently in the early economics literature (e.g. (Leff, 1964; Leys, 1965; Huntington, 1968)). Beck and Maher (1986) and Lien (1986) proposed corruption to increase efficiency because inefficient regulations constitute an impediment to investment that can be overcome by bribing bureaucrats. Studies elsewhere (Aidt, 2009) found very weak evidence supporting the "greasing the wheels hypothesis" but rather uncovers a strong negative correlation between growth in genuine wealth per capita and corruption, Some authors also argue that corruption would tend to lower economic growth (Shleifer and Vishny, 1993) supporting the "Sand in Wheel" Hypothesis. Mauro (1995) used cross-country subjective measures of corruption to show that corruption is negatively associated with private investment and therefore growth and this results is supported by other empirical studies (Knack and Keefer, 1995; Brunetti *et al.*, 1997; Elliott, 1997).

Research has established that corruption has both positive and negative effect on investment which means that there is a level of corruption that investors are likely to gain from their investments and so would not mind investing but beyond this level, investing is unattractive. A firm's entry mode in a foreign market has also been argued to depend on critical examination of the locational advantage of each specific market together with the firm's ownership advantages (Agarwal and Ramaswami, 1992). This study therefore seeks to find out how corruption influences the ability of transnational corporations to exploit their ownership and location advantages.

2. METHODOLOGY

The study deploys the firm production function to develop a theoretical framework to show that the level of productivity of a firm depends on the level of the quality of institutions in the country. The level of productivity of firm affects the return to capital invested and this helps the investor to take decision with respect to the choice of a country for investment. The study also uses a basic hypothesis on individual firm behavior in producer theory to find out the impact of the quality of institution of a country on foreign investment by deploying a firm's optimization problem. Finally the study deploys game theory to analyze the decision of a foreign investor in the choice of a country for investment taking into consideration the quality of institutions in the country.

2.1. Theoretical Framework

Consider an entrepreneur desiring to take an investment decision in a foreign country. The entrepreneur operates his/her own technology and also chooses the country to invest. This technology is assumed not to be subjected to individual-specific shocks but faces aggregate

uncertainty due to the state of institution in the country of investment. The choice of a country or economy depends on the level of corruption in that country. It is assumed that the firm's product has the same market opportunity and prices in all economies.

Production function

At every level of capital stock, greater technology would allow greater economic output. Therefore an increase in technology from A_0 to A_1 would shift the production function higher, increasing the marginal product of capital. However, the qualities of institutional arrangements in the country may affect the technology or productivity. If the level of quality of institution falls below $\bar{T}$ the entire production function will shift downwards from (1) to (2). A downward shift in the production function will result in the output decreasing from Y_1 to Y_2 and a subsequent decrease in the profits measured in units of output from $\frac{\pi_1(T)}{p}$ to $\frac{\pi_2(T)}{p}$ (the vertical intercept in figure 1) and this translates to a decrease in the return to capital invested. A typical production function is shown below with the capital on the horizontal axis.

