

Södertörns University | Department of Economics

Master Programme, Thesis | 2012

Determinants of Foreign Direct Investment Inflows to Sub-Saharan Africa: a panel data analysis

By: Gichamo, Tesfanesh Zekiwos

Supervisor: Karl-Markus Modén



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Master thesis in Economics

© Tesfanesh Zekiwos Gichamo

shegazek@gmail.com

Dedicated to my father;

Rev. Zekiwos Gichamo

Acknowledgement

“in him we live and move and have our being” Act 17:28

First of all, I would like to thank my advisor Karl-Markus Modén for his valuable advice, comments and encouragement. Thank you so much.

I would like to extend my heartfelt thanks to Salem Church members in Uppsala. Thank you for the love and kindness that you have showed me during my study period in Sweden. May God bless you more and more.

Much love to my family. I love you so much!!

Abstract

Most countries in the world are working hard to attract more foreign direct investment. Identifying the key determinants of foreign direct investment is therefore seen as a crucial task for policy makers. Compared to other parts of the world, the performance of Sub-Saharan African countries in attracting foreign direct investment is poor. This study deals with identifying the determinants of foreign direct investment inflow in Sub-Saharan Africa. The study employed panel data analysis: pooled ordinary least square method, fixed effects and Random Effect methods. Fourteen Sub-Saharan Africa countries were sampled for the study. Trade openness, gross domestic product, gross domestic product growth, gross domestic product per capita, telephone line (per 100 people), gross fixed capital formation, inflation and the lag of FDI are explanatory variables while the stock of FDI inflow is dependent variable. The analyzed data covered for the period 1986-2010. The study finding shows that trade openness, gross domestic product, inflation, and lag of FDI are the most significant determinants of foreign direct investment inflows to sub-Saharan Africa.

Key words: FDI, FDI determinants, fixed effect, Sub-Saharan Africa

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1. Introduction

1.1 Background

These days, foreign direct investment (FDI) is playing a great role for economic development in developed and developing countries. The host country will benefit as FDI creates employment opportunities, promotes economic growth, and facilitates technology transfer (UNCTAD 2010, Agrawal and Khan 2011). In addition to these, the foreign direct investment is seen to fill the gap between domestic investments and savings in most developing countries as their income and savings are very low (Odenthal 2001, Mottaleb and Kalirajan 2010). To gain the benefit most developing countries are trying to attract FDI by framing different policies such as trade liberalization and creating an attractive macroeconomic investment environment (UNCTAD 2004).

This study investigates the determinants of inward foreign direct investment in Sub-Saharan Africa using the panel data from the period 1986 to 2010. The models used for the study are pooled ordinary least square method, fixed effect method and random effect method. The study focuses on trade openness, market size, infrastructure and macroeconomic stability

1.2 Statement of the problem

The inflow of foreign direct investment to Sub-Sahara African countries is very low compared to other part of the world. The question is why it is very low and what are the factors that determine the FDI inflows to sub-Saharan Africa. By doing panel data analysis, it is important to find out which determinants are the most significant.

1.3 Objective of the study

The main aim of the study was to examine the determinants of foreign direct investment in Sub-Saharan Africa using panel data regression models.

There were four hypothesis tested

Hypothesis 1 Trade openness leads to FDI inflow

Hypothesis 2 Countries with large market size attract more FDI

Hypothesis 3 Infrastructure development is determinant factor for FDI inflow

Hypothesis 4 Macroeconomic stability is essential for FDI inflow

1.4 Research Question

What are the determinants of foreign direct investment in sub-Saharan Africa? Which factors are the most significant and which factors do not have much significance so they are not much important in policy formulation?

1.5 Significance of the study

This study examined foreign direct investment determinants in Sub-Saharan Africa using panel data analysis methods. We believe that the study will contribute useful information for sub-Saharan African policy makers. And it will be useful as a reference for students and teachers who may wish to do research in this subject area in the future using panel data analysis. In this study we found out that fixed effect method is appropriate method for the analysis of the data.

1.6 Delimitations

The selection of the countries is based on the availability of the data from 1986 to 2010. Due to limited availability of data it was not possible to include all sub-Saharan Africa to this study.

1.7 Structure of the thesis

This thesis report is divided into seven chapters. Background, statement of the problem, objective of the study, research question, significance of the study and delimitations are presented in chapter one. Chapter two presents international trade and foreign direct investment theories. Chapter three covers literature review and chapter four discusses empirical studies. In chapter five panel data regression models that were used for the study are presented. Chapter six deal with result and discussion. Finally conclusion and policy implication is presented in chapter seven.

2. Theoretical Framework

It is worth to start by classical and neo-classical theories of international trade to get full picture of how nations started international trade and how international trade paved a way for foreign direct investment. First Adam Smith's absolute advantage theory and David Hume's theory of current account balance are presented. And then, David Ricardo's comparative advantage and Heckscher-Ohlin (H-O) factor endowment theories are discussed. Afterward, the FDI theories are presented to see the determinants of FDI. Finally, the theory of market imperfection, the product cycle theory and eclectic theory are also analyzed.

2.1 Absolute advantage theory

Adam Smith and David Hume trade theories focus on absolute advantage. David Hume (1711-1776) who was an English economist was a pioneer to the theory of current account balance. He was against the mercantilist economic policy which promoted current account surplus. Hume criticizes the idea of mercantilist which is collecting more money and abandoning exportation of precious metal like gold and silver. Hume argued that accumulation of money can increase domestic labour and commodity price. As a result the imports increase and exports decrease. David Hume (1711-1776) stated that

“Can one imagine, that it had ever been possible, by any laws, or even by any art or industry, to have kept all the money in Spain, which the galleons have brought from the Indies? Or that all commodities could be sold in France for a tenth of the price which they would yield on the other side of the Pyrenees, without finding their way thither, and draining from that immense treasure? What other reason, indeed, is there, why all nations, at present, gain in their trade with Spain and Portugal; but because it is impossible to heap up money, more than any fluid, beyond its proper level? The sovereigns of these countries have shown, that they wanted not inclination to keep their gold and silver to themselves, had it been in any degree practicable.

Hume's argument was that import and export will be at equilibrium by automatic adjustment. Otherwise, discouraging export and encouraging import to increase current account surplus is self defeating.

Adam Smith, who is called the father of modern Economics, wrote a book titled *An Inquiry into the Nature and Causes of the Wealth of Nations* in 1776. In his book he explained how the idea of *mercantilism* was benefiting only merchants and producers while workers and others were neglected. Like David Hume, Adam Smith was against mercantilistic economic policy. Smith argued that the idea of *mercantilism* was not favorable for the whole nation and it did not bring wealth and economic growth for the whole country.

Adam Smith criticized the *mercantilists'* economic philosophy which encouraged export and discouraged imports to get more gold and silver. He stated that "the encouragement of exportation and the discouragement of importation are the two engines by which the mercantilist system to enrich every country" (Smith 1976 cited in Skousen 2007). And then, he proposed the theory of absolute advantage by promoting free trade between countries "If a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy it of them" (Smith 1976 cited in Skousen 2007). Adam Smith noted that all countries could gain by practicing free trade and specializing in their absolute advantage. Absolute advantage is determined by comparison of labor productivity.

Table 2.1 shows an example with two countries, A and B, which produce wine and car respectively. In country A 15 units of labor and in country B 12 units of labor is required to produce one car. To produce one unit of wine 5 and 24 units of labor are required for country A and B respectively. Country A has absolute advantage in producing wine and country B has absolute advantage in producing car.

Table 2.1 Units of labor required

Country	Units of Labour required to produce one unit of out put	
	car	wine
Country A	15	5
Country B	12	24

Table 2.2 Changes in outputs due to labor reallocation

Country	Units of Labour required to produce one unit of out put	
	Δ car	Δ wine
Country A	-1	+3
Country B	+2	-1
world	1	2

Table 2.2 shows changes in outputs due to labor reallocation in both countries. In country A when the production of car is less by one unit; it will free up 15 labors for 3 more wine production. In country B when the production of wine is less by one unit; it will free up 24 labors which will be reallocated in car production, and as a result 2 more cars will be produced. Due to specialization, world production of car increases by one and world production of wine increases by 2.

However, David Ricardo (1772-1823) came with new idea which focuses on opportunity cost of production than absolute cost of production and he developed comparative advantage theory. In comparative advantage trade is mutually beneficial but in absolute advantage trade is not mutually beneficial.

