UNIVERSITY OF GHANA

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ESSAYS ON FOREIGN DIRECT INVESTMENT IN SUB-SAHARAN AFRICA

BY

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DECLARATION

By submitting this thesis, I, Kwablah Edmund, hereby affirm that this work is the result of my own effort and that it has not been submitted previously for a degree either in whole or in part.

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ABSTRACT

This thesis comprises of five chapters with three empirical papers on essays on foreign direct investment (FDI) in SSA. The first empirical paper investigates the geographical determinants of FDI, while controlling for resources, market, efficiency and institutional factors in Sub-Saharan African (SSA) from 2002 to 2016. To achieve this objective, a panel data consisting of a sample of 40 SSA countries was estimated using Hausman-Taylor estimation technique. To check for the robustness of the results the sample was split into South and East, and West and Central SSA countries and further into regional and resource rich and non-resource rich countries. The estimation results indicate that the coefficient of geographical area in Km^2 is positive in the full sample and the subgroups. The coefficient of location in tropics exerts a positive and significant effect on FDI in the full sample while the coeficient of distance from the sea is negative and significant in the full sample and the West and Central SSA countries. With regard to geographical variables, regional analysis shows that the results obtained in the West and Central subgroup is influenced by countries in Central Africa and the results in the South and East subgroup is mainly propelled by countries in Southern Africa. The coefficient of market size (per capita GDP) is positive and significant in the South and East SSA countries confirming the market seeking hypothesis. For resource seeking variables, the coefficient of natural resource rent is significant in South and East African countries. In addition, the coefficient of investment in infrastructure measured by fixed telephone subscription is positive and significant in the full sample and the West and Central SSA countries. Geographical size of the country was found to attract FDI in both resource rich and resource poor countries. However, greater distance to the sea was found to limit FDI flows in resource rich countries but exert no effect in resource poor countries. The study

recommends that SSA countries should take advantage of their geographical size to come out with a common market to maximize the potential in FDI.

The second paper examines the effect of FDI and absorptive capacities on economic growth for 36 Sub-Saharan Africa (SSA) countries spanning the period 1998 to 2016.The hypothesis is that for FDI to propel growth, adequate absorptive capacities such as financial market development that accounts for fragility, and economic freedom should be present in the host country. A key point of departure from other studies is that while our financial market data accounts for market fragility, our economic freedom data also uses the overall score of all indicators of economic freedom. Using the Fully Modified Ordinary Least Squares (FMOLS) technique, the results indicate that FDI promotes economic growth in the presence of adequate host country's absorptive capacities in the full sample. However, in the absence of these absorptive capacities, FDI could retard economic growth. Moreover, FDI promotes growth in middle income and resource rich countries but hurts growth in low income countries and exert a negative but insignificant effect in resource poor countries in SSA. Thus, efforts should be geared towards the recognition and building of adequate absorptive capacities that can convert the spillover effect of FDI into tangible growth.

The third paper examines the differential effects of sector level FDI on carbon dioxide emissions in SSA from 1990 to 2016. Using system GMM estimation technique, the results show that FDI in agriculture and services reduce carbon dioxide emissions whereas FDI in industry pollutes the environment. However, the coefficients of the value added from the various sectors exert no significant effect on carbon dioxide emission. Domestic investment exerts a negative effect in the

services sector whereas financial market development exerts a positive effect in the services sector but both exert no effect in agriculture and industrial sectors. The coefficient of urbanization was found to be positive and significant in agriculture and industrial sectors. Finally, an inverted U-shaped Environmental Kuznet Curve (EKC) was found in the industrial sector while in agriculture and service a U-shaped EKC was found.

The study recommends the formulation and implementation of sound economic policies towards attracting more FDI into agriculture and service sectors so as to gain from the advantages associated with transfers of cleaner technology. Furthermore, policy makers should be more circumspect and concentrate more on revising their environmental laws regarding investments in industry.

DEDICATION

This thesis is dedicated to my wife Georgina Kwablah and my daughter Naa Dromo Yehowada Kwablah

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ADF	Augmented Dickey–Fuller test (ADF) tests
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BOD	Biochemical Oxygen Demand
BRICS	Brazil, Russia Federation, India, China
CIS	Commonwealth of Independent States
CO_2	Carbon Dioxide
CPI	Consumer Price Index
DOI	Domestic Investment
EKC	Environmental Kuznets Curve
ERP	Economic Recovery Programme
EU	The European Union
EXP	Exports
FDI	Foreign Direct Investment
FE	Fixed Effects
FGLS	Feasible Generalized Least Squares
FMD	Financial Market Developmemt
FMOLS	Fully Modified Ordinary Least Square Estimation Technique
GDP	Gross Domestic Product
GFCF	Gross (Fixed) Capital Formation
GHGs	Green House Gases
GLS	Generalized Least Squares

GMM	Generalised Method of Moment
HHC	Hadri Heteroskedasticity Conditional z-statistic
H-T	Hausman Taylor
IMP	Import
INT	Interactive Term
IPS	Im, Pesaran and Shin
LLC	Levin, Lin and Chu
M&As	Mergers and Acquisitions
MENA	Middle East and North Africa
MNCs	Multinational Companies
MNEs	Multinational Enterprises
N2O	Nitrous Oxide
NRD	Natural resource depletion
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PM	Particulate matter
PMG	Pooled Mean Group
P-P	Phillips-Perron
R&D	Research and Development
RE	Random Effects
SADC	Southern African Development Countries
SAP	Structural Adjustment programme
SIC	Schwarz Information Criterion

SO_2	Sulphur Dioxide
SSA	Sub-Saharan Africa
Sys-GMM	System GMM
UN	United Nations
UNCTAD	United Nation Conference on Trade and Development
US$	US Dollars
VECM	Vector Error Correction Model
WB	The World Bank
WDI	World Development Indicators
WLS	Weighted Least Sqquares

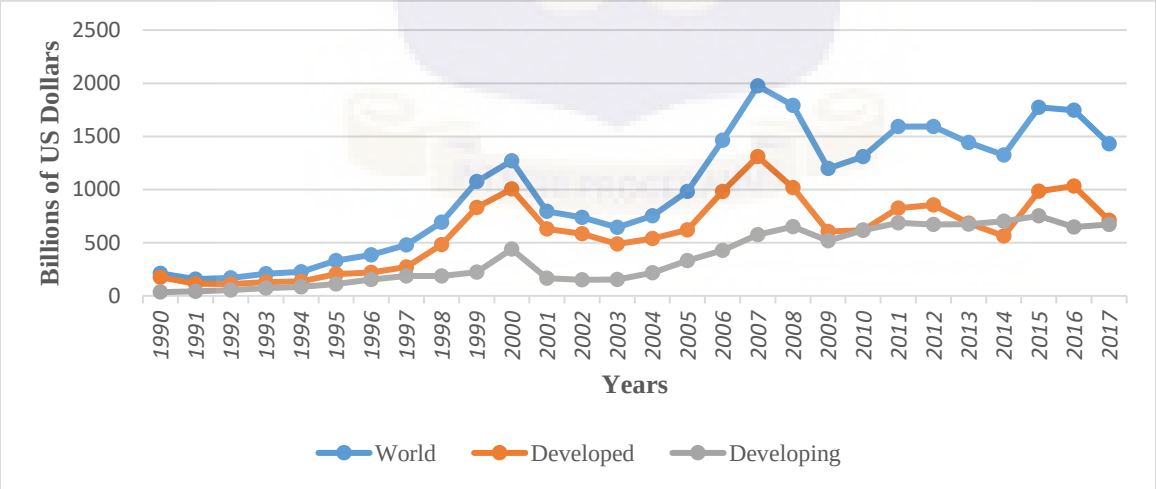
CHAPTER ONE

OVERVIEW AND INTRODUCTION OF THESIS

1.1 Introduction

Developing countries are characterized by low savings and they have limited access to the international capital market. Thus, governments in these countries have placed emphasis on foreign direct investment as a major source of development finance to address economic challenges, manifesting in the vigorous implementation of liberal and market focused policies in the 1980s to attract FDI. Consequently, FDI has increased exceeding the growth of global production and international trade (Herzer & Klasen, 2008). Figure 1.1 displays the trends in FDI inflows globally and regionally.

Figure 1.1: Trends in FDI Inflows, 1990-2017 (Billions of US Dollars)



Source: Author's Computation from UNCTAD World investment report various issues.

Globally, the flow of FDI have expanded since the mid-1980s to reach $211billion dollars in 1990. FDI continued to rise globally in every region in the 1990s reaching a peak in 2000 before taking a nose dive. Global FDI inflows continue to rise between the period 2005-2007. UNCTAD's (2009) world investment report indicates that the FDI landscape in 2008 was altered due to the economic and the financial crisis. Despite the financial crisis, global FDI inflows increased modestly in 2010 whiles global industrial production and international trade have already assumed their levels before the crisis. FDI flows in 2010 stayed below the average before the crisis and lower than their peak in 2007. Between 2010 and 2012, global FDI increased by 22 percent (UNCTAD, 2011).

The upturn in global FDI flows was vigorous in 2015 (UNCTAD, 2016). Global FDI flows rose by 34 percent between 2014 and 2015. This was largely driven by cross-border Mergers and Acquisitions (M&As) in 2014. The value of announced greenfield investments stayed at $766 billion dollars. Global FDI declined in 2016 after the strong rebound in 2015, indicating a jerky path to recovery. FDI flows declined by 2 percent between 2015-2016 amidst a fragile economic growth and policy risk, as perceived by Multinational Companies (MNCs) (UNCTAD, 2017). The fall in FDI was due to a decline in cross-border M&As. In addition, greenfield investment also dropped. GDP and trade saw a significant increase over the same period (UNCTAD, 2018).

In developed countries, the pattern of FDI inflows followed closely the global trend. FDI inflows to developed countries rose from the 1990s to attain a peak in 2000 and thereafter declined significantly in 2001. However, developed, developing and transition economies all witnesed a significant rise in FDI inflows nothwistanding the financial crisis that commenced in 2007. For

instance, in developed countries, from a mere $619 billion dollars in 2005, FDI increased to $1,310 billion dollars in 2007.

UNCTAD's (2008) report indicates that the United States continue to be the highest FDI destination.The United Kingdom is the second highest FDI destination, followed by France, Canada and the Netherlands. The European Union (EU) was the largest host region pooling close to two thirds of the aggregate FDI in developed countries. In 2008, FDI inflows declined in developed countries where the finiancial crisis began (UNCTAD, 2009). This fall was largely driven by the decline in value of sales in cross-border M&As following a five year increase which halted in 2007. Europe and Japan also experienced a fall in cross border M&A. Global transactions of values exceeding $1 billion was especially hit by the crisis. In contrast, FDI flows to developing countries and transition economies increased.

UNCTAD's (2016) report indicates that FDI flows increased in developed countries between the period 2014-2015. From a historical low level in 2014, FDI almost quadrupled in the United States. According to UNCTAD (2018) report, inflows of FDI dropped in developed economies to 712 billion dollars in 2017 from 1032 billion dollars in 2016. The sharp fall in FDI inflows in 2017 was largely influenced by the resumption to previous amounts in the United states and United Kingdom, after the downturn in 2016.

Over the period under discussion, FDI inflows to developing countries also increased to reach a peak in 2000 after which it declined in 2001. Despite the financial crisis which began in 2007, developing countries witnessed increased FDI flows. For instance in Africa, FDI inflows increased

significantly, with a 63 percent increase in West Africa over 2007. In East and South-East Asia, FDI inflows increased to attain a new record high. In West Asia, FDI flows increased for six consecutive years while in the Caribbean and Latin America, FDI inflows rose by 13 percent (UNCTAD, 2009).

UNCTAD´s (2016) report reveals that 50 percent of the largest 10 destinations of FDI are in developing countries. In developing Asia, FDI inflows rose to attain a new record of $541 billion. This was largely due to the impressive inflow to East and South Asian countries. Outflows from the region fell, the first decline since 2012. In the Caribbean and Latin America, FDI flows remained flat in 2015. In Africa, FDI flows declined in 2015. The inflow of FDI to North Africa was nullified by the declining trend in Sub-Saharan Africa particulary in West and Central SSA countries. The decline in FDI inflows was partly due to low commodity prices in countries with abundance of natural resources.

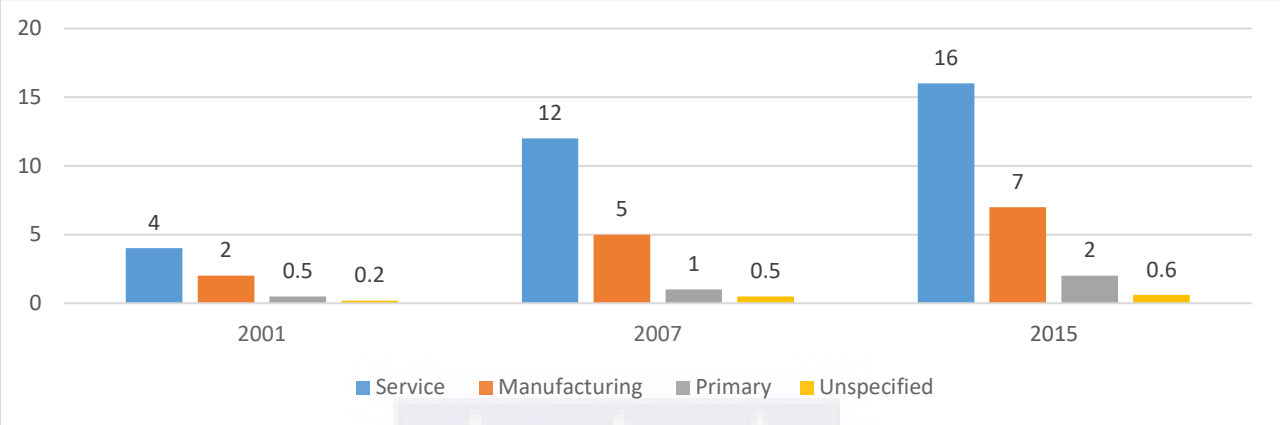
UNCTAD (2017) world investment report indicates that the persistent influx of FDI into Egypt enhanced FDI inflows to North Africa. However, low product prices have reduced economic expectations in SSA and discouraged investor interest. Inflows of FDI to Angola which is the top FDI destination in Africa declined. Despite the improvement in FDI inflows over its abysmal performance in 2015, FDI inflows to South Africa and Nigeria continued to be less than previous averages. In 2016, a number of diversified producers in East Africa recorded huge influx of FDI. For instance Ethiopia attracted more FDI than the previous years. Although, Multinational Enterprises (MNEs) from developed countries dominate investment in Africa, there are quite a number of MNEs from developing countries operating on the continent. Over the same period,

FDI outflows stayed at $18 billion dollars with larger outflows from Angola nullifying the fall in FDI to South Africa and Nigeria.

UNCTAD's (2018) report indicates that FDI flows remained stable in developing economies, unable to recover after the fall in 2016. In Africa, FDI continued to fall but remained the same in developing Asia. FDI flows to Latin America and the Caribbean increased largely driven by economic recovery in the region.

The allocation of global FDI to the various sectors has not been the same over time. From Figure 1.2 below, services industry led by finance, business activities, trade and telecommunication constitute a huge proportion of foreign investment, making 67 percent of total FDI stock (UNCTAD, 2017). For instance, the inflow of FDI to the services sector was 4 trillion in 2001 which was twice the amount received by the manufacturing sector and eight times the amount received by the primary sector. Consistent with its share in the global economy, close to 67 percent of total FDI went to the services sector in 2015. Whereas, manufacturing and the primary sector share of global FDI was 26 percent and 6 percent, respectively.

Figure 1.2: Global Inward FDI Stock by Sector, Industry and Mode of Entry (Trillion of Dollars)



Source: UNCTAD (2017)

UNCTAD (2016) world investment report reveals that, services share in global FDI stock was 64 percent, manufacturing share was 27 percent, primary sector share was 7 percent, with 2 percent unspecified in 2014. The general pattern of sectoral inward investment are parallel in developing and developed countries, however, differences in developing countries are huge. In Africa, the percentage of primary sector share in FDI was 28 percent whereas in Latin America and the Caribbean was 22 percent- over and above the 2 percent share in developing Asia, indicating the influence of extractive industries. In contrast, in developing Asia, a greater proportion of FDI went to the services sector.

Beyond the world pattern of FDI flows, several factors account for the rise in the degree and proportion of services sector FDI. The large inflow in FDI to the services sector are largely driven by increased liberalization in the host countries coupled with advancement in information and communication technology. Thus, services have become more tradable with an expansion in global

value chain resulting in the internationalization of services related to manufacturing (UNCTAD, 2015).

The trend in the flow of FDI to developing economies such as the Caribbean, Africa and Latin America have been affected largely by the breakdown in product prices. Cross-border M&As rose in 2015 particularly in manufacturing sector depicting different industrial trends in developed and developing countries. Thus, total value of cross-border M&A into the various sectors have altered drastically. Even though, total cross-border M&As to services sector rose by $95 billion dollars in 2015, it shifted towards manufacturing attracting 54 percent of the total cross-border M&As which was 41 percent in 2012, and 28 percent in 2009 (UNCTAD, 2016).

FDI as compared to other sources of external capital flows to developing countries such as remittances, portfolio investments and official development assistance is deemed the highest and the most stable (UNCTAD, 2017). According to Borenszstein et al., (1998) & Lim (2001) FDI increases capital accumulation through the introduction of new factors of production and technologies which reduce the cost of research and development in the recipient country. In addition, FDI builds the level of skills and knowledge in the host country by increasing the productive capacity of workers through training (Alfaro et al, 2004 and Ozturk, 2007). Furthermore, FDI breeds competition in the host country by summounting entry barriers and decreasing market power of existing firms. This increases production and supply of goods and services in the host country's market, thus lowering prices and consequently efficient allocation of resources (Pesoa, 2007).

The endogenous growth theory suggests that FDI can promote long-term growth effect due to the advanced technology embedded in it (De Mello, 1997). Empirically, scores of studies have investigated the effect of FDI on growth with divergent results. Some of these studies find that FDI promotes growth (see eg. Borenzstein et al., 1988; Balasubramanyam et al. 1996). Others find that FDI promotes growth contingent upon some absorptive capacities of the host country, especially where human capital is well developed beyond a certain level (Borensztein et al.,1998); where FDI and domestic capital are complements (De Mello, 1999); in cases where the country has attained a certain degree of income Blomstrom et al., 1994); the extent to which the country is open (Balasubramanyam et al., 1996; Frankel & Romer, 1999); where institutions are well developed Olofsdotter (1998). Institutions are important to growth as they create conducive investment climate for businesses to flourish. For instance, a robust financial institution facilitates capital accumulation, efficient allocation of resources, and reduction in information asymmetry as well as allowing risk sharing and portfolio diversification which spur growth. Given the underdeveloped nature of Africa's financial institutions, scores of studies have concentrated on the effect of financial market development on growth to the neglect of financial market fragility in the FDI-growth nexus. The deficiency with the financial market development indicators in these studies is that they fail to account for the robustness of the financial system to shock. Fragility of the financial system can impede the flow of funds from financial institutions to investors and consequently a reduction in investment which may hurt growth. According to Carkovic & Levine (2002) the FDI-growth link is not robust. Thus, in developing countries and SSA in particular, gaining the advantages of FDI spillover, if any, could pose more challenge than attracting FDI. Nonetheless, policies that enhance FDI to SSA could also impact directly on growth. In this regard, SSA countries are justified in implementing such policies.

Notwithstanding the benefits of FDI, host countries can become over dependent on foreign technology and this can stifle the interest of local firms to develop new technologies (Vissak & Roolaht, 2005). In addition, the introduction of advanced technology by foreign firms may lead to the forecast of demand for fewer workers than the requirements of local firms thereby aggravating the already existing unemployment situation in the host country. Also, workers with high education may migrate to other countries due to the limited research and development (R&D) opportunities in the host country (Vissak & Roolaht, 2005). Again, stiff competition beyond the carrying capacity of domestic firms leads inevitably to their collapse (Ram & Zhang, 2002). Mencinger (2003) also indicates that FDI affects imports more than exports which influences the balance of payments negatively. Moreover, large and unpredicted FDI flows could also result in increase in inflation, destabilize economic growth and adversely impact on excecution of economic policies (Vissak & Roolaht, 2005).

The impact of FDI on the environment in developing countries has also generated intense debate over the past few decades leading to scores of studies examining the effect of FDI on the environment (Kivyiro & Arminen, 2014; Shahbaz et al., 2015; Keho, 2016). Various theories have been proposed to support the relationship between FDI and the environment. For instance, the pollution haven hypothesis argues that host countries attract profit driven foreign firms escaping the cost of stringent environmental regulations at home leading to pollution in the host country. This is because the cost of meeting environmental standards in developing countries is relatively lower than what prevails in developed countries. In contrast, the pollution halo hypothesis argues that foreign firms tend to extend their greener technology to the host country thereby improving environmental quality in the host country. However, empirical studies examining the effect of FDI

on pollution have generated divergent results. Some studies find evidence in support of the pollution haven hypothesis (Cole & Elliot, 2005; Shahbaz et al., 2015), while others find evidence in favour of the pollution halo effect hypothesis (Eskeland & Harrison, 2003; Tamazian et al., 2009; Asghari, 2013). The lack of consensus on the empirical front could be attributed to the choice of variables, methodologies, time frame and various proxies.

The limitation with existing studies on the effect of FDI on the environment is the use of composite FDI instead of FDI by sector. The use of composite FDI could conceal the sectoral effect of FDI on carbon dioxide emission and consequently leading to errorneous sector-specific policy recommendations.

1.2 Statement of the Problem

With the advent of globalization, the critical role of FDI in promoting growth and development agenda has become even more imperative in developing countries and especially SSA. Hence, the need to use incentives to attract FDI to augment scant domestic resources. Consequently, many countries across the globe embarked on various reforms in the 1980s leading to significant inflows of FDI into almost every region of the world (Ozturk, 2007).

However, despite these reforms, Africa receives barely 3-5 % of the total global FDI, SSA accounts for 3% of global flows, whereas developing countries of Asia received 25% of the total FDI flows (Darley, 2012). Asiedu (2004) attributed the low inflows of FDI to SSA to the fact that reform has been ordinary relative to reforms implemented in other developing economies. Onyeiwu & Shrestha (2004) and Okafor (2015) also indicate that low flows of FDI is due to lack of economic freedom, macroeconomic and political instability which deter FDI.

The problem is that despite the rising attention and scores of studies on the determinants of FDI into SSA, specific geographical factors affecting FDI have not been given the needed attention. Geographical factors are country-distinct features that act as incentive to attract FDI inflows (Ogun et. al., 2018). The Eclectic theory suggests that FDI occurs due to ownership, location and internalization advantages (Dunning, 1993). However, empirical studies investigating the locational determinants of FDI in SSA have focused on resource seeking, efficiency seeking, market seeking and assets seeking (Asiedu, 2006; Cleeve, 2012; Okafor et al., 2017) to the neglect of specific geographic factors such as geographical size of a country, percentage of land located within the tropics and mean distance from the sea in SSA. Asiedu (2002) indicates that SSA countries have received less FDI by virtue of their geographical location.

Indeed, geography does matter due to the growing significance of spatial dynamics in economic growth and development in literature. Geographical factors may affect economic growth and can influence policy and the convergence of incomes across countries. Moreover, it determines climatic conditions, resource endowments, health and agricultural productivity. Geography may also affect the transportation cost and consequently the decision of foreign firms.

There are various channels through which transport cost and geographic friction can affect the decision of foreign firms. For instance, high transportation cost may encourage firms to duplicate production across countries known as horizontal FDI. In contrast, low transportation cost will encourage firms to take advantage of cross-country cost differentials to participate in vertical or complex FDI strategies where trade and FDI complement each other.

The cost of transferring goods and information influences firms' decisions to geographically separate production tasks or locate next to each other. Large scale economies derived from geographic proximity of individuals or firms in achieving product and factor market externalities and technology transfer could play a critical role in multinational production as foreign firms account for majority of trade and technology flow. Foreign firms usually incur high transport cost in obtaining their intermediate inputs and reaching buyers. Thus, low transportation cost could aid foreign firms as they source for goods, tasks and ideas from each other.

Second, it has been argued that for FDI to translate into growth, there must be adequate absorptive capacities in the host country. Prominent amongst host country's absorptive capacities are institutions. Financial market development and economic freedom have been identified in literature as key institutions in the host country that can enhance FDI's spillover effect on growth. Since foreign firms are risk averse, the presence of weak institutions which is an indication of weak absorptive capacity may deter foreign investment and adversely affect growth. Conversely, the existence of strong institutions would create a favorable market structure and increase foreign investment, output and ultimately growth.

For instance, a robust financial system mobilizes funds for investment, screens investment projects, influences credit rationing and determines the extent to which foreign firms can borrow to expand their innovative activities in the host country. Given the fact that African's financial sector is considered underdeveloped, a lot more of the focus of the literature has been on financial development and its relationship with FDI and growth (Ghirmay, 2004; Kargbo & Adamu, 2009;

Esso, 2010; Sghaier & Abida, 2013). However, there is rising concerns that financial fragility has implications for FDI and growth.

Financial fragility occurs when financial agents such as banks take on too many illiquid liabilities relative to the liquidity of their assets. Essentially, financial fragility arises due to assets – liability mismatch. The financial system can be described as fragile when banks are unsound or financial markets are unstable or both. Financial fragility can lead to liquidity constraints and this can affect the amount of loans banks can offer to borrowers to finance their investment projects. When liquidity constraints are heightened due to fragility in the financial system, borrowers are forced to cut back on their investment spending which result in a fall in output. Consequently, financial fragility can grind down the ability of banks to lend to productive investments which will have adverse effect on growth.

Notwithstanding the critical role of financial institutions, previous studies (Durham, 2004; Alfaro et al., 2004) have not sought to measure the degree financial fragility in examining the FDI-growth relationship. Measuring the growth effect of financial fragility may help appreciate the degree to which the weakening or reversal of the FDI-growth relationship can be attributed to financial fragility.

Third, concerns have been raised regarding the adverse effect of FDI on the environment in developing countries. It has been argued that in the absence of adequate absorptive capacities, developing countries tend to relax their environmental regulations to attract FDI (Hoffmann et al., 2005). However, the economic growth generated by FDI comes at the expense of the environment

in the form of greenhouse gas emissions (GHGs), deforestation and loss of biodiversity (Mabey & McNally, 1999). Olivier and Peters (2018) indicated that China, India, Japan, Russia, America and the European Union emits 63% of GHGs globally. Although, SSA is the most vulnerable region to the impacts of climate change, it contributes the least in terms of greenhouse gas (GHG) emissions such as carbon dioxide, the principal GHG responsible for global warming (Stern et al., 1996). Climate data for Africa for the last 30 to 40 years shows that if the current trend continues, by 2050, SSA will be warmer by 0.5 to 2 C°, and drier, with 10% less rainfall and water loss exacerbated by higher evaporation (Nyong, 2005).

Notwithstanding the adverse effect of FDI on the environment there is paucity of literature on developing countries. According to Chen et al. (2015) any impact assessment of FDI is contingent on the sectoral characteristics of investment. However, previous studies did not account for the sectoral composition of FDI when analyzing the impact of FDI in SSA. Few studies (Alfaro, 2003; Nunnenkamp & Spatz, 2004) have analyzed the effect of sectoral FDI on growth in developing countries but little attention had been paid to the sectoral effect of FDI on the environment in SSA. For instance, studies that examined the effect of FDI on carbon dioxide have used composite FDI instead of FDI by sector (Blanco et al., 2011; Asghari, 2013; Kivyiro & Arminen, 2014). The deficiency with these studies is that the use of composite FDI could mask the sectoral effect of FDI on carbon dioxide.

Three key research questions emerge from the above discussion

(i)What are the effects of geographical factors on FDI in SSA?

(ii) What are the effects of financial market fragility and economic freedom in the FDI-growth link in SSA?

(iii) What is the impact of sectoral FDI on carbon dioxide emissions in SSA?

(iv) Does the EKC exist in the case of FDI and carbon dioxide emission in SSA?

1.3 The Research Objectives

To address the questions raised above, the objectives are to explore the geographical factors that affect FDI flows to SSA countries and examine the implications of FDI on growth and the environment in SSA. Specifically the study seeks:

i. To examine the impact of geography on FDI in SSA.
ii. To examine the growth impact of FDI contingent on absorptive capacities in SSA.
iii. To determine the impact of sectoral FDI inflows on sectoral carbon dioxide emission in SSA.
iv. To test the existence of the EKC in SSA.

1.4 Structure of the Dissertation

This study is organized into five main chapters. The summary of the remaining four chapters is as follows: Chapter Two investigates Geographical Determinants of FDI into SSA. To answer objective (i), the Hausman-Taylor technique was used to examine the geographical factors driving FDI in SSA from 2002 to 2016. Chapter Three looks at Foreign Direct Investment, Absorptive Capacity and Economic Growth: Evidence from SSA. In line with objective (ii), the Panel Fully

Modified Ordinary Least Squares (FMOLS) estimation technique was followed to examine the role of absorptive capacities in the FDI-Growth Nexus in SSA from 1998 to 2016. Chapter Four examines Foreign Direct Investment, Gross Domestic Product and Carbon Dioxide Emission in SSA: A Disaggregated Analysis. To attain objective (iii), the system GMM estimation technique was followed to assess the linkage between Foreign Direct Investment, Gross Domestic product and Carbon Dioxide emission in SSA from 1990 to 2016. Chapter five summarizes the major findings and offer policy prescriptions.

1.5 Chapter Summary and Conclusions

Chapter one presents the overview and the introduction by providing the statement of the problem, research objectives and the structure of the dissertation. This chapter focusses on the global distribution of FDI and offers explanations regarding the varying patterns in global FDI flows, the likely reasons behind the flows and its implication on growth and the environment. Next, the pertinent research questions were raised and the problem formulated. The main objective is to determine how geographical factors affect FDI inflows, and to empirically examine how FDI affect growth and the environment in SSA. This was followed by the structure of the dissertation.

CHAPTER TWO

GEOGRAPHICAL DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN SUB-SAHARAN AFRICA

2.1 Introduction

The increase in globalization over the past two decades had resulted in the buildup of trade and foreign direct investment stimulating enormous research into MNE's location strategies and FDI determinants (Faeth, 2006; Mohamed & Sidolopolous, 2010). In Africa, existing studies on the determinants of FDI show that trade liberalization policies, market size, natural resource endowment and conducive investment climate are potential drivers of FDI (Morisset, 2000; Asiedu, 2002; Naudé & Krugell, 2007). However, trade liberalization may enhance FDI flows to non-Africa countries by reason of their geographical location (Asiedu, 2002).

Generally, the flow of FDI into developing economies and especially SSA is expected to promote growth and development by augmenting domestic investment, boost innovation via technological tranfer, develop human capital by the transfer of managerial skills, increase output by triggering competition in the host country, generate employment and increase economies of scale by intergrating the domestic economy into international production (De Mello, 1999; Asiedu, 2002; Chowdhury & Mavrotas, 2003; Mohamed & Sidiropoulos, 2010 ; Lee, 2013 and Omri & Kahouli, 2014).

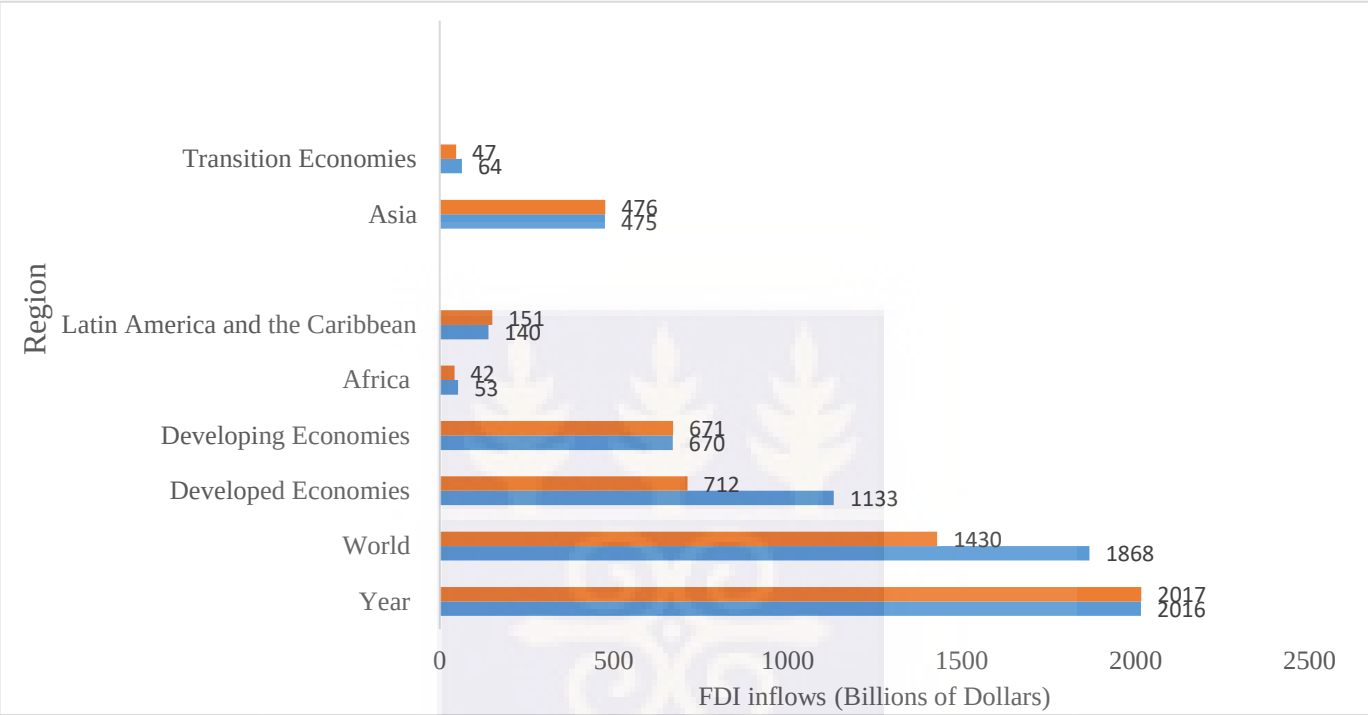
Undoubtedly, the critical role of FDI as a potential source of external finance has become imperative to SSA due to their low domestic savings and incomes(Asiedu, 2002). In addition, their

access to international capital market is limited. Thus, external finance is required to augment scant domestic savings to increase investment and growth (Asiedu, 2002; Mohamed & Sidolopolous, 2010).