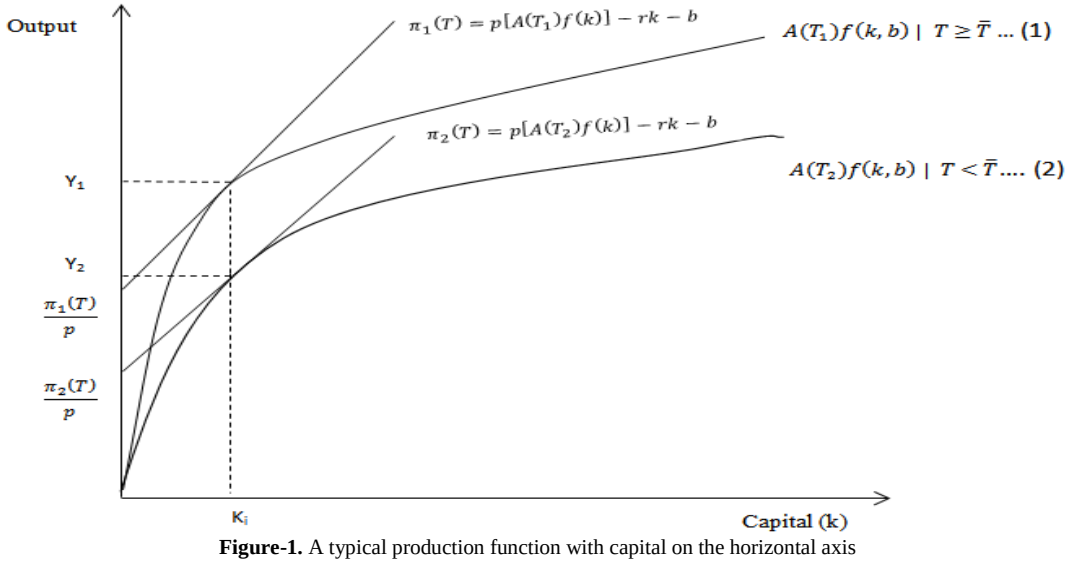

Figure-1. A typical production function with capital on the horizontal axis

Beyond a certain level of quality of institution in the country, the return to capital is high and below this level, the return is low. This level of quality is what is referred to as the Corruption Tolerable Level of Investment (CTLI) and indicated as $\bar{T}$ in the figure 1. The precise specification of the production function is described below. The productivity is a function of the level of institution in the country. The amount of labour input is normalized and fixed at a value of one. This assumption is also adopted elsewhere (Angeletos and Calvet, 2006; Cagetti and De Nardi, 2006; Covas and Fujita, 2011).

$$y_i = A(T_i)f(k_i)$$

Where y_i refers to the output, $A(T_i)$ represents the level of productivity which depends on the quality of institutions of the foreign country i. k_i is the physical capital used by firm in production.

Assumptions about $f(k)$:

$f(0) = 0, \quad f' > 0$ and $f'' < 0$ (production function is strictly increasing and strictly concave). The production function also obeys the Inada conditions to ensure that there is an interior solution.

The firm is "privately held" by the entrepreneur and so issuance of equity is not allowed. The investor has no access to risk free asset. The risk of eroding his/her capital if the corruption in a country exceeds a tolerable level can also not be insured by any insurance market.

Preposition:

Beyond a certain level of corruption in a country, firms no longer are interested in investing in that country

Figure 2 shows the return on investment with respect to the level of institution in the country of investment. At high quality of institution of a country, the return (R_2) is high and at low quality of institution, the return (R_1) is low.

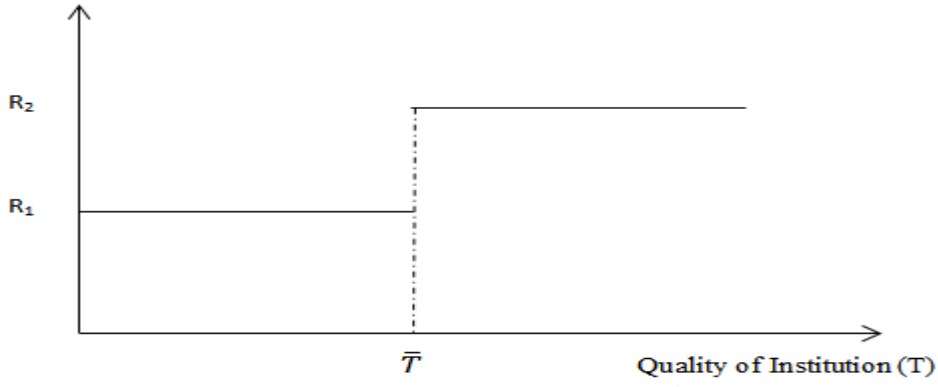

Figure-2. Return on investment with respect to the level of institution

2.2. Firm's Optimization Problem in the Foreign Country

A basic hypothesis on firms behavior in the producer theory is to always choose a most profitable production plan from the production set. Therefore by deploying a firm's optimization problem, it is possible to find out the impact of the quality of institution of a country on foreign investment. Corruption has also been categorized into two which are arbitrary corruption that is uncertain and pervasive corruption that is certain and widespread (Rodriguez *et al.*, 2005). These categorizations are brought to bear on the firm's maximization problem.

2.3. Firm's Optimization Problem with Arbitrary Corruption

In some of the countries, investors may be asked for bribes or not and this type of corruption is referred to as arbitrary corruption (Cuervo-Cazurra, 2008). Arbitrary corruption increases the uncertainty associated with corruption and for that matter the risk faced by the investor. With this type of corruption, investors are not able to factor the choice of bribe to be paid in their maximization problem.

The firm's optimization problem becomes

$$Max_{k_i} \ \pi(T_i) = p[A(T_i)f(k_i)] - rk_i$$

First Order Necessary Condition

$$\frac{\partial \pi(T_i)}{\partial k_i} = p[A(T_i)f_k(k_i)] - r = 0 \quad , \qquad \frac{\partial f(k_i)}{\partial k_i} = f_k(k_i) \tag{5}$$

At equilibrium

$$p[A(T_i)f_k(k_i)] - q = 0 \tag{6}$$

Taking total differential of the equation (6) we obtain

$$[A(T_i)f_k(k_i)]dp + pA(T_i)f_{kk}(k_i)]dk_i + \left[pf_k(k_i)\frac{\partial A(T_i)}{\partial T_i}\right]dT_i - dr = 0$$

To find the impact of the quality of institutions on capital invested, dp and dr is set to zero. That is $dp = dr = 0$.

$$pA(T_i)f_{kk}(k_i)]dk_i + \left[pf_k(k_i)\frac{\partial A(T_i)}{\partial T_i}\right]dT_i = 0$$

Therefore

$$\frac{\partial k_i}{\partial T_i} = \frac{-\left[pf_k(k_i)\frac{\partial A(T_i)}{\partial T_i}\right]}{pA(T_i)f_{kk}(k_i)]} > 0$$

This means that an increase in the level of quality of institution (decrease in corruption) increases capital investment.

