Determinants of Foreign Direct Investment Flows into Sudan

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Abstracts: This paper aims at investigating the short and long run determinants of Foreign Direct Investment (FDI) flow into Sudan, using cointegration and Vector Error Correction Model (VECM). The long-run analysis indicates that FDI flows are positively influenced by market size, trade openness, human capital and infrastructure. On the other hand, political instability discourages the flow of FDI. Similar to the long-run analysis, the results of VECM confirm the positive effect of trade openness, human capital and infrastructure in attracting FDI. Unlike the long-run results, the analysis of short-run reveals that FDI flows are negatively influenced by exchange rate and inflation. The results of short-run analysis also show that oil has positive impact on FDI, implying that the advent of oil was an important factor encouraged the substantial flow of FDI in the last decade. Moreover, the error term coefficient is found to be negative and significant, supporting the long-run analysis. Based on these findings, the paper concludes with some policy recommendations regarding the factors that facilitating the flow of FDI into Sudan.

Keywords: FDI, FDI determinants, Cointegration, VECM, Sudan,
JEL classification: F2, F23, C13

1. Introduction

The flow of foreign direct investment (FDI) is regarded as an important source of financing development in developing countries. In the last two decades, FDI flows between countries and regions exceeded other external financial sources such as, official development assistance (ODA) and portfolio investment (World Bank, 2008). According to UNCTAD' estimates, the flows of FDI to developing countries has increased dramatically from about $24 billion in 1990 to $574 billion in 2010 (UNCTAD, 2011). In addition, the aspiration of the poor countries towards achieving the millennium development goals (MDGs) raises the importance of FDI as source of external capital, since these countries lacking appropriate saving as well as efficient domestic investment. Therefore, most of the developing countries pay considerable attention to attract FDI flows via creating an attractive investment environment.

Over the last two decades, the flow of FDI into Sudan has increased dramatically from $3.5 million in 1990 to $2511 million in 2008 (Central Bank of Sudan, 2008). The flow FDI has played a decisive role in stimulating economic growth and improving the macroeconomic performance. The current situation in Sudan also implies that in the future the economy is expected to rely even more on FDI as source of financing development, particularly after the country lost most of its oil revenues due to the secession of South Sudan[1]. Therefore, understanding the factors influencing the flow of FDI into Sudan is very helpful to create an appropriate investment environment that attracts the flow of FDI. Moreover, as in other developing countries most of FDI flows into Sudan in the last decades have been directed towards the extractive sectors like, oil and mineral sectors, while the agriculture and manufacturing sectors have received a little amount of such flows. Thus, it is important to examine the factors determining the FDI flow as the country possesses several potential investment opportunities.

Based on the above, this paper contributes to the existing literature via identifying the short and long-run determinants of foreign direct investment inflows to Sudan economy, with emphasis on the impact of oil and political freedom on investment climate. Moreover, Sudanese economy has undergone many economic transformations in the last decades owing to the exploitation of oil and changes in the macroeconomic landscape; therefore, investigating the factors influencing the flow of FDI could reveal the importance of some variables that may be subject to the control of policy makers.

The rest of this paper is organized as follows: section two discusses some stylized facts about FDI inflows to Sudan economy. Section three presents the literature review on the determinants of foreign direct investment. While section four describes data and econometric model, section five presents the empirical results. Section six ends with conclusion and some policy implications.

2. Foreign Direct Investment to Sudan: Some Stylized Facts

The history of foreign direct investment in Sudan dated back to pre independence era, when the development projects in Sudan are financed mainly from the colonial authority – the British government (Ebaidalla, 2011). The FDI inflow at that time was concentrated mainly on small manufacturing enterprises and banking sector. After the independence in 1956, the national governments paid a considerable attention to attract FDI through the adoption of many investment measures and incentives. With the first development plan in 1961, the government had looked for alternative sources of funding including FDI to implement the development programs. Nevertheless, Sudan at that time had received little FDI flow and most of the development projects were financed by foreign aid.

In the 1970s, the need for foreign investment was urgent to recover the Sudanese economy that plagued by many economic problems such as, falling export earning, internal and external imbalance and mounting foreign debt, (Ali, 1985). Accordingly, the government exerted several efforts to encourage FDI inflows and adopted several investment policies and incentives. However, these efforts had thwarted by the nationalization and confiscation policies and markets distortion that dominated the 1970s decade. Hence, the economy had received a few amounts of FDI and most of it came from Arab countries. Notably, the prominent investment project was the

[1] Based on the Comprehensive Peace Agreement (CPA) of 2005, southern Sudanese were given the right of self determination through referendum, which took place as scheduled in January 2011. The result of the referendum revealed that about 98% of southern people voted in favor of independence. This event rendered Sudan loses most of its oil resources, as South Sudan was the source of about 75% of oil production.

