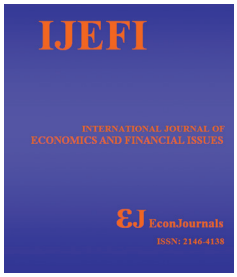

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How Oil Price Changes Affect Foreign Direct Investment Inflows in South Africa? An ARDL Approach

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ABSTRACT

The study examined how oil price changes affect foreign direct investment (FDI) inflow in South Africa. The study used annual quantitative data, obtained from the South African Reserve Bank (SARB) and World Bank development indicators. With the exception of real exchange rate, Augmented Dicky Fuller (ADF) and Phillips-Peron (PP) tests for stationarity indicated variables become stationary after first differencing. Stationarity test results suggested application of ARDL bounds test for cointegration. ARDL bounds test for co-integration confirms that variables of the study have long-run relationship with F-statistic of 6.59, which is higher than the lower (2.98) and upper (3.78) boundaries at least 5% level of significance. In the long - run oil prices coefficient found to have negative and significant influence in foreign direct investment inflows during 1980-2020 period. Empirical results provide practical implications for South Africa, as oil importing country can hedge crude oil price changes to maintain future quantity of crude oil to be imported. The study recommends expansion of renewable energy sources to reduce South Africa's vulnerability to oil price fluctuations. Moreover, since oil prices are exogenously determined, setting up forward looking institutions such as sovereign wealth funds and short- term stabilization funds will be better.

Keywords: Oil Price, Consumer Price Index, Oil Reserves, Capital Productivity
JEL Classifications: E31, F23, F31

1. INTRODUCTION

Foreign direct investment (FDI) has drawn the attention of both established and emerging nations over the past few decades, underscoring the fact that foreign capital flows complement domestic savings in an open economy by helping to build capital and boost economic growth (Mohamed and Mohammed, 2020). Oil, on the other hand, is nevertheless regarded as one of the most crucial commodities needed in every modern industrial economy. Various studies emphasise that oil has many economic importance around the world, such as electricity generation, fuelling transportation and in producing petroleum products such petrol, diesel, and paraffin (Maruping and Mongale, 2017). Increase in demand and supply disruptions exert pressure on oil prices. From the demand and supply analysis, increase in demand holding supply constant shift the entire demand curve to the right resulting into higher price of the good in question. On the other hand, decrease in supply holding demand constant, will shift the entire supply curve to the left leading to a rise in the price of the commodity under consideration. Global demand for oil has been rising surpassing oil production. In relation to demand and supply framework, demand for oil is greater than supply of oil and we have excess demand or shortage of oil. Developing countries have been growing rapidly contributing to an increase in the world demand for oil while oil production is not growing. Additionally, political turmoil in oil producing countries such as Iran and Iraq disrupt the supply of oil.

South Africa is a developing country faced with socio-economic challenges, compounded by the outbreak of COVI-19 pandemic.

The Covid-19 pandemic exposed the realities of inequality in South Africa. As a response to create jobs, alleviate poverty and reduce inequality, the government of South Africa is in a drive to make the country a more attractive destination for foreign direct investment. In a quest to make South Africa a more investor friendly, Invest SA, a division of the Department of Trade and Industry is assisting with permit approval and registration processes across the country (Global Investment trend monitor, 2021). Moreover, South Africa need to attract foreign investment to meet its post-COVID 19 recovery fundamentals (World investment report, 2020).

The World Investment Report (2020) findings indicated that the potential attractiveness of South Africa as foreign direct investment destination is high comparing it to other African countries. Contrary, its performance is comparatively weak for foreign investor attraction. The World Investment Report (2020) also revealed that foreign direct investment inflows declined by 15.1% in 2019 recording USD 4.6 billion, lower than USD 5.4 billion registered in 2019. However, in 2019 foreign direct investment stock increased to USD151 billion, surpasses USD 127 recorded in 2018. The FDI Intelligence (2021) report state that this trend is related to the South African government campaign to attract USD 100 billion of foreign direct investment by 2023. The South African Reserve Bank (2020) indicated that most of the investment is directed to the financial services, mining, manufacturing, and transportation and retail sectors. Most importantly, South African government enhance attraction of foreign direct investment, as they are responsible for job creation and wealth-creating economic growth.