Let b_i be the amount of bribes paid by investors in the foreign country. When the level of quality of institution is increasing or improving, it is expected that the amount of bribes paid reduces and so $b_i \approx 0$ if there is high level of quality of institution in the country. When level of the quality of institution is equal to or above the investment tolerable level in the country ($i.e. T_i \geq \bar{T}$, $y = f(k_i) = Y_1$ as shown in Figure 1), the amount of bribe paid is low. Therefore the profits measured in units of output minus the bribe paid $\left[\frac{\pi_1(T)}{p} - b_1\right]$ is high and thus the investor is motivated to invest in the country. It can therefore be postulated that when $T_i \geq \bar{T}$, corruption will have a positive effect on foreign investment inflow.

However, when level of the quality of institution is below the tolerable level for investment in the country ($i.e. T_i < \bar{T}$, $y = f(k_i) = Y_2$ as shown in Figure 1) the output is low with same amount of capital investment. The amount of bribe paid at this level of quality of institution is high. Therefore, the profit minus the bribe paid $\left[\frac{\pi_2(T)}{p} - b_2\right]$ is low and thus the investor is not motivated in this case to invest in the country. It can also be postulated that when $T_i < \bar{T}$, corruption will have a negative impact on foreign investment inflow. Therefore as the value of the expression in the parenthesis $\left[\frac{\pi(T)}{p} - b\right]$ increases, investments increases and as the value decreases, investments decrease as well. This assertion supports the argument that at low levels of corruption the beneficial effects of corruption dominate the detrimental effects and vice versa (Mendez and Sepulveda, 2006).

2.4. Firm's Optimization Problem with Pervasive Corruption

With pervasive corruption (known cost of corruption) investors are aware they will be asked for bribes by both public employees and politicians to obtain for example government contracts (Cuervo-Cazurra, 2008) and so will factor this in their profit maximization problem. This is because since bribery behavior is negatively related with the cost and positively related with the expected revenue (Lianju and Luyan, 2011) investors will take the choice of the amount of bribe to be paid with respect to the return on their investment into consideration.

Firm's optimization problem

If the entrepreneur invests k_i, and takes the amount of bribes (b_i) paid into consideration by optimizing both cost and benefit of bribe, the firm's optimization problem in the country becomes

$$Max_{k_i,b_i}\pi(T_i) = p[A(T_i)f(k_i,b_i)] - rk_i - b_i$$

Where p and r are exogenous. p = price of output, r = interest rate

First Order Necessary Condition

$$\frac{\partial\pi(T_i)}{\partial k_i} = p[A(T_i)f_k(k_i,b_i)] - r = 0 \quad (7)$$

$$\frac{\partial\pi(T_i)}{\partial b_i} = p[A(T_i)f_b(k_i,b_i)] - 1 = 0 \quad (8)$$

For an Interior Solution, $\frac{\partial\pi(T_i)}{\partial k_i} = \frac{\partial\pi(T_i)}{\partial b_i} = 0$

Assuming $k_i, b_i > 0$

The ratio of the marginal product of capital to the marginal product of bribe equals to the ratio of payments to the factors of production (capital and bribe) where the cost of capital is r and that of bribe is normalized to 1.

$$\frac{[f_k(k_i,b_i)]}{[f_b(k_i,b_i)]} = r$$

The impact of the country's level of quality of institution on capital and bribes is found by taking total differential of the equations (7) and (8) which yields;

$$[A(T_i)f_k(k_i,b_i)]dp + [pA(T_i)f_{kk}(k_i,b_i)]dk_i + [pA(T_i)f_{kb}(k_i,b_i)]db_i + \left[pf_k(k_i,b_i)\frac{\partial A(T_i)}{\partial T_i}\right]dT_i - dr = 0 \quad (9)$$

$$[A(T_i)f_b(k_i,b_i)]dp + [pA(T_i)f_{bk}(k_i,b_i)]dk_i + [pA(T_i)f_{bb}(k_i,b_i)]db_i + \left[pf_b(k_i,b_i)\frac{\partial A(T_i)}{\partial T_i}\right]dT_i - d\tau = 0 \quad (10)$$

dp and dr is set to zero from equations (9) and (10) in order to find the impact of the quality of institutions on bribes and capital invested.