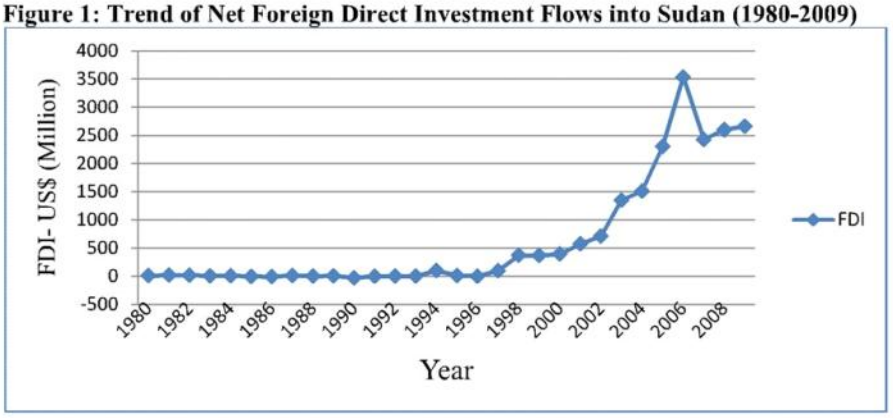
Kenana sugar factory which is a joint venture between Sudanese government and the Arab Authority for Agricultural Investment and Development (AAAID) (Sudan Ministry of Finance and National Economy, 1996).

Subsequently, during the 1980s decade Sudan also experienced low inflow of FDI, owing to political and economic instability. Notably, throughout 1980s the economy has undergone many economic and political events, such as, drought and famine in 1983-1984, the prolonged second civil war in 1983, Nimeiri regime withdrawn in 1985 and the military coup of 1989. All these, negatively affected the FDI inflows, and most of the development projects were financed mainly by external debts and foreign aid from USA, European countries and international financial institutions such as, World Bank and IMF.

Surprisingly, in the mid 1990s, Sudan economy has received a huge amount of FDI owing to the reform of economic landscape and advent of oil. Firstly, the economy in early 1990s has transformed from state control policies that characterized the period of 1970s and 1980s to free market policies (Mahran, 2007). The Salvation Revolution government of 1989 has lunched many economic recovery programs, aimed at encouraging the investment climate. The Comprehensive National Strategy (CNS), (1992-2002) was an ambitious one. The CNS had focused primarily on liberalization of exchange rate and financial sector, removing the agricultural subsidies, reducing the trade tariffs and privatization of inefficient public enterprise. The CNS also has launched two effective investment acts of 1990 and 1996 which provided fruitful investment incentives for the local and foreign investors. Secondly, in 1990s the government had paid a great attention to commercial exploitation of oil and opened the country to foreign oil companies, which were contributed to Sudan's success in starting oil exportation in 1999.

As a consequence of economic stability in terms of low inflation rates, high growth rates and advent of oil, the country has received a sizeable amount of foreign direct investment, in late 1990s (Ebaidalla, 2011). The massive flow of FDI is regarded as the main generator of high and positive economic growth rates in such period (Ali and Elbadawi, 2004). Figure 1 presents the trend of FDI flow in Sudan economy during the period 1980-2009. The figure shows that during the period (1980-1996) Sudan economy received few and volatile amounts of FDI. For example, throughout 1980s the country reported a low trend of FDI flow. However, the substantial surge of FDI flows has been registered since 1996, motivated by stable macroeconomic performance and the development of new sectors such as, telecommunication, mining and oil.

Figure 1: Trend of Net Foreign Direct Investment Flows into Sudan (1980-2009)

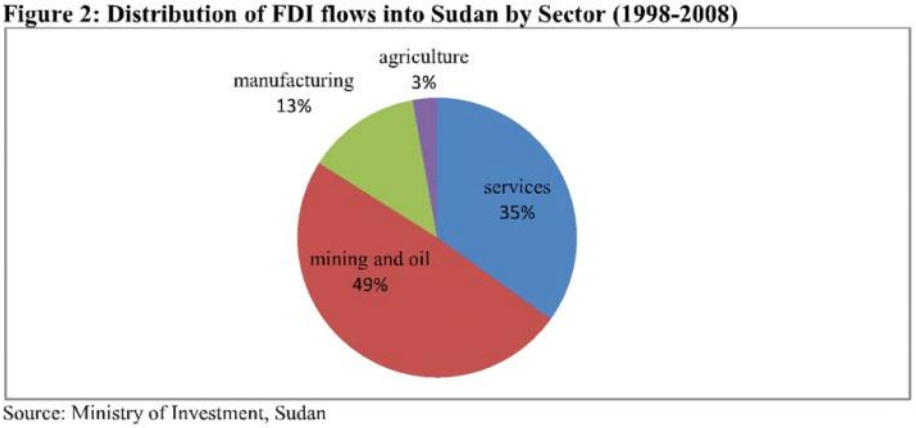


Source: World Bank Development indicators and the Central Bank of Sudan (CBOS) Annual Report- Various Issues.

Interestingly, during the 1997-2006 Sudan economy has witnessed remarkable increase in the surges of FDI, with a sharp increase from 97.9 US $ million in 1997 to 3541 US $ million in 2006 (Ministry of Investment, 2008). However, in 2007 and 2008-2009, FDI had declined may be due to the international economic crises. It is worth mentioning that, over the period 2003-2008 Sudan occupied the sixth position on the list of the top 10 FDI recipient countries in the Arab world with an annual average of 2291 million dollars (see Appendix B).