2.2 Comparative advantage theory

Ricardo is known for his modern international trade theory. Ricardo's theory is explained as following. It assumes two countries. Both countries produce two goods and they use only labor for production. Let the production function be $Q_j^i = b_j^i L^i$. The superscript i represent country and subscript j represent the products and the coefficient b_j^i is marginal

products of labor. To see the comparative advantage we compute wine to car ratio using the above example for country A and country B. The production functions of wine and car for country A are $Q_w^A = b_w^A L^A$ and $Q_c^A = b_c^A L^A$ respectively. The production functions of wine and car for country B are $Q_w^B = b_w^B L^B$ and $Q_c^B = b_c^B L^B$ respectively.

If b_w^A is greater than b_w^B , country A will have absolute advantage in wine production. If b_c^B is greater than b_c^A , country B will have absolute advantage in car production. What if country A has absolute advantage in both goods and country B has absolute disadvantage in both goods? We compute the ratio of labour input coefficients (the reciprocal of marginal products of labour) for both countries to see comparative advantage.

If country A's wine to car ratio is less than country B's wine to car ratio, country A will gain comparative advantage by selling wine and buying car from country B. The same to country B; if the car to wine ratio is less than country A's car ratio, country B will gain comparative advantage by selling car and buying wine from country A. In other word, if the opportunity cost of producing wine in country A is less than country B, country A will have comparative advantage in producing and selling Wine. If the opportunity cost of car production for country B is less than country A, country B will have comparative advantage in producing and selling car.

Table 2.3 Units of Labour required

Country	Units of Labour required to produce one unit of out put	
	car	wine
Country A	10	5
Country B	12	24

Table 2.3 shows that country A has comparative advantage in wine production since country A's wine to car ratio is less than country B's wine to car ratio. Country B has comparative advantage in production of car since it has less car to wine ratio compared to country A. Therefore Ricardo's theory concludes that it is better to consider comparative advantage than absolute advantage. On the other hand, the Heckscher-Ohlin model came with some more assumptions and it is more realistic than the Ricardo's international trade model.

2.3Heckscher-Ohlin model

Heckscher- Ohlin (H-O) model is known as factor proportion theory of comparative advantage and it is developed by Eli Hecksher and Bertil Ohlin. The Hecksher-Ohlin model assumes two countries, two goods and two factors of productions such as labor and capital and constant returns to scale. And also it assumes no technological difference. Hecksher-Ohlin model focuses on factor endowment. The model suggests that a country has to specialize in production where it is rich in resources. A country which is rich in labor will have comparative advantage in producing labor intensive good. The same for capital rich country, specializing in capital intensive products will give the country comparative advantage (Leamer, 1995). One important issue that H-O model mentioned is that where there is no commodity trade between the countries, there will be factors of production movement until the price of the factors will be equal. This is called factor price equalization. Factor movement is seen as a substitute for commodity trade (Mundell 1957). In the H-O model comparative advantage is determined by the difference of factor endowment (Markusen *et al* 1995). The H-O model is criticized as the assumptions are unrealistic and the model is static like Ricardo's comparative advantage theory.

Both classical and neoclassical international trade theories didn't say anything about FDI. However, some scholars believed that international trade theories paved a way for theoretical explanation of FDI especially the theory of comparative advantage and the H-O factor movement theory (Astatike and Assefa 2006). In addition to this, empirical studies argue that FDI and trade are substitute and complement (Mundell 1957, Carter and Yilmaz 1999, Hymer 1976). Hymer stated that “the industries in which international operations occur are often industries in which international trade was or is important. The international operations frequently were established to replace exports or to produce imports” (Hymer 1976).

2.4 Hymer FDI Theory

Hymer (1976) explained the theories of FDI by comparing the difference between foreign direct investment and portfolio investment. Based on the portfolio investment theory, capital moves from the place where there is low interest rate to where there is high interest rate until interest rate is equal everywhere. Here the theory assumes that no barriers to capital movement such as risks and uncertainties. However, Hymer argued that theory of portfolio investment does not explain control (Hymer 1976). In portfolio investment, investors who invest in foreign countries do not have a right to control enterprises which they invested their money.

Based on Hymer there are two reasons why investors seek control i.e multinational companies control foreign enterprise to make sure their investment is safe and to eliminate competition in foreign countries and other countries. Hymer stated that multinational companies are motivated to invest in foreign countries due to certain advantages which they get through control of the enterprises. Hymer analyzed the advantage of the foreign firms over host firms. These advantages are getting factors of production at a lower cost, know how, patents, capital etc. Where market imperfection exists (barrier of market entry, high transaction cost) multinational companies prefer to engage in direct investments.

2.5 Product life cycle theory

Vernon (1966) product life cycle theory has significant contribution for the analysis of foreign direct investment. It analyzed four production stages beginning with invention of new product. The product life cycle theory gives insight why and how export is replaced by foreign investment. Vernon's work was based on the US enterprises which were producing for domestic market and later on for international market. Vernon tried to understand the shift of international trade and international investment. At the initial stage, the enterprises are more focused on the domestic market. And then in the next stage, when the product matures, enterprises start exporting to developed countries. At this stage the innovating enterprises enjoys the profit of the sales of newly invented product until rival enterprises copy and produce the same product. Later when the demand for the product increases the product will be standardized.

At advanced stage, when the product is standardized, the enterprises would think less developed countries could be good production place. Economies of scale, transportation and labor cost are the determinant factor for location choice. Since less developed countries are rich in labor, the products which will be produced are labour intensive products. This is mentioned in H-O theorem. However, according to Vernon it is not only the low cost location hypothesis is leading entrepreneurs to decide and invest in other countries. He argues that any threat to the enterprises can be seen as stimulating force for the action.

Usually, a government which imports the product frame import substitution policy in order to increase employment and promote growth. This could be a threat for the exporting enterprises. So the entrepreneurs prefer to go and invest in this country. Vernon put the threat as “galvanizing force” for international investment. He stated that “an international investment by the exporter therefore becomes a prudent means of forestalling the loss of a market. In this case, the yield on the investment is seen largely as the avoidance of a loss of income to the system”. In the fourth stage, the home countries will be an importer since the production decreases. However, this theory is criticized as some enterprises skip export in the process and go directly to invest.

2.6 The Uppsala school approach

The Uppsala school approach or the Nordic internationalization model is an FDI model which is developed by researchers in Uppsala University. The model “focuses on the gradual, acquisition, integration and use of knowledge about foreign markets and operations, and on the incrementally increasing commitments to foreign markets” (Johanson and Vahlne, 1977). Like the product life cycle theory, Nordic internationalization model discusses the steps that the firms takes to international production in order to get involved in foreign countries. The study had been carried out to discover how Swedish firms got involved in foreign market. First the firms export through agents and then they establish sales subsidiary and finally they start producing in the foreign country.

The Nordic internationalization model noted knowledge as the determining factor to get new market opportunities in foreign countries. The process starts in neighbor countries and continues in other countries which are far away.

2.7 Eclectic FDI theory

John Dunning is one of the prominent scholars on the issue of foreign direct investment. He developed a framework called the OLI framework where he described three firms' advantages of foreign direct investment, i.e Ownership advantages, Locational advantages and Internalization advantages. Ownership (O) advantages include patents, trade-marks and goodwill. This will help the firms to compete easily in the host country. It would have been difficult to get this advantage in home country. Locational (I) advantages include all things which make the firm more profitable to produce and sell in the host country, rather than to produce at home and export to the other country. Since the firms will be planted in host countries there will not be trade barriers like tariffs, quotas, transport cost. Accessing the market will be easy. Internalization (I) advantage references to the advantage of multinational enterprises (MNE) due to ownership advantage internally inside the host country.

Dunning and Lundan (2008) classified MNE's activity in to four to explain the motives behind foreign production. 1. Natural resource seekers 2. Market seeker 3. Efficiency seekers and 4. Strategic asset or capability seekers.

1. Natural resource seekers : these are enterprises which are looking for natural resources at a lower cost compared to their country (if they have the resources) to make more profit out of it. The main aim of these enterprises is acquiring high quality resources at a lower cost to be more profitable and competitive in a market where they sell their products. There are three types of resource seeking FDI. The first are MNE's which are primary producers and manufacturing enterprises that seek raw materials and physical resources. They are mainly motivated by abundant and low cost resources.

The main resources that most MNE's are seeking are fuels, minerals, metals and agricultural products. Some resources are 'location bound', which can be found only in host countries. This is locational advantage that MNE's enjoys by investing in host countries which are rich in resources. The second resource seeking FDI are those enterprises which are looking for cheap unskilled or semiskilled labor. This is known as "labor seeking investment". Usually when the labor cost of the home country increases MNE's move or shift to other countries where there is low labor cost. The third types of resource seeking FDI are the enterprises that want to gain access to management and organizational skills, technology, information and marketing expertise.