$$[pA(T_i)f_{kk}(k_i,b_i)]dk_i + [pA(T_i)f_{kb}(k_i,b_i)]db_i + \left[pf_k(k_i,b_i)\frac{\partial A(T_i)}{\partial T_i}\right]dT_i = 0$$

$$[pA(T_i)f_{bk}(k_i,b_i)]dk_i + [pA(T_i)f_{bb}(k_i,b_i)]db_i + \left[pf_b(k_i,b_i)\frac{\partial A(T_i)}{\partial T_i}\right]dT_i = 0$$

This in a matrix form

$$\begin{bmatrix}[pA(T_i)f_{kk}(k_i,b_i)] & [pA(T_i)f_{kb}(k_i,b_i)]\\ [pA(T_i)f_{bk}(k_i,b_i)] & [pA(T_i)f_{bb}(k_i,b_i)]\end{bmatrix}\begin{bmatrix}\partial k_i\\ \partial b_i\end{bmatrix}=\begin{bmatrix}-\left[pf_k(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right]\\ -\left[pf_b(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right]\end{bmatrix}\partial T_i$$

Dividing both sides by ∂T_1

$$\begin{bmatrix}[pA(T_i)f_{kk}(k_i,b_i)] & [pA(T_i)f_{kb}(k_i,b_i)]\\ [pA(T_i)f_{bk}(k_i,b_i)] & [pA(T_i)f_{bb}(k_i,b_i)]\end{bmatrix}\begin{bmatrix}\dfrac{\partial k_i}{\partial T_i}\\ \dfrac{\partial b_i}{\partial T_i}\end{bmatrix}=\begin{bmatrix}-\left[pf_k(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right]\\ -\left[pf_b(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right]\end{bmatrix}$$

Solving by Cramer's rule for $\frac{\partial k_i}{\partial T_i}$ yields

$$\frac{\partial k_i}{\partial T_i}=\frac{det\begin{bmatrix}-\left[pf_k(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right] & [pA(T_i)f_{kb}(k_i,b_i)]\\ -\left[pf_b(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right] & [pA(T_i)f_{bb}(k_i,b_i)]\end{bmatrix}}{det\begin{bmatrix}[pA(T_i)f_{kk}(k_i,b_i)] & [pA(T_i)f_{kb}(k_i,b_i)]\\ [pA(T_i)f_{bk}(k_i,b_i)] & [pA(T_i)f_{bb}(k_i,b_i)]\end{bmatrix}}$$

Where;

a) $\frac{\partial f(k_i,b_i)}{\partial k_i}>0, \frac{\partial^2 f(k_i,b_i)}{\partial (k_i)^2}<0$ (production function is increasing and concave in capital)

b) $\frac{\partial A(T_i)}{\partial T_i}>0$, (Productivity function is increasing in the quality of institutional level)

c) $\frac{\partial f(k_i,b_i)}{\partial b_i}>0$, $\frac{\partial^2 f(k_i,b_i)}{\partial (b_i)^2}<0$ (production function is increasing and concave in bribes) and also obeys the Inada conditions;

d) $\frac{\partial^2 f(k_i,b_i)}{\partial b_i \partial k_i}>0$ (The marginal productivity of bribe is increasing in capital since capital and bribe are assumed to be complementary)

The denominator of the comparative static above is positive. Since the sufficient condition for a profit maximization problem is that the discriminant D should be positive - $D=pA(T_i)[f_{kk}f_{bb}-(f_{bk})^2]>0$, it can be concluded that $\frac{\partial k_i}{\partial T_i}>0$. This means that an increase in the level of quality of institution (decrease in corruption) increases capital investment.

Next is solving by Cramer's rule for $\frac{\partial b_i}{\partial T_i}$ which yields

$$\frac{\partial b_i}{\partial T_i}=\frac{det\begin{bmatrix}[pA(T_i)f_{kk}(k_i,b_i)] & -\left[pf_k(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right]\\ [pA(T_i)f_{bk}(k_i,b_i)] & -\left[pf_b(k_i,b_i)\dfrac{\partial A(T_i)}{\partial T_i}\right]\end{bmatrix}}{det\begin{bmatrix}[pA(T_i)f_{kk}(k_i,b_i)] & [pA(T_i)f_{kb}(k_i,b_i)]\\ [pA(T_i)f_{bk}(k_i,b_i)] & [pA(T_i)f_{bb}(k_i,b_i)]\end{bmatrix}}$$

Since the discriminant is positive, the relationship between the bribes paid and level of quality of institutions depends on the sign of the numerator. The numerator is also positive which means that $\frac{\partial b_i}{\partial T_i} > 0$. This theory postulate that when bribe is treated as an input factor, an increase in the level of quality of institution (reduction in corruption) increases bribe paid. This is inconsistent to the expectations that high quality of institutions should lead to decrease in bribes paid. It is conceivable that in countries with high quality of institutions, stringent punitive actions are taken against corrupt officials and makes corrupt practices a high risk venture. Therefore any official who get involved in corrupt practice will demand high bribes as compensation.