Regarding the sectoral distribution of FDI flows into Sudan, figure 2 shows that FDI has mainly been directed to the services and extractive sectors, particularly oil. Ironically, despite the huge agricultural resources of the economy, the agriculture (leading sector in the past), has not been benefited from the FDI boom. According to the Sudanese ministry of investment (2008), the number of foreign investment enterprises in all sectors until 2009 are 226 in the service sector, 78 in industrial sector, and 54 in the extractive sector, while the share of agricultural sector is only 24 projects. More precisely, more than tow fifth of FDI inflow into Sudan, in the last decade, is directed towards the extractive industry such as, oil and mining (see Figure 2). This situation confirms the findings in most of empirical literature on FDI, which revealed that resource abundant countries are luckier in attracting FDI (UNCTAD, 2008; Srinivasan, 1999 and Asiedu, 2002). Figure 2 depicts that during (1998-2008) mining and oil sectors are the main destination of FDI flows into Sudan, and accounted for about half of the total FDI. The service sector received 35% of the total FDI flows for the same period, while the manufacturing and agricultural sectors received about 13% and 3%, respectively.

Figure 2: Distribution of FDI flows into Sudan by Sector (1998-2008)



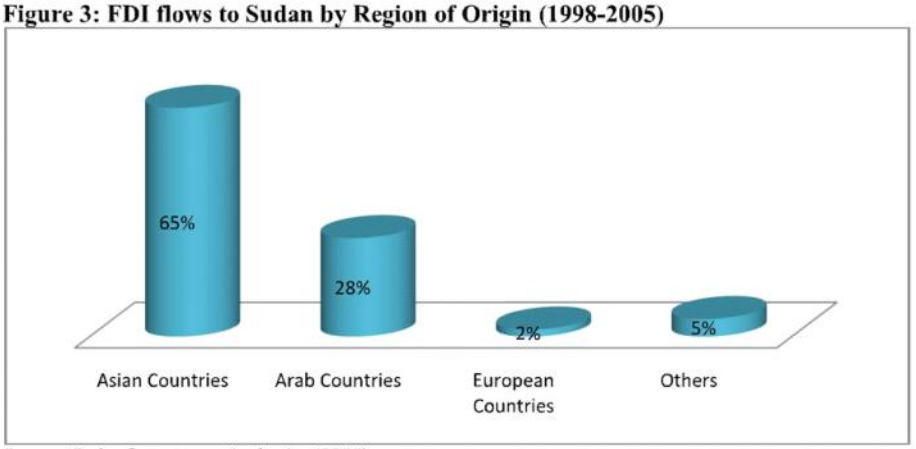
Source: Ministry of Investment, Sudan

In accordance with the source of FDI flow into Sudan, most of the FDI sourced from Asian and Arab countries. Figure 3 presents the origin of FDI flow to Sudan by region during the period 1998-2008. We observe that about two third of FDI flows to Sudan economy is sourced from Asian countries, especially, China, India, Malaysia and South Korea. For example, China is the biggest foreign investor in Sudan and participates in most of oil operations via its affiliate China National Petroleum Corporation (CNPC)[2]. The second largest source of FDI is the Arab countries, which are represented mainly in Saudi Arabia, Jordan, Qatar, and Syria. The Arab capital accounted for about 28% of FDI flow into Sudan during 1998-2005 (see Figure 3). However, most of FDI originated from Arab countries is directed toward the tertiary activity such as, telecommunication, construction, trade, hotel and tourism, transport services, banking sector, education and health services. The European countries, on the other hand, has a little share in FDI flow, equivalent to only 2% which provided by few countries like, United Kingdom, France and Turkey. The political reasons were the main causes prevented European countries and USA from investing in Sudan, in last two decades (Ebaidalla, 2011)[3].

[2] - CNPC is the dominant actor in the Sudanese oil sector and it holds the largest share in six of the eight oil producing concessions. Worth mentioning, the share of Chinese company in oil consortia ranging between 35 and 95%. (Ministry of Energy and Mining, 2009)

[3] - In the early 1990s, Sudanese government adopted policies that opposed the American interests in the region. In 1990, for example, Sudan stood with Iraq when Iraq invaded Kuwait at that time. The government of Sudan also, developed its relations with some countries which are not preferred by and not in harmony with USA such as, Iran, China and Libya. As a result, United States adopted an aggressive policies against the Sudanese regime, in the 1993 listed Sudan in the list of the countries sponsoring terrorism, and in 1997 the Clinton administration imposed comprehensive trade sanctions prohibiting American companies from doing any business in Sudan. Therefore, this tensioned relationship between Sudan and Western countries in the last two decades, is the main reason behind the little FDI flows originated from the European countries and USA.

Figure 3: FDI flows to Sudan by Region of Origin (1998-2005)



Source: Sudan Investment Authority (2009)

3. Literature Review

Motivated by the important role of FDI in economic growth and development, a huge body of literature has grown to identify the determinants of FDI, in the last three decades. The literature on FDI classified the factors that influencing FDI into two popular categories: firm advantage factors and location factors, Dunning (1981). The firm advantages involves factors that pertaining to the firm itself such as, products quality, technology used and ownership advantages as well as its engagement in production abroad. The location factors, on other hand, refer to the host economy conditions such as, large market size, infrastructure, abundance of natural resource, low factors cost and stable macroeconomic conditions.

As the purpose of this study is to identify the short and long run determinants, our focus will be on the location factors. The literature suggests many factors that affecting the flow of FDI into host country, the most significant are: the domestic market size, factor cost, degree of trade openness, political risk, economic stability, natural resource availability, fiscal incentives and investment and trade policies.