Due to the potential embedded in FDI, several countries have made efforts in the past few decades to upgrade their business climate in order to attract FDI. Consequently, there has been significant flows of FDI into every region of the world during the1980s and the 1990s (Ozturk, 2007). According to the United Nation Conference on Trade and Development UNCTAD (2018) report, global FDI increased from 0.49 as percentage of GDP in 1980 to 0.89 in 1990 and dropped to 2.10 in 2010 after reaching a peak of 4.06 in 2000 (see UNCTAD, 2018). For Sub-Saharan Africa (SSA), FDI rose from 0.09 in 1980 to 1.05 in 1990, 1.89 in 2000, and 2.31 in 2010 (see World Bank, 2018). The influx of FDI flows in the 1990s to developing countries show that foreign firms regard these host countries as lucrative investment destinations.

Notwithstanding the rise in global FDI inflows, Africa still remains the lowest recipient of FDI(see Figure 2.1).

Figure 2.1: Current Foreign Direct Investment Trends by Geography (2016-2017).



Source: UNCTAD (2018)

Figure 2.1 shows that global FDI flows to Africa in 2016 is $53 billion dollars constituting only 2.8 % of the global FDI inflows of $1868 billion dollars. In 2017, the inflows to Africa is $42 billion dollars which is only 2.9 % of the global total of $1430 billion dollars. Relative to other developing countries such as the Caribbean and Latin America, Asia and transition economies, FDI flows to Africa is the lowest. FDI in Africa is also relatively diverse with few countries attracting large shares of total global FDI inflows. For example, close to 70% of total FDI into Africa went to only five countries: Libya, Egypt, Angola, the Democratic Republic of Congo and Nigeria (UNCTAD, 2011). According to UNCTAD (2018) report, the two major recipients of FDI in SSA are South Africa ($7.4 billion) and Angola ($1.6 billion). Nigeria received $1.3 billion with Morocco and Togo receiving $1.0 and $0.3 billion respectively.

The inability of African countries to attract substantial amount of FDI to the region raises the following questions. What factors drive FDI inflows into SSA? Existing empirical studies on the factors that affect FDI inflows have failed to offer adequate explanation for the abysmal performance of SSA countries in attracting FDI. Asiedu (2004) argue that the mediocre reforms implemented in SSA compared to reforms in other developing countries is the reason why SSA attracts low FDI inflows. Onyeiwu & Shrestha (2004) and Okafor (2015) attribute low FDI inflows to lack of economic freedom, macroeconomic and political instability in SSA. However, empirical research on how geographical factors affect FDI in SSA has not been given the needed attention. Studies that examine the determinants of FDI in SSA have almost exclusively concentrated on asset seeking, efficiency seeking, resource seeking, market seeking and institutional factors, paying no attention to geographical factors.

Geography is vital in that it affects economic growth and can impact on economic policy and on the convergence of economic growth across countries. Furthermore, it is the main determinant of climatic factors (precipitation, temperature, relative humidity etc.), natural resource endowments, cost of transportation, diffusion of new technology and disease burden (Gulup et al., 1999). In addition, it may impact directly on health and agricultural output and indirectly influence economic growth through distance and the quality of institutions. Therefore, geographical factors might not only impact growth but may affect FDI as well (Naudé & Krugell, 2007).

Thus, the objective of this paper is to assess how geographical factors can affect FDI inflows into SSA. The point of departure of the present study from existing studies is that it incorporates geographical factors in examining the determinants of FDI. Gaining insight into how geographical

factors affect FDI will help SSA policy makers to put in place appropriate measures that will help trigger FDI inflows into SSA.The remaining sections of the chapter is organized as follows. Sections 2.2 discussess pertinent literature on the topic and section 2.3 presents the methodology whiles section 2.4 focuses on results and discussion. Conclusion and policy recommendations are highlighted in section 2.5.

2.2 Literature Review

2.2.1 Theoretical Literature on the Determinants of FDI

Theories of FDI based on perfect competition

Quite a number of studies have examined the determinants of FDI and have employed various theories to support their assertion. For instance, MacDougall (1958) presented the first theory of FDI based on the assumptions of a perfect market. The theory suggests that when there is free movement of capital from a home to the host country, the marginal productivity of capital between the two countries is equalized. In addition, after investment of the foreign firm in the host country, the output of the foreign firm tend to decline without any fall in the national income of the country. Traditional theories of FDI that assume perfect competition attribute FDI flows to interest rate differentials across countries. These theories suggest that FDI moves across international boundaries due to exchange risk, low cost of labour and higher returns on investment. However, Kindleberger (1969) argued that FDI would not occur in a world of perfectly competitive market. Thus, there is the need for market imperfections for FDI to occur.

Theories of FDI based on imperfect competition

Other theories have emerged that explain FDI with regard to increase in foreign firms based on market imperfections- monopolistic advantage and oligopolistic interdependence. For instance, Hymer (1976) proposed the industrial organization theory of FDI based on market imperfections to explain international production. The crux of the theory is that foreign firms have to compete with local firms which have legal, cultural and language advantages over foreign firms. Moreover, foreign firms are vulnerable to foreign exchange risk. For foreign firms to make profit in the host country, these disadvantages must be neutralized by some form of market power which stems from firm specific advantages or monopolistic advantages such as innovative products, patent right, advanced technology, managerial skills, economies of large scale production and access to cheaper sources of finance. Hymer (1976) identified advanced technology as the most critical because it enhances the production of new products with unique characteristics. Furthermore, the superior knowledge that foreign firms possess can assist in development of additional competencies to enhance production and marketing of products. The theory suggests that advantages are transferred from one location to another location regardless of whether these firms are in one country or in a number of countries.

Foreign firms are able to exploit the imperfections in the market to earn high profits by investing abroad due to firm specific advantages they have over local firms. However, it has been argued that though foreign firms may have inherent specific advantages, it does not necessarily mean they should engage in investment abroad as firms can as well enjoy the same advantages through exporting or licensing. Factors such as host country's policy, market size and conditions in the host country, riskiness of investment and reaction of rival firms can influence the choice between

FDI and exporting or licensing. The deficiency of Hymer's theory is that it fails to offer adequate explanation regarding where and when FDI takes place.

The work of Hymer (1969) was extended by Kindleberger (1969) who suggested that the advantages enjoyed by MNEs could be realized only in the presence of market imperfection. The theory postulates that (MNEs) possess relative monopolistic power abroad against the local competitive firms. The firm enjoys a monopolistic advantage due to their possession of superior knowledge (i.e intellectual capital plus advanced technology that confer a competitive advantage) and economies of scale. Thus, for MNEs to be competitive abroad, they must possess ownership advantages such as patents rights, managerial skills and innovative products (Dunning, 1993). Consequently, these advantages motivate foreign firms to invest abroad to earn higher returns rather than splitting profits with potential rival firms in the foreign market. The higher the probability that firms will make monopoly profits, the greater the motivation to invest abroad. Notwithstanding the numerous advantages foreign firms have over local firms, Kindleberger's theory fails to account for the specific advantage foreign firms should concentrate on. Secondly, foreign firms can only maximize the monopolistic power abroad subject to policies in the host country.

Knickerbocker (1973) also proposed the theory of FDI based on the interplay of oligopolistic power. In addition to the argument in economic literature that FDI occurs due to large markets and relatively abundant factors in the host country, this theory suggests that FDI occurs mainly to match a rival's move. Thus, FDI flow is an indication of the existence of strategic competition between firms in the international market in response to the entry of rival firms in certain markets.

Hence, foreign firms often imitate rivals by following the entry of rivals to new markets to ensure that they do not gain monopoly in those markets. As a result, they secure a significant share and control of the international market through vertical FDI where each stage of the production process is achieved in different geographical regions. Therefore, oligopoly theory clarifies the defensive conduct of foreign firms. However, the weakness of the theory lies in the assumption that there is uncertainty regarding cost in the host country because risk averse oligopolistic firms will set up a subsidiary abroad contingent on the presence of rival firms. Under conditions of uncertainty, however, the motivation to set up a subsidiary abroad declines with the presence of rivals in the same location. Another deficiency with the theory is that it fails to account for the motivation of the first firm to undertake international production.

Buckley & Casson (1976) first propounded the internalization theory based on market imperfections. The theory assumes that (i) foreign firms can increase the level of profits in an imperfect market (ii) foreign firms are motivated to create internal markets where there are imperfections in the market for intermediate products (ii) foreign firms emanate from internalization of markets across the globe. The theory explains FDI by stressing the importance of technology and intermediate inputs and examines industry and firm level determinants of FDI rather than country-specific determinants of FDI.

Due to the difficulty of a foreign firm to transfer a new technology or process to dissimilar firms that might find transaction cost to be high, they use the output of one subsidiary as an input in the production process of the other. Thus, internalization of operations in different locations give rise to FDI. Therefore, the internalization theory argues that MNEs can produce and sell through the

network of its subsidiary. The theory recognized a number of market imperfections that may stem from internalization:(i) The time lag involved in the co-ordination of resources (ii) Firms may have to resort to discriminatory pricing in order to exploit market power (iii) Unpredictable trading conditions are generated in the case of bilateral monopoly (iv) It is difficult for consumers to rightly evaluate the prices of goods (iii) Transfer pricing may occur in the face of excessive government involvement on international market. Though the theory identifies the danger regarding excessive government involvement, it did not factor in how these may differ across industries.

According to Buckley (1998), the internalization approach to the modern theory of MNEs rests on the assumption that, firms choose the least cost location and expand by taking over markets to the extent that the advantages of internalization exceed cost. The act of internalizing a market is undertaken to increase profit and as a strategic move confers an advantage on internalizing firm and by definition disadvantages others. The theory suggests that firms initially attempt to establish a competitive edge at home and extends their tentacles to foreign markets through export.

Dunning (1998) suggested the Eclectic theory which is a comprehensive logical approach for examining FDI and issues relating to the organization of foreign firms. Dunning theory suggests that foreign investment is profitable provided they possess ownership (O), location (L) and internalization (I) advantages. Thus, the Dunning eclectic paradigm is also called the OLI paradigm. The theory suggests that foreign firms initially build competitive advantage at home after which they relocate to specific countries abroad based on (L) advantages via FDI, which permits foreign firms to internalize (O) advantages. While the Eclectic paradigm is a more comprehensive approach, the internalization theory only seeks to justify the choice of entry mode.

The Eclectic theory brings together a variety of complementary theories, which identify a number of variables (ownership, location and internalization) which affect the location strategy of foreign firms (Dunning and Lundan, 2008). According to Ietto-Gillies (2005), the same logical framework encompasses the three main modes of internationalization namely: FDI, exports, and licensing.

The limitation with this theory is that each of the three motives is overdetermined. For instance, the (O) advantages include not only tangible assets such as natural resources, labour force, capital, the cultural, legal, institutional environment; and industry market structure) but also intangible assets such as information, organizational structure, managerial and entrepreneurial skills, brand awareness. Undoubtedly, the tangible assets can easily be analysed as country's factors.

Likewise, the theory has a wide-ranging meaning of location (L) advantages. Location advantages are mainly host country's characteristics such as factor endowments, market size, infrastructure, education system and institutions. Since foreign firms can obtain shelter type (O) advantages by governments through lobbying, it becomes difficult to distinguish between (L) and (O) advantages. For instance a foreign firm granted access to natural resources (gold, oil, mineral and forest) implies the host country's location (L) advantage is converted into (O) advantage. In the same vein, there is a strong link between (I) and (O) advantages. Undeniably, in the absence of institutional form of MNE it becomes problematic to decipher how (O) advantages could exist independently without being owned (internalized) by the firm.

Vernon (1966) also propounded the product life cycle theory to explain FDI and trade. The product life cycle postulates that firms initially commence production at home for the domestic market.

Overtime as the product matures and foreign demand increases, the firm establishes subsidiaries in other countries where production cost is relatively low to supply the host country and export the rest back home.

Theories of FDI based on institutions

Following the increased recognition of the critical role of institutions in a dynamic global market, researchers of international trade (Meyer & Nguyen, 2005) have incorporated institutional factors into Dunning's OLI paradigm to determine the location strategies of firms. Theoretically, institution denotes the set of rules, which govern political, social and economic relations between numerous economic agents in search for their interest and benefits (North, 1990; Scoth, 1995). North (1990) classified institutions into formal (regime type) and informal (traditional). The formal institutions comprises judicial independence, property rights, labour laws and trade restrictions. The informal institutions consist of the social structure of individuals networks, social values, ethics, corruption and political choices. Institutions determine the location strategy of firms as they affect the transactions cost, labour productivity and return on investment. Robust institutions help firms to acquire information needed to cope with market risks and to improve product quality and production process. However, the performance of firms is grossly affected by weak institutions characterized by corruption and abuse of property rights.

Theories of FDI based on international trade

Increased global FDI inflows and the growth in the output of foreign firms have altered the form of international trade to a greater magnitude, making FDI more important than international trade. Consequently, several efforts have been made to incorporate the theory of FDI into international

trade theory. Traditional trade theories offered the basic explanation regarding trade amongst nations. The traditional theory of trade is based on the assumptions of constant returns to scale and perfect competition. For instance the comparative advantage theory suggests that countries should specialize in the production of goods in which they have comparative advantage and exchange with goods in which they have comparative disadvantage. The theory of comparative advantage uses the country as its basic unit of analysis. However, traditional theory does not fully explain observed trade patterns.

The New Trade Theory

The new trade theory (NTT) identifies industries as a unit of analysis rather than countries as basic unit of trade. The basic features of the NTT are increasing returns to scale and monopolistic competition among firms using identical production technologies. The NTT explains trade patterns and gains from trade by focusing on intraindustry trade (exchange of similar products belonging to the same industry) but not on comparative advantage. Intraindustry trade refers to international trade where the same types of goods or services are both imported or exported. The NTT emphasized the need for free trade indicating extra benefits such as the increase in efficiency from large scale production and making a variety of goods available for consumers.

Krugman (1980) identified the home market effect as an important common feature of the NTT based on trade cost. He argued that larger countries tend to be exporters of a product because larger markets attract firms to locate there by assuming a monopolistically competitive sector producing differentiated products, subject to transportation costs in trade. Monopolistic competition implies that firms are often competing on branding, quality and not just price. Krugman (1980) argued that

increasing returns provides an incentive to concentrate production of any one product in a single location; given this incentive to concentrate, transport costs are minimized by choosing a location close to the largest market, and this location then exports to other markets.

The New New Trade Theory

The New New Trade Theory (NNTT) of Melitz (2003), extends the analysis of Krugman's 1980 theory from industries to firms assuming monopolistic competition and increasing returns to scale but introduced differences in firms' characteristics within industries, especially with regard to productivity. In this environment, increased trade forces the least efficient firms out of the market and generates within industry reallocations of resources from low productivity to high productivity firms. These models also shed light on firm level innovation responses to trade liberalization and spillovers from interactions in foreign markets.

2.2.2 Empirical Literature On The Determinants Of FDI

A plethora of studies have been carried out to determine which variables best explain the investment of foreign firms in host countries. The findings can be grouped broadly into three: First, is the location aspect of the OLI paradigm (production cost, human capital, infrastructure and economic stability); Second, the institutional approach (corruption, rule of law, political instability and financial and fiscal incentives); and finally, the New Trade Theory (factor endowments, openness, market size and market growth). These factors either deter or attract FDI. However, some studies have found inconclusive results with regard to these factors.

Geographical Location

Geographical location is critical in that it affects economic growth and can have effect on policy and the convergence of incomes across countries. In addition, geography determines precipitation, temperature, humidity, natural resource endowment and disease burden. Thus, geography can directly affect health and productivity and indirectly affect economic growth. Masters and McMillan (2001) indicate that countries found in temperate climatic zones tend to have converging income levels, contingent only on their policy preferences, while in tropical countries, mostly in Africa, convergence is determined by their ability to achieve economies of scale via larger urban agglomeration, more identical populations and greater integration into the global economy.

According to Gallup et al. (1999), most countries in the tropics are poor and that poverty is widespread in landlocked countries than in coastal countries. Countries in Africa are particularly disadvantaged on all these measures. For example, a greater percentage of land is located in the tropics, and its population is highly concentrated in the interior with more than 25 percent of the inhabitants residing in landlocked countries. Furthermore, most African countries, are distant from closest core markets in Europe which contribute to high transport cost and cost of doing business which negatively impacts on exports (Gallup et al., 1999).

Geographical Size

Existing studies have also examined the effect of land area or geographical size of a country on FDI inflows. For instance, Bartik (1985) examines how land area can influence the number of loations of firms in the United States of America. The author reveals that land area promotes the flow of FDI in the United States of America. In a study of foreign-owned branch plants, Coughlin

et al. (1991) find that land area attracts FDI, but that the elasticity was less than one. Using modified count data, List (2001) also examines how county-level features affects firm location in the United States of America. The results indicate that past counts of FDI, market size and access, and geographical size of the land are influential in attracting FDI. Woodward (1992) also examines factors that accounts for the location of Japanese manufacturing firms in the United States. By using count data, the results suggest that past counts of FDI, market size and access promotes FDI flow, while higher wage rates and strict environmental laws limit FDI flow.

Access to Sea

With regard to international trade, access to the sea is essential due to the realtively cheaper ocean cost of transporting goods and factors of production across countries. Closeness to sea is critical even within the same country as pertains to Japanese investment clusters in the China coastal provinces (Kawai, 2009). Particularly in poor countries, with inadequate road and rail infrastructure, access to sea is important because land transport costs are much higher than shipping by sea. According to Hausmann (2001) and Limao & Venables (2001), the cost of transporting goods over one extra kilometre of land is equivalent to shipping them over seven additional kilometres on sea. Furthermore, shipping is ideal for low value added and large items which constitutes a greater proportion of most economic activity in developing countries. Thus, long distance from the ports and sea in developing countries may diminish their attractiveness for efficiency-seeking FDI and render them less attractive for export-oriented FDI.

Human Capital

Previous studies indicate that human capital is a critical factor which affect FDI particularly in sectors that employ skilled labour since education increases productivity and enhances technological innovation (Ahmad & Malik, 2009). Thus, the expectation is that human capital should attract FDI. However, the results are divergent. Some studies have found that human capital attracts FDI and some have found inconclusive results.

Empirically, Cleeve (2008) examines the effect of education on FDI for 16 SSA countries from 1990 to 2000. The study employs secondary school education index as a measure of human capital. The measure indicates the proportion of secondary school pupils in the total population but fails to accounts for total stock of human capital. Thus, he used adult illiteracy as an indicator of the educated work force and skill level of the population. The author did not find any conclusive results due to less variability in the illiteracy rates in the samples from the various countries. In contrast, Asiedu (2006) finds that the percentage of adults literacy in a sample drawn from 22 SSA countries exert a positive effect on FDI. In a recent analysis of 30 African countries, Kinda (2018) using firm-level data from services and manufacturing sectors reveals that human capital attracts FDI.

Infrastructure

The extent to which infrastructure is developed as well as its reliability and availability raises the efficiency of investment and thus attracts FDI (Asiedu, 2002, Asiedu, 2006, Vijayakumar et al., 2010; Makoni, 2017). Several proxies such as rail networks, constant water and power supply, the number of sea and international airports and the availability of telephone main lines have been used to measure infrastructural development. The conclusions drawn from the various studies are

not unanimous. Some authors find that infrastructure attracts FDI since it raises the efficiency of production (Vijayakumar et al., 2010 ; Makoni, 2017). However, Mohamed &Sidiropoulos (2010) find no evidence that infrastructure enhances the flow of FDI. This is attributed to the fact that the study employed a small sample consisting of countries with similar characteristics. In a related study, Botrić & Škuflić (2006) used internet connections as an indicator and reveal that infrastructure limits FDI flow. The authors attributed this to internet usage which became widespread in these countries after 2000. However, Kinda (2010) argues that the negative relationship between poor infrastructure and FDI is the result of high transactions cost and operational challenges faced by MNEs operating abroad.

Economic and Financial Stability

An economy with steady financial and economic conditions suggest that prices are generally stable. Thus, a country having all these features is likely to attract FDI inflows (De Mello, 1997; Cleeve, 2008). Several proxies have been used in the literature to gauge economic and financial stability such as the inflation rate, exchange rate and interest rate. The inflation rate is commonly used to measure price stability. Thus, unstable inflation rates are indicators of macroeconomic instability and could deter FDI (Botrić &Škuflić, 2006; Demirhan & Masca, 2008; Majeed & Ahmad, 2009). For instance, using a panel analysis of 72 developing countries from 1970 to 2008, Majeed & Ahmad (2009) examine how the characteristics of the host country can affect FDI flows. By using the (GMM) estimation technique, the authors reveal that inflation, military expenditures, real exchange rate and balance of payments limit FDI flows.

In a panel analysis of 36 developing countries drawn from 12 MENA countries and 24 major destinations of FDI, Mohamed & Sidiropoulos (2010) also examine the influential factors that affect FDI using fixed effect estimation technique. The authors reveal that the effect of inflation on FDI is negative. Asiedu (2006) also finds that inflation deters FDI in a panel of 22 SSA countries. Inflation creates macroeconomic instability and it is a source of risk for foreign firms. However, Vijayakumar et al. (2010) for BRICS and Mhlanga et al. (2010) for South Africa Developing Countries (SADC) and find that inflation exerts no significant effect on FDI.

Scores of theoretical studies have also examined the mechanisms via which exchange rate affect FDI (Froot & Stein, 1991; Campa, 1993). The conclusion derived from these studies is that, depreciation of the host country's currency attracts FDI while appreciation deters FDI. According to Froot & Stein (1991), the depreciation of host country's currency renders their assets relatively cheaper causing foreign investors to acquire more assets in the host country. Again, where the motive for investment is for re-export to home market, depreciation might reduce the cost of production in the host country thereby increasing the wealth of foreign investors. However, where investment is for sale in the host country, depreciation of the host country's currency might erode the purchasing power of consumers and decrease their return to investment overtime.

In contrast, Campa (1993) contends that the expected future returns on investment dominates the decision of foreign firms to invest in other countries. Thus, when the host country's currency appreciates, the expected future returns from investing abroad is likely to be high. Hence, if host country's currency appreciates, it might lead to increase inflow of FDI in that country.

Empirically, a plethora of studies have examine how FDI is affected by the exchange rate with divergent results. For instance, in China,Yuqin (2006) investigates the effect of exchange rate on FDI from 1981 to 2002. The author demonstrates that real exchange rate affect the flow of FDI from Japan to China. Consequently, when the value of the Yuan falls, it increases FDI flows from Japan to China. Ellahi (2011) also investigates how FDI flows is affected by exchange rate and exchange rate volatility in Paskistan from 1980 to 2010. Using ARDL, VECM and Granger Causality test, the author indicates that in the short run, volatility of the exchange rate limits FDI inflows but promotes the flow of FDI in the long run.

Ahmad & Malik (2009) explore the effect of exchange rate on FDI in developing countries. Results from the study indicates that real exchange rate depreciation deters FDI. This implies that the host country's currency depreciation reduces production cost and relative prices. Thus, foreign firms might prefer host countries as production points rather than targets for export. Alaba (2003) also examines the effect of FDI on exchange rate and finds that parallel market exchange rate is a major driver of FDI in Nigeria. Osinubi & Amaghionyeodiwe (2009) also determine exchange rate effect on FDI from 1970 to 2004 in Nigeria. By using OLS estimation technique, the authors reveal that exchange rate promotes FDI flows. The result indicates that the depreciation of the Naira increases FDI inflows. In a related study, Tokunbo & Lloyd (2009) investigate the effect of exchange rate on FDI inflows in Nigeria from 1970 to 2004. The authors find that exchange rate enhances the inflow of FDI.

In Tanzania, Nyamrunda (2012) explores the effect of exchange rate on FDI inflows using VECM and find that exchange rate impacts positively on FDI. The results of Nyamrunda (2012) is

consistent with the findings of Alaba (2003), Osinubi & Amaghionyeodiwe (2009) and Tokunbo & Lloyd (2009) in Nigeria. In contrast, Ahmad & Malik (2009) find that exchange rate limits FDI flow while Dewenter (1995) for the United States for the period 1975-1989 and Naudé & Krugell (2007) for Africa find no evidence that FDI is affected by exchange rate.

In a recent study, Okafor et al. (2017) explore the effect of exchange rate on FDI by controlling for return on capital, infrastructure, basic literacy, natural resources and corruption using panel data for 20 SSA countries and 11 countries from MENA over the period 2000 to 2010. The authors reveal that FDI inflows are largely affected by basic literacy, infrastructure, control of corruption and return on investment. However, exchange rate deters FDI inflows and natural resource endowments exert no significant effect on FDI in this sample. They suggest that for natural resources to attract FDI, minimum threshold requirements are necessary with regard to trade openness and political stability. Furthermore, the authors reject the null hypothesis that SSA and MENA are not behaviorally and structurally different with regard to FDI determinants. In a further analysis, the results indicate that MENA countries attract more FDI than countries in SSA.

In a different light, Botrić & Škuflić (2006) examine the effect of the number of privitazations and the weight of the private sector on FDI inflows in six countries undergoing transition in South-East Europe from 1996 to 2002. Using the weight of the private sector and the number of privatizations to gauge economic stability and GLS estimation technique on a pooled sample, the authors demonstrate that the weight of the private sector attracts FDI while the number of privatizations limits the flow of FDI. Thus, privatization of small-scale businesses is what drive

FDI in these countries. Similarly, De Mello (1997) indicates that the acquisitions of small firms, economic growth, privitazation , trade and financial integration drives FDI.

Financial market development

Theoretically, financial markets are to reduce the frictions associated with information asymmetry and the cost of doing business. These frictions comprise the costs of obtaining information, contracts enforcement, trading and financial claims. A robust financial system which delivers effective financial services is likely to attract FDI, particularly in the service sector. Measures such as the total number of listed companies and total market capitalization have been used to gauge stock market development and credit to the private sector, liquid liabilities and domestic credit by the banking sector have been used as indicators of financial market development in existing studies. For instance, using a simple gravity model, Di Giovanni (2005) determines the factors that affect the flows of cross-border M&A from 1990 to1999. The empirical results indicate that both financial and institutional factors exert a positive effect on the flows of cross-border M&As. Stock market capitalization as a proportion of GDP used as an indicator of the size of the financial market promotes cross-border M&As. Using a conditional logit model, Deichmann et al. (2003) explore the effect of financial market development on FDI in Turkey and controlled for agglomeration, human capital, access to sea and public investment. The authors find that all the variables except public investment attracts FDI.

In a recent study, Makoni (2017) examines the determinants of foreign portfolio investment (FPI) and FDI by controlling for infrastructure, financial market development and inflation in Africa from 1980 to 2014. By using GMM estimation technique, the author reveal that FDI inflows is

dependent on the lagged values of FDI. In addition, financial market development, low inflation, infrastructure and growth attracts FDI. With regard to FPI, the lagged values of FPI, inflation rate, infrastructure and real exchange rate induce FPI inflow. In addition, the depth of the financial markets gauged by stock market capitalization exerts no effect on FPI

Production Cost

Using unemployment rate to gauge economic stability, Botrić & Škuflić (2006) find that unemployment rate enhances the flow of FDI contrary to the expectation that high unemployment is linked to economic instability. The authors argue that the positive effect can be attributed to the use of unemployment which indicates the existence of reduced labour cost which might attract FDI rather than an indicator of economic stability. However, Dunning & Lundan (2008) argue that in order to increase competitiveness, firms migrate to locations where the cost of doing business particularly wages are relatively low disregarding economic stability.Thus, low wage per worker used as a proxy for low wage cost could result in increase in FDI since this might result in lower cost of production (Dunning &Lundan, 2008). Studies such as Vijayakumar et al. (2010) for BRICS and Schneider & Frey (1985) for 80 developing countries obtained similar results. In contrast, Botrić & Škuflić (2006) find that wage per worker limits FDI inflows. This was attributed to the lucrative sevice sector in South -East Europe and higher wages in the sector.Thus, foreign firms operating in the region might be willing to endure the higher wages which is nullified by the higher returns in the sector. In a related study, Biswas (2002) examines wage per worker on FDI in 44 developing countries but fails to reach definite conclusion on the effect of low wages on FDI flows.

Corruption and Political Instability

Studies on economic development since the 1990s have centered on the quality of institutions as a major cause of the differences in incomes across countries. Various proxies that measure weak institutions such as political instability and the degree of corruption have been incorporated into the institutional dimension and they are expected to influence FDI negatively (Asiedu, 2006; Mohamed & Sidiropoulos, 2010). Some other studies find that corruption attracts FDI (Carike et al., 2012 ; Okafor, 2015). For instance, Wei (2000) explores the effect of corruption on FDI flows to 45 host countries from 12 source countries using quasi-fixed-effects model. The author finds that a rise in the level of corruption limits FDI flows. Studies such as Khamfula (2007) for 17 countries over the period 1994 to 2004 and Al-Sadig (2009) for 117 hosts for the period 1984 to 2004 also confirm that corruption limits FDI inflows. Habib & Zurawicki (2002) attribute the negative effect of corruption on FDI to the operational inefficiencies that corruption generates.

In contrast, other studies have found that higher levels of corruption and weak institutions attract FDI particularly into SSA due to resource-seeking motives of MNCs (Carike et. al., 2012; Okafor, 2015). For instance, Carike et. al., (2012) explore the nature and impact of Chinese FDI in Africa from 2003 to 2008. The authors reveal that the availability of agricultural land, oil and market size of the African economies were the main drivers of FDI. Other studies such as Cheung et. al., (2012) and Fung & Herrero (2012) find that natural resources, market size, strong trade and economic cooperation with China are the main drivers of FDI in Africa. Moreover, in Africa, Chinese FDI is not affected by corruption, human right records, political crisis and risk. Kolstad & Wiig (2012) indicate that weak institutions attract Chinese FDI in countries with abundant natural resources.

This makes FDI outflow from China to Africa different from outflows from transition and developed countries to Africa.

Using cross-sectional time series data of a sample of 40 SSA countries, Cleeve (2012) examines how institutional and political factors affect FDI flows. Using 12 instittional variables which include political risk and controlling for traditional and policy variables, the authors find that the factors affecting FDI are political stability, macroeconomic stability and strong institutions. The results reveal that institutional credibility is most critical in attracting FDI into SSA. He argues that fiscal incentives, the most common instrument used to attract FDI in Africa, have not yielded the expected results. Okafor (2015) also examines the factors influencing the location of US firms in 23 countries in SSA from 1996 to 2010. The author finds that location of firms in SSA is determined by the existence of infrastructure, human capital, market size, crude oil and natural gas. Thus, resources and markets drive US FDI and not efficiency seeking factors. Egger & Winner (2005) argue that corruption is useful because it helps to circumvent administrative and regulatory procedures and hence its positive effect on FDI. However, corruption could be a barrier or limit the entry of new foreign firms. Shan et al.(2018) explore the factors that drive Chinese FDI in 22 African countries from 2008 to 2014. Voice and accountability was found to enhance Chinese FDI flow while rule of law and corruption have no influence on FDI. However, political stability and regulatory quality was found to deter Chinese FDI. Numerous studies have explored the effect of political instability in relation to FDI inflows. Most of these studies find that political instability deters FDI (Biswas, 2002; Mhlanga et al., 2010). However, Cleeve (2008) and Mhlanga et al (2010) use the political and economic freedom indexes but fail to reach a definite conclusion probably due to the small size samples. Using the period and the type of

political regimes, Schneider & Frey (1985) and Biswas (2002) reveal that investors perceive long-lasting political regime as a signal of risk and thus deter FDI. In contrast, Mhlanga et al (2010) by using country risk rating find that higher risks countries tend to attract more FDI due to the abundance of natural resources in the sample of countries studied.