2.5. Game Theoretic Between Firm ("Briber") and Government Official ("Bribee")

This is a game with complete information. The two players (the firm and the official) have a better understanding of each other. The game is about firms choosing to invest in corrupt country and pay bribes or not to invest and the public officer choosing to accept the bribe or not. Therefore firms want to get a valuable service in the country of investment from the public officer. The game starts with firms choosing to invest or not to invest in a corrupt country and then decide to pay or not to pay bribes to the public officer as presented in figure 3. The public officer then chooses to accept the bribe or not to accept and when the public officer decides not to accept the bribe, he/she may choose to report or not to report the briber to the authorities. The payoff of a firm which does not invest in the foreign country is the return (r_i') the firm will get from the investment in the home country but the payoff of the government official in the foreign country is also zero. The payoff of the firm that decides to invest in the foreign corrupt country depends on whether the firm pays bribes or not to the public officer.

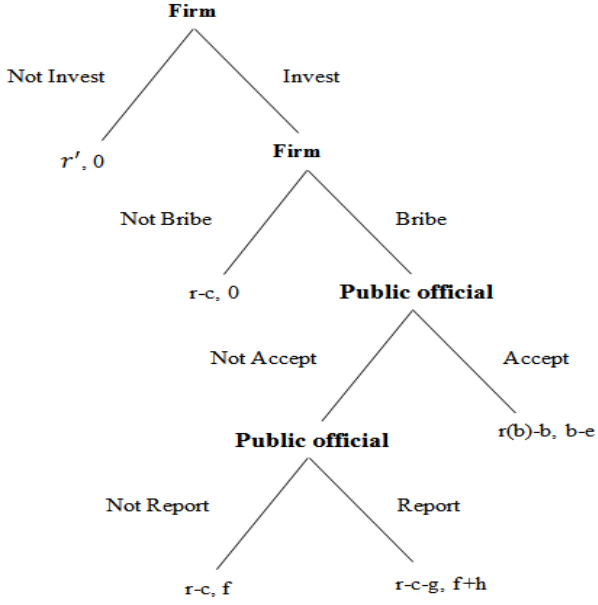

Figure-3. The game tree of the firm and the public official

If the firm invests but refuses to pay bribes, the firm incurs a cost as a result of red tape which impedes entrepreneurial activity and delays investment leading to loss of return on investment. The payoff to the firm is the return (r_i) minus the cost the firm incurs due to the red tape (c_i); i.e. ($r_i - c_i$)but the payoff to the public official is zero. If the firm pays bribes, the payoff will depend on whether the public official chooses to accept the bribe or not. If the public official decide to accept the bribe, the payoff of the firm is the return on investment of the firm which is a function of bribe paid ($r_i(b_i)$) minus the cost of bribe (b_i); i.e. ($r_i(b_i) - b_i$). Public officer, using his/her advantageous position as the unique provider of the service, tries to obtain illegal private benefit from these firms. The payoff to the public official if he/she accept the bribe is the benefit (b_i) that the public officer gets minus the cost of accepting bribes (e_i); i.e. ($b_i - e_i$). The cost of accepting bribes to the public official is the risk the official faces of being punished if caught. Now if the public official refuses to accept the bribes, the payoff will depend on whether the public official will choose to report the bribery incidence for the authorities to penalize the firm or not. If the public official decides not to report, the payoff to the firm is the return (r_i) minus the cost the firm incurs due to the red tape (c_i). The payoff of the public official is the satisfaction (f_i) the public official enjoys by avoiding the risk of being punished if caught. On the other hand if the public official decides to report, the payoff to the firm is the return on firm's investment minus the cost the firm incurs due to red tape (because the public official refused to be bribed) minus the cost of penalty the authorities will inflict on the firm ($r_i - c_i - g_i$). If the public official refuses to accept the bribes but chooses to report, the payoff is the satisfaction (f_i) the public official gets by avoiding the risk of being punished if caught plus the reward to the public official by the state (h_i). Whistleblower reward laws which was designed to protect and encourage "insiders" to report misconduct has proven to be an effective fraud detection mechanism in the fight against fraud and corruption (NWC, 2015). Becker (1977) posits that the elasticity of response of offenses with respect to a change in the probability of discovering an offense and the apprehension and conviction of the offender would generally, in equilibrium, have to exceed its response to a change in the size of the punishment for those convicted. Therefore Becker (1977) demonstrated that optimal policies to combat illegal behaviour are part of an optimal allocation of resources.