The size of the host economy's market measured by real GDP or growth rate of GDP is widely claimed as an important factor attracting FDI. It is well known that if the host country's market is large enough, the foreign firm is able to apply large-scale production to reach the lower cost of production. As result firm's competitiveness will increase and this further enables the firm to supply its products to the international market. Thus, it is expected that the bigger the host country's market, the larger the FDI inflows. Many empirical studies confirmed this assumption, among them are Kravis and Lipsey (1982), Schneider and Frey (1985), Lucus (1993, Morisset (2000) and Chakrabarti (2001). For example, Morisset (2000) analyzed the FDI in Africa, using both panel and cross-sectional data. He found that market size has a significant impact on determining the FDI flows into African countries.

Another variable has been found to be an important factor in attracting FDI is the state of openness of the host country's economy. Measured by the ratio of trade (exports + imports) to GDP, trade openness is seen as an important measure of trade restrictions (Asiedu, 2002). The expected magnitude of the effect of openness on FDI is ambiguous and may depend on the type

of investment. For example, in the service sector, barrier to trade in terms of the high tariff discourage FDI, because a high tariff increase the cost of intermediate goods, besides service output could not be traded. On the other hand, in the case of manufacturing sector barrier to trade could encourage more FDI flow, through the motivation of "protection jumping". However, most empirical studies show that trade openness of the host countries via liberalization and export-promoting macroeconomic policy has an effective impact on promoting FDI (Wheeler and Mody (1992) and Asiedu (2002)).

Some studies have argued that the cost of labour is one of the most important factors influencing the FDI flow. That is, a higher nominal wage, other things being equal deters FDI, this particularly true for the firms which engage in labor-intensive production activities. Therefore, the expected sign for this variable is negative. Nevertheless, many empirical studies found insignificant and positive relationship between wage and FDI (e.g. Wheeler and Mody (1990), Lucas (1993), Wang and Swain (1995) and Barrell and Pain (1996)). They justified their finding by asserting that higher wage is an indicator of higher productivity and quality of labour; thus, hi-tech investments prefer high quality labour to low quality with low wage. Another group of empirical studies in developing countries found that relative wage cost is a significant determinant of FDI flows (e.g. Flamm (1984), Schneider and Frey (1985), Lucas (1993), and Wheeler and Mody (1992)). In the case of Arab countries, Abdel-Rahman (2002) he found that wage rate negatively and significantly affecting the FDI flows into Saudi Arabia.

As good infrastructure facilitates production and reduces operating costs, the infrastructural development is assumed to play a significant role in encouraging FDI flow (Wheeler and Mody, 1992). Most empirical studies on FDI found a positive and significant relationship between infrastructure development and FDI (Karvis and Lipsey (1982), Edwards (1990) and Asiedu (2002)). In the literature, there are three measures commonly used as a proxy for infrastructure, including: the number of telephones per 1,000 population, electric power consumption and gross fixed capital formation (Ayanwale, 2007)[4].

Fiscal and investment incentives are found to be important factors that improves the investment climate and reinforces the foreign investors' confidence. These incentives include tax reductions and exemptions, special tax allowances, and financial incentives such as, low interest loans, subsidies as well as grants. Investment guarantees like, guarantees for transfer of profits and the provision of foreign currencies can be seen as an incentive to attract transnational corporations (TNCs). Gastanaga et al. (1998) and Asiedu (2002) found that fiscal policy reforms in developing countries are a significant determinant of foreign direct investment inflows.

In accordance with the macroeconomic conditions, exchange rate and inflation are to be the major determinants of FDI. However, the evidence regarding the impact of exchange rate on FDI flow is mixed. For instance, Elbadawi and Mwega (1997) and Ang (2008) observed that depreciation of the host country' exchange rate encourage FDI flows. In contrast, other studies found positive relationship between exchange rate and FDI (e.g. Edwards (1990) and Hasan (2007)). In the case of Africa, Alaba (2003) found that official market exchange rate volatility significantly reduces FDI flows into Sub-Saharan African countries

Moreover, investor surveys conducted by various business institutions have indicated that institutional quality and political stability play significant role in investment location decision. That is, a country with efficient bureaucratic and legal system, rule of law, lack of corruption and

[4] - The number of telephone is widely used as a proxy of infrastructure, as a country with a large number of telephone lines is more likely to have better roads, modern airports, seaports, Internet access, and electricity supply.

democratic regime would be more conducive to the flow of FDI. Several studies have also showed that inefficient and unstable institutions have negative impact on foreign direct investment flow (Wei (2000); Srinivasan (1999) and Shneider and Frey (1985)). Asiedu (2002) found that corruption and the absence of rule of law have deleterious impact on FDI flow in Sub-Saharan Africa. Srinivasan (1999) also argued that political stability is one of the most important determinants of FDI flow into Africa.

As the quality of human capital can improve a country's location advantage, many empirical studies revealed that the level of human capital plays an important role in attracting FDI flows into developing countries (Root and Ahmed (1979), Zhang and Markusen (1999) and Noorbakhsh et al. (2001)). However, their findings showed an ambiguous relationship between human capital and FDI flows. For instance, Noorbakhsh et al. (2001) measured human capital using three variables including secondary school enrollment, accumulated years of secondary schooling, and combined tertiary and secondary education in working population. Their results pointed out that all the three measurements are statistically significant and positively associated with the FDI flows. By contrast, Root and Ahmed (1979) found that human capital is insignificant determinant of FDI flow in developing countries.