2. Market Seekers: MNE's engaged in a market seeking investment in order to get access to large market and hoping the market growth in the future. This includes accessing domestic market and adjacent countries' market. The advantages of market seeking FDI are decreases production and transaction cost, can easily adopt local tests and preferences, they can be familiarized with the local language, business customs, legal requirement and market procedures. And there will not be any trade barriers such as tariffs.

3. Efficiency Seeker: These are the MNE's which invest in different countries to take the advantage of resource endowment and economies of scale. For example investing in developed countries to produce capital intensive goods and investing in developing countries to produce labor intensive goods. Dunning and Lundan 2008 stated "the intension of efficiency seeker MNE is to take the advantage of factor endowments, cultures, institutional arrangements, demand patterns, economic policies and market structures by concentrating production in a limited number of locations to supply multiple markets".

4. The strategic asset seeker: The main aim of strategic asset seeker MNE's is sustaining and strengthening their competitiveness to dominate global market.

3. Literature Review

3.1 International capital flow

There are three types of international capital flows (Figure 3.1); portfolio investment, foreign direct investment and loans (IMF 1993, Bosworth *et al* 1999, Feldstein, 1999, Protsenko 2004). Portfolio investment is the investment in bonds, stocks and equities. Investors purchase bonds and stocks from foreign countries hoping to get more return. Portfolio investment is related to interest rate change. However, foreign direct investment is more than adding to the stock of capital. Feldstein (1999) stated that foreign direct investment brings ‘better technology, modern management and expand access to global market.

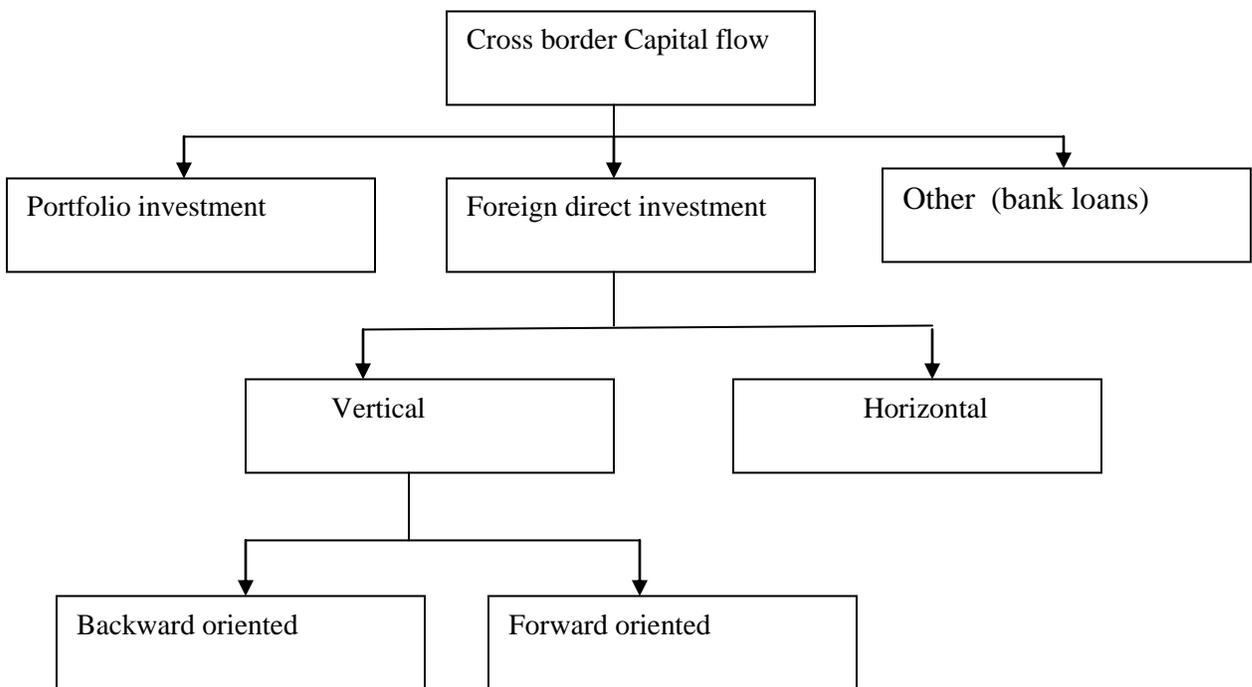


Figure 3.1. Capital flow
Source: Protsenko 2004

3.2 Definition of FDI

FDI definition by International monetary fund

Foreign direct investment is international investment made by a resident entity in one economy (direct investors) with the objective of establishing a lasting interest in an enterprise resident in an economy other than that of the investor (direct investment enterprise). Lasting interest implies the existence of a long term relationship between the direct investor and enterprise and a significant degree of influence by the direct investor on the management of the direct investment enterprises. Direct investment involves both the initial transaction between the two entities and all subsequent capital transactions between them and among affiliated enterprises, both incorporated and unincorporated.

FDI definition by world bank

Foreign direct investment is the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.

3.3 Types of FDI

There are two types of Foreign direct investment: Horizontal and vertical FDI

3.3.1 Horizontal FDI : When multinational enterprises invest in different countries to produce the same goods and services we call it horizontal foreign direct investment.

3.3.2 Vertical FDI:- Multinational enterprises benefit from factor price difference and trade cost in the vertical foreign direct investment.

3.4 FDI policy framework

Arango (2008) divided FDI policies in to two: passive and active policies (Figure 3.2). The passive policies are related to comparative advantage of the countries like natural resource availability, low labour cost, countries' geographical location. It is showing the

world the comparative advantage of the country; letting FDI inflow in to host countries due to comparative advantage.

Active policies are related to the policies that are framed by government to attract more foreign direct investment. This includes macroeconomic stability, trade liberalization and infrastructure development. The active policy should align with the countries development objectives as well as the MNC's strategy for mutual benefit.

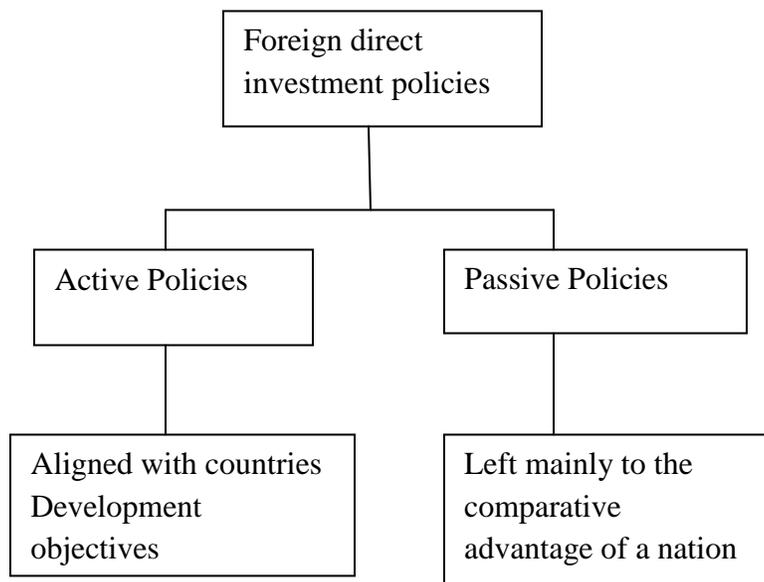


Figure3.2, Foreign direct investment policies
source: Arango (2008) and author

3.5 FDI trends

During 1980's worldwide outflow of FDI increased by 29 percent growth rate of a year, it was three times faster than world export and four times faster than world output (UNCTAD1991). One of the reasons for increase in inflow of FDI in 1980's was the shift in sectors from raw materials to service and technology intensive manufacturing. In the 1950's mainly the FDI focused on raw materials however during 1980's and 1990's it shifted to service and technology-intensive manufacturing. Moreover international

production through FDI is seen as complement and substitute for international trade and it eliminates trade barrier.

Based on World Investment Report (2010) half of global foreign direct investment inflow goes to developing and transitional economies (UNCTAD 2010). And one quartet of global foreign direct investment outflow is invested by developing and transition countries. The spread and importance of foreign direct investment varies from region to region. Early 1980's when FDI was becoming popular, the rate of FDI industries spread in Asia. This was in search of the cheapest labor which gave incentive for the increment of FDI in Asia. But these days the direction has shifted to other countries including Africa (OECD 2005).