2.6. Subgame-Perfect Nash Equilibrium

Let presume that the return on investment for paying bribe ($r_i(b_i)$) is higher than that of not paying bribe (r_i) and also the return on investment in a corrupt country with or without bribe is higher than the return (r_i') in the home country of the firm. Let also presume that the cost to the firm due to red tape is more than the cost of bribe; i.e. $c_i > b_i$, and also the benefit (b_i) that the public officer gets minus the cost of accepting bribes (e_i) is greater than the benefit (f_i) public official gets if bribes is refused; $(b_i - e_i) > (f_i + h_i)$. Presuming that each player maximizes his/her expected payoff, conditional on the information set available at which he/she has the move, then each strategy by the firm and public official exhibits sequential rationality. For games of perfect information, backward induction is the process to solve a game based on common knowledge of sequential rationality. Therefore we can eliminate actions that are not sequentially

rational, node by node, starting from the bottom of the game tree. From the bottom of the tree, the public official will choose to report since $(f_i + h_i) > f_i$. At the next stage of the tree, the public official will choose to accept the bribe because $(d_i - e_i) > (f_i + h_i)$. At the next level of the tree, the firm will choose to bribe since by the assumption $(r_i(b_i) - b_i) > (r_i - c_i)$. Similarly at the final stage of the tree, firm will choose to invest because $(r_i(b_i) - b_i) > r_i'$. Therefore using the subgame-perfect Nash equilibrium approach, the unique Nash equilibrium of the game is; "(Invest, Accept bribe)" which is also Pareto optimal solution. This is true because of the assumption made with respect to the benefits and costs to the both players. Without these assumptions it will be difficult to obtain the Nash equilibrium of the game. For example if the return on investment in a corrupt country with or without bribe ($(r_i(b_i)$, $r_i)$ is less than that in the home country of the firm (r_i'), investors will not invest in the foreign country. Also if the return on investment for paying bribe ($r_i(b_i)$) is less than that for not paying bribe (r_i), investors will invest but will not pay bribes. It is also worth noting that if cost to the firm due to red tape is less than the cost of bribe (i.e. $c_i < b_i$) investors will not pay bribes. On the part of the public official, if the reward for not accepting the bribe is higher than that for accepting, the official will not be motivated to involve him/herself in bribery activities.

2.7. Nash Equilibrium Analysis

Both players of the game, firm (Briber) and government official (Bribee) pursue profit maximization and therefore it is assumed that $a_i, b_i, c_i,\ e_i, f_i, g_i, h_i, r_i, r_i' > 0$. The mechanism of the game is that players choose the optimal strategy which maximizes their own profit while considering other players' strategies. Once these assumptions are relaxed, the Nash equilibrium of the above game can no longer be obtained by using the backward induction method. The strategies in Nash equilibrium must be best responses to each other, where the firm chooses to invest and pay bribes or not to invest in a corrupt country and the public officer choosing to accept or not to accept the bribe. Assuming at the point of Nash equilibrium, firm choose the strategy "Invest and pay bribe" with the probability p and choose the strategy "Not invest and not pay bribe" with probability $1 - p$ then the firm's optimal strategy is $(p, 1 - p)$. Similarly, assuming public official choose the strategy "Accept bribe and not report" with the probability q and strategy "Not accept bribe and report" with $1 - q$ probability then the optimal strategy of the public official is $(q, 1 - q)$. The payoff matrix of the game is presented in figure 4.

		Public official		
		Accept bribe/no report	Not accept bribe/report	
Firms	Invest/ Bribe	$(r_i(b_i) - b_i), (b_i - e_i)$	$(r_i - c_i - g_i), (f_i + h_i)$	p
	Not Invest/ Not pay bribe	$r_i', 0$	$r_i', 0$	$1 - p$
		q	$1 - q$	

Figure-4. The payoff matrix of a bribery game between firm and government official

Firm therefore choose an appropriate probability to optimize the following

$$Max_p \ pq(r_i(b_i) - b_i) + p(1-q)(r_i - c_i - g_i) + q(1-p)r_i' + r_i'(1-q)(1-p)$$