Recently, many studies on FDI determinants have emphasized the role of natural resources, such as, minerals and oil in attracting FDI (e.g. UNCTAD (1998) and Asdieu (2002)). In fact, the availability of natural resources attracts more FDI, particularly in the case of resource-seeking investment. This is evidenced by the fact that about two third of FDI inflows to Africa, in the last decades, have been received by the oil and resources-abundant countries such as, South Africa, Nigeria and Angola (UNCTAD, 2008). Several empirical studies in last decade also found that the abundance of natural resources in terms of oil and minerals is a decisive factor positively influencing FDI (Morisset (2000), Sadik and Bolbol (2001) and Asdieu (2002)).

4. Data and Methodology

4.1. Data and Model Specification

Based on the literature review discussed above, we observe that there are many factors influencing FDI inflow to recipient countries. However, in this paper we will focus on the most important factors, which will be chosen for their relevance, especially for the case of Sudan and availability of reliable data. Thus, the econometric model is specified as follows:

$$LogFDI_t = \beta_0 + \beta_1 LogFDI_{t-1} + \beta_2 GDP_t + \beta_3 LogOPN_t + \beta_4 LogREX_t + \beta_5 LogINF_t + \beta_6 LogHC_t + \beta_7 LogINFR_t + \beta_8 LogPS + \beta_9 OIL + \varepsilon_t \quad (1)$$

The model states that foreign direct investment inflow as ratio of GDP (FDI) is influenced by the size of FDI in the previous year FDI_{t-1}; domestic market (GDP); trade openness (OPN); real exchange rate (REX); inflation rate (INF); level of human capital (HC); level of infrastructure (INFR); oil exports (OIL) and political stability (PS)[5]. All variables are expressed in the natural logarithm, except GDP growth which bears some negative values.

The study expects that the coefficient of market size (GDP) would be positive, because, the empirical evidence suggests that foreign investors are interested where there is a large market for their product. The coefficient of lagged FDI would be positive, as FDI is related to its previous level. The coefficient of openness is positive, which implies that an economy without trade restriction would attract more FDI. The coefficients of exchange rate and inflation are ambiguous as suggested in the literature. Since, the foreign investors prefer the country with

[5] Definitions and sources of the data are presented in the appendix A.

good infrastructure and quality of human capital; hence, the coefficients of INFR and HC would be positive. Moreover, as it has been observed that FDI inflow to Sudanese economy increased after oil exploitation, so, the study expects that oil exports have a positive impact on FDI flow. Finally, the political instability is expected to be negatively correlated with FDI flows[6].

Due to the availability of data on foreign direct investment from 1975, the empirical analysis uses annual time series data, covering the period of 1975-2009. The data is collected from various sources (see definition and sources of data in appendix (A)).

4.2. Methodology

Since the main objective of this study is to examine the short and long run determinants of FDI, the paper uses cointegration and Vector Error Correction Model (VECM). The first is used to identify the long-run determinants, while the second approach captures the short-run determinants. Both methods based on the Vector Autoregressive (VAR) specification. The VAR model developed by Sims (1980), Doan et al. (1984) and Litterman (1986) is regarded as one of the most flexible and easy models to be used for the analysis of mutual time series relationships. Instead of classifying the variables into endogenous and exogenous variables, VAR model assumes all variables as endogenous and they appear on both right and left sides of regression equation with their lags. Therefore, the main advantage of VAR system over the single equation model is allowing us to avoid the problem of simultaneity bias and endogeneity, which may result from the correlation between the error term and the dependent variables. That is, some explanatory variables in our model may be endogenously related to FDI; for example, FDI affects GDP, human capital and infrastructure, and on the other hand FDI may be influenced by these factors.

For further inference we will adopt the causality test using Granger causality test. This test developed by Granger (1969), which is popular for testing interaction between the variables. The Granger causality test states that for two time series (X,Y), X is said to granger-cause Y if Y can be predicted by past values of X rather than not using such past values. For example, to examine non-causality from X to Y we test the hypothesis that all parameters on lagged values of X in equation Y are equal to zero. Such a hypothesis usually tested by OLS method using and conventional Fisher-Snedecor F-test of joint statistical significance.

Before employing the co-integration technique and vector error correction model, the analysis will start with stationarity (unit root) test to determine the order of integration of each variable used in the analysis. It is well known that when dealing with time series data, stationarity tests are necessary pre-tests to avoid the problem of spurious regression. Moreover, if two or more series are integrated of the same order, there exists the possibility to estimate a linear relationship between them (Engle and Granger, 1987). Therefore, the unit root test will be conducted using Augmented Dickey Fuller (ADF) and Philips and Perron (PP) tests.

After determining the order of integration of all variables, the next step is to check the presence of a long-run relationship between variables, using cointegration test. To do so, the study will employ Johansen and Juselius (JJ) (1990) multivariate cointegration test, based on VAR model.

5. Empirical Results and Discussions

5.1. Unit Root and Cointegration Test

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6 As we measure the political stability by Freedom House's Index of Political Freedom, the link between FDI and PS would be negative. This is because the index is scaled from 1 to 7, with 1 indicating the highest level of political freedom while 7 means the lowest level.

Prior to the estimation of our model, we conducted stationarity and cointegration tests. First, all variables were tested for a unit root using ADF and PP tests. The lags lengths were chosen according to the Akaike Information Criterion (AIC) statistics. The result of unit root test for each variable with constant and trend are presented in Table 1 below. The results show that most of the series are nonstationary at level. When taking the variables in their first difference, the results reveal that all the variables are I(1), either by Augmented Dickey-Fuller or Philips-Perron test, except the human capital, which is seems to be stationary at the second difference, i.e., I(2).