Due to the recession since 2008 the world economy has declined by 2 percent. As a result the amount of FDI inflow in some part of the world was low. However, FDI inflow has recovered from 2010 onward. World investment report (2010) identifies the factors that influence future FDI inflow globally from 2010 onwards i.e macroeconomic factors, firm level factors, policy factors. Macroeconomic factors include gross domestic product, gross fixed capital formation, the interest rate and commodity prices. Firm level factors are profit and liquidity position (cash holding). Yet, risks and uncertainties such as instability of global financial system (high inflation and instable exchange rate) may affect FDI inflow negatively (UNCTAD 2010).

Figure 3.3 shows that the share of FDI flows in different part of the world. When we see the trend of FDI inflow to Africa during 1980 - 1989 the share from developing countries increased from 9 percent during 1980-1984 to 12 percent during 1985 -1989. In 1989 the amount of FDI inflow was 4.3 billion dollar. However, oil producing countries accounted 86 percent of total amount. Since 1981, the inflows of FDI for non oil exporting sub-Saharan Africa have been below 0.5 billion dollar which is very low compared to other parts of the world. As world investment report (1991) stated except oil exporting country, Nigeria, the main recipient of FDI, most sub-Saharan Africa's FDI inflow is low due to deteriorating business conditions and political instability (UNCTAD 1991).

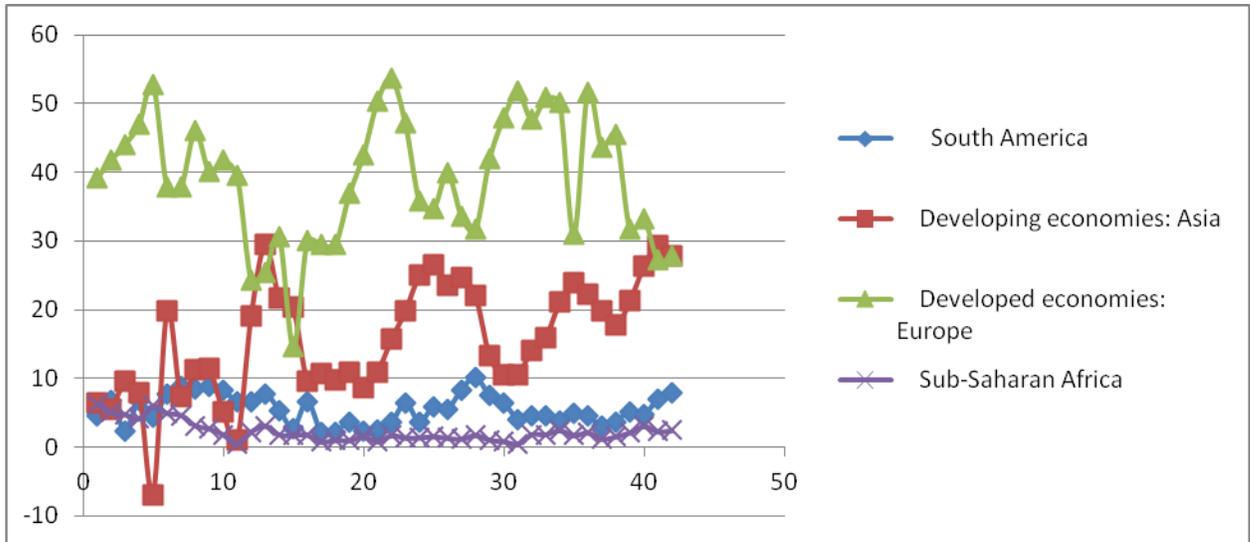


Figure 3.3 Share of FDI inflow (percentage of total world)

Source: UNCTAD Database/UNCTADStat

UNCTAD (2011) report indicated that while inflow of FDI decreased in the northern Africa due to insatiability, sub-Saharan Africa FDI inflow increased from \$29 billion in 2010 to \$37 billion in 2011 (UNCTAD 2011). The report stated that the amount of Sub-Saharan Africa inward FDI is recovering. Figure 3.4 shows the inflow of FDI to Sub-Saharan Africa from year 1970 to year 2010.

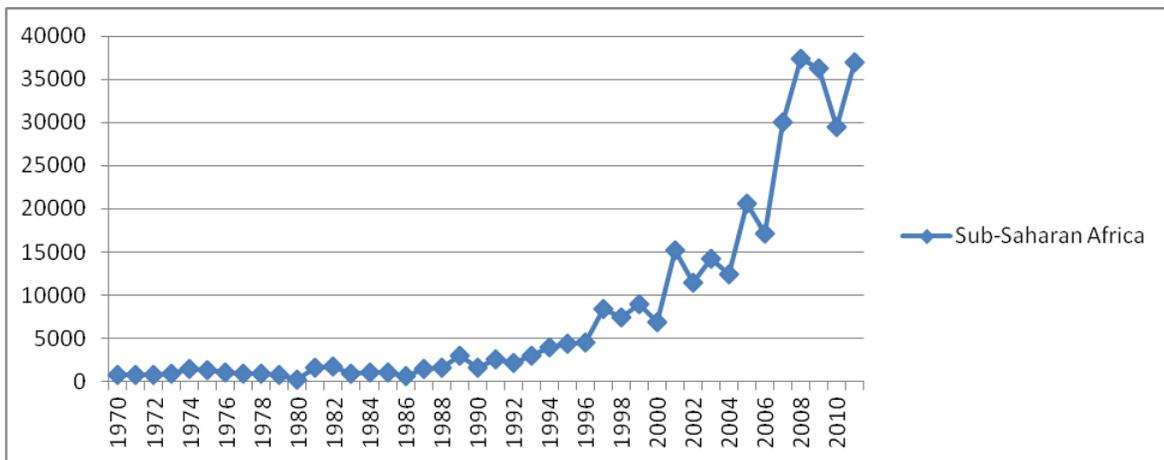


Figure 3.4 FDI inflow to Sub-Saharan Africa (\$ in millions)

Beside developed countries, developing Asian countries have significant contribution for FDI inflow to Africa countries. As can be seen in the table 3.1, the share of developing

economies increased from 17.7 during 1995-1999 to 20.8 during 2000-2008. India and Malaysia next to china are the major sources of FDI inflow to sub-Saharan Africa. While some FDI are Market and efficiency seeking investment, most FDI to Africa from developing countries are resource-seeking especially natural resources. Since FDI from developing Asia is labor intensive manufacturing it generates employment to African countries. Mostly China and India investors are involved in manufacturing and infrastructure (UNCTAD 2010).

Table 3.1. Distribution of estimated inward FDI and stock in African countries by source region

	Share in World Total (%)			
	Inflows		Inward stocks	
	1995-1999	2000-2008	1999	2008
Total world	100	100	100	100
Developed countries	79.0	72.1	89.0	91.6
Developing economies	17.7	20.8	6.9	7.4
South-East Europe and Commonwealth of Independent States	0.3	0.0	0.0	0.0
Unspecified	3.0	7.1	4.1	1.0

Source:- UNCTAD 2010

3.6 FDI policy framework in Sub-Saharan Africa

The bad image of Africa due to civil war, political instability, poor economic performance, poverty, disease, had negative impact on FDI inflow (UNCTAD 1999b). Due to these reasons, multinational enterprises didn't consider African countries as favorable location for investment despite the fact that most countries are at peace and political stability.

Since 1980's most African countries had been working hard to bring political stability and economic development. For most of them the gross domestic product per capital had shown significant increment. Odenthal (2001) indicated that African countries have had policy reforms from the late 1980s onward. The FDI policy reforms include political and economic reform such as macroeconomic stabilization, trade and investment liberalization, privatization, reduction of bureaucracy (Odenthal 2001).

During 1988 more than 20 sub Saharan African countries had done FDI policy reform. And they became open for international trade and foreign investment by creating business friendly environment. As a result, the FDI inflow increased during 1990's compared to 1980's. It is believed that FDI has significant contribution for economic development in sub Saharan African countries.

Like other African countries, Sub-Saharan Africa countries signed international agreements to deal with FDI issues. This includes bilateral investment treaties (BITS) (agreement between the host and foreign country to put terms and condition that both countries follow to create smooth relationship), Double taxation treaties (DTTS)(to avoid double taxation), and multilateral agreements (to settle investment disputes and FDI protection).

In Africa the Southern African Development Community (SADC) was formed by 14 member countries in order to create free trade zone (Jenkins 2001). All members of the SADC are Sub-Saharan Africa countries.