The solution to the unconstrained optimization problem is

$$q(r_i(b_i) - b_i) + (1-q)(r_i - c_i - g_i) - r_i' = 0$$

$$q^* = \frac{c_i + g_i + r_i' - r_i}{r_i(b_i) + c_i + g_i - b_i - r_i}$$

Firstly, the optimal probability q^* of firm increases with the increase in the parameters c_i, g_i and r_i'. This means that an increase in the cost due to red tape to the firm (c_i), the cost of penalty the authorities will inflict on the firm (g_i) or the return on investment in the home country of the investor (r_i'), increases the probability of choosing "Not invest and not pay bribe". Secondly, the optimal probability q^* of firm also increases with the increase in the parameters b_i and r_i. This means that an increase in the cost of bribe to the firm and return on investment when no bribe is paid increases the probability of choosing "Not invest and not pay bribe". As long as the cost due to red tape to the firm (c_i) andthe cost of penalty the authorities will inflict on the firm (g_i) are high, firms will choose not to invest since these costs will erode the firms' returns. Thirdly, the optimal probability q^* of firm decreases with increase in the return on investment of the firm when bribe is paid ($r_i(b_i)$. This indicates that an increase in the return on investment when bribe is paid decreases the probability of choosing "Not invest and not pay bribe". The public officer also choose an appropriate probability to optimize the following

$$Max_q \ pq(b_i - e_i) + p(1-q)(f_i + h_i)$$

The solution to the unconstrained optimization problem is

$$p(b_i - e_i) - p(f_i + h_i) = 0$$

$$p^* = 0$$

Thus the Nash equilibrium of the game when the assumptions are relaxed is a mixed strategy situation $[(p^*, 1-p^*), (q^*, 1-q^*)]$. This procedure was also deployed by Lianju and Luyan (2011) in investigating the mechanism of the bribery behaviour based on the non-cooperative static game theory. Lianju and Luyan (2011) postulate that bribery behavior is negatively related with cost and positively related with expected revenue which is consistent with analysis in this study. The game analysis above depicts that the cost due to red tape, the cost of bribery as well as the cost of penalty of bribery are positively related to the probability of choosing not to invest and not to pay bribe. The game analysis also shows that the return on investment of the firm in a corrupt country is negatively related to the probability of choosing not to invest and not to pay bribe. Since the analysis demonstrate that an increase in the cost due to red tape to the firm increases the probability of choosing "Not invest and not pay bribe", it implies that firms are not motivated to invest in countries with unnecessary bureaucratic structures. To overcome this hurdle, firms are enthused to bribe officials thus supporting the proponents of the 'grease the wheels' hypothesis especially when firms are sure of the cooperation of the officials. In countries where bribers are confident that favors will be reciprocated corruption is higher (Lambsdorff and Cornelius, 2000). The demand-side of bribery activity has associated overregulation to increased corruption (Friedman *et al.*, 2000). Literature elsewhere suggest that unrestrained bureaucracy, the rule of law,

and political legitimacy inflate national levels of corruption (Ali and Isse, 2003). Dreher and Gassebner (2013) posit that one way to circumvent regulation is by bribing officials. This suggest that in corrupt countries, government officials can easily be bribed to perform their official duties which potentially facilitate entrepreneurial activity and firm entry into an official market in particular. Firms use the temptation of payments of bribes as a method of influence and coercion of public officials to manipulate business functions such as obtaining contracts, garnering for favorable regulatory decisions and other government or policy determinations.

An increase in the level of quality of institution (i.e. decrease in corruption) will lead to a decrease in the amount of bribes. In countries where the level of quality of institution is comparatively high, firms pay lesser bribes with high marginal return on bribe. Therefore firms are not deterred from choosing to invest in these countries. Also in countries where the level of quality of institution is relatively low, firms pay more bribes with low marginal return and thus firms are deterred from choosing to invest in these corrupt countries. Therefore there is some level of quality of institution above which the marginal return on bribery activities is high and below which the marginal return on bribery activities is low. This level of quality of institution which translates into corruption is tolerable by investors. An increase in the cost of bribe to the firm increases the probability of choosing "Not invest and not pay bribe" from the game analysis. This implies that firms are not interested in investing in countries in which the cost of bribe is so high since this will culminate in high transaction cost. At high transaction cost, corruption is high above the investment tolerable level and this support the "sand in the wheels of commerce" hypothesis. Therefore countries with levels of corruption below the tolerable level attract more investment while countries with corruption above the tolerable levels attract relatively less investments.

2.8. The Corruption Tolerable Level of Investment

FDI involves ownership and/or control of a business enterprise abroad. According to Markusen *et al.* (1995) in the domestic market of the foreign country, these foreign firms are at an inherent disadvantage. This can be attributed to the cost involved in communication and transportation in maintaining branch plants or subsidiaries in foreign countries which is not faced by domestic firms. Also language and culture difference between the home country and the foreign (host) countries inevitably generate costs for the foreign firm. Other contributing factors are that foreign firms initially do not have any close familiarity with the host country's business community, tax, laws and other government procedures and also faces risks such as exchange rate changes, expropriation, or other capricious government actions that may not of importance to domestic firms. as a result of these disadvantages, the foreign firm will enter a foreign market only if it has some compensating advantages over the local firms. Since ownership advantages of transnational corporations as well as location advantages of different countries are the key factors in determining who will become host countries for the activities of the transnational corporations, it is important to find out how corruption impact on the capacity of these transnational corporations to exploit these advantages.