Table 1: Results of the ADF and PP unit root tests

Variable	ADF		PP	
	Level	First Difference	Level	First Difference
FDI	-1.49	-5.05***	-1.82	-5.06***
GDP	-6.22***	-6.79***	-7.01***	-10.84***
OPN	-1.45	-7.30***	-1.88	-7.25***
REX	-3.18	-6.42***	-3.21*	-8.86***
INF	-2.23	-10.67***	-2.06	-9.45***
HC	-2.73	-1.95	-4.19***	-1.96
INFR	-1.65	-6.15***	-1.82	-2.96
PS	-2.41	-5.50***	-1.40	-5.77***

Note: *, **, *** indicate significance at 10, 5 and 1 per cent respectively

Second, we applied Johansen-Juselius multivariate cointegration test to determine whether the long run relationship between the variables exists. Before undertaking the cointegration tests, first we have specified the relevant order of lags of the vector autoregressive (VAR) model. As the sample size is relatively small, we selected 1 for the order of the VAR, as proposed by Pesaran and Pesaran (1997). The results of trace and maximum eigenvalue statistics obtained from the Johansen-Juselius (JJ) method using the assumption of linear deterministic trend in the data are presented in Table 2 below:

Table 2: Cointegration Test Results

Null Hypothesis	Eigenvalue	Trace statistics	0.05 Critical Value	Maximum Eigenvalue	0.05 Critical Value
None	0.910	229.992*	159.529	79.644*	52.362
At most 1	0.761	150.347*	125.615	47.282*	46.231
At most 2	0.675	103.065*	95.753	37.102	40.077
At most 3	0.543	65.962	69.818	25.884	33.876
At most 4	0.516	40.077	47.856	23.995	27.584
At most 5	0.262	16.082	29.797	10.057	21.131
At most 6	0.166	6.024	15.494	6.003	14.264
At most 7	0.0006	0.021	3.841	0.021	3.841

Note: * denote rejection of null hypothesis at 5% level of significance. These nonstandard critical values are taken from Mackinon-Haug- Michelis (1999).
The is conducted using the dummy variable of the oil as exogenous variable

The results of JJ multivariate cointegration test show that trace statistics indicates three cointegration relations while maximum eigenvalue statistic simultaneously indicates two cointegration relations. For consistency, we can conclude that there is a cointegration

relationship between the variables. This also implies that, there is a long-run relationship between FDI inflows into Sudan economy and its major determinants.

5.2. Granger Causality Test and Long-run Results

Since the presence of cointegration indicates the existence of causal relationship between the variables (Engle and Granger 1987), we conducted Granger causality test between the dependent variable (FDI) and each explanatory variable. The result of Granger causality based on stationary VAR model, were presented in Table 3.

Table 3: Granger Causality Test

	F (Probability)	Inference
GDP does not Granger Cause FDI	9.619* (0.004)	Causality
FDI does not Granger Cause GDP	0.738 (0.396)	No causality
OPN does not Granger Cause FDI	0.404 (0.529)	No causality
FDI does not Granger Cause OPN	2.815 (0.529)	No causality
REX does not Granger Cause FDI	0.075 (0.784)	No causality
FDI does not Granger Cause REX	0.119 (0.731)	No causality
INF does not Granger Cause FDI	0.451 (0.506)	No causality
FDI does not Granger Cause INF	1.173 (0.287)	No causality
HC does not Granger Cause FDI	9.8106* (0.003)	Causality
FDI does not Granger Cause HC	8.833* (0.005)	Causality
INFR does not Granger Cause FDI	1.813 (0.187)	No causality
FDI does not Granger Cause INFR	2.241 (0.144)	No causality
PS does not Granger Cause FDI	3.133* (0.086)	Causality
FDI does not Granger Cause PS	0.883 (0.354)	No causality

The results of Granger causality test indicate that the GDP growth, human capital, and political stability are significantly Granger cause FDI flow. The results also reveal that there is a bidirectional causality between FDI and human capital (HC). The result of causality test; therefore, implies a degree of endogeneity seems to exist in our model, this which support the use of VECM in the analysis.

After establishing the long-run relationship between the variables, we utilize cointegration equation to drive the long-run determinants of FDI. We normalised on the FDI equation since this is the equation of our interest. The results of long-run analysis of FDI determinants are presented in the Table 4.

Table 4: The Results of Long Run analysis

Variable	Coefficient	t-statistics	Prob
GDP	0.198***	7.722	0.0001
OPN	1.052***	4.293	0.0001
REX	0.839***	4.613	0.0001
INF	0.872***	4.057	0.0004
HC	0.958**	2.345	0.0266
INFR	1.000***	4.859	0.0001
PS	-1.754***	-3.497	0.0016

Note: ***, ** and *, indicate significant at the 1, 5 and 10 percent level respectively

The results of long-run analysis point out that all the estimated coefficients carry their expected signs. All the variables also are statistically significant at least at 5 percent. The result

indicates that the inflow of FDI to Sudan economy in the long-run is positively influenced by the market size, trade openness, inflation rate, infrastructure and the quality of human capital. On the other hand political instability has negative impact on FDI flow as expected.