4. Empirical Study

Previous studies by different scholars have revealed several determinants of FDI inflow. Blonigen (2005) identified determinants of FDI inflow in a partial equilibrium framework and a general equilibrium framework i.e factors that affect FDI at firm level and country level. Some determinants which are covered by Blonigen (2005) are exchange rate, tax, institutions and trade protection (Blonigen 2005). Tsen (2005) stated that education, infrastructure, market size or current account balance leads to an increase in foreign direct investment. Other scholars' empirical study presented as follow.

Mahmood and Ehsanullah

In their study Mahmood and Ehsanullah (2011) assessed the impact of macroeconomic variables on FDI in Pakistan. They have done time series analysis based on annual data from 1972- 2005. Augmented dickey fuller test and OLS regression method were used to analyze the relationship between macroeconomic variables and FDI. The dependent variable was FDI and population, democracy, manufacturing products, real exchange rate, real exports, import duty and enrollment at secondary school lever were used as independent variable. The variable population was used as the size of economy. Their findings show that population growth, democracy and enrollment at secondary school have positive impact on foreign direct investment. On contrary, manufacturing products, real exchange rate, real exports and import duty have negative impact on foreign direct investment. And they suggested that to bring more foreign capital positive macroeconomic indicators should be improved.

Liargova and Skandalis

Liargova and Skandalis (2012) studied the relation between FDI and trade openness including other variables: exchange rate stability, nominal GDP, GDP per capita and political risk. FDI were taken as dependent variable and other variables were independent variables. 36 developing countries all over the world selected for the study (12 Latin American, 10 Asian, 4 African, 4 Common wealth of independent states and 6 Eastern European countries). The study covers the period from 1990 – 2008. Fixed effects model which is one of Panel regression analysis methods were employed to analyze the data.

The results disclosed that political stability, exchange rate stability, market size, trade openness are the factors that affect FDI inflow positively. More specifically, trade openness has positive impact on inflow of FDI in the long run.

Frenkel et al.,

The study by Frenkel et al., (2004) examined the determinants of FDI using panel data analysis based on gravity model. The study focused on bilateral FDI flow between 5 home countries (largest industrial countries worldwide) and 22 emerging economies from Asia, Latin America and Central and Eastern Europe. Since the study included both home and host counties, it analyzed push and pull factor of FDI outflow and inflow. FDI is dependent variable and distance between host and home countries, GDP growth, market size, inflation, risk, trade openness, are used as independent variables.

The result revealed that economic development which is indicated by GDP growth rate is important factor for FDI inflow to host countries. In addition to this, market size which is represented by GDP has significant role for FDI inflow. Trade Openness which is computed as export plus import divided by GDP had positive effect on FDI inflow to the host country. Inflation which is indicator of economic stability has negative effect on FDI inflow. In addition to these, distance between host and home countries is inversely related to FDI flow.

Asiedu

Asiedu (2002) assessed the determinants of FDI in developing countries. The main objective of the study was figuring out whether the factors that affect FDI in developing countries affect African countries specifically Sub-Saharan African. There were 71 countries selected for this study (32 were Sub-Saharan African countries and 39 were non Sub-Saharan African countries). Cross sectional data were used for the period from 1988 to 1997. OLS method was employed to analyze the data. The variable FDI was used as dependent variable and return on investment, infrastructure development, openness of the host country, political risk, financial depth, size of government, inflation rate, and GDP growth rate used as explanatory variables. The study result shows that trade openness has positive impact on both Sub-Saharan and non-Sub-Saharan Africa. However, Sub-Saharan Africa received less FDI than non Sub-Saharan African. This is because, as Asiedu (2002) argued, Sub-Saharan Africa countries are less open than other regions. While infrastructure development has positive impact on the FDI inflow in non sub-Saharan Africa, it has no significant effect on sub-Saharan Africa. The study suggests that the same policy cannot be effective in different regions.

Bende –Nabende

Bende –Nabende (2002) examined the factors that influence the decision of MNC's in sub-Saharan Africa countries. In this study 19 Sub-Saharan African countries were sampled. The co-integration analysis method used to analysis the data. The variables that are used in this study were real wage rates, interest rates, foreign exchange rates, openness, liberalization, current market size (GDP), market growth, human capital, export oriented policy. These variables are explanatory variables. FDI is dependent variable. Market growth, export orientation policy, and FDI liberalizations are the main factors that are suggested to be the dominant long run determinants of FDI inflow in Sub-Saharan Africa.

Astatike and Assefa

Astatike and Assefa 2005 did time series analysis to assess determinants of FDI in Ethiopia. The data covered the period over 1974 - 2001. The study focused on market size (Real GDP per capita and real GDP growth rate are included as a measure of market attractiveness), export orientation (export as a percentage of GDP), macroeconomic stability (rate of inflation based on consumer price index), infrastructure (gross fixed capital formation and number of telephones), Human capital (rate of adult illiteracy) and trade liberalization. There are four regression models. The sign and significance of the variables; GDP per capita (positive but not significant), Growth rate of GDP (positive and significant in three models out of four), export orientation (positive and significant in all models), inflation (negative and significant), trade liberalization dummy (positive and significant), telephone per 1000 (negative and significant), gross fixed capital formation (negative and insignificant) and illiteracy (negative but insignificant).

The study findings show that the growth rate of real GDP, export orientation and trade liberalization are found to have positive impact on FDI inflow to Ethiopia. Macroeconomic instability and poor infrastructure have negative impact on FDI. The result suggests that in Ethiopia, trade liberalization, stable macroeconomic and political environment and good infrastructure are essential to attract more FDI.

Anyanwu

The study by Anyanwu (2011) investigated the determinants of FDI inflow to Africa. Panel data analysis method were employed to analyze the data that covers over 1980-2007. The factors that were included in the model are urban population (as percentage of population), GDP per capita, openness (trade as a percentage of GDP), financial development (domestic credit to the private sector), inflation (annual inflation rate), exchange rate, government consumption (percentage of GDP), infrastructure (fixed and mobile subscriber per 1000), political right and regions.

The study result shows that large market size, trade openness, high government consumption expenditure have positive impact on FDI to Africa. In addition to this, the study indicated that high remittance has positive effect on FDI inflow. Natural resource endowment was also a factor that has positive impact in FDI inflow. Compared to other part of Africa, East and Southern African sub-regions attracted more FDI. However, Anyanwu (2011) stated that higher financial development had negative impact on FDI inflow.

Khachoo and Khan

The study by Khachoo and Khan 2012 identified the main determinants of FDI inflows to developing countries. 32 developing countries were sampled and the data covered the period over 1982- 2008. Panel regression methods were used. The dependent variables were gross domestic product (Market size), total reserves, electric power consumption, wage rate and openness (export plus import divided by GDP).

The result shows that large market size, more reserves, good infrastructures and less labor cost have positive impact on FDI inflow to developing countries. The positive relationship between GDP and FDI inflow shows that country with large market size can attract more FDI. More reserves have also positive impact on FDI inflow to host country. In addition to these, good infrastructures are also the determinant of FDI inflow. Moreover, low labour cost can also motivate MNC's to invest in a country where there is low wage rate. However, has shown that openness do not have impact on FDI inflow which is contrary to theories and to some empirical studies.

5. Methodology

This study employed panel data estimation. Following Baltagi (2001), Gujarati and Porter (2009), and Greene (2003) panel data regression model presented as follows. It has a double subscript on its variables which are space (cross-section) and time dimensions. Panel data regression model has space as well as time dimensions so panel data is the combination of cross-section and time series data (Gujarati and Porter 2009).

$$Y_{it} = \alpha_i + \beta X_{it} + u_{it} \quad i=1 \dots N \quad t=1 \dots T \quad (5.1)$$

In the above model Y_{it} is an observation on dependent variable, α_i is constant term (unit specific term), β is $K \times 1$ vector of unknown parameter, X_{it} is the i^{th} observation on K independent variables, u_{it} denotes error term, i denotes households, individuals, firms, countries etc... and t denotes time.

There are three panel data regression models that we used in this study 1. Pooled OLS Method (Common constant) 2. Fixed Effect and 3. Random Effects

5.1 Pooled OLS Method (Common constant): In pooled regression the model has common constant. Here the model neglects cross-section and time series nature and estimate the grand regression.