Tax Incentives

Wei (2000) investigates the effect of tax on FDI flows from 12 countries to 45 FDI destinations. Using quasi-fixed-effect model, the author reveals that tax limits FDI inflows. Demirhan & Masca (2008) also examine the effect of tax on FDI flows to 38 developing countries from 2000 to 2004. The authors reveal that tax limits the flow of FDI. In contrast, Bellak & Leibrecht (2009) indicate that lower tax rate increases the flow of FDI. Using firm level data on manufacturing and services, Kinda (2018) examines the effect of taxes on FDI for 30 African countries. The author finds that in Africa, taxation is not an important determinant for the location of foreign firms. This could be attributed to the fact that foreign firms perceive such incentives as baits by host governments and fear that such incentives will be withdrawn once such investments are made (Root & Ahmed, 1978).

Market Size

Pertaining to the determinants of FDI connected with the new trade theory, the size of the market and market growth are expected to enhance the flow of FDI (Nunnenkamp, 2002; Asiedu, 2006; Majeed &Ahmad, 2009; Carike et al., 2012). For instance, Nunnenkamp (2002) examines the determinants of FDI using detailed survey data obtained from European Round Table of Industrialists supplemented with data on investment in 28 developing countries. The author reveals

that traditional market-related factors account for the inflows of FDI. In a panel analysis of 72 developing countries, Majeed & Ahmad (2009) examine a number of host country's characteristics that affect FDI flows from 1970 to 2008. By using the (GMM) estimation technique, the results show that the various measures of market size promotes FDI flows consistent with the market-seeking behaviour of foreign firms. Several recent studies have also confirmed the positive significant relationship between market size and market growth with FDI (Okafor, 2015; Aman & Kaplan, 2017; Makoni, 2017; Ibeh et al, 2018 ; Shan et al., 2018).

In general, market size enhances FDI inflows, though inconclusive results have been observed in some studies. For instance, Mohamed & Sidiropolous (2010) by using total population as a proxy for market size, find inconclusive results. In a related study, Botrić & Škuflić (2006) by using the same proxy, find a negative effect due to the small sample of countries used in the analysis. Thus, the indicator used in measuring market size as well the sample size could greatly influence its impact on FDI.

Openness

Studies such as Asiedu (2006), Mohamed & Sidiropolous (2010) and Okafor et al. (2015) have recommended that countries that receive insignificant proportions of FDI stand the chance of attracting more by opening up their economies. For instance, in a panel study of 20 developing countries, Sekkat & Varoudakis (2007) examine the relevance of trade, political condition and infrastructure in attracting FDI. The authors show that trade openness is a dominant factor in attracting FDI. Recent studies such as Okafor et al. (2017) for 20 SSA and 11 MENA countries and Cantah et al. (2018) for SSA corroborate this finding. These findings have been attributed to

lower transactions cost associated with liberalized trade regimes. Vijayakumar et al. (2010), however, did not find conclusive results.

Natural Resources

The effectiveness of foreign firms can be enhanced in host countries that provide access to natural resources (Dunning & Lundan, 2008). Scores of studies have examined the effect of natural resources on FDI inflows. For instance, by using random and fixed effects models on 29 African countries, Onyeiwu & Shrestha (2004) examine the factors that affect FDI from 1975 to 1999. By controlling for other factors such as economic growth, openness, inflation and international reserves, the study finds that natural resources attract FDI flows to Africa. The reason is that most countries in their sample have an abundance of natural resources and have attained unparralled growth in natural resource deposits. In a related study, Mohamed & Sidiropoulos (2010) study the influential factors that affect FDI for a panel of 36 developing countries of which 12 are in MENA countries and 24 are major FDI destinations in their regions in developing countries. By using fixed effect methodology, the authors reveal that resource endowments are the dominant factors affecting FDI inflows in MENA countries. Dadzie et al. (2018) also confirm that resource seeking motive is the main driver of FDI for 115 manufacturing MNEs in Ghana over the period 1994 to 2013.

Surprisingly, Sanfilippo (2010), Kolstad & Wiig (2012), Carike et al (2012) and Fung & Herrero (2012) indicate that weak institutions attract Chinese FDI into countries endowed with natural resources in Africa. According to these authors, Chinese investment in Africa is driven largely by resource seeking motives. In contrast, Okafor et al. (2015) examine the impact of all four locational

factors by using GMM, fixed effects and pooled OLS panel estimation techniques in SSA over the period 1996 to 2010 and find that FDI is not resource seeking. Moreover, the authors find disparities among the subgroups. A separate sub-regional analysis indicate that market and efficiency factors drive FDI in West and Central and efficiency factors drive FDI in South and East SSA.

In a recent study, Okafor et al. (2017) explore the factors affecting FDI in 20 SSA and 11 MENA countries from 2000 to 2010. The authors reveal that resource endowments do not significantly influence FDI for this sample. They suggest that for natural resources to attract FDI, minimum threshold requirements are necessary interms of political stability and trade openness. Furthermore, the two regions were found to be structurally and behaviourally different with MENA countries attracting more FDI compared to countries in SSA. The differences in the effect of natural resources on FDI could be attributed to the type of natural resource in question, whether the sample of countries under study contains an adequate number of countries endowed with natural resources and the methodology employed in the study.

The determinants of FDI in the empirical literature have been analysed at the micro and macro level. In general, studies that examine the determinants of FDI in SSA have almost exclusively concentrated on market, assets and efficiency factors paying little attention to geographical factors such as the geographical size of the country, distance from the coast and land area in geographical tropics. This study sseks to examine how geographical factors affect FDI inflows in 40 SSA countries from 2002 to 2016 using Hausman-Taylor (H-T) estimation technique.

2. 3. Methodology

2.3.1 Theoretical Model

The classical theory of comparative advantage has been traditionally used to explain the location decision of firms. The motive to reduce production and supply costs lead to firms moving their activities across international boundaries.. Thus, Driffield (2002) and Naude & Krugell (2007) hypothesize that the chances of a foreign firm penetrating or increasing production in the host country is contingent on the expected profits (Π^e).

Suppose the lifespan of the investment is given as N-periods, j is the initial peiod of investment, the discount rate is r, t is the period for which the expected profit will last after the investment ends and φ is a functional notation. Following Driffield (2002) and Naude & Krugell (2007), the probability of profitability of FDI can be written as:

$$\Pr ob(FDI) = \varphi_1\left(\sum_{j=0}^{N}\left(\frac{1}{1+r}\right)^j \prod_{t+j}^{e}\right) \qquad (2.1)$$

Since this probability is not observable in practice, we present equation (2.1) as a function of the FDI motives by incorporating geographical factors into the model. According to Dunning (1993), motivations explaining the internationalization of firms distill into resource seeking aimed at accesing labour force, physical infrastructure and raw materials; market seeking with the prime aim of getting access and control of foreign market; efficiency seeking which is mainly to benefit from cheap labour or lower cost of production and strategic seeking to enjoy the benefit of research and development as well as sophisticated technology and innovation(Cleeve, 2008).

Thus, $$\sum_{j=0}^{N}\left(\frac{1}{1+r}\right)^{j}\prod_{t+j}^{e}=\varphi_2(G_{1i};M_{2i};E_{3i};R_{4i};A_{5i},I_{6i}) \quad (2.2)$$

Where G is a vector of geographical variables which include geographical size of the country in square kilometres (Km^2), mean distance to the coast or river in kilometres (Km) and proportion of land in geographic tropics calculated in equal land projections. Geographical variables are mainly to exploit the advantages of land size, access to sea due to cheaper ocean cost (Bartik, 1985; Hausmann, 2001; Limao & Venables, 2001).

M is a vector of market-seeking determinants of FDI usually captured by market size. Large markets or markets with a high growth potential may generate high revenue and economies of large-scale production. Market seeking factors are usually to maintain existing markets or take advantage of new markets (Majeed &Ahmad, 2009; Carike et al., 2012).

E is a vector of efficiency-seeking determinants such as exchange rate, the rate of inflation and financial market development etc. Efficiency-seeking determinants are usually to generate new sources of competitiveness for firms and seek an abundance of factors of production, mainly labour with low production costs in relation to their productivity (Schneider & Frey, 1985; Vijayakumar et al., 2010)

R is a vector of resource-seeking variables which include: natural resource rent (measured as the difference between the revenue generated and the cost of extraction of natural resources; infrastructure (measured by fixed telephone subscription); and human resource development (measured by school enrolment, secondary (percentage gross). Generally, resource-seeking

determinants are to seek natural resources, labour force and physical infrastructure (Onyeiwu & Shrestha, 2004; Vijayakumar et al., 2010; Makoni, 2017; Dadzie et al., 2018).

A is a vector which consist of asset-seeking determinants to access research and development, raw materials, innovation and technology (Okafor et al., 2015). Asset-seeking is mainly to gain "synergistic" knowledge and innovative ideas.

I is a vector of institutional factors such as political stability and rule of law (Cleeve, 2008; Shan et al., 2018).

Suppose x_{it} denotes all the variables of interest that could potentially affect the expected profitability of FDI, we re-write equation (2.2) as follows:

$$\sum_{j=0}^{N}\left(\frac{1}{1+r}\right)^{j}\prod_{t+j}^{e}=\varphi_3(x_{it}) \qquad (2.3)$$

Where x_{it} include geographical, market, efficiency and asset seeking variables which are hypothesized to affect expected profit positively or negatively. From the literature, human capital,. trade , market size, abundance of natural resources, availability and reliability of infrastructure, fiscal and monetary policy and financial market development attract FDI. In contrast, high inflation rate, high domestic investment and long mean distance from the sea may negatively affect FDI. Collinearity between these variables would not permit the simultaneous inclusion of all in the regression equation. The choice of variables was informed by data availability.

2.3.2 Empirical Model

This paper uses panel data techniques (Random effect and Hausman -Taylor estimator) on 40 SSA countries from 2002 to 2016. For robustness checks, the study divides the sample into two subregional groups namely: South and East, and West and Central SSA countries and further into regional as well as resource rich and resource poor countries. The year 2002 was the starting period to allow the inclusion of political stability and rule of law into the model to capture the strength of institutions. Following on the discussion on equations (2.1 – 2.3), the econometric model for estimating the determinants of FDI into SSA can be presented as:

$$y_{it} = x_{it}\beta + \upsilon_{it} \qquad (2.4)$$

Where x_{it} = vector of explanatory variables. y_{it} = FDI net inflow ($US). The $\beta's$ denote the unknown parameters of the explanatory variables $\upsilon_{it} = \mu_{it} + \xi_{it}$, μ_{it} is an idiosyncratic country-specific effect and ξ_{it} is the residual or white noise such that ξ_{it} $ii(0, \sigma_{\varepsilon}^2), \mu_{it} \tilde{i}i(0, \sigma_{\mu}^2)$; $i=1,2,3,\ldots,N.$ denotes an index for the individual countries used in the study and t = 1,2,3..T represents an index for time-invariant periods. There is no interdependence between the unobservable country-specific effect μ_{it} and the error term ξ_{it}. We estimate equation 2.4 using Hausman -Taylor (H-T) estimation technique.

The limitation with the use of pooled OLS and random effect in estimating panel data is that they generate bias and inconsistent estimators since they may not consider the possibility of the existence of endogeneity. In addition the issue of omitted variable bias is more likely in such instances. Moreover, using these approaches trades the unbiased estimation of time-varying variables for the ability to capture estimates of time-invariant variables.

H-T model is recommended for time-invariant variables in panel data and correlated unit effects (Hausman & Taylor, 1981). The H-T model profer a reliable way out of the correlation that might exist between the time-invariant variables and the unit effects. The H-T is ideal because it permits the inclusion of time-invariant variables (e.g. measures of geography and inheritance) which are wiped out by the fixed effects estimator. The H-T estimates a random effect model by instrumenting for the time-invariant regressors which are wiped out in the fixed effect estimator. Thus, The H-T model is essentially an instrumental variable approach which employs both within and between variations of the strictly exogenous variables as instruments. Specifically, the time-invariant variables are instrumented for by the use of the individual means of the strictly exogenous variables.

Unfortunately, the H-T model tend to do well only in situations where the instruments are not correlated with the errors and the unit effects are strongly correlated with the endogenous variables. However, it is an empirical challenge recognizing these instruments as the unit effect are unobserved and not observable in most cases. Despite these challenges, the H-T estimator has gained acceptance amongst economist (Egger & Pfaffermayr, 2004).

The GMM estimator may not perform well in this study because it requires a large cross section in relation to the time series dimension. Thus, GMM may not be applicable considering the number of cross-sections in relation to the time period especially for the sub-regional samples. Moreover, Okafor et al. (2015) indicate that the test for stationarity and cointegration are only feasible for panels with long data span. Thus, with panels with short data span, failure to conduct these test would not bias the estimates.

2.3.3 Sources of Data and Description of Variables

The source of data for the study is the World Development Indicators supplemented by country geography data from The Portland State University College of Urban and Public Affairs. The choice of the variables to capture FDI determinants is informed by data availability.

Dependent Variable

The dependent variable used is FDI net inflows. Scores of empirical studies on FDI have used FDI net inflows as a standard measure. FDI net inflows comprises total equity capital as well as reinvestment of profits and both short-term and long-term capital to obtain management interest in the long run usually in an enterprise producing abroad and not at home.

Independent Variables

Geographical Variables

Geography determines climatic conditions, natural resources endowment, transportation cost, and disease burden. Countries with large geographical area and located in the tropics are more likely to have natural resource endowments and may tend to attract more FDI. Countries with greater geographical area may be associated with a greater diversity and availability of natural resources. The mean distance from the sea may also affect FDI flows since it affects transportation cost. In this study, geographical size of the country is the surface area of the country in skilometres calculated in equal area projection. The mean distance from the coast is the distance from ice free coastline and sea-navigable rivers measured in kilometres. The land in the tropics is the proportion of land area in the tropics computed in equal area projection. Thus, it is expected that large geographical area measured in Km^2 should exert a positive effect on FDI. Second, the greater the

land proportion in the tropics the greater will be the abundance and variety of natural resources which is expected to exert a positive effect on FDI. Third, the greater the distance from the sea, the higher will be the transaction costs and therefore, a negative relationship is expected between distance and FDI.

Market Seeking Variable

GDP per capita is used to measure the market size in the host country. GDP per capita refers to the summation of gross value added by all producers in the economy plus net indirect taxes. GDP per capita is obtained by Gross Domestic Product divided by the population. Factors such as high demand for goods and services, conducive investment climate, and prospects for economies of scale are signals to foreign investors regarding business prospects in the host country. Large economies of scale imply more opportunities for diversification and sustenance of supplementary economic activities. Market size is critical due to the relative labour immobility across international boundaries even in the face of trade liberalization. Large market size enables full exploitation of foreign technology and inputs and hence minimizing cost and increasing revenue. Thus, large market size is deemed an opportunity for market-seeking FDI to penetrate domestic markets (Asiedu, 2002). Thus, large market size is expected to enhance FDI inflows. Cleeve (2006), Majeed & Ahmad (2009) and Carike et al., (2012) find that large market size attracts FDI.

Resource Seeking Variables

Resource availabity is captured by the rent from natural resources and the development in infrastructure. Thus, large resource rent from natural resources would be regarded by resource seeking FDI as an indication of the abundance of cheaper natural resources. The abundance of

natural resources attracts FDI (Onyeiwu & Shrestha, 2004; Mohamed & Sidiropoulos, 2010). Likewise, the availability and reliability of infrastructure reduce overhead costs and attracts foreign investors through its impact on investments. The proxy used for infrastructure is fixed telephone subscriptions which comprises fixed public pay phones, the number of analogue fixed telephone lines, fixed wireless loop subscriptions, voice over-IP subscription and ISDN voice channel equivalent. Infrastructure is expected to increase productivity and return on investment and hence attract FDI flows (Asiedu, 2002).

Efficiency seeking variables

Empirical studies have also identified macroeconomic factors as critical determinants of FDI. For example, the rate of inflation, trade openness, financial market development, domestic investment and exchange rate have been used in many empirical studies to gauge macroeconomic stability. The consumer price index is widely used to gauge inflation in macroeconomic studies. It denotes the variations in the cost of purchasing a basket of goods and services which may be constant or changed at regular periods. A high rate of inflation deters FDI because it raises the user cost of capital and increases the risk of doing business (De Mello 1999; Asiedu, 2006). High inflation rate stemming from careless monetary and fiscal policy might create instability and limit the flow of FDI.

Theoretically, trade openness indicates the extent of comparative advantage in undertaking investment and may guarantee a higher return on investment through lower transaction costs. Greater openness reduces administrative obstacles and creates a conducive investment environment in the host country. More open economies would attract export-oriented FDI because

transaction costs associated with market imperfections is significantly reduced. Moreover, foreign firms are able to import machinery, technology, and intermediate goods from home country for production and can repatriate profits accrued from investment. Amongst the functions of the financial market are resource moblilization, facilitation of trade, efficient allocation of financial resources, reduction in information asymmetry, pooling and diversifying risk and hedging (Duta & Roy, 2011). In addition, financial markets also aid in the appreciation and acquisition of new technology. Levine et al. (2000) note that financial market indicators gauge the scope, operations and effectiveness of financial markets and agents. Most existing studies reveal that financial market attracts FDI.

Another macroeconomic determinant of FDI is domestic investment proxied by gross fixed Capital formation (GFCF) as a proportion of GDP. GFCF comprises land improvements and the construction of schools, railways, roads and commercial buildings. Existing studies on the effect of domestic inveatment on FDI generates divergent results. For instance, Ndikumana and Verick (2008) find a bidirectional causality between domestic investment and FDI in 38 developing countries from 1970 to 2005. Lautier & Moreaub (2012) also find that domestic investment attracts FDI in 68 countries drawn from developing economies from 1984 to 2006. In contrast, MacMillan (1999) reveals that FDI is impacted negatively by domestic investment in OECD and developing countries. Harrison & Revenga (1995) also show that domestic investment exert no effect on FDI for transition and developing countries during the period 1970 to 1992. High domestic investment may reduce business opportunities available to foreign investors and may discourage foreign investment. On the other hand, low domestic investment could signal the presence of business avenues and may attract FDI.

In this study, we use official exchange rate as a measure to gauge macroeconomic stability and an efficiency seeking determinant of FDI. It denotes the exchange rate set by the authorities in a country or the rate established in an exchange market backed by law. It is computed as a yearly average using averages from monthly values. Theoretically, the depreciation of a host country's currency might enhance FDI inflows. With exchange rate depreciation, assets of the host country becomes relatively cheaper creating incentive for foreign firms to acquire more domestic assets and thereby attracting FDI. In addition, currency depreciation in the host country reduces the cost of production for foreign firms with the motivation to export back home or to other countries. In contrast, where foreign firms produce abroad with the intention of selling in the host country, depreciation of the currency might reduce the purchasing power of consumers in the host country and consequently the returns of foreign firms limiting FDI inflow. Following the empirical studies of Dewenter (1995), Naudé & Krugell (2007), Ahmad & Malik (2009) and Nyamrunda (2012), it is expected that exchange rate exerts either a positive, negative or no effect on FDI.

Asset Seeking Variables

Asset seeking is an opportunity to benefit from innovation, research and development (R&D) and technology (Okafor et al., 2015). This enables firms to access modern technology and skills in operations management and marketing (Pradhan, 2010). The unavailability of data on R&D in SSA excludes the inclusion of asset seeking determinants in the model.

Institutional variables

According to North (1990) institution denotes the rule of law that governs political, social and economic dealings between economic agents pursuing their own interest. In this study, we use rule

of law and political stability to measure the strength of institutions. Rule of law denotes the opinions of people regarding their trust and the degree to which they abide by the rule of law governing society especially in areas such as property rights, contract enforment, the police , and other courts and the occurrence of violence and crime. Political stability and absence of violence /terrorism portrays the views regarding the chances of political instability or politically-induced terroism or violence.Thus, strong institutions are expected to enhance FDI inflows(Cleeve, 2012)

Table: 2.1: Variable Description and Sources

Variable	Expected Sign	Description / Source
Dependendent Variable		
FDI net inflows ($US)		FDI net inflows comprises total equity capital as well as reinvestment of profits and both short-term and long-term capital to obtain management interest in the long run usually in an enterprise producing abroad and not at home.. Source: World Development Indicators (WDI)
Independent Variable		
Geographical Variables		
Geographic Size of the Country (Km^2)	Positive	Surface area of country in kilometres squared in equal area projection. Source: Portland State University College of Urban and Public Affairs
Mean distance to nearest coastline or sea navigable river (Km)	Negative	Average distance fro ice free coastline and sea-navigable rivers in plate caree projection. Source: Portland State University College of Urban and Public Affairs
Percentage of Land in Geographic Tropics	Positive	Proportion of the land area situated in the tropics in equal area projection. Source: Portland State University College of Urban and Public Affairs.
Market Seeking Variable		
Gross Domestic Product Per Capita (Constant 2010 US$)	Positive	GDP per capita refers to the summation of gross value added by all producers in the economy plus net indirect taxes. GDP per capita is obtained by Gross Domestic Product divided by the population. Source: WDI
Resource Seeking Variables		
Natural Resource Rent	Positive	Rents from natural resources measure the difference between the revenue generated and the cost of extraction of natural resources. Source:WDI
Fixed Telephone Subscription (Infrastructure)	Positive	It comprises fixed public pay phones, the number of analogue fixed telephone lines, fixed wireless loop subscriptions, voice over –IP subscription and ISDN voice channel equivalent. International Telecommunication Union, World Telecommunication/ICT Development Report and database. Source: WDI
Efficiency Seeking Variable		
Official Exchange Rate (LCU per US$, period average)	Positive/ Negative	It denotes the exchange rate set by the authorities in the country or the rate established in an exchange market backed by law. It is computed as a yearly average using averages from monthly values (Local currency units relative to the U.S. dollars)
Institutional Variables		
Rule of Law	Positive	Denotes the opinions of people regarding their trust and the degree to which they abide by the rule of law governing society especially in areas such as property rights, contract enforment, the police , and other courts and the occurrence of violence and crime.Source: World Governance Indicators (WGI)
Political stability and absence of violence /Terrorism	Negative	It portrays the views regarding the chances of political instability or politically-induced terrorism or violence Source: WGI

2.4 Results and Discussion

The regression results are presented in this section. Prior to the estimation of the regression equation, the correlation and the descriptive analysis were carried out. Appendix 2.1 and 2.2 presents the correlation analysis and the descriptive statistics respectively. Following the correlation analysis and the descriptive statistics, the long run relationship between the variables are estimated. The results are presented in Table 2.2. Column (1) of Table 2.2 presents the results of the entire sample using random effect model and column (2) presents the results using Hausman -Taylor (H-T) estimation technique. Columns (3) and (4) present the H-T results for resource rich and resource poor countries respectively.

In this study, we limit our discussion to H-T model because it addresses the problems of serial correlation and endogeneity. In addition, it accounts for both time and country-specific effect.

Table 2.2: Regression Results of the full Sample

(Dependent Variable=FDI)

	(1)	(2)	(3)	(4)
VARIABLES	RE	H-T	Resource Rich	Resource Poor
lGeog Size of the Country	2.029***	0.633***	0.672***	0.110***
	(0.267)	(0.111)	(0.243)	(0.036)
lMean Distance from Sea	-1.301***	-0.165**	-0.565*	-0.022
	(0.182)	(0.065)	(0.334)	(0.048)
% of Land Area in Tropics	1.818***	0.336**	1.651	0.002
	(0.230)	(0.146)	(1.573)	(0.189)
lGDPpercapita	0.092	0.092	0.072	0.357***
	(0.183)	(0.183)	(0.110)	(0.083)
lExchange Rate	-0.003	-0.003	-0.004	-0.002
	(0.004)	(0.004)	(0.005)	(0.003)
Fixed Telephone Subscription	0.310***	0.310***	0.455	17.270
	(0.069)	(0.069)	(0.210)	(0.686)
LNatural Resource Rent	-0.003	-0.003	0.029	0.107*
	(0.055)	(0.055)	(0.082)	(0.055)
Political Stability	0.042	0.042	0.121	-0.089*
	(0.063)	(0.063)	(0.094)	(0.053)
Rule of Law	-0.014	-0.014	-0.246	0.200**
	(0.117)	(0.117)	(0.220)	(0.082)
Constant	-0.131	13.922***	12.954***	0.000
	(2.274)	(0.335)	(2.783)	(0.000)
Observations	569	569	310	259
Number of countries	40	40	21	19

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

In column (2) of Table 2.2, the H-T regression results show that geographical factors such as area in square kilometres (Km^2) and location in the tropics both exert a positive effect on FDI in the full sample. This result is plausible in that the greater the land area and a country's location within the tropics, the greater would be the variety and abundance of natural resources which could attract FDI. For both resource rich and resource poor countries, geographical size is important in attracting FDI (Columns (3) & (4). Studies such as Coughlin et al (1991) and List (2001) find that the greater the land size, the more FDI it attracts.

In contrast, distance from the sea exerts a negative effect on FDI in the full sample and resource rich countries. This is because the greater the distance from the sea the higher the transaction cost such as transportation cost and this may deter FDI. This result corroborates with the findings of Head & Mayer (2004) who find that geographic proximity could affect the decision of foreign firms particularly export-oriented foreign firms. Chen & Moore (2010) also reveal that distance between host and headquarter countries decreases affiliate sales and number of multinational affiliates.

In Africa, bulk commodities such as coal, iron ore, oil and petroleum products as well as agricultural products are shipped almost exclusively via ocean cargo. Many African countries, are far away from central markets in Europe which contribute to high transport cost and cost of doing business which negatively impact on exports (Gallup et al., 1999). High transportation cost often render the shipping of such goods to distant locations entirely unprofitable. Hausmann (2001) and Limao & Venables (2001) reveal that the cost of transporting goods over one extra kilometre of land is equivalent to shipping them over seven additional kilometres on sea. Thus, long distance from the sea and ports in developing countries may diminish their attractiveness for efficiency seeking FDI and render them less attractive for export-oriented FDI.

The market size hypothesis was examined by employing GDP per capita. In the full sample, the market size proxied by GDP per capita exerts no effect on FDI. This could be attributed to the small and fragmented markets in the region. Small market size does not allow the full exploitation of the factors of production by foreign firms and may lead to inefficient use of imported technology which increases the production cost and decreases the profitability of foreign firms.

Natural resource rent and investment in infrastructure were employed to examine the resource-seeking hypothesis. Natural resource exerts no effect on FDI. The result corroborates the findings of Okafor et al. (2017) in a panel of 20 SSA and 11 MENA countries from 2000 to 2010. The authors indicate that for natural resources to attract FDI, minimum threshold requirements such as the existence of political stability and trade openness are necessary. Political stability creates the right investment climate and boost investor confidence which attracts FDI. According to Onyeiwu & Shrestha (2004) host countries with greater openness to trade attract FDI. In theory, the extent to which a country is opened to external trade indicates its level of comparative advantage and guarantees higher profitability on investment via lower transactions cost. It is more likely that countries with greater openness would attract export-oriented FDI due to the reduction in the cost of transaction mostly associated with market imperfections. In contrast, close economies make it difficult for foreign firms to import factors of production from home for production as well as repatriation of profits accrued from production and this may limit FDI inflows. Moreover, FDI usually goes into extractive industries which has limited space and is a highly regulated sector. Hence, FDI into the sector is highly controlled and inflows into the sector is limited.

Infrastructure measured by fixed telephone subscription attracts FDI. This corroborates the findings of Asiedu (2006) and Makoni (2017). This can be attributed to the existence of quality, reliable and available infrastructure which raises productivity and thus attract FDI. In contrast, Kinda (2010) finds that infrastructure exerts a negative effect on FDI. High transaction cost and operational challenges faced by foreign firms could possibly be the reasons why infrastructure exerts a negative effect on FDI.

The efficiency seeking variable measured by the exchange rate exerts no effect on FDI. The finding is consistent with Dewenter (1995) in the United States and Naudé & Krugell (2007) for Africa. In addition, institutional variables measured by political stability and rule of law exert no significant effect on FDI. This corroborates the findings of Shan et al (2018) for a panel off 22 countries in Africa from 2008 to 2014. Onyeiwu & Shrestha (2004) and Okafor (2015) argued that lack of economic freedom, macroeconomic and political instability limit the flow of FDI in SSA.

Table 2.3: Regression Results for West & Central and , South & East SSA Countries

(Dependent Variable=FDI)

VARIABLES	(1) West&Central	(2) South&East	(3) West	(4) Central	(5) South	(6) East
lGeog Size of the Country	1.340***	0.159***	0.055	1.715***	0.070***	0.126
	(0.138)	(0.025)	(0.101)	(0.186)	(0.019)	(0.170)
lMean Distance from Sea	-1.324**	-0.027	-0.013	-2.495***	-0.731***	0.080
	(0.543)	(0.118)	(0.076)	(0.759)	(0.158)	(0.090)
LGDPpercapita	0.059	0.278*	0.095	-0.534	0.582***	0.378
	(0.242)	(0.149)	(0.393)	(0.425)	(0.104)	(0.445)
lExchange Rate	-0.007	0.002	-0.008	-0.025	-0.005	-0.001
	(0.007)	(0.004)	(0.007)	(0.024)	(0.007)	(0.004)
Fixed Telephone Subscription	0.315***	0.311	0.287*	0.211	0.451	0.243
	(0.099)	(0.087)	(0.155)	(0.122)	(0.004)	(0.144)
lNatural Resource Rent	-0.097	0.119*	-0.035	-0.262	0.073	0.104
	(0.086)	(0.072)	(0.162)	(0.170)	(0.120)	(0.132)
Political Stability	0.074	-0.065	0.000	0.658***	0.055	0.111
	(0.082)	(0.131)	(0.096)	(0.213)	(0.141)	(0.119)
Rule of Law	-0.049	-0.130	0.050	-0.698	-0.075	-0.123
	(0.202)	(0.159)	(0.263)	(0.509)	(0.413)	(0.216)
Constant	12.164***	16.755***	19.303***	19.697***	20.021***	16.314***
	(3.241)	(1.046)	(1.581)	(5.665)	(1.109)	(0.634)
Observations	325	244	325	101	83	117
Number of countries	22	18	16	7	7	9

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Furthering the analysis, the study disaggregates the sample into West and Central, and South and East as well as regional and resource rich and non-resource rich countries. Table 2.3 presents the results for West &Central (column 1) and South & East (column 2). Columns (3), (4), (5) and

(6) present the results for West, Central, South and East African countries respectively. The results indicate that geographical size enhances FDI inflows in the subgroups. In addition, mean distance from the sea exerts a negative effect in both samples but significant only in west and central SSA category. For West and Central subgroup, the result is driven by countries in Central Africa and for the South and East subgroup, the result is determined by Southern Africa countries as shown in columns (4) & (5). With regard to distance, countries located in the central part of SSA are far away from the sea and this may discourage FDI inflows. The percentage of land located in the tropics was dropped due to collinearity.

Unlike the full sample and West and Central SSA countries, the coefficient of market size measured by GDP per capital exerts a positive and significant effect on FDI in the South and East SSA subgroup validating the market seeking hypothesis. However, the result is driven by Southern African countries. This is plausible in that countries in Southern Africa are relatively developed than countries in other regions and may have larger markets to attract FDI compared to other regions. This finding is consistent with recent studies such as Okafor (2015), Aman & Kaplan (2017) and Shan et al. (2018). Interestingly, Botrić & Škuflić (2006) employed total population to measure market size and find a negative effect due to the small sample of countries. Hence, the sample size and the variable used in gauging market size could possibly affect its influence on FDI.

The size of the market has become more important because of the relative labour immobility across countries despite the emphasis on trade liberalization. With large markets, foreign firms can make optimal use of imported raw materials and technology thereby reducing their operational cost and

increasing returns on their investments. Hence, the expansion in the market size is regarded as an avenue for market-seeking FDI to enter domestic markets (Asiedu, 2002).

The coefficient of natural resource rent is positive and significant in the South and East SSA subgroup but negative and insignificant in West and Central SSA countries. Large quantities of natural resources remain untapped especially in Africa as a result of misplaced priorities and conflicts associated with resource rents between interest groups. For example, Liberia, Nigeria, Angola, DRC Congo and the Republic of Congo have been characterized by militancy and conflicts which have limited the extraction of natural resources in these countries (Okafor et al., 2015). With the exception of Angola, all the countries cited above are in West Africa. This could partly explain why natural resources exert no effect in the West and Central Africa since most of the resource-rich countries within the sub-region have experienced conflicts.