The coefficient of market size measured by GDP growth is positive and significant, implies that an increase in domestic market size of Sudan encourages FDI flow. This finding corroborates the study of Abdel-Rahman (2002) who found that market size measured by GDP growth rate is a significant factor attracting FDI into Saudi Arabia. Furthermore, most of the empirical studies on FDI reported a similar result, Kravis and Lipsey (1982); Morisset (2000) and Chakrabarti (2001), among others.

With regard to the infrastructure and human capital, the result indicates that their parameters are positive as expected. This suggests that non-policy factors like infrastructure and human capital are critical factors in inducing FDI flow into Sudan economy. Similar evidence was reported by Wheeler and Mody (1992), Edwards (1990) and Asiedu (2002).

Expectedly, the sign of trade openness is positive and significant indicates that trade openness encourages the flow of FDI into Sudan. This result is consistent with most of the previous literature (e.g. Wheeler and Mody (1992) and Asiedu (2002)). In addition, the long-run analysis reveals that real exchange is positive and statistically associated with FDI flow into Sudan. This finding suggests that a depreciation of the Sudanese pound against the US dollar encourages FDI inflow.

Finally, the long-run analysis shows that the coefficient of political instability measured by the political freedom is negative and statistically significant. This implies that ineffective and bad institutions deter the flow of FDI into Sudan. This finding confirms most of previous literature (e.g. Srinivasan (2002) and Asiedu (2002).

5.3. Vector Error Correction Model (VECM)

Having obtained the long-run cointegration relationships between FDI flows and its determinants, the next step is to use the VECM (Vector Error Correction Model) to identify the short-run determinants of FDI. The VECM also allows for examination of how fast the FDI inflow adjusts to the changes in their underlying equilibrium. The results of the estimation of the VECM are presented in Table 5 below:

Table 5: Short run results - Vector Error Correction Model

Variable	Δ(FDI)	Δ(GDP)	Δ(OPN)	Δ(REX)	Δ(INF)	Δ(HC)	Δ(INFR)	Δ(PS)
Δ(FDI(-1))	0.108	4.879	0.160	0.614	-0.721	-0.0005	0.281	0.079
	(0.492)	(1.159)	(0.821)	(2.104)	(-1.634)	(-0.031)	(1.639)	(0.782)
Δ(GDP(-1))	-0.003	0.348	0.007	0.044	-0.061	0.001	0.009	-0.005
	(-0.347)	(1.586)	(0.753)	(2.950)	(-2.677)	(1.484)	(1.030)	(0.988)
Δ(OPN(-1))	0.014	-0.214	-0.221	0.0826	0.336	-0.005	-0.178	-0.086
	(0.053)	(-0.041)	(-0.921)	(0.230)	(0.618)	(-0.223)	(-0.844)	(-0.692)
Δ(REX(-1))	-0.345**	2.577	-0.232	-0.198	-0.315	0.014	0.010	-0.056
	(-2.580)	(2.561)	(-1.957)	(-1.118)	(-1.176)	(1.216)	(0.105)	(-0.915)
Δ(INF(-1))	-0.074	1.459	0.001	0.177	-0.531	-0.0007	0.006	0.029
	(-1.050)	(1.069)	(0.029)	(1.879)	(-3.719)	(-0.129)	(0.123)	(0.896)
Δ(HC(-1))	0.584	38.114	0.965	1.297	-5.291	0.896	0.994	0.670
	(0.559)	(1.90)	(1.039)	(0.936)	(-2.524)	(9.926)	(1.220)	(1.396)
Δ(INFR(-1))	0.271	-2.073	0.150	-0.038	-0.667	-0.019	0.447	-0.034
	(1.190)	(-0.475)	(0.744)	(-0.126)	(-1.459)	(-0.990)	(2.518)	(-0.328)
Δ(PS(-1))	-0.873**	-28.264	-0.731	-1.293	0.510	0.012	-0.059	-0.053
	(-2.096)	(-3.547)	(-1.976)	(-2.343)	(0.611)	(0.358)	(-0.183)	(-0.280)
Δ(OIL(-1))	0.0436	-9.207	-0.100	-0.368877	0.619	-0.008	-0.149	-0.006
	(0.291)	(-3.222)	(-0.760)	(-1.863)	(2.068)	(-0.693)	(-1.288)	(-0.088)
ECT(-1)	-0.131**	5.975	0.068	0.155	-0.352	0.011	0.059	-0.037
	(-2.099)	(4.993)	(1.239)	(1.877)	(-2.808)	(2.111)	(1.227)	(-1.301)
C	0.095051	0.463	-0.032	-0.034135	0.209	0.013	-0.020	-0.035
	(1.410)	(0.359)	(-0.542)	(-0.382)	(1.554)	(2.252)	(-0.387)	(-1.162)
R-squared	0.47	0.68	0.40	0.48	0.56	0.90	0.39	0.29
F-statistic	1.95	4.69	1.49	2.06	2.81	19.92	1.41	0.90

Note: t values in parenthesises.
***, ** and *, indicate significance at the 1, 5 and 10 percent level respectively

The results of the short run show that all the estimated parameters bear the expected signs, except the market size. The coefficient of lagged dependent variable is positive, implying that the short-run dynamics of FDI flows positively influenced by the previous development of FDI flow.