5.2 Fixed Effects least squares dummy variables (LSDV) model: In the least-squares dummy variable (LSDV) model all cross-section units have their own fixed intercept (dummy variable). Model 5.2 is fixed effect regression model (FEM) showing that each unit has its own intercept (Subscript i in the intercept show that the units may have different intercepts). There will be heterogeneity among the unit due to individual intercepts. Here in fixed effect model the unit intercepts are time-invariant (do not vary over time) even if they might be different among cross section units. However the FEM assumes that the coefficients of the independent variables do not vary across cross-section unit or over time.

$$Y_{it} = \beta_{1i} + \beta_2 X_{it} + \dots + \beta_N X_{it} + u_{it} \quad (5.2)$$
$$i=1 \dots N \quad t=1 \dots T$$

Dummy variable technique is the way to create different intercept among the cross section unit as shown in equation 5.3.

$$Y_{it} = \alpha_1 + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \dots + \alpha_N D_{Ni} + \beta_2 X_{it} + \dots + \beta_N X_{it} + u_{it} \quad (5.3)$$

$i = 1 \dots N \quad t = 1 \dots T$

Here α_1 is the intercept value of the first cross sectional unit and the other α coefficient represent by how much the intercept value of the other cross section units differ from the intercept value of the first cross- section unit. For example α_2 tells us by how much the intercept value of the second cross section unit differs from α_1 . The sum of α_1 and α_2 gives as the actual value of the second cross section unit. The estimators that we get out of fixed effect model are called fixed effect estimators. In order to decide whether fixed effect model should be included or not we apply standard F-test (equation 5.5). The F-test will be used to check fixed effect against Pooled OLS Method (Common constant). The null hypothesis (equation 5.4) is that all the intercepts are the same and the Pooled OLS Method (Common constant) is applicable.

$$H_0: \alpha_1 = \alpha_2 = \dots = \alpha_N \quad (5.4)$$

$$F = \frac{(R^2_{UR} - R^2_R)/m}{(1 - R^2_{UR})/(n - k)} \quad (5.5)$$

Where R^2_{UR} = unrestricted R squared

R^2_R = restricted R squared

m = number of restrictions

n = total number of observation

k = number of parameters in the unrestricted regression

Since in Pooled OLS Method (the common constant) model has common intercept for all units it is a restricted model. If the value of F is statistically significant we reject the null hypothesis that all the intercepts are the same. If the F value is not statistically significant we know that all the intercepts are the same. So the Pooled OLS Method (Common constant) will be appropriate model.

We call the model (5.2) one way fixed effects since we allow different intercept for all units. If we include time dummies in one way fixed effect model it will be two way fixed effects since we allow the unit and time effect. However in this study we only use one way fixed effects model. Here it is good to note that introducing many dummy variables has multicollinearity and degree of freedom problem.

5.3. Random Effects model (REM) : Random effects model is also called error component model (ECM). In this model the cross section units will have random intercept instead of fixed intercept. In the fixed effects model we replace β_{1i} by β_1 (equation 5.6) which is the mean value of cross section unit intercepts and random error term ε_i the deviation of individual intercept from the mean value (β_1) with mean value of zero and variance of σ^2_ε .

$$\beta_{1i} = \beta_1 + \varepsilon_i \quad (5.6)$$

$$Y_{it} = \beta_1 + \varepsilon_i + \beta_2 x_{it} + \dots + \beta_N x_{it} + u_{it} \quad (5.7)$$

$$Y_{it} = \beta_1 + \beta_2 x_{it} + \dots + \beta_N x_{it} + w_{it} \quad (5.8)$$

$$w_{it} = \varepsilon_i + u_{it} \quad (5.9)$$

As we see in equation 5.9 w_{it} is the sum of ε_i and u_{it} where ε_i cross section unit error term and u_{it} is a combination of both cross section unit and time series error term.

We apply Hausman test to choose the best model with reliable result from fixed effect and random effect model. In the Hausman test the null hypothesis is that there is no significant difference in the estimator of fixed effect model and random effect model. If we reject the null hypothesis the fixed effect model will be the appropriate model. Rejecting null hypothesis shows us there might be correlation between the error term (w_{it}) and dependent variables.

5.4 Advantage of Panel data regression

There are several benefits of panel data regression that Baltagi 2001 indicated. Panel data helps us to controls heterogeneity of cross-section units such as individuals, states, firms, countries etc... over time. Panel data estimation considers all cross-section units as heterogeneous. It helps us to get unbiased estimation. There are time invariant and state invariant variables which we observe or not. As Baltagi 2001 stated compared to pure cross section and time series, panel data estimation is better to identify and measure effects of independent variables on dependent variables what we cannot measure using time series and cross section data.

In addition to this “Panel data give more informative data, more variability, less collinearity among the variables, more degree of freedom and more efficiency”. It is also better estimation method to study the duration of economic states and the “dynamics of change” over time (Baltagi 2001). It is a good estimation method to ‘construct and test complicated behavioral models’.

5.5 Data and Model specification

This study is based on the data collected for 14 Sub-Sahara African countries for the period of 1986-2010. The data for each country over the period 1986-2010 constitute time series data; and data for all countries for a given year is cross-sectional data. The data on FDI inflow have been compiled from the World Investment Report (UNCTAD 2012). All other data have been compiled from the World Development Indicators (WDI) CD-ROM and IMF data base. Table 5.1 gives the list of countries that are included in this study and abbreviation.

Table 5.1 List of countries

1. Botswana	BWA
2. Cameroon	CMR
3. Cote d'Ivoire	CIV
4. Ethiopia	ETH
5. Gambia, The	GMB
6. Kenya	KEN
7. Madagascar	MDG
8. Mali	MLI
9. Mauritius	MUS
10. Mozambique	MOZ
11. Senegal	SEN
12. South Africa	ZAF
13. Swaziland	SWZ
14. Uganda	UGA

Eight independent variables such as trade openness, Gross domestic product, GDP per capita, GDP growth, Telephone line (per 100 people), Gross fixed capital formation Inflation and the lag of FDI were included in the model based on availability of data set. The study analyses how these independent variables affect inflow of FDI in the Sub-Saharan Africa.

$$FDI_{it} = f(TRDO_{it}, GDP_{it}, GDPPC_{it}, GDPG_{it}, TEL_{it}, GFCF_{it}, INF_{it}, FDI_{1it}) \quad (5.10)$$

In the equation 5.10 i is used to index the countries and t is used to index time

Where FDI = Inward Foreign Direct Investment stock (percentage of Gross Domestic Product)

TRDO = trade openness (Export plus import divided by GDP)

GDP = Gross domestic product (current prices US \$ billion)

GDPPC = GDP per capita (Gross domestic product per capita, current prices)

GDPG = GDP growth (annual %)

TEL= Telephone line (per 100 people)

GFCF = Gross fixed capital formation (% of GDP)

INF =Inflation, consumer prices (annual %)

FDI_1 = First lag of inward foreign direct investment stock (% of GDP)

Trade openness

In this study trade openness is computed as export plus import divided by GDP. The sign of the coefficient is expected to be positive.

Market Size

GDP used as a proxy of the market size. The sign of the coefficient for GDP, GDP per capita and GDP per capita growth is expected to be positive.

Inflation

Inflation is used as indicator of macroeconomic stability. Inflation is expected to be negative and significant.

Infrastructure

In this study telephone line (per 100 people) and gross fixed capital formation are used as a measure of infrastructure. We expect both positive correlations with FDI coefficient.

FDI_1 (Lag of FDI)

FDI_1 is used to test the agglomeration effect. It is believed that the country which has FDI inflow is better in attracting new FDI inflow. Investors tend to invest in a country where there are foreign enterprises.

The definition of variables is given in table 5.2, together with their sources.

Table 5.2 Definition of Variables and Data sources

Variables	Definition	Source
FDI	Inward foreign direct investment stock (% of GDP)	UNCTAD
TRDO	Trade openness (Export plus import divided by GDP)	World Bank Database 2012
GDP	Gross Domestic product	International Monetary Fund, World Economic Outlook Database
GDPG	Gross Domestic product growth (annual %)	World Bank Database 2012
GDPPC	Gross Domestic product per Capita	International Monetary Fund, World Economic Outlook Database
TEL	Telephone line (per 100 people)	World Bank Database 2012
GFCF	Gross fixed capital formation (% of GDP)	World Bank Database 2012
INF	Inflation, consumer prices (annual %)	World Bank Database 2012
FDI_1	First lag of inward foreign direct investment stock (% of GDP)	This study

6 Result and discussion

6.1 Descriptive analysis

In this chapter first descriptive data analysis and correlation coefficients are presented. Then regression results and discussion is presented

In Table 6.1 summary statistics of all the variables that were used in the study are reported. The mean value of FDI stock (percentage of GDP) is 16.9077 with minimum value of 0.0298482 and maximum value of 73.9919 during the period 1986- 2010. The minimum value of GDP (billion \$) is 0.294 and maximum value is 363.475 with mean 18.7745. The mean value of GDP per capita is 1322.12 with 99.9190 minimum and 8116.87 maximum values. The mean value of inflation is 11.1267 with the minimum value of -14.93660 and the maximum value of 200.026.