Infrastructure exerts a positive effect on FDI in West and Central SSA subgroup but insignificant effect in East and South SSA subgroup. In general, most countries in Africa have poor road networks, weak communications systems and depend on private generators for production as electricity supply is unreliable. These factors are likely to increase production cost and deter FDI. In addition, it is likely that the small sample size of countries in East and South SSA possess similar characteristics (Cleeve, 2008).

2.5 Conclusions and Policy Implications

The study examines the geographical determinants of FDI for 40 SSA countries over the period 2002-2016 using Hausman-Taylor estimation technique. The sample is divided into South and East, and West and Central and further into regional as well as resource rich and resource poor countries to check for robustness. The study reveals that geographical size of the country in Km^2 and the percentage area of land in the tropics attract FDI but greater distance from the sea limits FDI inflows. For West and Central, and South and East subgroups, geographical size was found to be important determinant of FDI. Market size and natural resource rent attract FDI in South and East subgroup. Infrastructure attracts FDI in West and Central subgroup. The results in the West and Central subgroup is largey determined by countries in Central Africa while Southern Africa countries drive results in the South and East subgroup. Geographical size also attracts FDI in both resource rich and resource poor countries but greater distance from the sea limits FDI flow in resource rich countries but has no effect on FDI in resource poor countries.

The study recommends that SSA should take advantage of its greater geographical size in coming out with a common market to maximize the potential embedded in FDI. This would reduce transactions costs and break the barrier of long distance transport. The formation of a common market would help in collective bargaining and contract deals as investors would regard them as part of a bigger group rather than small individual markets and this would go a long way to attract FDI into the region. In addition, emphasis must be placed on the distance from markets rather than distance to sea or port to benefit land locked countries.

CHAPTER THREE

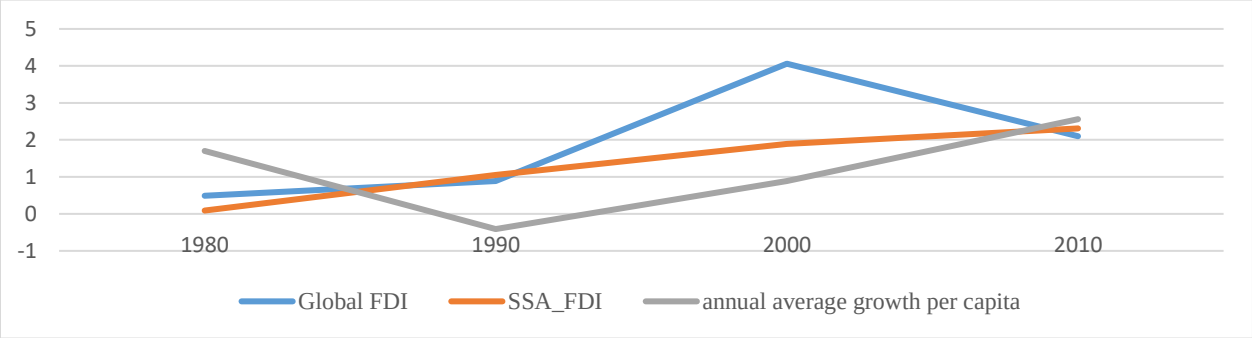
FOREIGN DIRECT INVESTMENT, ABSORPTIVE CAPACITY AND ECONOMIC GROWTH: EVIDENCE FROM SSA.

3.1 Introduction

Mencinger (2003), points out that foreign direct investment (FDI) can be described as a critical ingredient for growth, and can serve as a channel that provides the panacea to the myriads of problems plaguing several developing countries. Studies such as Lee (2013) and Omri & Kahouli (2014) have outlined among other factors some spill-over effects of FDI which include direct capital financing, technology transfer, productivity gains, access to new processes, technical and managerial skills, development of local enterprise opportunities which stimulate economic growth.

Consequently, governments have employed several policy measures that seek to promote and sustain FDI because of its associated benefits. For example, the adoption of deregulation policies and a heavy dependence on market forces by developed and developing countries in the 1980s focused on attracting more FDI leading to significant influx of FDI in almost every region of the world. For Sub-Saharan Africa (SSA), the share of FDI to GDP rose from approximately 0.09 in 1980 to 1.05 in 1990, 1.89 in 2000, and 2.31 in 2010 (see World Bank, 2018). Ironically, increases in FDI did not simultaneously translate into sustainable growth in SSA (see Figure 3.1). For example, the annual average growth per capita in 1980, 1990, 2000 and 2010 was 1.70, -0.41, 0.89 and 2.56 respectively.

Figure 3.1: Trend of FDI and GDP In SSA (1980-2010)



Source: Author's computation from the World Development Indicators.

Although governments in SSA have made efforts towards attracting FDI with the goal of impacting growth and development, countries specific experiences have been mixed. Whereas some studies find that FDI promotes growth in the recipient countries (e.g. Sunde, 2017; Suliman, et al., 2018), other studies find that FDI is detrimental to growth (e.g. Herzer, 2012; Mencinger, 2003). Furthermore, some authors have argued that FDI exert no effect on growth (e.g. Yabi, 2010; Alege & Ogundipe, 2014). Existing literature has shown that host country's absorptive capacities translates FDI's effect into growth.

Zghidi et al. (2016, p.72) make reference to Cohen & Levinthal's (2000) definition of absorptive capacity "…as the ability of a firm to recognize the value of new external information, assimilate it, and apply it to commercial ends". Absorptive capacities are host country characteristics which enhance FDI spillover-effect on growth. Thus, one can argue that host countries with robust absorptive capacities have a higher probability to benefit from FDI relative to countries with porous absorptive capacities. Some authors have argued that economic growth through FDI-effect strongly depends on absorptive capacities such as educated work force, development of the

financial sector, trade openness, infrastructure, institutions and technology. Consequently, FDI spillover promotes economic growth via absorptive capacities.

For instance, the importance of trade has been identified as critical to growth (Dollar, 1992; Winters, 2004). Frankel & Romer (1999) argue that trade openness as an absorptive capacity, can facilitate efficient production through re-allocation of production resources. The essence of human capital and trade have also been documented in previous studies (Borensztein et al., 1998; Balasubramanyam et al.,1996). In addition, studies by Calderon & Serven (2010), Kumo (2012), and Melnyk et al. (2014) have identified the importance of infrastructure in propelling growth. Similarly, some previous studies have shared parallel views with regard to market size, abundance of natural resources, and technology amid a host of other factors.

Many scholars such as Schumpeter (1911), McKinnon & Shaw (1973), Demetriades & Hussein (1996) and Demetriades et al. (2017) argue that financial market development is a key driver of economic growth. The dominant view shared by these authors is that a sound financial market reduces cost of doing business and information asymmetry. High production cost and information asymmetry might lead to misallocation of financial resources and hinder efficient supervision of investment projects. In addition, a sound financial market also aids in the appreciation and acquisition of new technology. Similarly, studies by Alfaro et al., 2004; Adeniyi et al., 2012; and Elboiashi (2015) find that the extent to which the financial market is developed matters for FDI to translate into economic growth.

Key amongst host country's characteristics is the extent to which institutions are developed. Economic institutions affect the incentive structure within which economic actors (such as investors and producers) operate to ensure that resources are allocated efficiently. Specifically, they affect investments in human and physical capital, technology, and how the production process is organized. Disparities in economic institutions account for divergencies in economic growth across nations as well as cultural and geographical factors. Various empirical research have acknowledged the role of institutions in economic growth prospects. For instance, Edwards (1998) by using business regulation index and property rights index as proxies for institutional quality, reveals that there is a minimum threshold of institutional quality that exploits FDI spillover efficiently. Asandului et al. (2016), investigate the effect of social progress and economic freedom on growth. The study reveals that social progress and economic freedom enhances GDP per capita growth rate. The main research question is: Does absorptive capacities enhance the spillover effect of FDI on economic growth in SSA?.

This chapter, therefore examine the effect of absorptive capacities on the growth effect of FDI in SSA. Given the fact that it will be an empirical challenge to identify all host country's absorptive capacities both in theory and in practice, we chose two unique proxies that can capture most of the other absorptive capacities in developing countries. These indices are expected to address factors that have influenced SSA's volume and direction of trade, kinds of infrastructure, technological advancement, institutional quality etc. Following recent literature that emphasizes the relevance of economic freedom and financial market development in the growth process, we used the economic freedom indices developed by The Heritage Foundation and the financial market fragility indices by Andrianova et al. (2015) which accounts for the vulnerability of the financial

system to crisis rather than the traditional proxies (i.e. broad money and private credit to domestic sector). For example, a free (socio-politico-economic) country with a sound and robust financial system can aid both the public and the private sector through credit availability in the provision of infrastructure, technology, trade, quality institutions among others.

The study was conscious of possible endogeneity and serial correlation problems that have also become an empirical challenge. Against this background, the study used the Fully Modified Ordinary Least Squares (FMOLS) econometric technique that addresses some of the empirical challenges. First, we estimated the growth effect of financial fragility. We find that fragility in the financial market is deleterious to growth. Second, we estimate the effect of economic freedom on economic growth. We find that sound economic environment promotes economic growth. Lastly, we estimate the casual effect of FDI on economic growth with and without the host country's absorptive characteristics. Without the absorptive capacities, we find that FDI limits economic growth. However, by accounting for host country's absorptive capacities, the study reveals that FDI translates into a tool that enhances economic growth.

This chapter contributes to the literature on FDI on grounds that it uses the most recent developed financial market development data that accounts for fragility and complemented it with an aggregated economic freedom data. The point of departure from existing studies is that, to the best of our knowledge, this is the only study that combined a financial market variable that accounts for fragility and aggregate economic freedom variable as proxies for host country's absorptive capacities. The rest of the chapter is presented as follows. In section 3.2, the empirical literature examining the effect of absorptive capacities in investigating the growth effect of FDI are

discussed. The methodology for carrying out our empirical strategy is presented in Section 3.3. In Section 3.4, the analysis and discussion of results are presented. Section 3.5 focuses on the summary of key findings and conclusion.

3.2 Empirical Literature

Evidence from empirical literature have shown mixed results in attempting to establish the link between FDI and economic growth. While a significant number of these studies have established a statistically significant positive and negative results, a few have shown no effect. Host country's characteristics (absorptive capacities) have been identified as the driving forces underlying the direction of the FDI-growth relationship. We present the literature under four main sections. The first section investigates the link between foreign direct investment and economic growth. The second looks at economic freedom and economic growth nexus. The third section presents literature on the link between financial market and economic growth and the final section focuses on foreign direct investment, absorptive capacity, and economic growth with focus on economic freedom and financial market development as indicators of absorptive capacities.

3.2.1 Foreign Direct Investment and Economic Growth Nexus

The neoclassical growth model assumes a constant rate of technological progress and diminishing marginal returns to capital. The model suggests that FDI has the same efficiency as domestic investment with little spillover effect and can promote growth only in the short run. However, the endogenous growth model has sophisticated technology embedded in it and thus has higher efficiency than domestic capital (De Mello, 1997). Thus, in the endogenous growth model, in the

short and the long run, FDI can promote economic growth through technology diffusion and capital accumulation (Borensztein et al., 1995).

Empirically, scores of studies have explored the growth effect of FDI with divergent results. Some of the studies are cross-country panel studies (Sghaier & Abida, 2013; Gui-Diby, 2014) while others are country specific studies (Marwah & Tavakoli, 2004; Chowdhury & Mavrotas, 2005). Some of the studies find that FDI stimulates economic growth (Gammoudi et al., 2016; Sunde , 2017). In contrast, others find a negative effect (Saltz,1992; Mencinger , 2003) while some find that FDI exerts no effect on economic growth (Carkovic & Levine, 2002; Herzer et al., 2007). UNCTAD's (1999) report indicate that the positive or negative results could be traced to the choice of variables used in the analysis. Moreover, the cause of varied outcomes in many empirical studies have been attributed to the failure to take cognizance of host country's characteristics (Mohnen, 2001; Asheghian (2004); the use of inappropriate estimation techniques (Nair-Reichert & Weinhold, 2001) and finally the use of composite FDI instead of sector specific FDI (Wang, 2009).

Abida & Sghaier (2013) explore the growth effect of FDI in 4 countries in North Africa (Algeria, Tunisia, Egypt and Morocco) from 1980 to 2011. The authors find that FDI spurs economic growth. In the Economic Community of West African States (ECOWAS), Alege & Ogundipe (2014) examine the growth effect of FDI from 1970 to 2011. By using random effect, fixed effect and pooled OLS, the authors find that absorptive capacities such as trade openness, political and economic stability, and human capital in ECOWAS enhance FDI's effect on growth.

Using the system GMM estimation technique, Gui-Diby (2014) also investigates the growth effect of FDI for 50 countries from Africa over the period 1980 to 2009. The author finds that FDI spurs growth in the selected SSA countries for the whole period. For the period 1980 to 2009, FDI limits economic growth while for the period 1990 to 1994, FDI promotes economic growth. In the Middle East and North Africa countries (MENA), Gammoudi et al. (2016), also study the extent to which FDI affect per capita GDP from 1985 to 2009. By using GMM estimation technique, the results support the positive evidence already discussed.

In a recent study on Western Asian countries, Suliman et al. (2018), explore the nexus between FDI and economic growth from 1980 to 2011. The authors applied a a two-stage least squares (2SLS) estimator for the simultaneous equations. The robustness of the results was checked using Generalized-Method of Moments (GMM). The authors find that FDI propels economic growth consistence with the evidence provided by Gui-Diby (2014) and Gammoudi et al. (2016)

In a detailed analysis of country specific studies, Bende et al. (2001) test the FDI-growth relationship in Philippines, Indonesia, Malaysia, Thailand and Singapore from 1970 to1996. The authors find that FDI promotes growth in three of these countries namely: Philippines, Indonesia, and Malaysia, but retards growth in two countries namely: Thailand and Singapore. Also, Marwah & Tavakoli (2004) explore FDI-growth link in Thailand, Indonesisa, Philippines, and Malaysia from 1970 to1998. They find that FDI stimulates economic growth across the selected countries, Likewise, Chowdhury & Mavrotas (2005) also explore the causal relationship between FDI and economic growth in Malaysia, Chile and Thailand from 1969 to 2000. For this relationship, a bidirectional causality exist for Thailand and Malaysia but unidirectional causality for Chile.

Some country specific studies in Africa also support the positive relationship evidence between FDI and economic growth. For instance, Sakyi et al. (2015), investigate the extent to which FDI and trade openness have impacted on economic growth in Ghana from 1970 to 2011. The authors use ARDL model, and find that interacting FDI with exports drive growth. Using the same method for South Africa, Sunde (2017) tests the FDI-growth link and finds that FDI promotes economic growth. Similarly, Adams et al.(2017), explores the effect of capital inflows on economic growth from 1970 to 2014 in Senegal. Employing the (ARDL) approach, the authors demonstrate that capital inflows trigger economic growth in Senegal. However, in contrast to the findings of Sunde (2017), the authors find no FDI-growth relationship in the long run.

Ample evidence from the literature reviewed affirms that FDI spurs growth in both country specific and panel studies. The evidence is overwhelming regardless of the methodologies, time span and variables employed in the study. Surprisingly, for 68 developing countries from 1970 to 1980, Saltz (1992) finds that, FDI limits economic growth. This resonates with the results of Mencinger (2003) for 8 transitional economies spanning from 1994 to 2001. The author attributes the negative impact of FDI to Mergers and Acquisitions (M&A) and further argue that proceeds of M&A are expended on imports resulting in current account deficit.

In another study, De Mello (1999) combines time series and panel data for 32 countries (developed and developing). He investigates the possible effect of FDI and capital accumulation on economic growth. His findings were in two parts. First, the author finds that FDI promotes better technology and enhances management skills. Second, in contrast to earlier studies, there was a relatively weak evidence supporting the extent to which FDI drives economic growth in the host country. In a

related study, Carkovic & Levine (2002), employs the System General Method of Moment (GMM) to examine the FDI and economic growth nexus. Using a cross-country dataset spanning from 1960 to 1995, they find that FDI inflows neither directly or indirectly (through human capital) influence economic growth. Additional studies with such results include Herzer et al. (2007) and Kang & Du (2005).

Firm level analysis of the effect of FDI on productivity have also yielded divergent results**.** For instance, Blomstrom (1986) indicates that firms in Mexico owned by foreigners grow faster than domestic firms. Also, Aitken & Harrison (1999) in a study on Venezuela find that there is a marginal net effect of FDI on firm's productivity. The authors show that, for firms that received investments, FDI promotes productivity. However, FDI was found to be detrimental to domestically owned firms. Wang (2009) examines FDI inflows to different sectors using data from some selected Asian economies from 1987 to 1997. The author use a random effects estimation, feasible generalized least squares (FGLS) and weighted least squares (WLS) panel regression and find that FDI in the manufacturing sector promotes economic growth in support of existing evidence. FDI inflows in non-manufacturing sectors is not growth enhancing. In addition, the effect of manufacturing FDI on economic growth is reduced by 48% when composite FDI is used instead of dissagregated FDI.

3.2.2 Economic Freedom and Economic Growth Nexus

Economic theory postulates that economic freedom affects the incentive structure within which economic actors such as investors and producers operate as well as efficient allocation of resources. Since the time of Adams Smith, many scholars have argued that the freedom of choice

and resource allocation, competition, exchange of goods and services, protected property rights among others are fundamental components of economic growth (North & Thomas, 1973).

Institutions have emerged with various measures of economic freedom. These institutions are: The Fraser Institute, The Freedom House, and The Heritage Foundation (THF). There have been many studies which have followed these measures of economic freedom. Most of these studies find that economic freedom stimulates economic growth. For instance, Gwartney et al. (1999), examine the critical role of economic freedom indices by using four measures of economic freedom and controlled economic structure, money , international trade, inflation and taxation. The study used a panel data for over 100 countries spanning from 1975 to 1995. The economic freedom measure for the countries was ordered over a ten-year period and captured in different regression models. The study finds that, after controlling for capital (human and physical) economic freedom still promotes growth,

Acikgoz et al. (2016) analyze the effect of tax burdens measured by fiscal freedom index and government regulations of business which was also measured by business freedom index, and their effect on economic growth. The study use countries that are moderately free and unfree in a panel data structure from 1993 to 2011. The authors use the panel co-integration approach, and established a long-run relationship between the measures of economic freedom and economic growth. Regarding the variables of interest for all three-country groups, the study reveals that fiscal freedom enhances economic growth. In addition, the study finds that tax burdens and government regulations play a critical role on economic growth. However, for business freedom, the positive and significant effect was found for only two-country groups.

In a related study, Cebula (2011), disaggregated economic freedom into ten measures and complemented it with a measure of political stability to investigate their effects on economic growth for OECD countries. Using panel two-stage least squares technique, the author finds that political stability in addition to the disaggregated measures (particularly freedom from corruption, property rights freedom, fiscal freedom, labor freedom, investment freedom, business freedom and monetatry freedom) promote growth in OECD countries. The result of Cebula (2011) resonates with the earlier studies by Gwartney et al. (1999), Williamson & Mathers (2011) and Hall & Lawson (2014).

From the review of existing literature, one may argue that economic freedom as an absorptive capacity explains changes in economic growth. However, studies that have used disaggregated economic freedom measures have found that the economic freedom's effect on economic growth is mixed (positive, negative or no effect). For instance, Carlsson & Lundström (2002) examine the growth effect of economic freedom in 74 countries from 1975 to 1995 and finds that economic freedom spur growth. However, this does not necessarily imply that increasing economic freedom in general drives economic growth. This is because some of the indices such as monetary policy and price stability were found to be insignificant in the sample. In addition, the effect of markets and freedom of exchange in the capital market and economic structure exert a weak effect on growth. Moreover, government size and freedom to trade both exert a negative effect on growth. However, private ownership and freedom to use alternative currency, and legal structure were found to exert positive effect on growth.

Aisen & Veiga (2013), in a panel study with 169 countries, empirically estimate the role of political instability on economic growth from 1960 to 2004 using five-year averages and the system-GMM estimator. The authors indicate that higher degrees of political instability is deliterous to economic growth. In terms of mechanism, the authors reveal that political instability negatively impact growth by reducing both physical and human capital accumulation and productivity growth rates. Lastly, while ethnic homogeneity and economic freedom propels economic growth, democracy rather retards growth.

Similarly, in an empirical estimation of a panel of 28 EU nations**,** Kacprzyk (2016) examines the possible effect of economic freedom on economic growth from 1985 to 2009 using five-year averages. By using system-GMM econometric approach, which controls endogeneity, the author finds a positive relationship between economic growth and four (security of property rights, quality of monetary policy, freedom to trade and regulatory policies) of the five aspects of economic freedom: The size of government was the fifth index used in the model. However, this exerts no significant effect on growth. The reason is that different types of government spending are likely not to have the same growth effect.

There are limitations in using either the composite measure of economic freedom or the disaggregated measures. The use of a disaggregated measure of economic freedom may not be a true representation of the complex economic system. Whereas, the use of a composite index makes it difficult to prescribe specific policies. That notwithstanding, from the literature, there is an overwhelming evidence that economic freedom generally, positively impacts on economic growth.

3.2.3 Financial Market Development and Economic Growth Nexus

The development of the financial sector is critical to investment and economic growth. Schumpeter (1911) outlined the functions of the financial market in the course of economic development. He argues that the acquisition of new production technology requires the existence of a sound credit market that provides financial assistance to entrepreneurs. Gurley & Shaw (1955), Hicks (1969) and Goldsmith (1969) also contend that a sound financial system is critical in promoting economic growth consistent with the ealier view of Schumpeter.

During the course of economic development, changes occur with regard to the direction of causality between financial market development and economic growth (Patrick, 1966). Supply leading finance occurs in the initial stages of economic growth where financial institutions channel resources from the traditional sector to the modern sector leading to higher growth. Demand following occurs in the second phase where economic growth triggers the need for financial markets and services. Notwithstanding the divergent views in literature regarding the financial market-growth link, there is ample evidence that financial markets enhances growth and the reverse is true.

Keynesians view in support of financial repression prevailed for many years on the finance-growth debate. Keynes (1936) financial repression hypothesis postulates that, government intervention in the credit market will promote growth and raise revenue through artificially low interest rates and inflationary monetary policy channels.

McKinnon (1973) and Shaw (1973) hypothesis of financial liberalization shifted focus from proactive government intervention and advocate for greater dependence on the market to determine interest rate and credit allocation. They suggest that through the price system, by allowing interest rates to adjust freely, the rise in the real interest rates will encourage individuals to save in banks. Increased savings would increase the supply of loanable funds and banks will be in a good standing to increase their loan portfolios while at the same time decreasing their reliance on external support. McKinnon (1973) and Shaw (1973) contend that Keynesians policies directed at low interest rates within a fixed policy regime could create distortions, uncertainties and imperfect conditions that repress the development of both financial and real sectors of the economy. Thus, they advocate for financial liberalization to eliminate distortions in the financial market.

According to Greenwood & Jovanovic (1990), the endogenous growth literature postulates that financial market development is associated with efficient allocation of savings to more viable investment projects. In contrast, the financial crisis literature postulates that financial liberalization could destabilize the financial market as a result of unduly huge expansion of credit. They argue that agencies mandated to regulate and monitor the activities of the banks have limited capacity. Moreover, banks failure to isolate good projects during investment boom, may lead to overlending (Schneider & Tornell, 2004).

Several empirical studies have explored the financial market-economic growth nexus with mixed outcomes regarding the direction of causation. However, most of these studies have indicated that financial market development promotes growth (Adu et al., 2013). For example, Arestis et

al.(2001), explore the stock market-economic growth link for 5 developed economies (Japan, France, United Kingdom, United States and Germany) using time series data and econometric approach. In their model, the authors control for the volatility in stock market and banking system, and find that, the growth effect of banks outweigh that of stock markets. The results indicate that though stock markets might stimulate economic growth, their impact is marginal. The authors argue that the growth effect of stock markets might have been overstated and misleading especially by cross-country growth regression studies.

Valickova et al (2015) also carry out a meta-regression analysis of 1334 estimates from 67 studies that investigate the growth effect of financial market development. The authors find significant heterogeneity in the estimates and observe that nearly 50% indicate that financial market development propels growth. The authors find that indicators based on stock markets are associated with greater growth effects. Furthermore, it was observed that studies that have controlled for human capital, initial income, and financial fragility ends up with larger effects, suggesting that uncertainty in the regression model and omitted variable bias are important drivers of the estimated effect.

Similarly, using 13 countries drawn from sub-Saharan Africa, Ghirmay (2004), explores the financial market-growth link and find long run relationship in 12 out of 13 countries. The authors demonstrate the existence of both unidirectional and bidirectional causality. For 7 SSA countries, Enisan & Olufisayo (2009) investigate the stock market-growth link and find both unidirectional causality (in South Africa and Egypt) and bidirectional causality (in Zimbabwe, Kenya, Morocco and Cote D'Ivoire). In Nigeria, there is no evidence of the growth-led finance hypothesis. The

study concludes that stock market development promotes economic growth in SSA when there is appropriate regulatory framework and sound macroeconomic policies.

Following the choice of proxy of financial development, some studies find the effect on economic growth as either negative, positive or no effect. For instance, in a panel analysis of a sample of northern and southern Mediterranean countries, Ayadi et al.(2015) explore the financial market - growth link spanning from 1985 to 2009. The authors include relevant controls to account for both quantity and quality effects of the sector. The authors find that bank deposits as well as private sector credit are detrimental to growth. This they attribute to deficiencies in credit allocation and flexible financial regulation and supervision. The results further reveal that liquidity and stock market size promote growth given instituional quality. Again, foreign and domestic investments were found to be growth enhancing.

Using panel estimation methods, Samargandi et al. (2015) re-examine the financial market -growth link for 52 middle income countries over the period 1980 to 2008. The authors find that financial market development is detrimental to growth. Furthering the analysis, the authors test for non-linearity between the variables and find an inverted U-shaped relationship in the long run. These findings suggest that there is a limit beyond which financial sector development hurts growth.

Some related studies in the literature can also be found in Ghana. For example, Prah & Quartey (2008) examine the financial market-growth nexus using broad money to GDP ratio to proxy financial markets. The authors confirm the existence of the demand-following hypothesis. However, neither the demand following nor supply leading hypothesis was validated using other

proxies. Similarly, Adu et al. (2013) examine how the financial sector affects growth. The authors reveal that, the variable used to gauge financial sector development is what drives its effect on growth. Specifically, private sector credit and domestic credit enhance growth while broad money to GDP limits growth. In sum, the choice of an indicator determines whether the effect of the financial sector development will be positive or negative on growth.

In Sierra Leone, Kargbo & Adamu (2009) explore the financial market development-growth nexus from 1970 to 2008. In an attempt to deal with some identification issues, the authors employ the ARDL econometric approach, and find that financial market development propels growth validating the finance led growth hypothesis. Moreover, investment is the channel via which financial market development promotes economic growth. Odhiambo (2009) also explores the financial market-growth link and controlled for interest rate. By using standard cointegration and error correction approaches, they find a strong evidence that interest rate liberalization impacts positively on financial deepening in Kenya. Moreover, financial market also propels growth.

Esso (2010) examines financial market-economic growth link in ECOWAS from 1960 to 2005. The author reveals that financial market development promotes economic growth in Cote d'Ivoire, Liberia, Guinea, Cape Verde and Ghana. Moreover, the author reveals that the growth effect of financial development in Ghana, Mali and Liberia. Also, it was found that, in Cote d'Ivoire, growth causes financial market development, and a bidirectional causality in Sierra Leone and Cape Verde.

In as much as several studies in the developing world have examined the financial market-growth link, it is worth mentioning that less attention has been paid to the importance of fragility within the financial market context, and how it affect economic growth. Some of the papers that have tried to capture this include, for example: Loayza & Ranciere (2006), Adalet (2009) and Demetriades et al. (2017). For instance, Loayza & Ranciere (2006) explore the relationship between development in the financial sector, financial fragility and growth using a panel structure and the Pooled Mean Group estimator (PMG). The authors find that for countries which are financially fragile, in the short run, financial intermediation exerts an adverse effect on growth. However, for more stable nations, this effect is absent. In addition, the authors argue that aspects such as volatility and crisis of financial intermediation influence growth determinants, along with the usual measures of financial development. However, whereas financial development propels growth, financial fragility is inimical to growth.

In a multivariate logit econometric framework, Demirgüç-Kunt & Detragiache (1998) investigate the causal factors of systemic banking crises for both developing and developed nations. The period under consideration was from 1980 to 1994. The authors reveal that crises erupt when macroeconomic fundamentals are weak. For example, when economic growth rate is low, inflation rate is high, real interest rate is high and balance of payments deficit keeps rising.

In a related study, Adalet (2009) explores the relationship between structure of financial institutions and financial fragility. The author use countries in Europe during the period 1920s and 1930s. Analyzing both monthly and annual data, the author demonstrates that European countries with universal banking are prone to crisis. In addition, those countries with universal banking, also

experience an adverse effect on the growth of their economy. Also, Demetriades et al. (2017) have developed a new dataset which provides an elaborate measure of financial market development that further accounts for fragility. In their study, they use these new indices to examine the effect of financial fragility measures on growth from 1998 to 2012 for about 124 countries. Using the instrumental variable approach, the authors find that, both private credit and financial fragility have adverse effect on GDP growth. After controlling for banking crises, the results was still robust. This confirms the fact that financial fragility is inimical to growth, even without banking crisis.

3.2.4 Foreign Direct Investment, Absorptive Capacity and Economic Growth

Economic freedom has been treated in literature as an absorptive capacity. For example, using property rights and business regulation indices as indicators of institutional quality, Edwards (1998), investigates the FDI-growth link for a sample of 80 countries from 1979 to 1998. The author finds that FDI triggers growth in countries that exceed certain minimum threshold of institutional quality. Tiwari (2011) also examines the growth effects of FDI and economic freedom for the period 1998 to 2007 for 28 countries in Asia. The author reveals that financial freedom, life expectancy, fiscal freedom and domestic capital stock propel growth. However, aid, FDI and freedom from corruption are detrimental to growth.

Bengoa & Sanchez-Robles (2003), explore the link between FDI, economic freedom and economic growth covering the time period from 1970 to 1999 in a panel setting with 18 Latin American countries. The authors reveal that FDI stimulate economic growth. In addition, economic freedom enhances FDI inflows. In another study, Fukumi & Nishijima (2010) examine the link between

FDI and institutional quality for 19 Caribbean and Latin American countries. By using a simultaneous equation model, the authors find that FDI improves institutions and strong institutons also attract more FDI.

In a panel analysis of 85 countries, Azman-Saini et al. (2010) examine the link between FDI, economic freedom and growth. The authors find that FDI has no growth effect directly. However, FDI propels economic growth where there is economic freedom. The study indicates that, countries with better economic freedom gain more from MNEs. Alguacil et al. (2011), use both OLS and GMM for a period 1976 to 2005 using a sample of developing economies. The authors reveal that local capacities relating to macroeconomic and institutional environment are critical in the promoting economic growth.

Zghidi et al. (2016), explore the causal interactions between FDI, economic freedom and economic growth for Egypt, Tunisia, Algeria, and Morocco), spanning from the period 1980 to 2013. Using the system-GMM estimation technique, the authors find that FDI enhances growth. Furthermore, the authors conclude that FDI with economic freedom affect growth. The study indicates that countries with better economic freedom are more likely to gain from the presence of foreign firms. The results of Zghidi et al. (2016), is consistent with the earlier studies of Bengoa & Sanchez-Robles (2003) and Azman-Saini et al. (2010).

Darrat et al. (2005) examine the differential growth effect of FDI between EU accession and non-applicant economies in Eastern and Central Europe and the MENA countries. The authors reveal that FDI propels growth in EU accession economies but the evidence is weak in Eastern and

Central Europe and the MENA countries. In their conclusion, they argue that institutional quality and policy-making environments between groups of countries can be attributed to the variations in the growth effect of FDI. In a sector specific study of 30 countries from Europe, Sayari et al. (2018) examine how the value added component from FDI and GDP affect economic freedom. The authors find that apart from agriculture value added that negatively affect economic freedom, industry and service value added promotes economic freedom. In the random effect model, the authors find that FDI impacts negatively on economic freedom.

A recent study by Bougharriou et al.(2019) examine two particular channels namely FDI and public consumption expenditure via which democracy affect growth for I6 Arab countries from 2002 to 2013. The authors use a simultaneous equation model and find no direct link between democracy and economic growth. However, democracy was found rather to promote growth indirectly through FDI. However, it was found to be associated with generating higher public consumption expenditure. Generally, studies that employ disaggregated measures of economic freedom did not arrive at a definite conclusion. However, most of the studies that employs aggregate economic freedom measure were found to positively affect economic growth.