Similar to the long-run results, the short-run analysis indicates that trade openness, infrastructure and human capital positively affect FDI flow as expected. Contrary to long run analysis, the VECM show that inflation and real exchange rate have negative impact on FDI flow in the short-run. Unexpectedly, the sign of market size is negative but it is not significant, contradicting the long-run results. This finding implies that increasing of market size measured by GDP growth discourages FDI flow in the short-run. This result also suggests that FDI flow into Sudan is not a market seeking but it is motivated primarily by natural resources like oil and minerals.

The sign of the dummy variable (oil) is found to be positive as expected. This result supports the actual situation in Sudan is that after the oil exploitation the country has received a huge amount of foreign direct investment. This finding also confirms the results of Sadik and Bolbol (2001) who found that FDI flows to Arab world mainly concentrated on the oil and minerals abundant countries like, Saudi Arabia and Morocco. moreover, many empirical studies in Africa supports this hypothesis, which states that the resources abundant-countries often receives more FDI than resource-deficient countries (e.g. Morisset (2000) and Asiedu (2003))

Finally, the error correction term in FDI equation is found to be negative and statistically significant confirming the long-run findings. This implies that the long-run disequilibrium in FDI can be corrected each year a proportion of about 13%, indicating that the adjustment of FDI towards long-run equilibrium needs about 0.13 year.

6. Conclusion

This paper aims at identifying the short and long run determinants of foreign direct investment flows into Sudan, using cointegration and Vector Error Correction (VECM) techniques, during the period 1975-2009. The long run analysis indicates that FDI inflow to Sudan economy is positively influenced by the market size, trade openness, human capital and infrastructure. On the other hand, political instability is found to be has a negative effect on the FDI flow. This implies that the improvement of investment environment in terms of huge market size and good level of infrastructure and human capital plays significant role in attracting FDI into Sudan. Contrary to the long-run results, the short-run analysis shows that inflation rate and exchange rate exerts a negative impact on FDI flows. This implies that economic policy variables have an important impact on the flow of FDI. The effect of oil is found to be positive, indicating that the advent of oil has played important role in attracting substantial flow of FDI in the last decade. Further, the error term coefficient is negative and significant, confirming the result of the long-run analysis.

Based on the above results, we can draw some policy implications regarding the factors that attracting the FDI flow into Sudan. First and foremost, policy makers should pay a great attention to the policy variables, such as, real exchange rate, inflation and trade openness, which plays significant role in affecting FDI flows. Therefore, tight fiscal and monetary policies and adequate tariff policy should be adopted to maintain inflation and exchange rate at a moderate level. The stimulus factors of FDI like market size, infrastructure and human capital also needs more attention in order to improve the investment climate. In addition, Sudan economy is abundant with potential agricultural and minerals resources, so further efforts should be exerted to create environment so as to attract FDI in these sectors.

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Appendixes

Appendix A: Description of Variables and Data Sources

Variable	Definition	Source
FDI	Foreign Direct Investment, measured as ratio of FDI to GDP.	UNCTAD and Central Bank of Sudan (CBOS)
GDP	Real GDP growth as proxy for market size.	World Bank's World Development Indicator CD-Rom and COBS.
OPN	Trade openness, defined as value of exports plus imports divided by GDP.	Central Bureau of Statistics, Sudan
INFR	Level of infrastructure, measured by the number of telephones per 100 population.	World Bank's World Development Indicators.
HC	Human capital, measured by average years of tertiary schooling[7].	Barro and Lee (2010), Data Set of Educational Attainment in the World
INF	Is the inflation rate, measured by the annual average of inflation rates	Central Bureau of Statistics, Sudan
REX	Real exchange rate, is defined as $e_t \times \frac{P_{US}}{P_t}$, where e_t is nominal exchange rate (local currency by US$), P_{US} is US wholesale price index, and P_t is local price index. REX is measured as ratio of US$/SDG.	Central Bank of Sudan (CBOS) and World Bank's World Development Indicators
Oil	Dummy variable takes the value of 1 after 1998 and zero otherwise.	
PS	Political stability is measured by Freedom House's Index of Political Freedom. The index scaled from 1 to 7 (1 represent the highest level of political rights and 7 the lowest)	Freedom House's Annual Survey of Freedom in the World (2011). Available at http://www.freedomhouse.org/

Appendix B: The top 10 FDI recipients Arab countries, average 2003-2008

Country	FDI inflows (Millions of US$)
Saudi Arabia	15,942
UAE	10,975
Egypt	6,481
Qatar	3,204
Lebanon	2,732
Sudan	2,291
Morocco	2,084
Libya	2,059
Jordan	1,701
Tunisia	1,616
Oman	1,561
Bahrain	1,483

[7] - Barro and Lee' data are available at five years intervals. The annual series are derived via time trend regressions.

Source: Own calculations based on UNCTAD, World Investment Report, different issues and The Arab Investment and Export Credit Guarantee Corporation statistics.

Appendix C: Global Distributions of FDI Flows, (in millions of US$)

Region	1991-2000	2001-2008	1991-2008
World	518,448	1107,593.9	780,290.56
Developing economies	140,306	347,360.0	232,330.25
Economies in transition	5,055	45,243.8	22,916.52
Developed economies	373,087	714,990.1	525,043.79
Arab Countries	4,352	44,031.1	21,987
Arab Countries / World %	1	3.5	2
Arab Countries / Developing Economies %	4	10.9	7

Source: own calculations based on UNCTAD, World Investment Report, different issues and The Arab Investment and Export Credit Guarantee Corporation statistics.