Table 6.1 Summary Statistics

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
FDI	16.9077	12.8629	0.0298482	73.9919	14.1213
TRDO	0.715089	0.612090	0.226025	3.12978	0.449507
GDP	18.7745	6.16200	0.294000	363.475	45.9405
GDPG	4.17664	4.11139	-12.6738	21.0180	4.05475
GDPPC	1322.12	572.337	99.9190	8116.87	1646.24
TEL	3.82287	0.967586	0.0902566	29.8421	5.91131
GFCF	18.8621	19.1039	4.56250	40.3955	5.84290
INF	11.1267	7.08086	-14.9360	200.026	21.2876
FDI_1	16.8623	12.7969	0.0298482	73.9919	14.1159

Table6.2 presents the relationship between inflows of foreign direct investment stock and trade openness, gross domestic product, GDP growth, GDP per capita, telephone, gross fixed capital formation, inflation and lagged FDI. As can be seen in the table 6.2, the correlation coefficients between FDI and trade openness, GDP per capita, Telephone, gross fixed capital formation and lag of FDI are positive and significant at the one percent level. The correlation coefficient between FDI and gross domestic product is positive and significant at the five percent level. However, the correlation coefficients between FDI

and gross domestic product per capita, telephone, gross fixed capital formation is positive but insignificant. The correlation coefficient between FDI and inflation is negative and significant at the one percent level.

Table 6.2 Relationship between foreign direct investment and variable that are used in this study during 1986-2010

	FDI	TRDO	GDP	GDPG	GDPPC	TEL	GFCF	INF	FDI_1
FDI	1								
TRDO	.294** .000	1							
GDP	.130* .017	-.139* .010	1						
GDPG	.159** .003	.032 .552	-.094 .083	1					
GDPPC	.107* .048	.334** .000	.464** .000	-.028 .609	1				
TEL	.059 .273	.293** .000	.248** .000	-.086 .114	.704** .000	1			
GFCF	.080 .138	.132* .015	-.041 .449	.281** .000	.283** .000	.055 .310	1		
INF	- .164** .002	-.126* .020	-.051 .348	.034 .530	-.108* .045	- .125* .020	-.124* .022	1	
FDI_1	.876** .000	.302** .000	.096 .077	.214** .000	.105 .053	.027 .617	.043 .424	-.141** .009	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

6.2 Regression result

All variables transformed in to logarithmic form in order to interpret the result as elasticity.

Pooled OLS Model

$$\ln\text{FDI}_{it} = \alpha + \beta_1 \ln\text{TRDO}_{it} + \beta_2 \ln\text{GDP}_{it} + \beta_3 \ln\text{GDPG}_{it} + \beta_4 \ln\text{GDPC}_{it} + \beta_5 \ln\text{TEL}_{it} + \beta_6 \ln\text{GFCF}_{it} + \beta_7 \ln\text{INF}_{it} + \beta_8 \ln\text{FDI}_{1it} + \mathbf{u}_{it}$$

Table 6.3 presents the result of pooled OLS model using 282 observations.

Table 6.3 Pooled OLS

Dependent variable: lnFDI					
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.789018	0.378049	2.0871	0.03781	**
lnTRDO	0.0835946	0.0818538	1.0213	0.30803	
lnGDP	-0.00937712	0.0258311	-0.3630	0.71687	
lnGDPG	0.0449972	0.0339441	1.3256	0.18607	
lnGDPC	-0.136608	0.0518878	-2.6327	0.00895	***
lnTEL	0.0980931	0.0366543	2.6762	0.00790	***
lnGFCF	0.215095	0.0839882	2.5610	0.01097	**
lnINF	-0.0644568	0.0265228	-2.4302	0.01573	**
lnFDI_1	0.829523	0.0262372	31.6163	<0.00001	***
Mean dependent var	2.458705	S.D. dependent var		1.124919	
Sum squared resid	56.28031	S.E. of regression		0.454043	
R-squared	0.841727	Adjusted R-squared		0.837089	
F(8, 273)	181.4831	P-value(F)		1.4e-104	
Log-likelihood	-172.9104	Akaike criterion		363.8207	
Schwarz criterion	396.5979	Hannan-Quinn		376.9647	
rho	0.194666	Durbin-Watson		0.972561	

F-test

An F test has been carried on to choose the best model. The null hypothesis is that all the intercepts are the same and the alternative hypothesis is at least one of the intercept is not the same. The F value of 8.87455 (for 13 numerator degree of freedom and 260 denominator degree of freedom) is highly significant. So, based on the F test, we rejected the null hypothesis in favor of fixed effect.

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic: $F(13, 260) = 8.87455$

with p-value = $P(F(13, 260) > 8.87455) = 5.21779e-015$

Fixed-effects Fixed Effect Least squares dummy variable Model

$$\ln\text{FDI}_{it} = \alpha_1 + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \dots + \alpha_{Ni} + \beta_2 \ln\text{TRDO}_{it} + \beta_3 \ln\text{GDP}_{it} + \beta_4 \ln\text{GDPG}_{it} + \beta_5 \ln\text{GDPC}_{it} + \beta_6 \ln\text{TEL}_{it} + \beta_7 \ln\text{GFCF}_{it} + \beta_8 \ln\text{INF}_{it} + \beta_9 \ln\text{FDI_1}_{it} + u_{it}$$

Table 6.4 Fixed Effect Least squares dummy variable Model

Dependent variable: lnFDI					
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	6.19702	1.94552	3.1853	0.00162	***
lnTRDO	0.329086	0.133936	2.4570	0.01466	**
lnGDP	0.801913	0.240319	3.3369	0.00097	***
lnGDPG	0.0228976	0.0304966	0.7508	0.45344	
lnGDPC	-0.987299	0.264845	-3.7278	0.00024	***
lnTEL	0.0426904	0.0780679	0.5468	0.58496	
lnGFCF	0.499299	0.0956761	5.2186	<0.00001	***
lnINF	-0.113085	0.0276456	-4.0905	0.00006	***
lnFDI_1	0.652519	0.0288453	22.6213	<0.00001	***
du_2	-1.6403	0.734903	-2.2320	0.02647	**
du_3	-1.77422	0.592119	-2.9964	0.00300	***
du_4	-3.27412	1.11593	-2.9340	0.00365	***
du_5	0.710619	0.22627	3.1406	0.00188	***
du_6	-2.63549	0.870305	-3.0282	0.00271	***
du_7	-2.09913	0.774725	-2.7095	0.00719	***
du_8	-1.78272	0.69849	-2.5522	0.01128	**
du_9	-0.100969	0.195606	-0.5162	0.60616	
du_10	-1.84604	0.807538	-2.2860	0.02306	**
du_11	-2.18666	0.572295	-3.8209	0.00017	***
du_12	-2.19748	0.809522	-2.7145	0.00708	***
du_13	0.464328	0.190268	2.4404	0.01534	**
du_14	-2.46615	0.909787	-2.7107	0.00716	***
Mean dependent var	2.458705	S.D. dependent var	1.124919		
Sum squared resid	38.98263	S.E. of regression	0.387212		
R-squared	0.890372	Adjusted R-squared	0.881517		
F(21, 260)	100.5549	P-value(F)	8.0e-112		
Log-likelihood	-121.1312	Akaike criterion	286.2623		
Schwarz criterion	366.3843	Hannan-Quinn	318.3921		
rho	0.214922	Durbin-Watson	1.007258		

Random-effects (GLS)

$$Y_{it} = \beta_1 + \beta_2 \ln\text{TRDO}_{it} + \beta_3 \ln\text{GDP}_{it} + \beta_4 \ln\text{GDPG}_{it} + \beta_5 \ln\text{GDPC}_{it} + \beta_6 \ln\text{TEL}_{it} + \beta_7 \ln\text{GFCF}_{it} + \beta_8 \ln\text{INF}_{it} + \beta_9 \ln\text{FDI_1}_{it} + w_{it}$$

Table 6.5 Random-effects (GLS)

Dependent variable: lnFDI					
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.889561	0.464437	1.9154	0.05649	*
lnTRDO	0.184548	0.0989696	1.8647	0.06330	*
lnGDP	0.0131288	0.0339104	0.3872	0.69894	
lnGDPG	0.0426609	0.0326921	1.3049	0.19302	
lnGDPC	-0.176563	0.0630306	-2.8012	0.00545	***
lnTEL	0.123385	0.0428937	2.8765	0.00434	***
lnGFCF	0.340299	0.0883004	3.8539	0.00014	***
lnINF	-0.0967612	0.0269712	-3.5876	0.00040	***
lnFDI_1	0.77024	0.0273713	28.1404	<0.00001	***
Mean dependent var	2.458705	S.D. dependent var	1.124919		
Sum squared resid	58.38219	S.E. of regression	0.461599		
Log-likelihood	-178.0803	Akaike criterion	374.1606		
Schwarz criterion	406.9378	Hannan-Quinn	387.3046		

The Hausman test

We compared the fixed effect model with the random effect model the Hausman test. The Hausman test indicated that the fixed effect is the appropriate model so we focus on it.