Scores of studies have investigated the FDI-growth link using various measures of financial market developmet as a measure of absorptive capacity. For instance, Hermes & Lensink (2003) employ domestic credit to the private sector to gauge absorptive capacity in examining the FDI-growth link for 67 developing countries from 1970 to 1995. They find that financial market is critical for FDI to translate into growth. The authors reveal that 37 out of the 67 countries under investigation

have adequate financial market that is developed to exploit the benefit of FDI inflows sufficiently to propel growth.

Alfaro et al. (2004), explore the FDI-growth link while controlling for financial markets for 49 countries from 1975 to 1995. The authors reveal that FDI independently exerts an ambiguous effect on economic growth. However, FDI performs well in countries with robust local financial markets. The findings are consistent with alternative indicators of financial market development and inclusion of relevant control variables. In a panel analysis of 80 countries, Durham (2004) explores FDI - growth link from 1979 to 1998. The authors use extreme bound analysis (EBA) and find that lagged values of FDI have no influence on growth. However, the growth impact of FDI is contingent on strong financial markets and institutions.

Lee & Chang (2009) also examine the FDI-growth nexus and control for financial market development for 37 countries for the period 1970 to 2002. The authors find that the growth effect of financial market outweighs that of FDI. Thus, the potential benefits of FDI is greater with well-functioning financial market. In a related study, Sghaier & Abida (2013) explore the FDI-growth link using financial markets to gauge absorptive capacity for four countries in north Africa: Egypt, Algeria, Morroco and Tunisia spanning the period 1980 to 2011. Using GMM panel data estimation method, the authors reveal that financial market development promotes growth. This results resonates with ealier studies (Alfaro et al., 2004 ; Durham, 2004).

From the previous literature, FDI independently has an ambiguous effect on economic growth. However, its positive effect on growth is certain when relevant absorptive capacities are controlled

for. From the literature, it is clear that existing research suffer from a number of deficiencies. First, there is scarcity of studies in SSA that have examined economic freedom, financial market fragility, FDI and their effect on economic growth in a single multivariate framework. In addition, there is paucity of literature in SSA that uses financial market fragility as a measure of financial market development that checks the robustness of the financial system to shocks. The empirical literature presents two opposing views on the effect of financial intermediation on economic growth. The first argues that financial depth measured by domestic credit to private sector and stock market capitalization exert a positive effect on growth (Arestis et al, 2001; Adu et al., 2013). The second which is the banking and currency crisis literature revealed that monetary aggregates, such as domestic credit to the private sector and broad money to GDP ratio are among the best indicators of crisis which results in economic decline (Ayadi et al., 2015). However, these measures contain indicators of financial fragility of commercial banks only. Depending on the jurisdiction, focusing on commercial banks indicators only can overestimate or underestimate financial fragility. For instance, in countries where deposit taking institutions (eg real estate, mortgage banks and investment banks) have played a critical role in buildup to the subprime crisis, the use of commercial banks indicators alone could lead to underestimation of financial fragility.

This study employs a comprehensive and a unique data set by Andrianova et al. (2015) which has a wider coverage on financial fragility to explore the effect of financial fragility in the FDI-growth nexus. This unique data set includes commercial banks indicators and all types of deposit taking institutions to explore the implications of financial fragility within the FDI-growth nexus in Sub-Saharan Africa.

3.3 Methodology and Data

We empirically determine the effect of absorptive capacities in investigating the FDI-growth nexus. This is achieved by combining three different datasets. The index of economic freedom was sourced from The Heritage Foundation, the financial market fragility index (ratio of cost to revenue) measuring managerial inefficiency was extracted from the New International Database of Financial Fragility developed by Andrianova et al. (2015). All other variables used were sourced from the World Development Indicators.

3.3.1 Econometric Model

We present a general production function as:

$$Q = AK^{\alpha}L^{\beta} \tag{3.1}$$

Where Q is the total output obtained from the production process, A is a constant term that measures the state of technology, K &L are units of capital and Labour, respectively. α and β represent the elasticities of the inputs employed in the production process.

In our model for estimation, we modified the general production function presented in equation one with some additional arguments and present it as:

$$lnQ_{i,t} = \varphi_0 + \varphi_1 K_{i,t} + \varphi_2 L_{i,t} + \varphi_3 FDI_{i,t} + \varphi_4 AC_{i,t} + \varphi_5 (FDI \times AC)_{i,t} + \varphi_6 \mathbf{Z}_{i,t} + \varphi_7 \gamma_{i,t} + \varphi_8 \eta_{i,t} + u_{i,t} \tag{3.2}$$

Where lnQ denotes the natural logarithm of real GDP per capita growth. This measure resonates with Alagidede et al. (2014), Acikgoz et al. (2016), Zghidi et al. (2016). FDI is FDI as a proportion of GDP, AC denotes absorptive capacity such as economic freedom and financial fragility, **Z** is a

vector of control variables used. This includes inflation and trade openness. Time (t) and country (i) fixed effects are represented by γ and η, respectively u represents the error term.

Our panel data constitutes 507 observations. This covers the period from 1998 to 2016, with 36 Sub-Saharan African countries.The choice of countries and time span was informed by data availability for our traditional growth variables as well as our variables of interest.

Table 3.1: Data Description, Measurement and Sources

Variable	Notation	Description and Sources
Dependent Variable: Real Gross Domestic Product Per- capita growth(% annual)	$GDP_{pcgrowth}$	Real GDP per capita is the annual percentage growth rate of output in constant 2010 local currency, divided by the population. Real GDP is measured by the summation of gross value added by all producers in the economy plus net indirect taxes. Source WDI
Explanatory Variables	***Regressors***	
Foreign Direct Investment (% GDP)	$FDI^{+/-}$	Net inflows of investment, being the sum of equity capital, reinvestment of profits, other long-term capital, and short-term capital, to acquire long-term management interest in an enterprise operating in an economy other than that of the investor, expressed as a percentage of nominal GDP. Source: WDI
Gross fixed capital formation (%GDP)	*Capital* $(lngcf\_gdp)^{+}$	Gross fixed capital formation is the actual additions to capital stock or fixed assets in the economy including net changes in inventories. Capital formation refers to improvements made on land, acquisition of plant and machinery, purchases of equipment, and general constructions. Source :WDI
Trade (% of GDP)	*Openness* $lntradeop^{+/-}$	Trade is the total value of exports and imports of goods and services expressed as a percentage of gross domestic product. Source WDI
Consumer Price Index	$lninf\_cpi^{-}$	Consumer price index (2010 = 100). Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Data are period averages. Source: WDI
*Financial Market Development	*Fragility* $(lncost)^{-}$	Managerial inefficiency is a measure of financial fragility in literature (Andrianova et al.2015) calculated as cost to revenue ratio.Increase in the ratio indicates managerial inefficiency.
*Economic Freedom	*Overall Score* $lnEcon^{+}$	Economic freedom is an index measuring the degree of freedom economic agents have in undertaking production and consumption activities in a country. It is measured on a scale of 0 (lowest) to 1 (highest). The index comprises four key component measures, each with its sub components – Rule of Law (comprising judicial effectiveness, property rights); Government role (comprising government integrity, government spending, tax burden, fiscal health, fiscal freedom); Regulatory Efficiency (comprising labor freedom, monetary freedom, business freedom); and Open Markets (comprising investment freedom, financial freedom, trade freedom). Source: The Heritage Foundation (THF).
Labour Force	$lnlab\_t^{+}$	Labour force participation rate is a measure of the proportion of the working age population (15 to 65 years) that are in the labour force. It is calculated by dividing the labour force by the working population and expressed as a percentage. Source: WDI

NB:Absorptive capacities are measured by financial market fragility and economic freedom.
(+/-) are the expected signs.

Prior to the estimation, the descriptive statistics was carried out and the results are presented in Table 3.2 below.

Table 3.2 Descriptive Statistics

Statistics	Lnrgdppcgrowth	fdigdp	lncost	lnEcon	lninf_cpi	lntradop	lngcf_gdp	lnlab_t
Mean	6.600	4.245	4.012	0.070	1.911	4.217	35.080	15.113
Median	6.309	2.585	4.083	0.063	1.905	4.197	35.280	15.338
Stan. Dev.	1.051	6.456	0.407	0.051	1.293	0.484	1.515	1.316
Skewness	0.791	4.746	-2.238	5.217	1.200	0.433	-12.569	-0.232
Kurtosis	2.886	38.577	12.753	28.826	10.814	3.506	239.442	2.285
Min.	4.612	-5.497	1.338	0.035	-3.305	3.043	5.283	12.183
Max.	9.353	74.124	5.441	0.366	10.103	6.276	36.841	17.865
N	**683**	**678**	**653**	**630**	**622**	**661**	**632**	**679**

**Note: lnEcon was scaled by 100. Labour & trade reports the highest correlation coefficient of -0.48.*

From Table 3.2, FDI as ratio of GDP has a mean of 4.245 and the highest standard deviation of 6.458 reflecting the highest variability among the series. In contrast, economic freedom recorded the lowest mean and standard deviation of 0.070 and 0.051, respectively, showing the lowest variability among the series. Amongst the series with low variability are financial market fragility with a mean of 4.021 and a standard deviation of 0.407 and trade openness with a mean and standard deviation of 4.217 and 0.484 respectively. Real GDP per capita records a mean of 6.600 and a standard deviation of 1.051. This is an indication of low-income levels in many countries in SSA. GFCF has the largest mean of 35.080 and a second standard deviation of 1.515 after FDI. To proceed with our estimation, we try to exonerate this study from criticism of spurious regression.

So we test the stationarity properties of all the variables used in the study using panel unit root tests.

The Panel Unit Root

In general, most econometric variables demonstrate stochastic trends that produce spurious regression.Thus, investigating the long run relationship between economic growth and it drivers calls for the examination of the stationarity properties of the series. There are many unit root test available for testing the unit root properties of variables which include Fisher P-P test, Maddala and Wu (1999) and Choi (2001), Im, Pesaran, and Shin(IPS, 2003), Breitung (2001) and Hadri(2001). In this chapter, we use the Fisher P-P test because unlike other methods, it does not rely on different lag lengths in each ADF estimation. It can also be applied whether the panel is balanced or unbalanced. Moreover, it can be used on panels with missing data points. The ADF Fisher chi square and IPS were carried out for robustness.The null hypothesis is that the variables are stationary. The alternative hypothes is that the variables are not stationary.

Table 3. 3: Panel Unit Root Test Results.

Panel Unit Root Tests Method	Variables	lnQ	FDI	lnCost	lnEcon	lnCPI	lnTardeop	lnGCF	lnLab
ADF$_{\text{Fisher chi-square}}$	Level	289.43	235.93	163.61	235.73	301.90	116.30	353.97	59.01
	Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PP$_{\text{Fisher chi-square}}$	Level	414.04	498.46	225.05	548.50	322.38	151.40	397.57	35.18
	Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IPS$_{\text{w-stat}}$	Level	-12.09	-9.63	-6.23	-24.59	-13.73	-3.73	-12.75	16.11
	Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	1.diff.								-3.78
	Prob.								0.00

In cases where countries with dissimilar degrees of development are panelled as in our case, dynamic models may be prone to suffer some degree of bias (Acikgoz et al., 2016). A solution

suggested by Im et al. (2003) which has been reiterated by Apergis & Payne (2009) is to average the coefficients of the ADF unit root tests with different orders of serial correlation.

The panel unit root results are presented on Table 3.3. All the variables are stationary at levels based on the Fisher P-P Chi-square unit root test which is deemed ideal regardless of whether the panel is balanced or unbalanced. The robustness of the results was checked using ADF Fisher chi square and the IPS test. The ADF Fisher chi square confirms the stationarity of the variables at levels while the IPS confirms the stationarity of the variables at levels with the exception of total labour force which become stationary at first difference. In general, the variables are stationary and the cointegration test is carried out.

Panel Cointegration

Cointegration tests are carried out to test whether a long run relationship exist between variables. The methods used to test panel cointegration are Kao (1999), Pedroni (1999) and Maddala & Wu (1999) or Fisher test. Cointegration test addresses issues of endogeneity, slope heterogeneity and omitted variables which are often encountered in econometric models. In addition, panel cointegration techniques can be applied on data with short time periods unlike time-series techniques.

The Pedroni test estimates the cointegration equation distinctly for each panel member and assesses the residuals in relation to the unit root attribute. The rejection of the null hypothesis denotes the presence of long run equilibrium. However, the cointegration vector could vary.

Pedroni (1999) suggest seven tests which can be classified into panel test (between dimension) and group test (within dimension) [See Table 3.4].

The Fisher test is built on the Johanssen (1998) framework. He proposed the likelihood ratio trace statistics and the maximum eigen value statistics to assess whether the variables move together in the long run. The Fisher test can be applied whether the panel is balanced or unbalanced. With Pedroni and Kao test, the lag lengths are set automatically by Schwatz Information Criterion (SIC).

Table 3.4 : Panel Cointegration Test Results

1. Pedroni's Cointegration Test (Deterministic intercept & Trend)				
Common Autoregressive coefficients (within dimension)				
Tests	**Statistic**	**p-value**	**Weighted statistic**	**p-value**
Panel v-Statistic	-1.442052	0.9254	-7.783818	1.0000
Panel rho-Statistic	6.227602	1.0000	6.074392	1.0000
Panel PP-Statistic	-5.494600	0.0000	-6.997361	0.0000
Panel ADF-Statistic	-3.379113	0.0004	-5.779598	0.0000
Individual Autoregressive coefficients (between dimension)				
Group rho-Statistic	8.109241	1.0000		
Group PP-Statistic	-14.95116	0.0000		
Group ADF-Statistic	-4.357379	0.0000		

2. Kao Residual Cointegration Test (No Deterministic Trend)	
Test Statistic	**p-value**
2.148540**	0.0158

3. Johansen Fisher Panel Cointegration Test (Linear deterministic trend)				
Null hypothesis	**Fisher Statistic (Trace test)**	**p-value**	**Fisher Statistic (Maximum Eigenvalue)**	**p-value**
r = 0	13.86	0.8374	13.86	0.8374
r ≤ 1	11.09	0.9438	47.93	0.0004
r ≤ 2	8.318	0.9895	82.00	0.0000
r ≤ 3	1.386	1.0000	167.2	0.0000
r ≤ 4	184.2	0.0000	184.2	0.0000
r ≤ 5	94.38	0.0000	83.29	0.0000
r ≤ 6	94.38	0.0005	47.39	0.0000

For robustness purposes, three different tests are provided in Table 3.4 to provide evidence of cointegration amongst the regressors. First, the Pedroni's test statistic is estimated under the assumption of common autoregressive coefficients (within dimension). The Panel v-Statistic and the Panel rho-Statistic at levels and when weighted failed to reject the null hypothesis of no cointegration. However, the Panel PP-Statistic and Panel ADF-Statistic rejects the null hypothesis

and provides evidence of a long-run relationship amongst the regressors. Furthermore, under the assumption of individual autoregressive coefficients (between dimension), except the Group rho-statistic which failed to provide evidence of co-integration, Group PP-statistic and Group ADF-statistic shows evidence of cointegration. Second, the Kao residual cointegration rejects the null hypothesis of no cointegration at 5 percent level of significance. Thirdly, the evidence to reject the null hypothesis is further supported by both the Trace and Eigen values of the Johansen Fisher Panel cointegration tests which provide strong evidence of cointegration.

3.3.2 Econometric Methodology

Now, to obtain long-run estimates of the role of absorptive capacities in determining the effect of FDI on economic growth, we proceed with the FMOLS econometric model. The ordinary least squares (OLS) produces biased estimates when the regressors are not strictly exogenous. Thus, the estimates cannot not be used for valid inferences when the integration of the variables is uniquely ordered. The reason is that under such conditions, they fail to produce efficient estimates (see Shahbaz et al 2015; Kwablah et al. 2014; Ouedraogo, 2013). Again, OLS estimates may suffer from serial correlation of the error terms and endogeneity of the non-stationary variables. Several asymptotically efficient panel cointegration estimators exist in addressing such deficiencies. For example, in making inferences, both FMOLS and Dynamic OLS give evidence of estimates of the standard errors that are consistent. Although the latter is found to perform well in parameter estimation and inference testing. However, the disadvantage according to Maeso-Fernandez et al. (2006) as cited in Ouedraogo, (2013, p.642) is that its “degrees of freedom are lowered by leads and lags”. A key advantage of the former, is that, it requires less assumptions than the DOLS. So, we used the FMOLS as it tends to produce more robust estimates (Ouedraogo, 2013). Toward this

end, we used the FMOLS econometric technique in order to address such deficiencies commonly associated with OLS estimators.

The FMOLS suggested by Phillips & Hansen (1990) is a semi-parametric approach which employs instrumental variables to generate robust estimates for both stationary and non-stationary variables which are cointegrated I(1). Again, it provides consistent estimates in small samples, and it is free of large size distortions in the presence of endogeneity and heterogeneous dynamics and absence of cointegration (Ouedraogo, 2013; Kwablah et al. 2014; Shahbaz et al 2015). Following Funk (2001), our conintegrated panel regression can be simplified as

$$Q_{i,t} = \gamma_i + \boldsymbol{X}_{i,t}\varphi + \varepsilon_{i,t}$$

Where Q is the outcome variable and a measure of economic growth as earlier indicated, **X** and ε are the m-dimensional vector of the regressors integrated of order I(1) and the stationary residuals, respectively. The rest of the variables is as earlier defined.

We specify X as a dynamic function and present it as:

$$X_{i,t} = X_{i,t-1} + v_{i,t}$$

The standard panel FMOLS estimator is given by:

$$\hat{\varphi}_{FM} = \left[\sum_{i=1}^{N}\sum_{t=1}^{T}(X_{i,t} - \bar{X}_i)(X_{i,t} - \bar{X}_i)'\right]^{-1}\left\{\sum_{i=1}^{N}\left[\sum_{t=1}^{T}(X_{i,t} - \bar{X}_i)\,(\hat{Q}^{+}_{i,t} - T\hat{\Delta}^{+}_{\varepsilon,v})\right]\right\}$$

Where $Q^{+}_{i,t}$ *is* the correction term for endogeneity and $\Delta^{+}_{\varepsilon,v}$ is the serial correlation term. 3.4: Results and Discussion

Table 3.5 shows the results obtained from the FMOLS econometric technique. Our study first find that FDI as a percentage of GDP exerts a negative effect on real gross domestic product per capita growth (Column 1). Specifically, a one percent increase in foreign direct investment retards growth

by 0.0273 percent. This is plausible in that, in SSA, most of the FDI goes into resource-seeking activities such as extraction of minerals and oil exploration which creates less job opportunities. In addtion profits from these activities are repatriated. Moreover, natural resources are mainly traded away rather than processed in the region. Therefore, resource-seeking FDI may be harmful to economic growth.

Table 3.5: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FMOLS	FMOLS	FMOLS	FMOLS	FMOLS	FMOLS†
FDI (%GDP)	-0.0273***			-0.0018*	0.0430***	0.0430***
	(0.003)			(0.001)	(0.004)	(0.004)
Financial Fragility (lncost)		-0.0730*		-0.0951***	-0.0459***	-0.0459***
		(0.040)		(0.022)	(0.006)	(0.006)
Economic Freedom (lnecon_100)			0.5639***	0.1267	-0.0333	-0.0333
			(0.135)	(0.079)	(0.028)	(0.028)
FDI ×Financial Fragility (c.fdigdp#c.lncost)					-0.0117***	-0.0117***
					(0.001)	(0.001)
FDI × Economic Freedom(c.fdigdp#c.lnecon_100)					0.0454***	0.0454***
					(0.006)	(0.006)
Inflation (lninf_cpi)				-1.0516***	-1.0493***	-1.0493***
				(0.005)	(0.001)	(0.001)
Openness (lntradeop)				-0.5111***	-0.5097***	-0.5097***
				(0.028)	(0.006)	(0.006)
Capital (lngcf_gdp)				0.0058**	0.0058***	0.0058***
				(0.002)	(0.001)	(0.001)
Labour (lnlab_t)				0.0871	0.1143***	0.1143***
				(0.079)	(0.018)	(0.018)
Constant	4.4152***	4.5983***	4.0498***	8.6458***	8.0648***	8.0648***
	(0.160)	(0.051)	(0.107)	(1.252)	(0.281)	(0.281)
Observations	616	600	582	507	507	507
R-squared	0.606	0.560	0.667	0.981	0.980	0.987

Dependent Variable: Real Gross Domestic Product Per Capita growth (% annual) (ln), †Model without South Africa
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Furthemore, the ability of a country to exploit FDI spillover efficiently is contingent on certain host country's characteristics (absorptive capacities) such as a well-developed financial market, quality human capital, the extent to which the country is opened to maximize the gains from trade, the degree of economic freedom as well as the extent to which the social infrastructure is developed. The absence of these absorptive capacities in most countries in SSA may account for

the negative effect of FDI on growth. This finding is in line with those of Mencinger (2003) and Herzer (2012).

In column (2), the fragility of the financial market impacts negatively on growth (see column 2). Specifically, a one percent increase in fragility hurts growth by 0.0730 percent. This is plausible in that, fragility can lead to a rise in growth volatility by tightening liquidity constraints. This will cause firms to cut down on their investment spending leading to a fall in output and growth. This finding is consistent with earlier studies of Adalet (2009), Ayadi et al.(2015) and Demetriades et al.(2017). In Sub-Saharan Africa, banks play important function in the selection as well as the monitoring of the activities of borrowers with good track record. Since bank crisis lead to recessions, an expansion of credit even to credit worthy borrowers is likely to slow down growth.

In column (3), economic freedom is found to have positive and significant impact on growth. Particularly, a one percent rise in economic freedom propels growth by 0.5639 percent. The reason is that the economic freedom creates the incentive structure for the private sector to thrive and this increases investment ouput and growth. Greater economic freedom motivates individuals to save a higher amount of their incomes for investment. In addition, where less constraint is imposed on economic activity, it will boost investment and growth.

Though the coefficient of the effect of FDI on growth is negative, after controlling for host country characteristics such as the degree of economic freedom, the stability of the financial market amidst crisis (fragility), trade, inflation, labour force and Gross Fixed Capital Formation, the study reveals a positive effect of FDI on growth(see column 4). This implies that in the presence of adequate

absorptive capacity in the host country, FDI is growth enhancing. Similar results have been obtained by Gwartney et al. (1999), Alfaro (2003) and Lee & Chang (2009).

In column (5), the coefficient of the interactive term between FDI and fragility is negative and significant indicating that fragility of financial markets in SSA could be detrimental to growth. A further investigation of the channel of transmission was explored. Using the interaction terms of FDI and financial fragility, one would expect that fragility in the financial market will impede a possible positive effect of FDI on economic growth. This is possible in that, investors who would want to build their businesses using local funds may be disappointed as it will cost them more relying on a fragile financial market. This is because such markets are susceptible to internal and external shocks which can increase the cost of borrowing from such financial institutions. Also, investors who enter the domestic market with the intention of depositing their funds with the fragile financial sector perhaps due to high crime rates in SSA, do so at their own peril. This is because such markets are characterized by high business risks and non-performing loans which easily collapse financial institutions.

On the other hand, the coefficient on the interactive term between FDI and economic freedom is positive and significant, an indication of a strong complementary effect between FDI and economic freedom. This is plausible because countries with high economic freedom indices are mostly bound by a system of accountability and low levels of corruption. Using the interaction terms of FDI and economic freedom to show the transmission mechanism, one would expect that economic freedom will not only attract FDI but also facilitate a possible positive effect of FDI on economic growth. Simply put, FDI in the presence of economic freedom promotes economic

growth in SSA. However, FDI in the presence of fragility hurts growth. Loayza & Ranciere (2006) find that financial development propels growth but financial fragility measured by banking crisis and financial volatility are inimical to growth. The total effect of financial liberalization and intermediation on economic growth may be a mixture of these effects but their relative effects might depend on the extent to which the financial market is developed in each country.

Interestingly, the magnitude of effect of financial fragility on growth when interacted with FDI reduces. It also shows that FDI perhaps has some complementary factors on financial market stability. FDI brings in managerial expertise which can induce competitive managerial behavior locally and this can in the face of financial fragility help strengthen the system. Also, the combined effect of FDI and economic freedom outweighs the financial FDI financial fragility effect. So, in the end the net effect of FDI remains positive in the presence of economic freedom. This shows the importance of economic freedom.

Inflation exerts a negative and statistically significant effect on growth. Particularly, a one percent rise in inflation results in a reduction in growth by 1.0493 percent. This result is plausible in that inflation is a measure of economic uncertainty and risk about future investment projects and therefore can suppress investment and consequently hurt growth. Furthermore, since inflation is an indicator of macroeconomic instability, high variability in inflation discourages investment in the long run. The reason is that high levels of inflation points to macroeconomic breakdown which erodes gains from investment. Besides, inflation may erode the international competitiveness of the country by making its exports relatively expensive and consequently harm growth. Other empirical studies in SSA find similar results.

In Ghana for instance, Murbuah (2010) explores the effect of inflation on economic growth from 1955 to 2009. The authors reveal that inflation retards economic growth. In addition, there is a unidirectional causality from inflation to growth. Using time series data from Ghana from 1970 to 2006, Quartey (2010) finds that inflation hurts growth consistent with Murbuah (2010). In Tanzania, Odhiambo (2012) aslo examines the causal link between inflation, investment and growth from 1990 to 2009. Using the bound test approach, the study reveals a one-way causality from inflation to growth.

Domestic investment measured by gross fixed capital formation is another critical ingredient of economic growth. The study finds that domestic investment impacts growth positively. Specifically, when gross fixed capital is used as proxy for domestic investment increases by one percent, growth increases by 0.0058 percent. This results compares well with the findings of Adam (2009) and Elboiashi (2015). For example, In SSA, Adam (2009) explores the effect of FDI and domestic investment on economic growth from 1990 to 2003.Using both fixed effect and OLS estimation methods, the author finds that investment promotes growth. Similar results was found by Elboiashi (2015) in developing countries (Asia, Africa and Latin America) from 1970 to 2005.

The effect of trade on economic growth is negative and statistically significant. Specifically, a one percent rise in trade hurts growth by 0.5097 percent. This result demonstrates that trade limits economic growth. This result resonates with recent studies in SSA (Polat et al., 2015 ; Lawal et al., 2016). For instance in Africa, Polat et al. (2015) indicate that trade is injurious to economic growth. In Nigeria, Lawal et al. (2016) by using ARDL approach show that trade limits growth.

In contrast, Brueckner & Lederman (2015) by using instrumental variable approach reveal that trade promotes growth for 41 SSA countries both in the short and the long run.

In a more recent study, Keho (2017) examines the effect of trade on economic growth in Cote d'Ivoire from 1965 to 2014. Using the ARDL bounds test to cointegration and the Toda and Yamamoto Granger causality tests, the author reveals that both in the short and the long run, trade promotes growth. Moreover trade and capital formation plays a complementary role in promoting growth.Whereas, Musila & Yiheyis (2015) find no growth effect of trade in Kenya.

The negative effect of trade on growth could be attributed to high imports compared to exports. Again, where the prices of imports rise relative to prices of exports, it is an indication that the terms of trade have shifted in an unfavourable direction. This means that it now receives less imports for each unit of goods exported. Thus, a fall in terms of trade is expected to generate less FDI and consequently less growth. Furthermore, inadequate infrastructure, transport and communication systems and institutions lower efficiency, raise cost of doing business and erodes gains from trade. Theoretically, free trade enables countries to concentrate on the production of goods in which they are more efficient. However, trade restriction hinders countries from mutual beneficial exchanges as it reduces market size and limits full exploitation of comparative advantage in production. This leads to misallocation of resources which retards growth.

The coefficient of labour force is positive and significant. More specifically, a one percent increase in total labour force propels growth by 0.1143 percent. This result is plausible where a greater percentage of the labour force is educated and they perform jobs related to their skills. Quality

instituitions and well developed infrastructure are also likely to promote growth. In addition, the quality and stock of human capital can be increased by spending on health and education. The results from this study corroborates with the findings of Borensztein et al. (1998) and Jyun-Yi & Chih-Chiang (2008). For instance, using a cross-sectional data, Jyun-Yi & Chih-Chiang (2008) also find that FDI propels growth contingent on initial level of GDP and human capital. In contrast, Blomstrom et al (1992) examine the effect of FDI on economic growth for 101 countries over the period 1960-1985 and reveal that educational attainment is not crucial to achieve FDI growth effect.

3.6 Robustness Checks: Middle-Income versus low-income Countries, and Resource Rich versus Non-Rich Countries.

Table 3.6: Regression Results

VARIABLES	FMOLS(1) *Middle-Income Countries*	FMOLS(2) *Low-income Countries*	FMOLS (3) *Resource Rich Countries*	FMOLS (4) *Non-Resource Rich Countries*
FDI (%GDP)	0.0852***	-0.0499***	0.0895***	-0.0187
	(0.009)	(0.015)	(0.018)	(0.025)
Financial Fragility (lncost)	0.0262	-0.1132***	0.0382	-0.0917***
	(0.016)	(0.018)	(0.041)	(0.026)
Economic Freedom (lnEcon_100)	-0.2678***	0.5351***	-0.6631***	0.2613*
	(0.066)	(0.127)	(0.226)	(0.135)
FDI×Financial Fragility (c.fdigdp#c.lncost)	-0.0221***	0.0135***	-0.0245***	0.0060
	(0.002)	(0.004)	(0.004)	(0.006)
FDI×Economic Freedom c.fdigdp#c.lnoverscore_100	0.0527***	-0.0499*	0.1417***	-0.0594
	(0.013)	(0.027)	(0.035)	(0.044)
Inflation (lninf_cpi)	-1.0920***	-1.0327***	-1.0573***	-1.0421***
	(0.005)	(0.002)	(0.009)	(0.004)
Openness (lntradeop)	-0.5329***	-0.1807***	-0.7618***	-0.1805***
	(0.020)	(0.018)	(0.038)	(0.031)
Capital (lngcf_gdp)	0.0038***	-0.0074***	0.0050*	0.0017
	(0.001)	(0.003)	(0.003)	(0.005)
Labour (lnlab_t)	0.8354***	0.0857*	-0.1928*	-0.2187**
	(0.052)	(0.051)	(0.114)	(0.091)
Constant	-3.2942***	6.1528***	13.7316***	10.2933***
	(0.841)	(0.789)	(1.839)	(1.337)
Observations	259	247	221	285
R-squared	0.978	0.985	0.978	0.989

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Dep Variables: Real Gross Domestic Product Per Capita growth (% annual) (ln)

Furthering the analysis by grouping the countries into middle income and low income countries (columns 1&2) and resource rich and non-resource rich countries (columns 3&4), the estimation results indicate that the effect of FDI as percentage of GDP on growth is positive and significant for middle-income and resource rich-countries but negative for low-income and non-resource rich countries. These results could be attributed to the fact that countries in the middle-income and resource rich- countries have adequate absorptive capacities compared with low income countries and non-resource rich countries. The use of a somewhat sophisticated technology, quality human capital, improved investment climate and quality institutions and domestic financial markets in relatively middle-income and resource countries may have accounted for this relationship. However, for low-income countries and non-resource rich countries, production is undertaken with obsolete technology by SMEs. The replacement of these obsolete technologies is a major challenge due to inadequate capital to purchase new ones. The presence of absorptive capacities in middle-income countries enable them to exploit FDI more efficiently. These results are consistent with the results of the aggregate sample presented in Table 3.5.

Finacial fragility in middle-income and resource-rich countries have no significant impact on growth but hurts growth in low-income and non-resource rich countries. The disparity in the results could be attributed to the existence of a relatively weak financial sector in low-income and non-resource rich countries. Ironically, greater freedom in middle-income and resource rich-countries retards growth but propels growth in low-income and non-resource rich countries. We conclude our analysis by acknowledging from our evidences that FDI impacts on growth provided the right absorptive capacities are put in place by the host countries.

3.6 Summary , Conclusion and Policy Recommendations

One major source of capital needed for growth in developing countries is FDI. However, the spillover effect of FDI on growth is contingent on host country characteristics known as absorptive capacities. Several studies have shown that FDI promotes growth in the presence of adequate absorptive capacities in the recipient country. Most of these studies have concentrated on trade openness, human capital development, domestic investment etc.

A robust financial system have been identified as a requirement for FDI to translate into growth. It has been argued that a robust financial system reduces transactions cost, information asymmetry and aid in efficient allocation of resources. However, the major deficiency with these studies is that they did not take into cognizance the fragility of the financial market on the growth effect of FDI. We contend that, ignoring the fragility of the financial market on the growth effect of FDI may weaken economic growth. The reason is that, the development of the financial market is dependent on the degree of fragility in the market.

The present study employs two absorptive capacities-financial market fragility and economic freedom to examine the growth effect of FDI in 36 developing countries from 1998 to 2016. The results indicate that the growth effect of FDI can be misleading without accounting for economic freedom and the role of fragility in the development of the financial system. The results indicate that greater economic freedom propels economic growth whiles the fragility of the financial market is detrimental to growth. Thus, the growth effect of FDI depends on robust financial system and greater economic freedom. In general, developing countries and SSA in particular have fragile financial system. Thus, there is the need for policy makers to regulate banks' balance sheets

through capital requirements to make them more robust to shocks. In addition, since fragility results from banks taking on too many illiquid liabilities relative to the liquidity of their assets, fragility can be addressed by increasing taxes on such liabilities or reducing the volume of liabilities. Moreover, policy makers should place restrictions on the flows of financial capital and assets to curb the spread of fragility. There is also the need to create incentive structure by promoting economic freedom.