Certain benefits could not be obtained without corruption (bribes) by investors. This is because corruption may be beneficial in a second best world by alleviating the distortions caused

by ill-functioning institutions. Egger and Winner (2005) seem to confirm this position by finding a positive impact of corruption on FDI. Some other authors are also of the view that corruption by government officials such as bribes acts as an irregular tax on business that increases costs and distorts incentives to invest (Shleifer and Vishny, 1993; Wei, 2000a). Corruption also create uncertainty regarding the costs of operation in the country (Kaufmann, 1997; Rose-Ackerman, 1999). The result of these increases in cost and uncertainty according to Cuervo-Cazurra (2008) is a decrease in the level of FDI coming into a country.

The "grease the wheels" hypothesis suggests that an inefficient bureaucracy create a major impediment to economic activity and so some ''grease" money may be needed to circumvent this impediment. With the "sand in the wheels of commerce" proposition, the malfunctioning of government institutions actually create impediment to economic activity. On the one hand, when corruption reduces FDI because it increases transaction costs of firms, uncertainty and production inefficiencies, corruption is described as "sand in the wheels of commerce". On the other hand, when corruption increases efficiency, winning contracts, obtaining official permits, and avoiding cumbersome bureaucratic structures, corruption is described as "greasing the wheels". Thus depending on the level of quality of institutions in the country, corruption may play the role of "sand in the wheels of commerce" or "greasing the wheels". At low level of institutional quality corruption is high and at higher level of institutional quality corruption is low. Mauro (1995) found lower investment levels to be associated with lower institutional quality.

This theory posits that at high level of institutional quality, corruption is expected to have a positive impact on FDI and at low level of institutional quality, corruption is expected to have a negative impact on FDI. At high level of institutional quality corruption goes beyond paying bribes to win contracts, obtaining official permits, and avoiding unnecessary bureaucratic delays to situations where there is malfunctioning of government institutions. The malfunctioning of government institutions affects the adoption of available technologies and the productivity of physical capital as demonstrated in the firm maximization problem and the game analysis above. This affects the returns to the firm's investments as a result of inefficiencies and high transaction cost. This implies that FDI inflow to countries with institutional quality above certain level (CTLI) increases but decreases to countries with institutional quality below this level.

Therefore, above CTLI corruption plays the role of "sand in the wheels of commerce" since the levels of corruption in these potential host countries preclude transnational corporations from exploiting their ownership as well as location advantages and thus these transnational corporations are less motivated to invest in potential host country because of high transaction cost due to corruption as explained earlier. Below CTLI corruptions play the role of "greasing the wheels" since at these levels of corruption in these potential host countries, transnational corporations are able to exploit their ownership as well as location advantages to reduce their transaction cost and this motivate these transnational corporations to invest in potential host country.

3. CONCLUSION

Both economic theory and empirical studies support the notion that FDI inflow is conducted in anticipation of profits. Economists generally agree that FDI inflows lead to an increased rate of economic growth (Blonigen, 2005). Since corruption cannot be completely eradicated, reducing it to a threshold that can be accommodated by investors must be the goal that most governments should endeavour to achieve. The model appears simple but gives an indication that there is a level of corruption that investors are likely to gain from their investments and so would not mind investing but beyond this level, the returns to the firm's investments begins to dwindle and this makes investing in that country unattractive. This means that at some level of quality of a country's institution, foreign investors are not deterred from investing in that country. This threshold is referred to as the Corruption Tolerable Level of Investment (CTLI) in this study. Corruption has become endemic in most developing countries and cannot be completely be eradicated. Therefore reducing corruption to an appreciable level must be a realistic goal for most authorities. It is recommended that further studies on this should be focused on the empirical assessment of the aptness of this theory. The Corruption Tolerable Level of Investment will not only motivate leaders in developing countries to try and control corruption in their countries to levels that will not deter FDI inflows but also serve as guide to potential investors in the choice of countries to invest. Since the game theory analysis shows that firms are not motivated to invest in countries with unnecessary bureaucratic structures, this study recommends that governments should endeavour to remove all unnecessary bureaucratic structures in their countries. This will prevent the creation of red tape by officials which will intend reduce the cost of bribe to the firm. This is because the more red tapes are created; the more opportunities are also created for more bribes to be demanded by officials. Therefore, the removal of all unnecessary bureaucratic structures will encourage foreign investors to invest in these countries.

The limitations include the assumption that the technology adopted by the investor is not subject to individual-specific shocks and also that market opportunity for the firm's product is the same in all economies.

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