Hausman test -

Null hypothesis: GLS estimates are consistent

Asymptotic test statistic: Chi-square(8) = 72.9143

with p-value = 1.289e-012

As can be seen the result of fixed effect model in table 6.4, lnTRDO, lnGDP, lnGFCF and lnFDI_1 are positive and significant. Both lnGDPC and lnINF are negative and significant. Both lnGDPG and lnTEL are positive and insignificant. The sign of the coefficient for lnTRDO, lnGDP, lnGDPG, lnGFCF, lnINF and lnFDI_1 are as expected.

To check the robustness of the finding we run the regression excluding GDPG, the regression result is presented below. The result in table 6.6 shows that the coefficients of the variables lnTRDO, lnGDP, lnGFCF and lnFDI_1 are positive and significant. The coefficient of the variable lnGDPC is negative and significant. The coefficient of the variable lnTEL is positive and insignificant.

Table 6.6 Fixed Effect Least squares dummy variable Model

Dependent variable: lnFDI					
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	8.34905	2.21283	3.7730	0.00020	***
lnTRDO	0.331427	0.165097	2.0075	0.04561	**
lnGDP	1.07554	0.281309	3.8233	0.00016	***
lnGDPC	-1.37429	0.301698	-4.5552	<0.00001	***
lnTEL	0.0238355	0.0942747	0.2528	0.80058	
lnGFCF	0.742105	0.109596	6.7713	<0.00001	***
lnINF	-0.107736	0.0311847	-3.4548	0.00063	***
lnFDI_1	0.598926	0.0355391	16.8526	<0.00001	***
du_2	-2.34107	0.851987	-2.7478	0.00637	***
du_3	-2.35338	0.673565	-3.4939	0.00055	***
du_4	-4.64026	1.301	-3.5667	0.00042	***
du_5	0.730835	0.272854	2.6785	0.00781	***
du_6	-3.68751	1.01071	-3.6484	0.00031	***
du_7	-2.99905	0.899164	-3.3354	0.00096	***
du_8	-2.69962	0.812932	-3.3208	0.00101	***
du_9	-0.0534734	0.24072	-0.2221	0.82436	
du_10	-3.08381	0.938282	-3.2867	0.00114	***
du_11	-2.90591	0.664698	-4.3718	0.00002	***
du_12	-3.03586	0.944241	-3.2151	0.00145	***
du_13	0.571689	0.236675	2.4155	0.01632	**
du_14	-3.55629	1.06507	-3.3390	0.00095	***
Mean dependent var	2.414240	S.D. dependent var	1.158748		
Sum squared resid	71.49431	S.E. of regression	0.493131		
R-squared	0.830424	Adjusted R-squared	0.818888		
F(20, 294)	71.98693	P-value(F)	1.2e-100		
Log-likelihood	-213.4003	Akaike criterion	468.8005		
Schwarz criterion	547.6045	Hannan-Quinn	500.2857		
rho	0.168848	Durbin-Watson	1.026659		

6.3 Discussion

The result reveals that trade openness, gross domestic product, gross fixed capital formation and inflation are significant determinants of FDI inflow in Sub-Saharan Africa. The result in Table 6.6 shows that a one percent increase in TRDO increases the inflow of FDI by 0.33 percent; a one percent increase in the size of GDP increases the inflow of FDI by 1.07 percent and a one percent increase in GFCF increases the inflow of FDI by 0.74 percent. In addition to these, the result signifies that a one percent increase in FDI_1 increases the FDI inflow by 0.59. However, a one percent increase in inflation in a host country decreases the inflow of FDI by 0.10 percent.

6.3.1 Trade Openness

A positive and significant value of trade openness coefficient shows that trade openness significantly determine FDI inflow in Sub-Saharan Africa. This finding is supported by the previous studies Aseidu (2002), Liargova and Skandalis (2012) and Frenkel et al., (2004). Aseidu (2002) indicated that Sub-Saharan Africa is getting less FDI inflow. This is because Sub-Saharan Africa is less open than other non Sub-Saharan Africa.

6.3.2 Market Size

GDP which is used as a proxy of market size have a positive and significant relationship with FDI inflow. The positive and significant relationship between GDP and FDI inflow shows that the host country market sized is the determinant of FDI inflow in Sub-Saharan Africa Countries. In their study Liargova and Skandalis (2012), Frenkel et al., 2004 have found the same result. In addition to gross domestic product, gross domestic product per capita is used as proxy of market size. The result indicated negative relationship between gross domestic product per capita and FDI inflow. But it is highly significant. The result is unexpected. However, the study findings by Alsan et al., 2006 and Anyanwu 2011 have also showed that gross domestic product per capita is negatively related to FDI inflow.

6.3.3 Infrastructure development

There is positive relationship between telephone line (per 100 people) and FDI inflow, but it is insignificant. This result is unexpected. Since most findings show that the infrastructure development leads to more FDI inflows. However, the finding is supported by previous study (Aseidu 2002). The study by Aseidu (2002) showed that the infrastructure development doesn't have effect on FDI inflow to Sub-Saharan Africa compared to other non-Sub-Saharan Africa. On the other hand, Gross Fixed capital formation is positive and significant determinant of FDI inflow.

6.3.4 Macroeconomic stability

Negative and significant relationship between FDI inflow and inflation shows that high inflation leads to less FDI inflow to Sub-Saharan African. This finding is in line with Frenkel et al., (2004). The study finding by Frenkel et al., (2004) indicated as inflation has negative effect on inflow of FDI. By time series analysis, Astatike and Assefa (2006) have also showed the same result negative effect of inflation on FDI inflow.

6. 3. 5 Agglomeration Effect

The relation between lag FDI and FDI is positive and highly significant. This Finding supported by Anyanwu (2011). It shows that the agglomeration effect has positive impact on FDI inflow to sub-Sahara African countries.

7. Conclusions and policy implications

Using panel data analysis this study investigated the determinants of FDI stock inflow in Sub Saharan Africa. There were three panel data analysis methods used in the study: pooled ordinary least square method, fixed effects method and random effects method. Among the three methods, fixed effect method was found to be the appropriate method based on an F test and the Hausman test. Eight explanatory variables were included as independent variables; trade openness, Gross domestic product, GDP per capita, GDP growth, Telephone line (per 100 people), Gross fixed capital formation, inflation and the lag of FDI . Since it is not feasible to include all Sub-Sahara African countries, due to limited availability of data, only 14 countries were sampled.

The trade openness, gross domestic product, gross fixed capital formation, inflation and lag of FDI are the main determinants of FDI to Sub-Saharan Africa. From the finding we learned that a country which is open for trade attracts more FDI inflow than other countries. So, in order to attract more FDI inflow the governments need to see their policies related to trade openness. Large market size has significant contribution for inflow of FDI in sub Saharan Africa. Even if there is insignificant relationship between telephone line (per 100 people) and FDI, the positive and significant relationship between gross fixed capital formation and FDI indicated that infrastructure has positive contribution to FDI inflow. Macroeconomic stability is very essential to attract more FDI in Sub-Saharan Africa. The agglomeration effect has positive impact on FDI inflow as investors tend to invest in a place where there are companies than investing in a place where no one invested previously.

From this and previous studies we have learned that the variables that are significant in one part of the world are not significant in other part of the world. This sheds light on the fact that the same policies might not be effective in different countries.

Further study is important including all Sub-Saharan Africa countries to find out why some factors are significant and some are not significant determinants to sub-Saharan Africa.

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