In sum, there is the need for policy makers to formulate and implement macroeconomic and development policies aimed at building a strong financial system that is robust to shocks. Furthermore, governments must ensure the liberty and freedom of citizens as this might translate into economic growth.

CHAPTER FOUR

FOREIGN DIRECT INVESTMENT, GROSS DOMESTIC PRODUCT AND CARBON DIOXIDE EMMISON IN SSA: A DISAGGREGATED ANALYSIS

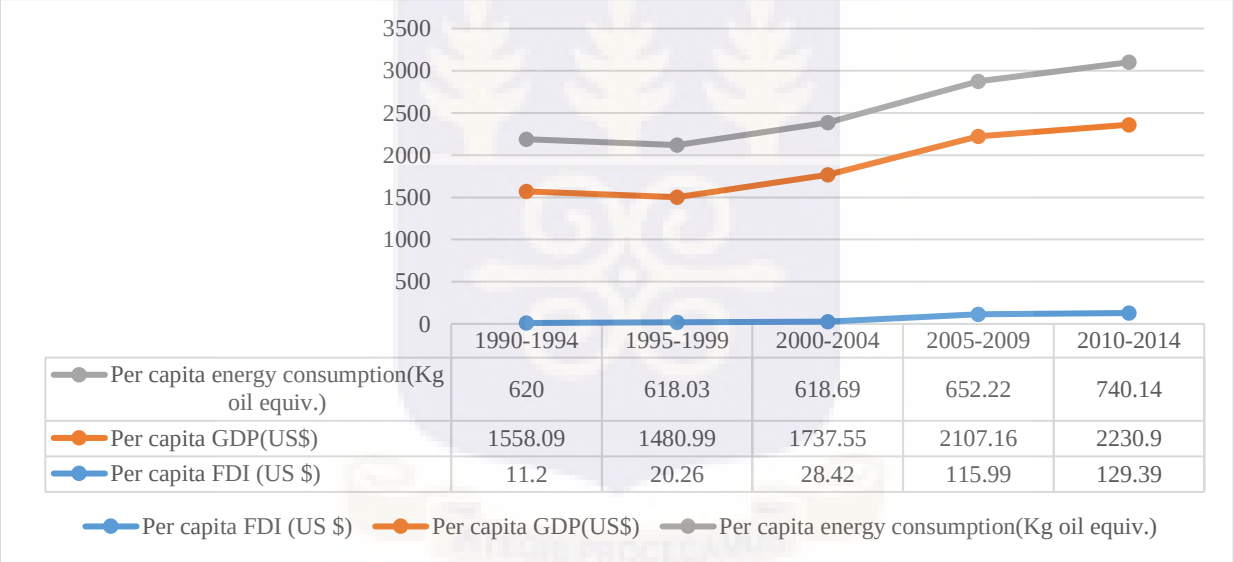
4.1 Introduction

Globally, the rise in Green House Gases (GHGs) has been of enormous concern to researchers and policy makers for more than two decades. This is because GHGs deplete the ozone layer which plays a vital role in blocking the direct rays from the sun from hitting the earth's surface causing global warming (Ravishankara et al., 2009). The adverse effects of global warming comprises, the gradual washing away of sandy beaches, increase in the sea level, droughts and floods (Douglas et al., 2000). Currently, global climate change as a result of increasing concentration of GHGs particularly CO_2 emissions from fossil fuel combustion, continue to pose a major environmental challenge**.** McLellan et al. (2014) indicate that the persistent increase in demand for natural resources and rising concentration of carbon dioxide (CO_2) have negatively affected biodiversity and bio-capacity as well as the survival of humans pertaining to food production and water scarcity.

Existing literature indicates that FDI increases economic activity which triggers the demand for energy and consequently CO_2 emission (Shahbaz & Leitão, 2013; Sbia et al., 2014). In Sub-Saharan Africa most of the FDI goes to extractive industries such as mining and oil exploration. The blasting of rocks during mineral extraction and the use of heavy equipments which require high amount of energy contribute significantly to CO_2 emission. The key drivers of CO_2 emissions are the combustion of coal, oil and natural gas constituting 89 percent of global CO_2 emissions(Olivier &Peters, 2018).

Though Sub-Saharan Africa (SSA) contributes less CO_2 the main GHG which causes climate change, it is highly vulnerable to its adverse consequences. Africa's vulnerability to climate change is further aggravated by widespread poverty, persistent droughts and floods, regular dependence on natural resources and biodiversity (Simms & Murphy, 2005). Figure 4.1 and 4.2 show the trend of FDI, GDP, energy consumption and natural resource depletion in SSA.

Figure 4.1: Trends in Per capita Foreign Direct Investment, Gross Domestic Product and Energy Consumption in Sub-Saharan Africa.



	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014
Per capita energy consumption(Kg oil equiv.)	620	618.03	618.69	652.22	740.14
Per capita GDP(US$)	1558.09	1480.99	1737.55	2107.16	2230.9
Per capita FDI (US $)	11.2	20.26	28.42	115.99	129.39

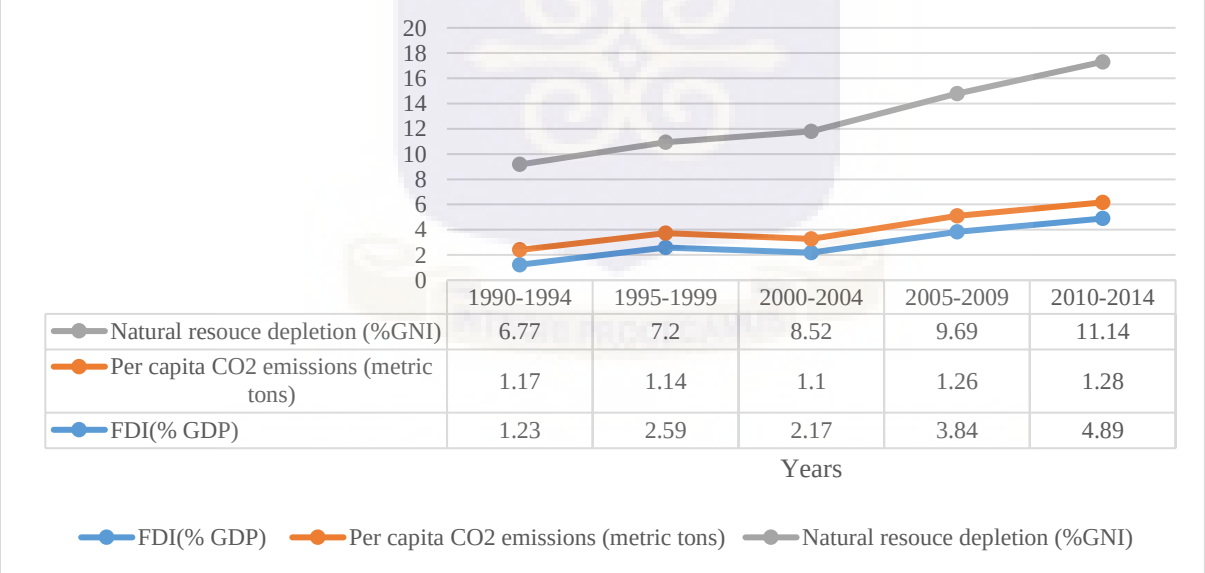
Source: (World Development Indicators, 2016).

From figure 4.1, per capita FDI increased from 11.2 US dollars during the period 1990-1994 to 129.4 US dollars in 2010-2014**.** The inflows of FDI in SSA over this period can be attributed to the response of the gains that effective outsourcing and international production techniques can possibly offer to the host country. The mean annual per capita GDP also surged from 1558.09 US

dollars to 1735. 55 US dollars during the period 2000-2004 and further rose to 2230.90 during the period 2010-2014.

This increase in per capita income has triggered demand for energy and natural resources. The energy per capita measured in kilograms (kg) oil equivalent increased from 620.00 to 740.14 representing 16.15 percent rise in energy consumption over the entire period. The rise in GDP per capita coupled with the rise in the requirements for energy and natural resources have exacerbated the problem of environmental degradation.

Figure 4.2: Trends In Foreign Direct Investment, Per capita Emissions and Natural Resource Depletion in Sub-Saharan Africa.



	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014
Natural resouce depletion (%GNI)	6.77	7.2	8.52	9.69	11.14
Per capita CO2 emissions (metric tons)	1.17	1.14	1.1	1.26	1.28
FDI(% GDP)	1.23	2.59	2.17	3.84	4.89

Source: (World Development Indicators, 2016).

From Figure 4.2, the amount of average annual FDI in SSA stood at 1.23 percent of Gross Domestic Product (GDP) in the early 1990s and this rose to 2.59 percent during 1995-1999 period.

However, the percentage of FDI declined to 2.17 percent of GDP during the 2000-2004 and increased to 4.9 percent of GDP during 2010 -2014 period. CO_2 emissions in metric tons per capita on the average also rose from 1.17 in the early 1990s to 1.26 during 2005-2009 and further increased to 1.28 metric tons per capita in the period 2010-2014. Over the same period, natural resource depletion also increased from 6.77 percent of GNI in the early 1990s to 8.52 in the early 2000s and increased further to 11.14 percent of GNI during 2010-2014. Total GHG emissions also rose by 27.37 percentage points from 1990 - 2014 (Appendix 4.2).

The adverse effects of GHGs cannot be overemphasized International treaties have been signed aimed at decreasing the level of GHGs concentration in the atmosphere. For instance, the Kyoto Protocol was signed in 1997 with the objective of reducing GHGs concentration to 5.2 percent less than the 1990 intensity from 2008-2012. The Copenhagen (CP) accord adopted in December 2009 also requires countries to pledge to reduce their GHGs voluntarily. Notwithstanding these measures, the concentration of GHGs especially CO_2 has been rising. For instance, SSA recorded 6 percent increase in energy consumption between 2000 and 2008 whiles CO_2 emissions expanded by 20 percent over the same period (Al-mutali, 2012).

There has been scores of studies linking FDI, GDP and CO_2 emission (Pao & Tsao, 2011; Kivyiro & Arminen , 2014; Shahbaz et al , 2015). These studies have examined the effect of total FDI on carbon dioxide emissions in all sectors combined. However, the activities of foreign firms in different sectors may contribute unequally to greenhouse gases from particular sectoral activities. Hence, the need to examine the sectoral effect of FDI on carbon dioxide emissions in SSA. This study departs from previous studies by disaggregating both FDI, GDP and CO_2 emissions into

various sectors and incorporating domestic investment into the model to make pollution source clear.

The objective is to provide a comprehensive investigation of the impact of sectoral FDI on sectoral CO_2 emission in SSA and examine the existence of EKC for agriculture, industry and services in SSA involving 36 countries drawn from SSA from 1990 to 2016. The GMM estimation techinique is employed to resolve the issue of simultaneity that might originate from the existence of correlation involving the error term and the lagged dependent variable. The results show that total FDI per capita as well as investment in agriculture and services sector reduces CO_2 emissions. In contrast, FDI in industry increases CO_2 emissions. Total value added and value added from thevarious sectors exert no effect on CO_2 emissions. Furthermore, domestic investment in the services sector reduces CO_2 emissions but financial market development generates pollution in the services sector but both exert no effect in the agriculture and services sector. Moreover, urbanization was found to generate pollution in agriculture and industrial sectors. Finaly, there was evidence of inverted U-shaped EKC in the industrial sector validating the EKC hypothesis only in the industrial sector.

From a policy perspective, understanding the linkages between sectoral FDI, GDP and CO_2 emissions is key to designing and implementing sector specific environmental policies aimed at attenuating GHGs emissions in SSA. The rest of the paper is presented as follows: Section 4.2 presents the theoretical framework. Discussion and summary of selected empirical literature on FDI, GDP and the environment is presented in Section 4.3. The methodology is discussed in

section 4.4. The estimation results and discussion are presented in Section 4.5 and Section 4.6 draws conclusions and offer policy prescriptions from the results.

4.2 Theoretical Framework.

The theories that underpin the motivation by foreign firms to participate in FDI have been expressed in previous studies. Prominent among these include the market imperfections theory (Kindleberger, 1969; Knickerbocker, 1973; Buckley & Casson, 1976) and theories related to international trade (Vernon, 1966). However, a number of recent studies have identified the measure of environmental stringency in the host countries as another motivation by foreign firms to engage in FDI (Kivyiro & Arminen, 2014). Two main theories - pollution haven and pollution halo effect hypothesis have been articulated in the previous literature based on the stringency of environmental regulations. The pollution haven hypothesis postulates that MNEs have the tendency to gravitate to countries with lax environmental laws (Xing & Kolstad, 2002; Cole & Elliott, 2005). In contrast, the halo effect hypothesis states that MNEs use advanced and environmentally friendly techniques of production which can improve environmental performance (Eskeland & Harrison, 2003; Abornoz et al., 2009).

Existing empirical studies on FDI based on the strigency of environmental regulations have generated divergent results. For example, Markusen (1995) contends that strict environmental laws do not provide enough incentives for foreign firms to expand production or move to other countries. In contrast, Ulph & Valentini (1997) demonstrate that under certain conditions, strict enforcement of environmental laws might cause industries to move to other countries where the

cost of pollution is low. The open economy analysis was extended by Markusen (1995) to incorporate endogenous market structure.

Following Markusen (1995), Doytch & Uctum (2016) analyze the effect of FDI on environment using partial equilibrium model for two firms from two countries operating in an imperfect market under the following assumptions:

(i) A local (home-grown) and a foreign firm (MNE) compete in both markets with different goods that are not perfect substitutes for each other.

(ii) Each firm can influence the price of their own products in the market and has the prerogative to make decisions to either produce at home or open a subsidiary in order to produce at home and abroad. In line with literature, local firms are those producing domestically. In contrast, foreign firms are investments in which the firm exerts a significant controll in the enterprise or sites a subsidiary abroad (Markusen, 1995).

In line with Markusen (1995) the model takes into account only horizontal FDI and disregards vertical FDI. Vertical FDI occurs when foreign firms divide their operations internationally, siting each stage of operation in the country where the cost of production is relatively low. On the other hand, horizontal FDI arises when foreign firms produce identical goods or service in many countries.

The status of the environment (in terms of the level of pollution) is a by-product of local production.The status of the environment E_{it} (in country *i* at time *t*) is a function of aggregate production X_{it} and an exogenous factor.

$$E_{it} = \theta + \pi X_{it} \qquad (1)$$

Aggregate production X_{it} in the host economy is the sum of the production of a domestic company (X_{itd}) which either be a foreign firm or not, and the production of a foreign firm MNE (X_{itf}) Thus aggregate production is presented as:

$$X_{it} = X_{itd} + X_{itf} \qquad (2)$$

Since the aim of the study is to examine the effect of FDI on the environment, the foreign company is considered a MNE producing both at home and abroad and the domestic company is a national company producing locally. It is assumed that both domestic and foreign companies produce using capital K and labour L and the same technology. The state of the environment (pollution level) that minimizes their cost of production are E_{itd} for the domestic company and E_{itf} for the foreign MNE. The cost minimization of the domestic economy in a static equilibrium without time subscript can be presented as:

$$C = WL + RK + TE_d \qquad (3)$$

Subject to the resource constraint:

$E_d^{\alpha}(KL)^{1-\alpha} \geq \overline{X}$ Where $0 < \alpha < 1$

$E_d \leq \overline{E}_d$

Pollution is deemed a joint production technology and a factor of production. *W* denotes the wage rage, R represents rental rate of capital and *T* denotes the cost of polluting the home or domestic environment (abatement cost) , $\overline{X}$ represents the required output target and E_d is the pollution generated as a result of domestic or local production, $\overline{E_d}$ is target or maximum allowable level at which domestic or local production can pollute the environment. The optimal output of the domestic firm is obtained by substituting the conditional demand equation into the production function. Thus, $X_d^* = X_d(V_d, \overline{E_d}, \overline{X})$ (4)

Where V_d = *(W, R, T).* This implies V_d denotes a vector of domestic cost of production.

The foreign company operatess both at home and abroad and thus affect the environment in both countries. With regard to production in recipient country, MNEs engage local labour and pay prevailing local wages. When producing at home, it engages labour and pays wages pertinent to the foreign country.

To enable the MNE to produce X_h abroad, it engages labour L_h from the host country at the existing wage of W and brings in foreign capital K_h at a rate R prevailing at its home market. The MNE pollutes its own environment by E_d in the home country and E_h in the host country where it faces similar target levels of pollution at an abatement cost of T .

Given that the goods in question are not perfect substitutes, their cost equations can be separated. Thus, the production cost of the MNE abroad is given as:

$$C_h = WL_h + RK_h + TE_h \quad (5)$$

The cost that MNE will incur in producing at home is given by:

$$C_d = WL + RK + TE_d \quad (6)$$

Thus, total cost of the MNE for producing at home and abroad is given by $C_T = C_d + C_h$

The MNE minimizes total cost

$$C_T = (WL + WL_h) + (RK + RK_h) + (TE_d + TE_h) \quad (7)$$

Subject to:

$$E_h^{\alpha}(K_h L_h)^{1-\alpha} \geq \overline{X}_h$$

$$E_h \leq \overline{E_h}$$

To concentrate on the pollution of MNE in the host country, the study ignores the production of MNE at home. Thus, MNE optimal output in the host country is represented as:

$$X_h^{*} = X_h(V_h, K_h \overline{E_h}, \overline{X_h}) \quad (8)$$

Where $V_h = (W, R, T)$. V_f denotes the vector of production cost of MNE in the recipient country. Since K_h is a covariate in the reduced form environmental equation, it is not replaced in the output function. The environmental quality equation is obtained by substituting equations (2), (4), and (8) into (1). Substituting for the optimal demand for FDI is equivalent to instrumenting K_h using factor prices. The system GMM method instruments the current levels of FDI by its lagged differences and the current differences of FDI are instrumented by it lagged levels.

$$E = \theta + \pi[X_d(V_d, \overline{E}_d, \overline{X})] + X_h[V_h, K_h, \overline{E_h}, \overline{X}_h)] = E(\theta, V_d, V_h, K_h, \overline{E_d}, \overline{E}_h, \overline{X}, \overline{X_h}) \quad (9)$$

We transform equation (9) by log-linearizing both sides of the equation and integrating to obtain environmental pollution equation of the form:

$$E = \Phi_0 + \Phi_1 v_d + \Phi_2 v_h + \Phi_3 \bar{x} + \Phi_4 \bar{x}_h + \Phi_5 \overline{E}_d + \Phi_6 \overline{E_h} + \Phi_7 f \quad (10)$$

Where lower case variables are the natural logs of higher-case variables and *f* is FDI inflows which is denoted by (K_h) in equation (9): Where Φ_0 is a constant and Φ_1; Φ_2; Φ_3; Φ_4; Φ_5; Φ_6 and Φ_7 are the elasticities:

To determine the impact of FDI on the environment consistent with what is used in previous literature, we transform equation (10) as follows:

$$E_t = \alpha_0 + \alpha_1 v_t + \alpha_2 x_t + \alpha_3 f_t \qquad (11)$$

Assuming cross symmetric effect for cost, output and target pollution ($\Phi_1 = \Phi_2, \Phi_3 = \Phi_4, \Phi_5 = \Phi_6$)

($\partial E / \partial \overline{E_d} = \partial E / \partial \overline{E_h}$ and $\partial E / \partial \bar{x} = \partial E / \partial \overline{x_h}$)

To examine the threshold effect of FDI on the environment, we incorporate a quadratic term into equation (11) and re-write as:

$$E_t = \alpha_0 + \alpha_1 v_t + \alpha_2 x_t + \alpha_3 f_t + \alpha_4 f_t^2 \qquad (12)$$

Where $x = \bar{x} + \bar{x}_h$; $E = \overline{E_d} + \overline{E_h}$ and $\alpha_1 = \Phi_0 / \Phi_5; \alpha_2 = \Phi 3 / \Phi 5$ $\alpha_3 = \Phi 7 / \Phi_5$

The vector $v_t = (V_d, V_h)$ is the aggregation of control variables which involve country specific effects such as demography, institutions and production cost.

In equation (12) we expect the coefficient α_3 to positive and α_4 to be negative to validate the EKC hypothesis.

4.3 Literature Review

Previous studies linking FDI, GDP and the environment can be classified into three groups. The first group investigates the energy-growth nexus, the second looks at the growth-environment nexus. The third group examines all the nexuses by integrating all the relevant variables in a multivariate framework. This strand includes FDI as another determinant of the environment based on two conflicting hypotheses namely: the pollution halo hypothesis and the pollution haven hypothesis.

4.3.1 Energy – Growth Nexus

Since the pioneering work of Kraft & Kraft (1978) who investigate the relationship between energy and economic growth in the USA, scores of studies have emerged with diverse conclusions about the kind of link that exist between the variables. The first group of literature comprises individual country studies (Akinlo , 2008; Ouédraogo , 2010). Some of these studies have been on Africa (Wolde-Rufael, 2005 ; Akinlo , 2008; Ouédraogo , 2010). The second group employs a cross-country panel data approach (Lee, 2005; Von, 2009; Ozturk et al., 2010; Saidi & Hammami, 2015).Theoretically, as the economy grows, more energy is required to excecute economic activities. The implication is that the demand for energy to fuel economic activities rises as economic growth occurs. Moreover, it is expected that developed countries use energy more efficiently than developing countries. The nexus suggest that greater economic development is associated with increased energy consumption. In the same vein, for energy to be used efficiently it requires a geater degree of economic development. Consequently, the link between energy and growth could be either positive or negative. However, the expectation is that the link between the two variables should be positive.

4.3.2 Growth-Environment Nexus

The second nexus is strongly connectecd to the verification of the existence of Environmental Kuznets Curve (EKC) hypothesis. The EKC hypothesis postulates that environmental pollution rises with income but begin to fall as rising incomes exceed a certain threshold. Thus, the relationship between income and pollution is inverted U-shaped. Several subsequent studies have examine the growth-evironment link following the seminal work of Grossman & Krueger (1991). These studies include individual country studies (Shyamal & Rabindra,2004; Jalil & Mahmud , 2009; Freitas & Kaneko , 2011 & Adom et al., 2012), as well as cross-country panel studies (Judson et al., 1999; Harbaugh et al., 2002; Narayan & Narayan , 2010 ; Jaunky, 2011). Some of the proxies used in these studies as environmental indicators are CO_2, particulate matter (PM10) and sulphur dioxide (SO_2) (Akbostanci et al. 2009; Freitas & Kaneko, 2011; Orubu & Omotor, 2011). While some of the studies find evidence in support of EKC (Lucas et al.1992; Judson et al., 1999; Jalil & Mahmud, 2009; Narayan &Narayan , 2010 ; Orubu & Omotor, 2011; Jaunky, 2011) others find no evidence in support of the EKC (Boopen & Vinesh, 2011; Alam, 2015).

4.3.3 Foreign Direct Investment - Growth - Environment Nexus

The third category of the literature incorporates all the nexuses into a single multivariate framework and identifies FDI as a crucial determinant of the environment. This line of literature is based on the pollution haven and pollution hallo hypothesis. The pollution haven hypothesis postulates that FDI inflows is at a cost to the environment in the recipient country. Polluting industries in high-income countries face higher regulatory costs than their counterparts in developing countries and tend to shift their polluting activities to developing countries with lax

environmental regulations. Consequently, countries with stringent environmental regulations will lose all the dirty industries and poor countries with lax environmental regulation become 'haven' for the world's polluting industries. The pollution halo hypothesis, however, states that MNEs tend to use advanced technology that is environmentally friendly and thus improves the environmental quality in the host country.

Scores of studies have been carried out to test these hypotheses. Some of these studies are country specific studies (see eg Elliott et al., 2013; Kivyiro & Arminen , 2014; Keho , 2016). Another line of this literature are cross-country panel studies (Eskeland & Harrison , 2003; Tamazian & Rao , 2010 ; Asghari, 2013 ; Pao &Tsai , 2011; Aboagye & Nketiah-Amponsah , 2016). This category of the literature employs CO_2, Sulfur dioxide (SO_2), Nitrous Oxide ($N2O$), energy consumption or energy intensity, Biochemical Oxygen Demand (BOD), particulate matter, forest depletion and natural resource depletion as basic indicators of the environment. In general, results are mixed. Some studies lend support to the pollution haven hypothesis (Cole & Elliot , 2005 ; Acharyya , 2009 ; Mahmood & Chaudhary , 2012; Hitam & Borhand , 2012 ; Shahbaz et al., 2015). Other studies claim evidence in support of the pollution halo hypothesis (Eskeland & Harrison, 2003; Tamazian et al.,2009, Tamazian & Rao, 2010 ; Lee, 2013; Asghari , 2013]. Blanco et al. (2011) note that the lack of clarity in various studies could be traced to the dissimilarities in scope, estimation techniques, methodologies, proxies and issues relating to data. In this study,we group the literature linking FDI, growth and the environment under the following sub- themes: Cross-country panel studies, country specific studies and sector specific studies.

Cross-Country Panel Studies

We begin by reviewing relevant cross-country panel data studies which examine the non-linear relationship involving the variables by investigating the existence of EKC hypothesis. For instance, using panel data for 24 transition economies, Tamazian & Rao (2010) examine the effect of FDI, energy consumption and economic growth on CO_2 emissions from 1993 to 2004. By using the GMM estimation technique, the authors find that both energy consumption and economic growth produce CO_2 emissions. In contrast, FDI reduces CO_2 emissions. The empirical evidence validated environmental Kuznets curve (EKC). The authors reveal that FDI through the use of technology which is efficient with regard to energy consumption can improve the quality of the environment.

In a study of 99 low, middle and high countries from 1975 to 2012, Shahbaz et al.(2015) explore the non-linear link between FDI and CO_2 emissions. Using the fully modified ordinary least squares (FMOLS) estimation method, the authors confirm the existence of an inverted U-shaped EKC between the variables. The effect of FDI in high income countries was negative but exerts no effect in the low income countries. In addition, the authors find a bidirectional causality between CO_2 emissions and energy consumption in the full sample and high income countries. The disparities with regard to the effect of FDI on the various income categories could be attributed to the differences in the enforcement of environmental regulations and the method of production used across income groups. Whereas high income groups may employ energy efficient methods of production and enforce strict environmental regulations, low income countries may relax environmental laws to attract FDI.

Panayotou (1997) examines the link between income and the environment for 30 countries drawn from developed and developing countries from 1982 to 1994. The author reveals that strong intitutions and effective policies are required to reduce SO_2 emmisions when income levels are low but speeds up improvements when income levels are high. Thus, it lowers the EKC and reduces the environmental cost associated with growth. In another study, Harbaugh et al. (2002) explore the link between income and air pollution globally and tested the EKC hypothesis using revised and updated panel data. Using different functional forms and controlling for country and year effects, the authors find that air pollution is driven by income. However, they did not find strong support of EKC for a number of pollutants and national income.

In a study of five East Asian countries (Malaysia, Thailand, Singapore and the Philipines and Indonesia), Zhu et al. (2016) examine the effect of FDI, energy consumption and economic growth on CO_2 emissions using panel quantile regression model. The authors find differential effect of the variables on CO_2 emission. The results indicate that FDI reduces CO_2 emission only at upper quantiles. In addition, energy consumption adds to CO_2 emissions but signicant only at upper quantiles. Moreover, population size and economic growth decrease emissions in high income countries. Trade openness also reduces CO_2 emission, especially in low and high income economies. The study validates the halo effect hypothesis in high income countries. However, they find weak support for the existence of U-shaped EKC in these countries.

Quite recent studies have also tested whether EKC exist in Africa. For example Aboagye & Kwakwa (2014) explore the effect of FDI on CO_2 emissions for 35 countries drawn from SSA over the period 1985 to 2010. By using GMM estimation method, the authors find that FDI reduces

CO_2 emission. The authors find no evidence in support of EKC with respect to CO_2 emissions. In the same vein, Jebli et al. (2015) examine the causal link between CO_2 emissions, renewable energy, trade and growth for 24 countries in SSA from 1980 to 2010. Using Granger causality test, the authors find a bidirectional causality between CO_2 emissions and economic growth in the short run. Again, a bidirectional causality was also observed between CO_2 emissions and exports. However, they find a unidirectional causality running from imports to CO_2 emissions and another from trade to renewable energy.

In a different light, Narayan & Narayan (2010) examine the presence of the EKC employing data from 43 developing countries which include Senegal, Ghana and Morocco. The results indicate a reduction in carbon dioxide emission overtime as income rises in Senegal, Ghana and Morocco. In the case of Middle, Eastern and South Asian countries, it was observed that as incomes rises overtime a point is reached when CO_2 emmisions begin to fall indicating the existence of an inverted U-shaped EKC. In the same vein, Orubu & Omotor (2011) test the existence of EKC for a sample of 49 countries which include Senegal, Ghana and Morocco and find evidence in support of the existence of EKC for air and water pollution. The turning points of the EKC for both measures of the environment were low demonstrating that African countries may attain the turning point on the EKC much faster and at a lower income level.

In a recent study, Aboagye & Nketiah-Amponsah (2016) examine the effects of economic growth, urbanization and industrialization on energy intensity in 36 SSA countries from 1980 to 2015. Using GMM estimation technique, the authors find that urbanization, industrialization and inflation tend to increase energy intensity. However, FDI and trade openness tend to decrease

energy intensity. Moreover, the authors find that the relationship between economic growth and energy intensity is non-linear.

The linear relationship between FDI, economic growth and the environment has also been investigated. For instance, using a panel data of 19 countries of G20, Lee (2013) examine the impact of FDI on CO_2 emissions, clean energy and economic growth from 1971 to 2009. The fndings from the study, indicates that FDI spur growth and reduces CO_2 emissions in these countries. However, FDI exerts no effect on energy consumption. In a study of 54 countries using silmutaneous equation approach from 1990 to 2011, Omri et al. (2014) find that both FDI and GDP increase CO_2 emissions. Dividing the countries into three regional sub-groups, the authors find both unidirectional and bidirectional causality between the variables.

Tamazian et al. (2009) also examine the link between financial market, economic growth and CO_2 emissions from 1992 to 2004 for Brazil, Russia , India, and China (BRIC). By using random effect model, the authors find that both economic growth and financial market development increase CO_2 emission in these countries. Using panel cointegration and Ordinary Least Squares estimation technique, Pao & Tsai (2011) also explore the link between FDI, energy consumption, economic growth and CO_2 emissions for BRIC from 1980 to 2007. The authors show that both energy and GDP generate more pollution than FDI. A bidirectional causality was found between FDI and CO_2 emissions; GDP and CO_2 emissions and GDP and energy consumption. In contrast, a unidirectional causality runs from GDP to FDI and from energy consumption to CO_2 emissions. The results validates both the pollution haven and halo hypothesis.

Using a fixed effect model, Holtz-Eakin & Selden (1995) examine the link between GDP and CO_2 emissions for 108 countries from 1951 to 1986. Using the estimated relationship to predict global emissions from 1986 to 2100, the authors find that as countries grow, CO_2 emissions declines. However, global emissions would rise annually by 1.8 percent. This can be attributed to the economic and population growth rates that contribute significantly to CO_2 emissions. In spite of that, the spate of development would not largely affect the annual rate or accumulation of CO_2.

Using data from 44 developing countries from 1987 to 1995, Talukdar & Meiser (2001) determine the impact of private sector involvement on emission of industrial CO_2 by controlling for cross-country differences in institutional and structural features which include the development of the financial market, FDI and industrial sector compostion. The authors find that, the more the private sector is involved in economic activity the less effect it has on the environment. Moreover, a well-developed financial market is likely to decrease environmental degradation when developed countries take part in the development of the private sector.

Eskeland & Harrison (2003) determine the impact of FDI in four developing countries from 1977 to 1990 using GMM estimation technique. Using different pollution indicators, the authors find that foreign firms dominate sectors that generate high pollution, though the evidence is not strong. However, foreign investment in developing economies is not associated with the cost of reducing pollution in developed economies. Furthermore, foreign plants use energy efficiently. Asghari (2013) tests the pollution haven and pollution halo hypothesis between FDI and CO_2 emission in MENA from 1980 from 2011. Using random and fixed effect models, the authors find that FDI brings managerial skills and sophisticated technolgy which uses energy efficiently.

Hoffmann et al. (2005) explore the causal link between FDI and CO_2 for 112 countries disaggregated into various income groups from 1971 to 1999. Using random effect and fixed effect models, the authors find a unidirectional causality from CO_2 to FDI in low-income countries. In the middle income countries, FDI causes CO_2 emissions and in the high-income countries, there is no causality between FDI and CO_2. The authors argue that low income countries with inadequate absorptive capacities like infrastructure and human capital may reduce environmental standards to attract FDI. Thus, low income countries become pollution havens due to the high cost of enforcing environmental regulations. The causality running from FDI to CO_2 in middle income countries show that foreign firms are duping governments to relax their environmental laws.

Country Specific Studies

In a detailed analysis of country specific study, Acharyya (2009) examines the benefits (GDP) and costs of FDI (environmental degradation) in India from 1980 to 2003. Using cointegration technique, the author indicates that FDI causes CO_2 emissions through GDP growth. In a related study, Hitam &Borhand (2012) investigate the benefit (GDP) growth and cost (environmental degradation) of (FDI) in Malaysia using Johansen cointegration and a non-linear model during the period 1965 to 2010. The authors find that FDI pollutes the environment in Malaysia consistent with the earlier studies of Acharyya (2009). Hitam & Borhand (2012) also demonstrate the existence of the environmental Kuznets curve. In a recent study, Balibey (2015) explores the causal links between FDI, GDP and CO_2 emissions in Turkey from 1974 to 2011. The author finds that FDI and GDP increase CO_2 emissions validating the pollution haven hypothesis.

Using ARDL approach, Merican et al. (2007) explore the link between FDI, GNI per capita and pollution for five ASEAN nations (Malaysia, Indonesia, Thailand, Singapore, and the Philippines) from 1970 to 2001. The authors find that, structural change is responsible for the rise in CO_2 levels in all five nations. In addition, FDI pollutes the environment in the Philippines, Malaysia and Thailand. However, FDI improves the environment in Indonesia but in Singapore it exerts no significant effect. Using the same method, Baek & Koo (2009) examine the link between FDI, GDP and energy consumption in India and China from 1978 to 2007. The authors find that FDI increases energy consumption in China but reduces energy consumption in India. The results could be attributed to the differences in the stringency in environmental conditions prevailing in these countries.

Another group of studies have focused on the impact of income on the environment. In general, studies that examine the environmental impact of income find that it pollutes the environment. For instance, using time series and panel data for Turkey, Akbostanci et al. (2009) explore the link between income and environmental quality. The time series model using cointegration technique was employed to explore the link between CO_2 emissions and per capita income. In contrast, panel data estimation technique was used to examine the link between income and particulate matter (PM10) and Sulphur dioxide(SO_2). The time series analysis reveals a monotonic relationship between CO_2 emissions and income. The panel data analysis indicates N-shaped relationship for (PM10) and (SO_2). Boopen & Vinesh (2011) aslo examine the link between CO_2 emissions and economic growth for Mauritius from 1975 to 2009. The authors reveal that economic growth pollutes the environment. Furthermore, there was no turning point for EKC and thus no evidence for inverted U-shaped EKC. The results indicate that notwithstanding the economic growth, the

country could not control its CO_2 emissions. In Greece, Hatzigeorgiou et al. (2011) explore the causal link between GDP, energy intensity and CO_2 emissions from 1977 to 2007. The results indicate the existemce of both unidirectional and bidirectional causalities among the variables. Furhermore, the anticipated changes in CO_2 emissions may be attributed to changes in energy efficiency and GDP. In a different light, Freitas & Kaneko (2011) investigate the link between energy consumption and pollution in Brazil. The authors find that demographic pressures and economic activity are the major drivers of emission. The main factors accounting for emission mitigation are carbon intensity reductions and a move toward renewables energy sources.

Several studies have been carried out in China with varied outcomes and sometimes conflicting results. These studies have used both energy intensities per unit of GDP and CO_2 emissions as indicators of environmental quality. We first examine studies that use CO_2 as an environmental quality variable. For instance, using time series data, Jalil & Mahmud (2009) explore the relationship between CO_2, trade, GDP and energy consumption in China from 1975 to 2005. By using ARDL approach, an inverted U-shaped relationship between income and CO_2 emission was found validating the EKC hypothesis. Moreover, there is a unidirectinal causality from GDP to CO_2 emissions. Thus, in the long run, GDP and energy consumption increase CO_2 emissions. However, the effect of trade on CO_2 emissions is negligible. Wang et al. (2013) also find that FDI increases CO_2 emissions using data of 287 cities from China.

Energy intensity has also been used as a proxy for the environment in scores of empirical studies in China. For example, Elliott et al. (2013) explore the link between FDI and energy intensity in China from 2005 to 2008. The authors, however, show that FDI reduces energy intensity.

However, this varies across cities. Moreover, an inverted U-shaped relationship between energy intensity and per capita income was found validating the EKC hypothesis. Similarly, Bao et al. (2011) explore the effects of FDI on emissions of five pollutants in China from 1992 to 2004. Using simultaneous equation to determine the scale, technique and composition effect, the authors reveal that FDI improves the environment via the technique effect. Moreover, the effect of FDI on the environment varies across regions and for different pollutants. In general, studies using energy intensity as proxy of environmental quality, indicates that FDI reduces energy intensity (Black &Wu (1998) in China; Cole et al.(2008) in Côte d'Ivoire, Mexico and Venezuela, and Ghana; Yue et al. (2011) in China; Herrerias et al. (2013) in China and recently Huang &Yu (2016) in China.

The differences in results can be attributed to different proxies of the environment and different geographical locations. It is evident from China specific studies that regardless of the econometric methods used, most studies that used CO_2 as proxy of the environment find that FDI pollutes the environment whereas studies that employ energy intensity find that FDI reduces energy intensity in China. The reduction in energy intensity is an indication of a lower price or cost of changing energy into GDP and therefore less pollution due to efficient use of energy.

Ajide & Adeniyi (2010) explore the link between FDI, GDP and CO_2 emissions in Nigeria from 1970 to 2006. The result shows a causal link between CO_2 per capita and FDI. Kivyiro & Arminen (2014) also examine the causality between energy consumption, FDI, GDP and CO_2 emissions in Kenya, South Africa, Zambia, Republic of Congo, the DRC (Democratic Republic of Congo) and Zimbabwe using time series data from 1971 from 2009. By using the ARDL approach, the authors find support for both the pollution haven and halo hypothesis. Most of the variables Granger cause

CO_2 emissions in different countries. Causality also runs from GDP to FDI in different countries. Granger causality running to CO_2 emissions are observed in countries where there is evidence of the EKC. The EKC was found in Kenya, DRC and Zimbabwe. The mixed results obtained by Kivyiro & Arminen (2014) are in line with the studies of Merican et al. (2007) and Baek & Koo (2009).

Using time series data from three countries in Africa, Adom et al. (2012) examine the effect of GDP, CO_2-intensity and industry value added as percent of GDP and CO_2 emissions from 1971 to 2007. Using ARDL bounds cointegration tests, the authors show that CO_2 emissions does not impede growth in Senegal but impedes growth in Ghana and Morocco. Finally, GDP fuels future CO_2 emissions in Senegal and Morocco. In Ghana, CO_2-intensity is the main driver for future changes in CO_2 emissions. In a recent study, Keho (2016) examines the effect of trade and FDI on energy intensity in 6 SSA countries from 1970 to 2011. Using bounds test and Granger causality, the author finds that FDI reduces energy in Nigeria and Benin. In Togo and Cote d'Ivoire, as FDI increases energy efficiency falls. In addition, as import rises, energy intensity falls in Cote d'Ivoire, Togo and Cameroon implying that trade improves energy efficiency.

The deficiency with the studies above is the use of time series data which have short data span which lowers the power of the test for stationarity and cointegration. In addition, they ignored possible endogeneity of regressors. Using panel data estimation help address these limitations. Panel data techniques have advantages over other methods since they provide more collinearity, variability, efficiency and degress of freedom and also control for unobserved and individual heterogeneity (Baltagi, 2005).

Sector Specific Studies on FDI Growth and the Environment

In a sector specific analysis, Jorgenson (2007) investigates the effect of investment in agriculture on CO_2 emissions in less-developed countries from 1980 to 1999. By using panel regression analyses of 35 less developed countries, the study confirms that these countries depend heavily on external capital. In addition, the use of tractors and the scale of production in the agriculture sector contributes to the build up of CO_2 emissions from this sector. Doytch & Uctum (2016) examine the effect of FDI on the environment using GMM estimation technique. The authors find that investments in manufacturing and non-financial services hurt the environment. The study further shows that FDI improves the environment in high income countries across industries, but hurts the environment in low income countries.

Using decomposition analysis, Paul & Bhattacharya (2004) also examine how changes in energy consumption and economic growth affect CO_2 emissions in India. The study show that economic growth is a major contributor of pollution is all the sectors. The industrial and transport sectors show a decline in CO_2 emissions as a result of improved energy efficiency and fuel switching. However, energy intensity exerts no significant effect in the agricultural sector. Energy intensity varies across sectors and its effect on CO_2 emissions from energy consumption is larger. Kumbaroglu (2011) examines the effect of energy intensity and growth across various sectors in Turkey from 1990 to 2007. The author finds that growth was the main driver of emissions in the transport, electricity and manufacturing sectors but has no effect on agriculture and household sectors. Energy intensity, however, was found to be the principal source of emission in household and agriculture sector. Alam (2015) determines the effect of value added in GDP from agriculture, manufacturing and servies on CO_2 emissions in South Asia from 1972 to 2010. The results indicate

that agriculture value added in GDP improves the environment whiles value added from industry and services pollutes the environment. The authors find no support for U-shaped EKC because CO_2 emissions rises with income.

The literature linking FDI, GDP and the environment suffer from a number of deficiencies. First, the use of aggregate FDI instead of disaggregating them by sector could mask the sectoral effect of FDI on carbon dioxide emisssions. The studies that use FDI by sector are Wang & Jin (2002) in China; Blanco et al., (2011) in Latin American; Doytch & Uctum (2012) and Doytch & Narayan (2016) for 74 countries. Again, the studies that employ GDP by sector are (Shyamal & Rabindra, 2004; Kumbaroglu, 2011; Alam, 2015). In developing countries, data on FDI is in aggregate form while FDI effect on the environment may be sector specific. Thus, the use of aggregate FDI could mask the sectoral effect of FDI on the environment. In addition, previous studies have used the composite measure of CO_2 instead of decomposing into the various sectors. Moreover, previous studies made no distinction between domestic and foreign investment to make pollution source clear.

4.4 Methodology

The methodology is presented under the following sub-themes: The econometric model and the econometric methodology.

4.4.1 Econometric Model

Existing studies(Pao & Tsao, 2011; Kivyiro & Arminen , 2014; Shahbaz et al , 2015) linking FDI, GDP and carbon dioxide emission can presented in an algebraic form as follows:

$$\ln CO_{2it} = \alpha_1 + \alpha_2 \ln FDI_{it} + \alpha_3 \ln FDI_{it}^2 + \alpha_4 \ln GDP_{it} + \alpha_5 \ln E_{it} + v_{it} \qquad (4.1)$$

Where CO_2 is carbon dioxide emission metric tons per capita, FDI denotes FDI per capita , GDP denotes GDP per capita and E represents energy consumption per capita and $\alpha's$ represent the regression coefficients. $v_{it} = \mu_{it} + \varepsilon_{it}$, μ_{it} is an idiosyncratic country specific effect and the error terms ε_{it} are such that ε_{it} $ii(0, \sigma_{\varepsilon}^2), \mu_{it} \tilde{i}i(0, \sigma_{\mu}^2)$. α_1 is a scalar such that $|\alpha_1|<1$; $i=1,2,3,...,N.$ denotes an index of individual selected countries , t = 1,2,3..T is an index for time-invariant periods. The unobservable country-specific effect μ_{it} and the error term ε_{it} are not correlated . The $\alpha's$ denotes the unknown parameters of the explanatory variables.

According to Hoffmann et al. (2005) and Kivyiro & Arminen (2014) accumulation of CO_2 is a major cause of climate change and it is correlated with other GHGs emissions such as sulfur dioxide and nitrous dioxide. Besides, several studies (Talukdar & Meiser, 2001; Blanco et al., 2011; Kivyiro & Arminen, 2014) have used per capita CO_2 emission (in metric tons) due to the availability of data on carbon dioxide. Therefore, CO_2 is used as a dependent variable.

FDI per capita will be used to test its impact on the environment. Previous studies have indicated that initially, FDI pollutes the environment during economic growth and at a certain turning point FDI begins to improve the environment as the country develops. Thus, the relationship between FDI and the environment is non-linear known as an inverted U-shaped EKC. Following recent study of Shahbaz et al. (2015) and previous studies of Eskeland & Harrison (2003) and Aliyu (2005), the squared term of FDI was included in the regression equation to examine the non-linear relationship between FDI and CO_2 emission. Thus, both FDI_{it} and FDI_{it}^2 are included to test the

existence or otherwise of the EKC. Therefore, it is expected that the sign of α_2 is positive and α_3 is negative.

In line with previous studies, GDP which denotes economic growth is proxied by per capita GDP ($ USD) (Merican et al., 2007; Hitam & Borhand, 2012; Kivyiro & Arminen, 2014; Shahbaz et al, 2015). The reason is that, the scale effect is part of the expected FDI effect on the environment. Thus, the sign of GDP is expected to be positive since growth rises with environmental degradation at the initial stage of development.

The current study extends the existing models of Pao & Tsai (2011); Kivyiro & Arminen (2014) and Shahbaz et al. (2015) by disaggregating both FDI,GDP and CO_2 into agriculture, industry and services respectively to determine sectoral impact of FDI on CO_2 emission. Unlike previous studies, domestic investment (DOI) is also included in the model in order to distinguish between CO_2 emission produced by FDI and that generated by domestic investment. According to Agarwal (2000) and Wang (2009) gross fixed capital formation denotes total investment and FDI is investment by foreign firms. Thus, domestic investment is obtained by subtracting FDI from gross fixed capital formation. Domestic investment is expected to either pollute or improve the environment.

The interactive term (INT) which is the product of FDI and domestic investment is also included to determine whether higher domestic investment drives FDI into clean or dirty industries. Higher domestic investment would drive FDI into either a clean or dirty industry depending on the technology employed by domestic firms. Where domestic firms employ advanced technology it

implies there is stringent environmental regulation in the host country that will attract FDI into clean industries. In contrast, where domestic firms use inefficient technology in production it implies weak enforcement of environmental regulations in the host country that will lead to the influx of dirty industries in the host county. Thus, the sign of the interactive term is expected to be either positive or negative.

In line with existing studies (Tamazian et al., 2009; Talukdar & Meiser , 2009; Pao &Tsai, 2011 and Zhang(2011) financial market development (FMD) is included to determine its impact on the environment. For instance, Frankel &Romer (2002) indicate that the depth of financial market development may attract FDI and higher investments in research and development can propel economic growth and affect the dynamics of the environment. Tamazian et al. (2009) indicate that economic growth and financial sophistication decrease environmental degradation. In contrast, Al-Mulali et al. (2012) reveal that financial depth triggers energy consumption and CO_2 emission in SSA via an increase in investment in energy intensive industry. Thus, financial development could either increase or decrease emission depending on whether investment is in a clean or dirty industry. Thus, it is expected that the coefficient of financial market development could be either positive or negative.

Urbanization (URB) has also been identified as a major determinant of environmental quality (Aboagye &Kwakwa , 2014; Aboagye & Nketiah-Amposah, 2016; Adusah-Poku, 2016; Huang & Yu, 2016). Urbanization may increase demand for houses and consequently demand for building materials such as cement which is a major source of carbon dioxide. Moreover, the process of construction requires clearing of trees and grassland thereby releasing carbon dioxide stored in

trees into the atmosphere. Thus, it is expected that the coefficient of urbanization should be positive.

Following Hitam & Borhan (2012), both imports (IMP) and exports (EXP) are included in the regression to examine the extent to which trade openness affect pollution. The conclusion from previous studies is that trade spurs growth in developed countries but hurts growth in developing countries due to its negative effect on the environment (Managi et al., 2008; Abdulai & Ramcke , 2009)]. Since most developing countries have lax environmental conditions, it is likely that a greater percentage of their imports will be carbon-intensive products. Thus, it is expected that imports will exert a positive effect on CO_2 emissions. Moreover, the entire chain of production, including value addition processes to the final product requires high amount of energy consumption. Thus, it is expected that export (EXP) of goods and services will increase CO_2 emission. This is because, the demand for manufactured goods creates upsurges in energy demand and consumption leading to CO_2 emission. Due to insufficient data on energy consumption in the sample, it is not included in the model.

To depict the strong memory of the environment (pollution), the model is extended to incorporate dynamic effects (Kwakwa & Aboagye, 2014; Doytch & Uctum, 2016). After the modifications, the dynamic panel data model for the 36 SSA countries from 1990 to 2016 is specified as:

$$\ln CO_{2it}{}^{j} = \alpha_o + \alpha_1 \ln[(CO_{2it-1})]^j + \alpha_2 \ln[(FDI_{it})]^k + \alpha_3 \ln[(FDI_{it}{}^2)]^k + \alpha_4 \ln[(GDP_{it})]^m + \alpha_5 \ln(DOI_{it}) + \alpha_6 \ln[(INT_{it})]^n + \alpha_7 \ln IMP_{it} + \alpha_8 \ln EXP_{it} + \alpha_9 \ln FMD_{it} + \alpha_{10} \ln URB_{it} + v_{it} \quad (4.2)$$

Where DOI denotes domestic investment; INT is the interactive term between sector specific FDI and domestic investment; IMP represents import; EXP represents export; FMD is financial market development and URB represents urbanization.

The superscripts j, k and m in equation (4.2) denotes an index for total, agricultural, industry and services CO_2, FDI and output respectively. The superscript n represents an index of the interactive term (INT) between sector specific FDI and domestic investment for total, agricultural, industry and services respectively.

Table 4.1: Description of Data, Measurement and Sources

Variable	Notation/ Expected Sign	Description and Sources
Dependent Variables		
Carbon Dioxide (Metric tons per capita)	$lnCO_2$	Carbon dioxide emissions generated from fossil fuels and the manufacture of cement. It comprises carbon generated during consumption of solid, liquid, and gas fuels and gas flaring. Source: World Development Indicators(WDI)
Agricultural methane emissions (thousand metric tons of CO_2 equivalent)	$ln ACO_2$	These are emissions produced from savannah and agricultural waste burning. It is also generated during rice production and from animals and animal waste. Source (WDI)
Industrial carbon dioxide emission CO_2 emissions (% of total fuel combustion)	$ln ICO_2$	Consist of total carbon dioxide generated from construction, manufacturing, electricity and heat production. Source: Author's computation based on WDI
Services carbon dioxide emission (% of total fuel combustion)	$ln SCO_2$	Consist of total carbon dioxide produced from transport, residential buildings and commercial and public services and other sectors. Source: Author's computation based on WDI
Explanatory Variables		
Lagged Dependent Variable	$_{lnCO2t\text{-}1}{}^{j}$	Immediate past value of the dependent variable. Source: Author's computation based on data from WDI

Variable	Notation/ Expected Sign	Description and Sources
Foreign Direct Investment per capita(% GDP)	*lnFDI* $^{+/-}$	FDI comprises total equity capital as well as reinvestment of profits and both short-term and long-term capital to obtain management interest in the long run usually in an enterprise producing abroad expressed as a proprtion of nominal GDP divided by population Source: WDI
FDI per capita squared (%GDP)	*ln*FDI^{2} $^{+/-}$	Quadratic term of FDI obtained by squaring FDI. Source: Author's computation based on WDI.
Agric FDI per capita(% GDP)	*lnAFDI* $^{+/-}$	Comprises FDI in livestock and crop production as well as fishing hunting and forestry. Source: Author's computation based on WDI
Industry FDI per capita (% FDI)	*lnIFDI* $^{+/-}$	Consist of FDI in mining, quarrying and petroleum, manufacturing ,electricity, gas , construction and water and sewerage Source: Author's computation based on WDI
Service FDI per capita (% GDP)	*lnSFDI* $^{+/-}$	Service FDI consists of flows in retail and wholesale trade in intangibles such as education, health care, transport, finance and government services. It also includes hotels and restaurants and personal services. Total service FDI is divided by total population and expressed as a percentage of GDP. Source: Author's computation based on WDI.
Value added (constant 2010 U.S. dollars)		Value added is the difference between a finished product and the raw materials used in its production. It includes depreciation but does not cater for non-market transactions such as depletion and degradation of natural resources. Source WDI
Agric Value added	*lnAVA+*	
Industry Value added	*lnIVA+*	
Service Value added	*lnSVA+*	
Gross domestic product per capita (Constant 2010 US$)	*lnGDP*$^{+}$	GDP per capita refers to the summation of gross value added by all producers in the economy plus net indirect taxes. GDP per capita is obtained by Gross Domestic Product divided by the population. Source: WDI
Domestic Investment (%GDP)	*lnDOI* $^{+/-}$	Gross fixed capital formation could be considered as the total investment in a country. Inward FDI is investment by foreign firms. Thus, the difference between GFCF and FDI as a share of GDP becomes a measure of domestic investment Source: (Agrawal 2000; Wang, 2009).
Export of goods and services (% GDP)	*lnEXP*$^{+}$	This is the value of all goods and services supplied by a country to the rest of the world. These comprise insurance, freight, travel, license fees, merchandise, transport, freight, and other services such as personal, financial, business, construction, information and government services. Compensation of employees, transfer payments and investment income are excluded. Source : WDI
Import of goods and services (% GDP)	*lnIMP*$^{+}$	This is the value of all goods and services acquired by a country from the rest of the world. These comprise insurance, freight, travel, license fees, merchandise, transport, freight, and other

Variable	Notation/ Expected Sign	Description and Sources
		services such as personal, financial, business, construction, information and government services. Compensation of employees, transfer payments and investment income are excluded.Source: WDI
Urbanization (% of total)	$lnURB^{+}$	Urbanization refers to the growth of population in towns and cities as evaluated by national statistical offices. Data obtained are adjusted by the United Nations.Source: WDI
Financial Market Development Broad money (%GDP)	$lnFMD^{+/-}$	Broad money is the sum of currency with the non-bank public, demand deposits excluding those with the Central Bank, foreign currency deposits, savings and time deposits, bank and traveler's checks, deposits of resident sectors other than government, and other securities such as commercial paper and certificates of deposit. Source: WDI
Interactive term	$lnINT^{+/-}$	The interactive term (INT) is the product of FDI and domestic investment(DOI) Source:Author's computation based on WDI.

NB. *The a priori sign is indicated by +/- in the notation Column.*
ln is the natural logs of the variables

4.4.2 Econometric Methodology

The study presents the econometric methodology under the following sub-themes: the panel unit root, the panel cointegration and the system Generalized Method of Moments (GMM).

The Panel Unit Root Test

The determination of the long run relationship between CO_2 and its determinants requires investigating the panel unit root properties of the variables because most economic variables demonstrate stochastic trends that produce spurious results. There are several methods used in examining the unit root of a panel data (Maddala and Wu (1999) and Choi (2001); Levin, Lin & Chu (LLC, 2002); Im, Pesaran, and Shin, (IPS, 2003) and Breitung (2001) and Hadri (2001). Panel unit root test have gained acceptance because they can handle country specific effects and addresess issues of heterogeneity in the direction and size of the parameters. In addition, the power of the panel unit root test is higher than the individual time series unit root tests.

The most widely used unit root test is the LLC(2002) which is basically the panel version of the Dickey-Fuller or the Augmented Dickey-Fuller test used in time series econometrics and it proceeds from the assumption of a homogeneous panel. The null hypothesis is that each individual time series is not stationary at levels while the alternative hypothesis is that each time series is stationary at levels. The main deficiency of LLC is that it does not perfom well when there are missing data points and also cannot handle heterogeneous panels.

In the case of IPS (2003), the assumption of homogeneous panel in LLC is relaxed to permit differences in the autoregressive coefficients for all panel members. The IPS and the LLC both assume the existence of cross-sectional dependence between the panel units with the exception of common time effect. This assumption is restrictive given the cross-sectional correlations and spillovers across different regions, states and countries. The assumption of cross-sectional independence on which the asymptotic results of the IPS and LLC methods thrives has drawn the attention of researchers. Breitung, Maddala and Wu and Choi, and Hadri tests address the issue of cross-sectional dependence in panel unit roots tests.

Breitung (2001) contends that when individual-specific trends are included, the LLC and IPS tests suffer from loss of power. He proposed a test which does not adopt a bias adjustment and has higher power than IPS and LLC test. The null hypothesis is that the panel series are not stationary and the alternative hypothesis assumes that the panel series are stationary.

Maddala & Wu (1999) and Choi (2001) test is a non-parametric test which is a type of Fisher P-P test used in time series analysis. The null hypothesis is that there exist a unit root in the individual

series in the panel. The null hypothesis, however, allow some of the individual series to be non-stationary. Unlike other methods, its value is independent of different lag lengths and can be applied on both balanced and unbalanced panels with missing data points.

Hadri Heteroskedasticity Consistent z-statistic (HHC) test is a Lagrangian Multiplier (LM) test.This method can be applied in panels with issues of heteroskedasticity but in panels with missing data points.The null hypothesis is that there is no unit root in the panel. The alternative is that there exist unit root in the panel.

Amongst the five tests above, this study employs the Fisher Phillips-Perron (Fisher P-P) chi-square test. The value of Fisher P-P is not dependent on different lag lengths and is applicable for both balanced and unbalanced data with omissions. The ADF Fisher chi square and IPS were carried out for robustness.

Panel Cointegration Test

Three different tests can be used to ascertain whether a long run relationship exist between variables. These are Pedroni (1999), Kao (1999) and Fisher test based on Johanssen (1998) framework. Cointegration test is capable of addressing many of the econometric challenges such as endogeneity, omitted variables and slope heterogeneity. Moreover, it can be applied on panel with short data span.

Pedroni (1999) proposed seven tests categorized into panel test (within dimension) and group test (within dimension). Fisher on the other hand suggested two methods namely: the likelihood ratio trace statistics and the maximum eigen value statistics to examine the long run relationship

between variables. The Fisher test can be employed to examine long run relationship in both balanced and unbalanced panels.

The System Generalized Method of Moments

The dynamic relationship between FDI, growth and CO_2 emissions in this study was carried out using GMM estimation technique. There are three variants of the GMM. Arellano & Bond (1991) recommended the difference GMM; Arellano & Bover (1995) suggested the deviation GMM and Blundell &Bond (1998) proposed the system GMM. The choice of the GMM estimation technique is based on the fact that it addresses econometric problems prevalent in macro-panel models such as endogeneity, serial correlation and cross-sectional interdependence (Arellano & Bond , 1991).

The variance of the estimates obtained from the difference GMM may increase asymptotically producing bias coefficients. In addition, the difference GMM and the deviation GMM use information provided in differences only. To address these limitations, Blundell and Bond (1998) suggested an estimation technique with a system of regressions in levels and differences. The lagged levels of the explanatory variables are used as instruments in the regression in differences while the lagged differences of explanatory variables used as instruments in the levels regression. These instruments are deemed appropritate based on the assumption that though level variables might correlate with country specific effects, variables in differences and the country specific effect would not correlate.

The system GMM estimator is efficient because though the country specific effect might correlate with level variables, such correlations is absent between variables in differences and the country

specific effect. Furthermore, the system GMM estimator generates a standard covariant matrix that is robust to heteroscedascity and autocorrelation. However, the weakness with the GMM estimator is instrument proliferation in which a number of instruments may be individually significant, but insignificant as a group in infinite samples because the instruments overfit the endogenoues variables.

The Sargan test and Arellano-bond test are used to test for the consistency of the System GMM estimator. The Sargans test is used to test for the joint significance of the instruments. The null hypothesis is that instruments used as a group are exogenous versus the alternative hypothesis that the instruments are not exogeneous. The model is supported when the null hypothesis is rejected. The Arellano-bond test for second order serial correlation examines the null hypothesis that the error term is not serially correlated and is applied to the differenced residuals. The model is supported when the null hypothesis is rejected.

4.5 Results and Discussion

The empirical results are presented in this section. Prior to the estimation of the long run elasticities using system GMM estimation technique, the correlation and descriptive statistics were computed (Appendix 4.4 & 4.5). Next, the panel unit root properties of the variables and the panel cointegration test was conducted. The model was then estimated using GMM estimation technique.

Panel Unit Root Test

The results of the panel unit root test is presented in the Table 4.2. Based on the Fisher P-P Chi-square unit root test which is deemed ideal for both balanced and unbalanced panel data, it is

established that all the variables are stationary at levels. To check for the robustness of the results, ADF Fisher chi square and the IPS were carried out and both test confirm the stationarity of the variables at levels.

Table 4.2: Panel Unit Root

Methods	Variables	lnCO2	lnFDI	lnGDP	lnDOI	lnIMP	lnEXP	lnFMD	lnURB
PP-Fisher chi square	[Level]	443.95	499.72	390.77	434.01	558.83	536.14	440.48	579.47
	[Prob]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
ADF Fisher chi square	[Level]	386.6	415.194	356.277	391.833	521.842	488.856	385.116	511.047
	[Prob]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
IPSw-stat	[level]	-15.71	-17.46	-13.32	-16.79	-21.63	-20.24	-15.46	-16.52
	[Prob]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]

Panel Cointegration Test Results

The panel cointegration test between CO_2 and the explanatory variables is tested using the Kao residual cointegration test and Johansen Fisher panel cointegration test. The results are presented in Table 4.3. The Kao test demonstrates panel cointegration at 1% level of significance. The results are conisistent: Johansen Fisher panel cointegration test (both trace and Max-Eigen statistics) demonstrates the existence of cointegration relations between the variables for the two models.

Table 4.3: Panel Cointegration Test Results

1	Kao Residual Cointegration Test	
	t-Statistic	p-value.
ADF	-9.322168	0.000

2	Johansen Fisher Panel Cointegration Test			
Hypothesized	Fisher Statistic		Fisher Statistic	
No. of CE(s)	(Trace test)	p-value	(Max-Eigenvalue)	p-value
r=0	518.5	0.000	554.7	0.000
r≤1	488.5	0.000	212.9	0.000
r≤2	255.6	0.000	142.5	0.000
r≤3	149.8	0.000	69.85	0.001
r≤4	92.85	0.000	40.86	0.266
r≤5	66.79	0.001	24.79	0.921
r≤6	61.57	0.005	26.12	0.887

Following the establishment of the long relationship between the variables, we proceed to estimate the associated long run elasticities employing the GMM estimation technique and the result is presented in Table 4.4. Column (1) presents the impact of total FDI per capita on total CO_2 emissions. Column (2) reports the impact of agricultural FDI per capita on methane emissions (thousand metric tons of CO_2 equivalent) from the agricultural sector; column (3) shows the impact of industry FDI per capita on CO_2 emission from industry and column (4) displays the impact of service FDI per capita on service CO_2 emission from the services sector.

Table 4.4: Panel Regression Results

Dep. Variables:	$lnCO_2$	$lnACO_2$		$lnICO_2$		$lnSCO_2$	
TOTAL		AGRIC		INDUSTRY		SERVICE	
ln CO_2t-1	0.343***	lnA CO_2t-1	0.237***	lnI CO_2t-1	-0.062	lnS CO_2t-1	0.343***
	[0.072]		[0.060]		[0.051]		[0.082]
lnFDI	-0.192***	lnAFDI	-0.561*	lnIFDI	2.591*	lnSFDI	-0.452*
	[0.068]		[0.293]		[1.450]		[0.246]
lnFDI^2	0.007**	lnAFDI^2	0.006*	lnIFDI^2	-0.028*	lnSFDI^2	-0.005*
	[0.003]		[0.003]		[0.006]		[0.003]
lnGDP	0.005	lnAVA	-0.079	lnIVA	0.195	lnSVA	-0.079
	[0.054]		[0.081]		[0.137]		[0.079]
ln DOI	-0.143**	lnDOI	0.602	lnDOI	-3.429	lnDOI	-0.438*
	[0.063]		[0.638]		[4.125]		[0.219]
ln INT	0.011***	lnINT	-0.009	lnINT	0.067	lnINT	0.009**
	[0.004]		[0.012]		[0.080]		[0.004]
lnIMP	0.100*	lnIMP	-0.011	lnIMP	-0.136	lnIMP	0.164*
	[0.054]		[0.069]		[0.119]		[0.068]
lnEXP	-0.032	lnEXP	-0.036	lnEXP	-0.198	lnEXP	0.0013
	[0.059]		[0.066]		[0.227]		[0.067]
lnFMD	0.110	lnFMD	0.0347	lnFMD	0.343	lnFMD	0.136**
	[0.053]		[0.078]		[0.264]		[0.064]
ln URB	0.010	lnURB	0.0311*	lnURB	0.075***	lnURB	0.022
	[0.017]		[0.016]		[0.033]		[0.016]
Constant	17.331***	Constant	42.361***	Constant	-44.576	Constant	25.575***
	[4.054]		[9.166]		[42.779]		[9.068]
Observations	747	501		372		676	
No. of countries	36	35		19		35	
AR(1), p-value	0.000	0.001		0.052		0.000	
AR(2),p-value	0.027	0.247		0.104		0.035	
Sargan test, p-value	0.993	0.985		0.995.		0.724	

//*** denotes statistical significance at 10%, 5%, 1% respectively*. INT= interactive term between sector specific FDI and domestic investment.

From Table 4.4, the coefficient of the lagged dependent variable is positive. This means that the present level of CO_2 increases future level of CO_2. This indicates a strong persistent effect underlying the cumulative nature of CO_2 in the region. Particularly, in column [1], a 1% increase in the lagged dependent variable results in 0.343 increase in CO_2 emission. The coefficient of FDI per capita is negative and statistically significant indicating that FDI per capita reduces aggregate CO_2 emissions in the 36 sampled SSA countries. Specifically, a 1% increase in FDI per capita reduces aggregate CO_2 emissions by 0.192 validating the pollution halo effect hypothesis. This

findings is consistent with that of Zhu et al (2016) in Singapore, Thailand, the Philippines, Indonesia and Malaysia.

However, the quadratic term of FDI per capita is positive indicating a U-shaped instead of an inverted U-shaped EKC suggested by Grossman & Krueger (1991). This implies, total FDI reduces CO_2 emissions due to the clean technology employed by foreign firms. Foreign firms may come with energy efficient technology prevailing in the home country. However, due to lax environmental regulations in the host country and the profit driven motive of foreign firms, as these equipment get outdated and become less energy efficient they pollute the environment.

Domestic Investment

Similarly, in column (1) the coefficient of domestic investment is negative and significant indicating that domestic investment reduces CO_2 emission. Specifically, a 1% increase in domestic investment reduces CO_2 emission by approximately 0.143. This indicates that domestic investment improves the quality of the environment. Wang & Jin (2002) reveal that firms that are owned by the state and private individuals generate more pollution than firms owned by the community or foreign firms. This is due to the use of advanced technology by foreign firms which are more energy efficient. Community owned firms also generate less pollution because the cost of production which include the cost of pollution is borne by the firm. Eskeland & Harrison (2003) also indicate that foreign firms are more efficient in energy consumption and the techniques of production are more environmentally friendly compared to domestic firms.

Interactive term

The coefficient of the interactive term between FDI per capita and domestic investment in column (1) is positive and significant. Specifically, a 1% increase in the interactive term raises the level of CO_2 emission in the region by approximately 0.011. This implies that higher domestic investment drives FDI into dirty industries. This is plausible in that the use of inefficient production technology by domestic firms is an indication of weak enforcement of environmental regulations in the host country that will lead to the influx of dirty industries.

Imports

The coefficient of the import variable is positive and significant. Specifically, a 1% increase in imports increases CO_2 emission by 0.100. This implies that import of goods and services degrade the environment in the 36 sampled SSA countries. This results is plausible in that importers driven by the profit motive could take advantage of the lax environmental regulation to import carbon intensive factors of production or goods and services which are not environmentally friendly. This result corroborates with the findings of Managi et al., (2008) and Abdulai & Ramcke (2009).

In some developing countries, individuals have the tendency to purchase items or acquire properties that make them comfortable whenever their income level rises. Thus, it is common to observe a rise in the purchase of secondhand cars, washing machines, fridges and air conditioners. In addition, to supplement meager salaries, others purchase over-aged vehicles for commercial purposes. The increase in demand for these items fuels their import. Since most of these items and vehicles are old, they tend to be energy inefficient and pollute the environment.

Sectoral Analysis

In column (2), agricultural FDI per capita exerts a negative effect on CO_2 emission in the sector but the coefficient on the quadratic term is positive. This is plausible in that, the obvious feature of agriculture in SSA is the predominance of peasant producer mode of production with few medium and large scale farmers. Technology applied is rudimentary and represents a very low level of capital intensity. Apart from fertilizer and insecticide which are in little use, there are little use of tractors and other advanced machinery for cultivation. It could be argued that since a greater percentage of FDI goes into extraction industries it generates more pollution in those industries compared to agriculture and services FDI. However, with increased mechanization overtime and weak regulatory compliance, foreign firms take advantage to pollute the environment.

In contrast, most of the environmental degrading effect of sector level FDI per capita is generated by investment in the industrial sector. For instance, in column (3), inflows into the industrial sector raises pollution significantly. Specifically, a 1% increase in industrial FDI per capita raises CO_2 emission by 2.591 validating the pollution haven hypothesis**.** The rising levels of CO_2 due to industry FDI could be attributed to the increased extraction of natural resources- oil, gas and minerals in the region. In SSA, the activities of MNEs dominate the extractive industry because mineral extraction is capital-intensive and requires advanced technology. UNCTAD (2007) indicates that in 2005 the share of oil production by foreign firms constitute 57% for SSA compared to 18% for Latin America, 11% for transition economies and 19% for all developing countries.

Asiedu (2013) indicates that the increased exploration and production in the region had resulted in increase in extractive industry FDI. Consequently, four top oil exporting countries received significant proportions of foreign production from 1992 to 2011. For instance, Equitorial Guinea received 92 %, Angola 74 %, Sudan 64 %, and Nigeria 41%. The author indicates that over the period 1992-1996 to 2008-2011, the production of oil in Africa expanded by 40% compared to 15% in Europe, 24 % in South America, 32 % for Asia and a fall of 4% for North America. Moreover, the top four oil exporting economies share of production increased from 38% to 53 %. Sudan and Equitorial Guinea experienced increased production over the period. Thus in SSA, the discovery of oil in Equitorial Guinea in 1990 and Sudan in 1991 was responsible for the increased production.

Thus, the rising levels of CO_2 in the region could be linked with the activities of oil and mining firms in the region. For example, the blasting of rocks during mineral extraction and the high levels of energy consumption by heavy equipment during oil exploration contribute to the release of obnoxious gases into the atmosphere. Moreover, the proliferation of small scale mining activities in some countries in the region leads to indiscrimate disposal of waste chemicals which pollutes the air, land and water bodies. With regard to gas and oil exploration, the burning of natural gas to dispose of gas generates nitrogen dioxide, carbon dioxide and photochemical oxidants. The power generation and flaring of hydrocarbons during well testing and clean-up operations also pollute the environment.

The results obtained in this study is consistent with Hoffmann et al., (2005); Shahbaz et al., (2014) and Kivyiro & Arminen, (2015) and Doytch & Uctum (2016). For instance, Hoffmann et al (2005)

reveal for 112 countries spanning the period 1971 to 1999 that low income countries tend to relax environmental regulations to attract FDI in the absence of absorptive capacities such as infrastructure and skilled labour. Thus, these countries become pollution havens because of the high cost of enforcing environmental laws. Kivyiro & Arminen (2015) also attribute the rise in CO_2 emissions to low quality of technology employed in production and lax environmental laws and regulations in SSA. Increase in FDI requires more energy to fuel economic activity resulting in increase in CO_2 emissions. Thus, FDI might have had spillover effect on economic growth decreasing energy efficiency and reducing clean energy use causing CO_2 emissions.

Also, the coefficient of the quadratic term of industry FDI per capita is negative and significant. This implies an inverted U-shaped relationship between industry FDI per capita and CO_2 emissions. Thus, in the long run, FDI per capita in the industrial sector support the EKC hypothesis. This is consistent with the findings of Jalil & Mahmud (2009) and Narayan & Narayan (2010). Thus, the conventional explanation of the EKC hypothesis is applicable to the industrial sector in the sampled SSA countries. This could be attributed to the fact that initially, citizens might trade off cleaner environment for jobs and incomes but beyond a certain threshold they then begin to demand for cleaner environment. Furthermore, the turning point of the inverted EKC in the industrial sector could be attributed to the response of SSA countries to the Kyoto protocol signed in 1997 and the Copenhagen protocol adopted in 2009 which entreat countries to reduce the levels of GHG concentration.

Initially foreign firms may take advantage of lax environmental regulations in developing countries to engage in polluting activities. However, pollution tends to fall when countries begin

to distance themselves from pollution associated with their consumption. Distancing could be achieved by either moving people away from pollution or moving pollution away from people. Thus, distancing could be a potential cause of EKC results.

In column (3), the results also demonstrates that FDI per capita in the industrial sector pollutes the environment whiles domestic investment improves the environment. This results is consistent with majority of the previous studies. For instance, Talukdar & Meisner (2001) for 44 developing countries, Tamazian et al. (2009) and Lee (2013) for G20 countries. Talukdar & Meisner (2001) report that greater involvement of the private sector in economic activity lower pollution in developing countries. In addition, a well developed financial market could lead to reduction in pollution when developed countries are involved in private sector development. Similarly, Narayan & Narayan (2010) find a reduction in carbon dioxide emission overtime as income rises for Ghana, Morocco and Senegal. Panayotou (1997) suggests that strong institutions and effective policies can help lower pollution.

In column (4), investment in the services sector reduces CO_2 emission in the sector and the coefficient on the quadratic term is negative. This is plausible in that the services sector is ICT-driven based on efficient technology. Once an economy attains matured level of economic development, it shifts from industrial to the service sector which is less energy intensive and emit low CO_2 emmissions.

In general, results are mixed regarding the effect of sector level FDI per capita on the environment. Whereas the effect of FDI per capita is positive for the industrial sector, it is negative for both

agricultural sector and the services sector. Usually, business activites in SSA are either small or micro in nature with low technical know-how and few or no linkages with larger, more dynamic enterprises.

Similar to the results at the aggregate level, the interactive term between FDI in the service sector and the domestic investment in the service sector pollutes the environment for the same reason outlined above. In the same vein, import in the service sector hurts the environment. Financial market development also fuels pollution in the service sector.

Finally, in column (2), the effect of urbanization on agricultural CO_2 emission is positive. Particularly, a 1% increase in urbanization raises CO_2 emission in the sector by 0.031. Similarly, in column (3), a 1% increase in urbanization raises industrial CO_2 emission by 0.075. These results are plausible in that urbanization and population explosion in the region may require increased need for land for settlement and agricultural production to meet food demand. Since the forest has the ability to capture and store CO_2, clearing of land either for settlement or agricultural purposes may release tons of CO_2 into the atmosphere. In addition, the demand for building materials such as cement to meet the demand for houses is a major source of CO_2 emission. Furthermore, urbanization could lead to both human and vehicular traffic with an increase in energy used for economic activities leading to pollution.

It is evident from the analysis that neither aggregate GDP nor value added from the sectors exert any effect on CO_2 emission. This is plausible in that these variables could exert a lag rather than a

contemporaneous effect on CO_2 emission. Furthermore, there is no compelling evidence that exports increase CO_2 emission at the sector or aggregate level.

4.6 Conclusion & Policy Recommendations.

The study investigates the heterogeneous effect of sector level FDI on carbon dioxide emissions in 36 sampled SSA countries from 1990 to 2016. In addition, the study tests for the existence of EKC in agriculture, industry and service sector. By using system GMM estimation techique, the study indicates that industry FDI increases CO_2 emissions validating the pollution haven hypothesis while Agric FDI and service FDI reduce CO_2 emissions. In general a U shape hypothesis holds for Agric FDI and CO_2 emissions, but an inverted U shape for industry FDI and Industry CO_2 emissions and a linear and negative relationship between services FDI and services CO_2 emissions.

The results suggest some policy prescriptions for governments in SSA. First, the presence of foreign firms in the industrial sector in SSA could increase the level of CO_2 emissions and therefore, the need to evaluate the environmental cost of investment in the industrial sector before granting foreign investors permit to operate. In the agriculture and services sectors, there is the need for SSA countries to offer incentives that have the potential of attracting foreign investment in order to benefit from the positive spillover effect of transfers of cleaner technology, while at the same time ensuring that environmental regulations are strictly enforced. Policy makers should also exercise caution and concentrate on reviewing their environmental laws regarding investments in industry.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATION

5.1 Review and Summary of Key Findings

Developing countries are characterized by low incomes and low domestic savings. In addition they have limited access to international capital markets. Thus, the need for external capital to augment scant domestic resources to propel growth and investment. FDI provides external capital for investment, generates employment, transfer of skills and technology and therefore promotes growth (De Mello, 1999; Asiedu, 2002). FDI is also regarded as the most stable source of external capital flows to developing countries compared to remittances, portfolio investments and official development assistance (UNCTAD, 2017). Due to the potential embedded in FDI, several countries embarked on various reforms in the 1980s leading to significant inflows of FDI in almost every region of the world. Consequently, FDI flows in the 1990s increased significantly to a peak in all major economic groupings but declined due to global oil shock in 2000. The inflows of FDI increased in the year 2001 to a peak in 2007 but dropped in 2008 due to the financial and credit crisis in 2007. There was slight recovery in FDI inflows in 2009 and FDI inflows gained momentum in 2015.

In terms of sectoral distribution of FDI, services sector received 64 %, manufacturing sector 27 % and primary sector received 7% (UNCTAD, 2016). Services sector received 67 %; manufacturing sector 26 % and primary sector 6 % (UNCTAD, 2017). With regard to geographical distribution, Africa has received less FDI compared to other developing countries. For instance, UNCTAD's (2018) report indicates that Africa received less FDI compared to other developing countries in

Asia, Latin America and the Caribbean. Thus, with regard to FDI, Africa's experience as compared with that of other developing countries can be characterized as *absolute progress but relative decline* (Asiedu, 2004). Mediocre reforms, macroeconomic and political instability have been identified as reasons for low inflows of FDI to Africa. Asiedu (2002) argued that Africa on the average receive less FDI by virtue of their geographical location. However, how specific geographical factors affect FDI inflows have not been given the needed attention.

The Eclectic theory Suggest that FDI occurs due to ownership, location and internalization advantages (Dunning, 1993). However, Studies on locational determinants of FDI in SSA have focused on resource seeking, efficiency seeking, market seeking and assets seeking (Asiedu, 2006; Cleeve, 2012; Okafor et al., 2017) to the neglect of specific geographical factors such as geographical size of a country, location within the tropics and mean distance from the sea. These geographical factors can affect transactions cost and the type of FDI. This study therefore examines FDI inflows and its implications for growth and the environment.

The study examines three distinct essays on FDI in SSA. The first empirical chapter (Chapter Two) examines the geographical determinants of FDI while controlling for market size, resources, assets, efficiency and institutional factors using Hausman-Taylor estimation method for 40 SSA countries over the period 2002 to 2016. The Hausman-Taylor estimation technique is ideal for panel data analysis with time-constant variables and provides a way out of the correlation that might exist between time-constant variables and the unit effects. Additionally, it permits the inclusion of time-constant variables which are wiped out by the fixed effects estimator. The H-T is an instrumental variable estimator which uses both within and between variations of the strictly exogenous

variables as instruments. For robustness checks, the study divides the sample into two sub-regional groups namely: South and East, and West and Central SSA countries and further into regional as well as resource rich and resource poor countries. For the full sample, geographical size of the country in Km^2 and the percentage area of land in the tropics were found to attract FDI but greater distance from the sea deters FDI. For West and Central, and South and East subgroups, geographical size was found to be important determinant of FDI in both subgroups. GDP per capita an indicator of market size enhances FDI flows only in the South and East SSA countries confirming the market seeking hypothesis. With regard to resource seeking variables, natural resource rent attracts FDI inflows only in the South and East SSA countries. Infrastructure measured by fixed telephone subscription exert a positive effect on FDI except in the South and East SSA countries.

Disaggregating the sample into regional groups, the analysis show that in the West and Central subgroup the results is largely influenced by countries in Central Africa and the results obtained in South and East subgroup is driven by countries in Southern Africa. Further analysis indicates that geographical size attracts FDI in both resource rich and resource poor countries but greater distance from the sea limits FDI flow in resource rich countries but has no effect on FDI in resource poor countries.

In Chapter three, the study examines how host country's characteristic (absorptive capacities) can enhance FDI spillover effect on economic growth in 36 SSA countries from 1998 to 2016. The study used economic freedom indices and financial market fragility indices as absorptive capacities and the FMOLS estimation technique. The FMOLS is a semi-parametric approach which generates robust estimates for both stationary and non-stationary variables and provides

consistent estimates in small samples. Moreover, it is free of large size distortions in the presence of endogeneity and heterogenous dynamics and is able to accommodate considerable heterogeneity across individual members of the panel.

The results suggest that FDI is detrimental to growth in the absence of absorptive capacities. However, after controlling for host country's characteristics such as the degree of economic freedom, and the stability of the financial market amidst crisis (fragility) and other factors such as trade, inflation, labour force and gross fixed capital Formation, the study reveals a positive effect of FDI on growth. The results indicates that financial fragility limits economic growth while greater economic freedom enhances economic growth. In addition, FDI and economic freedom were found to be complimentary. Further analysis indicates that, FDI promotes growth in middle income and resource rich countries but hurts growth in low income countries and exert a negative but insignificant effect in resource poor countries in SSA.

In Chapter Four, the study examines the impact of sectoral FDI and growth on sectoral CO_2 emission in SSA and test for the existence of EKC in agriculture, industry and services using data from 36 SSA countries spanning the period 1990 to 2016 and system GMM estimation technique. The system GMM employs level equations to generate a system of two equations–differenced equation and level equations such that by adding the second equation additional instruments are generated. By allowing for more instruments, system GMM provides more efficient and consistent estimates that are robust to autocorrelation and serial correlation.

For aggregate FDI, the result from the system GMM estimator indicates that previous levels of emissions increases current levels of emissions. The study suggests that the existence of MNEs in SSA results in the transfer of clean technology validating the halo effect hypothesis. However, the result is not supportive of the EKC hypothesis. Domestic investment was found to improve the environment. Interestingly, as domestic investments increases it drives foreign investment into dirty industries. Unlike domestic investment, imports, financial sector development and urbanization pollute the environment.

With regard to sector specific analysis, the results indicate that industry FDI increases CO_2 emissions validating the pollution haven hypothesis while Agric FDI and service FDI reduce CO_2 emissions. In general a U shape hypothesis holds for Agric FDI and CO_2 emissions, but an inverted U shape for industry FDI and Industry CO_2 emissions and a linear and negative relationship between services FDI and services CO_2 emissions.

5.2 Policy Recommendations

The findings from empirical chapter two have key policy recommendation for SSA. First, since the larger the size of the host country and closer geographical proximity to main FDI countries, the greater the cumulative FDI, SSA can take advantage of its greater geographical size in coming out with a common market to maximize the potential embedded in FDI. This would reduce transactions costs and break the barrier of long distance transport. The formation of a common market would help in collective bargaining and contract deals as investors would regard them as part of a bigger group rather than small individual markets and this would go a long way to attract FDI into the region. In addition, emphasis must be placed on the distance from markets rather than

distance to sea or port, to benefit countries which are located at the central part of the continent which is far from sea.

With regard to empirical paper 3, there is the need for technological transformation in the banking sector to improve efficiency and reduce the cost of transaction. To ensure the development of local financial market, efforts must be driven by local reforms. The study recommends the need to raise the minimum capital requirements of financial institutions to make them robust to shock. There is also the need to reduce illiquid liabilities by increasing taxes on them or reducing the volume of liabilities. Restrictions should also be placed on the movement of capital to limit the spread of fragility. Finally, there is also the need to create incentive structure by promoting economic freedom to enable the private sector to thrive.

For the final empirical paper, the study recommends the need to strengthen environmental laws with regard to investment in the industrial sector and examine the environmental impact of foreign investment before granting permit to operate. Second, offer incentives to attract investments in agricultural and services sector. Third, ensure that both foreign and domestic firms adopt energy efficient techniques of production so as to increase output and reduce CO_2 emissions. Finally, the need to emphasize the use of renewable energy in production.

5.3 Limitations of the study

Though steps have been taken to ensure that the results of this study are reliable to inform policy, there are a number of limitations regarding the availability and quality of data. Since data on FDI in SSA are in a composite form, disaggregation of FDI into the various sectors was carried out using GDP by sector.

5.4 Contributions of the thesis

The main contributions of this thesis are as follows: First, the reforms by various countries in the 1980s led to the influx of FDI into every region of the world. However, the share of FDI into Africa compared to other developing countries have been consistently low. Mediocre reforms, lack of economic freedom, political and macroeconomic instability have been found to account for the low inflows of FDI into the region (Asiedu, 2004; Onyeiwu & Shrestha; 2004; Okafor, 2015). Asiedu (2002) have argued that Africa on the average receive less FDI by virtue of their geographical location. Unfortunately, previous studies examining the locational determinants of FDI have focused exclusively on market, resource, asset and strategic seeking to the neglect of geographic factors. This study contributes to the existing literature by incorporating specific geographic factors such as geographic size of the country, percentage of land located in the tropics and the distance from the sea in investigating the determinants of FDI in SSA. Geographical factors are important as they affect the diversity and availability of natural resources, transactions costs and locational decisions of firms.

Second, existing studies have shown that the growth effect of FDI is contingent on host country's characteristics. Institutions have been found to enhance FDI's growth effect because it creates

incentive structure for the private sector to thrive. For instance, financial market development mobilizes funds for investment, screens investment projects and determines the amount of funds that foreign firms can access to expand their innovative activities in the host country. Previous studies have concentrated on the role of financial market development in the FDI-growth link. It has been argued that fragility of the financial markets has implications for FDI and growth. This study employs a unique data set on financial fragility and aggregate measure of economic freedom as measures of institution in examining the FDI-growth link in SSA.

Finally, it has been argued that developing countries tend to relax their environmental regulations to attract FDI from firms escaping high abatement cost at home. However, growth generated from FDI pollutes the environment of the host country due to inefficient production techniques employed by foreign firms. Previous studies examining the effect of FDI on the environment have used composite FDI instead of FDI by sector which could conceal the sectoral FDI effect on the environment. This study adds to the existing literature by disaggregating FDI into different sectors to examine its effect on the various sectors.

The study recommends that SSA should take advantage of its geographical size in coming out with a common market to maximize the potential in FDI by addressing issues of financial fragility and being careful about the sectors where FDI should go.

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APPENDICES

Appendix 2.1: Correlation Analysis	1	2	3	4	5	6	7	8	9	10
1.lForeign Direct Investment	1									
2. lGeog Size of country	0.4031	1								
3. lMean Distance from Sea	0.1443	0.5247	1							
4. % of land in tropics	-0.11	-0.0185	0.0316	1						
5. lGDPpercapita	0.3499	0.1644	-0.0347	-0.3215	1					
6. lExchange Rate	0.0232	0.0803	0.117	-0.0487	0.1129	1				
7. Fixed telephone subscription	0.0842	0.1453	0.1945	-0.049	0.0346	-0.0328	1			
8. lNatural resource rent	0.1716	0.003	0.0598	0.3187	-0.0091	-0.0271	-0.0833	1		
9. Political Stability	-0.0153	-0.2123	-0.1598	-0.2954	0.358	0.0423	0.0223	-0.3021	1	
10. Rule of law	0.0614	-0.0011	0.1236	-0.4341	0.2255	0.0774	0.1377	-0.497	0.3677	1

Appendix 2.2: Descriptive Statistics Full Sample Variable	Mean	Std. Dev.	Min	Max
lForeign Direct Investment	21.00	0.70	13.82	23.58
lGeog Size of country	12.55	1.37	9.21	14.73
lMean Distance from Sea	5.83	0.96	3.27	7.15
% of land in tropics	0.92	0.22	0.00	1.00
lGDPpercapita	6.73	1.03	4.71	10.03
lExchange Rate	30.66	6.41	7.89	36.82
Fixed telephone subscription	0.98	0.14	0.00	1.00
lNatural resource rent	2.39	0.82	-0.59	4.12
Political Stability	-0.63	0.88	-3.31	1.20
Rule of law	-0.79	0.60	-2.61	0.73

Appendix 2.3: Descriptive Statistics for West and Central Variable	Mean	Std. Dev.	Min	Max
lForeign Direct Investment	20.99	0.82	13.81	23.58
lGeog Size of country	12.38	1.37	9.21	14.05
lMean Distance from Sea	5.68	1.05	3.27	7.15
% of land in tropics	0.99	0.04	0.83	1.00
lGDPpercapita	6.79	1.01	4.89	10.03
3lExchange Rate	30.76	5.79	7.89	36.78
Fixed telephone subscription	0.96	0.19	0.00	1.00
lNatural resource rent	2.68	0.77	0.89	4.12
Political Stability	-0.63	0.75	-2.69	0.83
Rule of law	-0.90	0.46	-1.82	0.15

Appendix 2.4: Descriptive Statistics for South& East SSA Countries Variable	Mean	Std. Dev.	Min	Max
lForeign Direct Investment	21.02	0.53	20.49	23.03
lGeog Size of country	12.77	1.34	10.21	14.73
lMean Distance from Sea	6.02	0.79	4.54	6.96
% of land in tropics	0.84	0.31	0.00	1.00
LGDPpercapita	6.65	1.06	4.71	8.98
lExchange Rate	30.54	7.15	9.31	36.82
Fixed telephone subscription	1.00	0.00	1.00	1.00
lNatural resource rent	2.03	0.74	-0.59	3.70
Political Stability	-0.63	1.03	-3.31	1.20
Rule of law	-0.64	0.71	-2.61	0.73

Appendix 2.5: 40 Sub-Saharan African Countries

West and Central African Countries	South and East African Countries
Benin	Botswana
Burkina Faso	Lesotho
Côte D'Ivoire	Madagascar
Gambia	Mauritius
Ghana	Namibia
Guinea	South Africa
Guinea-Bissau	Zambia
Liberia	Zimbabwe
Mali	Burundi
Mauritania	Eritrea
Niger	Ethiopia
Nigeria	Kenya
Senegal	Malawi
Sierra Leone	Rwanda
Togo.	Somalia
Angola	Sudan
Cameroon	Tanzania
Central African Republic	Uganda
Chad	
Congo Republic	
Equatorial Guinea	
Gabon	

Appendix 3.1: Regression Results by Regions

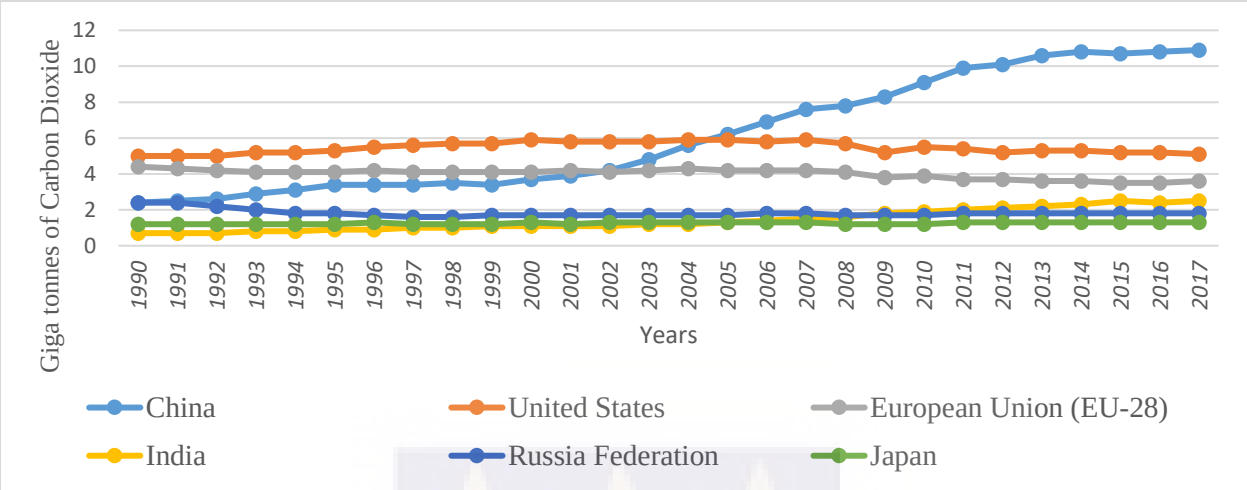
Variables	(1) FMOLS	(2) FMOLS	(3) FMOLS	(4) FMOLS
	West	*East*	*Central*	*South*
FDI (%GDP)	0.1843***	-0.3084***	-0.0101	-0.0553***
	(0.025)	(0.069)	(0.067)	(0.013)
Lncost	0.1088***	-0.1844***	-0.2243***	-0.0325**
	(0.032)	(0.051)	(0.064)	(0.015)
lnoverscore_100	4.2536***	-0.0958	0.5424	-0.0613
	(0.717)	(0.175)	(1.751)	(0.059)
c.fdigdp#c.lncost	-0.0374***	0.0767***	-0.0206***	0.0128***
	(0.006)	(0.017)	(0.008)	(0.003)
c.fdigdp#c.lnoverscore_100	-0.4030***	0.0848	1.4509**	0.0414***
	(0.084)	(0.066)	(0.680)	(0.011)
lninf_cpi	-1.0230***	-1.0064***	-1.0229***	-1.0673***
	(0.005)	(0.005)	(0.012)	(0.003)
Lntradeop	-0.6660***	-0.1175***	-0.6446***	-0.1595***
	(0.025)	(0.032)	(0.058)	(0.020)
lngcf_gdp	0.0052***	0.0241***	-0.0069	-0.0010
	(0.001)	(0.004)	(0.008)	(0.004)
lnlab_t	-0.4305***	-0.4371**	0.3982***	-0.4518***
	(0.065)	(0.173)	(0.151)	(0.065)
Constant	13.9615***	11.5251***	5.3806**	15.1630***
	(0.982)	(2.430)	(2.450)	(0.866)
Observations	196	68	80	158
R-squared	0.933	0.995	0.996	0.990

Dep Variables:lnrgdp_pc
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 3.2 : 36 Sub-Saharan African Countries

Angola	Mali
Benin	Mauritania
Botswana	Mauritius
Burkina Faso	Mozambique
Burundi	Namibia
Cameroon	Niger
Central African Republic	Nigeria
Congo, Dem. Rep.	Rwanda
Côte d'Ivoire	Senegal
Equatorial Guinea	Sierra Leone
Eritrea	South Africa
Ethiopia	Sudan
Gabon	Swaziland
Ghana	The Gambia
Guinea	Togo
Kenya	Uganda
Lesotho	Zambia
Madagascar	Zimbabwe

Appendix 4.1: Trends in the Largest Emitting Countries and Regions (1990 – 2017)



Source: (Olivier & Peters, 2018)

Appendix 4.2: Trends in FDI, GDP, Emissions, Energy Use and Natural Resource Depletion in SSA

Year	FDI (%GDP)	Per capita FDI (US S)	Per capita GDP	Per capita CO_2 emission (metric tons)	Total GHG kt ofCO_2equivalent	Energy Intensity (MJ)	Per capita energy consumption (Kg oil equivalent)	Natural resource depletion (% GNI)
1990 – 1994	1.23	11.20	1558.09	1.17	135838.40	10.60	620.00	6.77
1995 - 1999	2.59	20.26	1480.99	1.14	130595.30	10.83	618.03	7.20
2000 - 2004	2.17	28.42	1737.55	1.10	139836.90	10.08	618.69	8.52
2005 - 2009	3.84	115.99	2107.16	1.26	132725.10	9.33	652.22	9.69
2010 - 2014	4.89	129.39	2230.90	1.28	173013.60	9.87	740.14	11.14

Source: World Development Indicators (CD-ROM, 2015)

Appendix 4.3: 36 sampled countries in SSA

Benin	Madagascar
Botswana	Malawi
Burkina Faso	Mauritania
Burundi	Mauritius
Cameroon	Mozambique
Central African Republic	Namibia
Comoros	Nigeria
Congo, Dem. Rep.	Rwanda
Congo, Rep.	Senegal
Cote d'Ivoire	.Seychelles
Eritrea	Sierra Leone
Gabon	South Africa
Gambia, The	Sudan
Ghana	Swaziland
Guinea	Tanzania
Guinea-Bissau	Togo
Kenya	Uganda
Liberia	Zimbabwe

Appendix 4.4: Pairwise Correlation Test

	$lnCO_2$	lnFDI	lnGDP	lnDOI	lnIMP	lnEXP	lnFMD	lnURB
$lnCO_2$	1.000							
lnFDI	0.029	1.000						
lnGDP	0.071*	0.055	1.000					
lnDOI	-0.026	-0.275*	0.029	1.000				
lnIMP	0.117*	0.138*	0.073*	-0.027	1.000			
lnEXP	0.074*	0.079*	-0.005	-0.011	0.122*	1.000		
lnFMD	0.106*	-0.008	0.068*	-0.037	0.020	0.001	1.000	
lnURB	0.102*	0.013	-0.046	0.039	0.031	0.084*	-0.018	1.000

**Denotes statistical significance of collinearity*

Appendix 4.5: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$lnCO_2$	892	34.87	1.31	23.45	36.83
lnFDI	887	19.24	2.99	0.80	25.53
lnGDP	965	35.52	1.14	29.17	36.84
lnDOI	865	0.20	2.01	30.07	13.29
lnIMP	943	35.58	0.91	25.73	36.83
lnEXP	943	35.44	0.97	30.28	36.81
lnFMD	924	35.25	0.94	30.31	36.84
lnURB	967	10.44	3.24	3.22	36.83