It is against this background, that this study examines how oil price changes affect oil foreign direct investment inflow in the context of South Africa. In pursuance of the set objective, oil price uncertainty remains the key concern. This study provides an understanding of oil price uncertainty as threat to potential investors and gives insight on how to protect investors against future risk. Notably, South Africa has no oil reserves of its own (South African Petroleum Industry Association, 2019). Most of the oil consumed in South Africa is imported from Western African and Middle Eastern producers in the Organisation of the Petroleum Exporting Countries (OPEC). For example, crude oil price was on average 97.5 US$, translating to an average rand price/barrel of 715. 6 based on an average exchange rate of 7.34 in 2010 (BP Energy economics, 2019). In 2018 the rand depreciated against the US$, and the exchange rate was around 13.24, whilst crude oil price was 70.9 average US$ equivalent to an average rand price/barrel of 938.9 (BP Energy economics, 2019). Fluctuations in oil prices as well as exchange rate will impact economic health of crude oil importing country like South Africa. This may be because oil price is determined in terms of foreign currency (US$), implying that exchange rate fluctuations will change rand price per barrel.

BP energy economy (2019) indicated that the consumption of oil in South Africa measured in thousands of barrels per day was 538 in 2010, peaked to 578 in 2015 and fell to 533 in 2018. On the other hand, Energy Information Agency (2017) stated that South Africa oil imports account for 6% of imported items and by 2015 over 96% of the crude oil requirements was imported, the bulk of which were supplied by Saudi Arabia (45.8%), Iran (33.7%), and Nigeria (16.6%). Achieving high and sustainable rate of economic growth is the macroeconomic policy priority in South Africa since democracy. In oil importing country oil price play an important role in economic growth (Tehranchian and Mohammad, 2017). Furthermore, Kibunyi et al., (2018) argued that oil price in both exporting and importing countries affect aggregate demand for good and service as well as aggregate supply of goods and service.

South Africa as an oil importing country, if oil price changes are viewed, as persistent oil will be used less in production, labour, and capital productivity decline as well as the rate of potential output. Oil price changes affect price stability, corporate earnings, and profitability. The ultimate result is declining tax revenue, lower domestic savings rate, and wide budget deficit. Considering that South Africa is in the drive to attract foreign direct investment, oil price fluctuations engender price instability and uncertainty. Moreover, oil price invariable can translate into higher production, transportation and heating costs which can put a drag on industrialisation drive.

While previous studies have focused on the effect of oil price volatility and economic growth particularly, in South Africa (Chiweza and Aye, 2018; Sekati et al., 2020) there is no clear attempt on explaining the impact on foreign direct investment inflows.

In pursuance of the stated objective, the remainder of the study is organised as follows: Following the introductory section, is section two presenting literature review. Section three provides research method and estimation techniques. Section four discusses empirical findings and interpretation of results and section six contains conclusion and policy recommendations.

2. LITERATURE REVIEW

Dunning (1981) developed eclectic paradigm, which seeks to explain three possible drivers of Foreign Direct Investment DI: ownership-specific (O), location-specific (L), and internalisation (I). This paradigm is popularly known as the OLI Framework. With reference to ownership-specific, Multinational Corporation ensures that the host country has a monopolistic advantage in respect to resources such as human capital, patents, and technologies. While, location-specific is a pre-requisite of ownership, taking into consideration stable macroeconomic environment. One of the major considerations under this arm of the paradigm is access to cheap input. Internalisation leg, ensure that ownership and location are sufficient to monopolise on the market imperfection and to get the market share or profits. Dunning (1981) discovered that natural resource-seeking multinational corporations might wish to obtain natural resources at a lower cost than they can in their own country. Such firms are concentrated in primary production and manufacturing relying on raw materials and physical resources including fuel, minerals, metals, and agricultural products. The pioneer of eclectic paradigm argues that natural resource endowment is not the only consideration for FDI planning, low production and transaction costs are also important. Thus, trade barriers and sufficient size of the market is another determining

factor. The study finds the most appropriate to evaluate how eclectic paradigm, changes in the price of oil affect FDI inflows in South Africa.

Empirically, several studies have been carried out on the impact of oil price volatility on macro economy both in developed and developing economies. However, few of these studies are reviewed. For instance, Akinlo and Apanisile (2015) modelled the impact of the volatility of oil price on economic growth in 20 Sub-Saharan African countries. The paper divided the countries into 10 non-oil exporting countries and 10 oil-exporting countries. The paper employed econometric techniques for analysis. Panel pooled OLS, panel fixed effect model and generalized method of Moment model were used in the estimation for both oil exporting and non-oil exporting countries. The panel estimation results for the oil exporting countries showed that the oil price volatility has a positive and statistically significant effect on the economic growth of oil exporting countries. Similarly, panel estimation result for non-oil producing countries panel showed that the volatility of oil price also has a positive and statistical insignificant impact on economic growth for the period covering 1986-2012.

On the same issue, Nwanna and Eyedayi (2016) investigated the impact of crude oil price volatility on economic growth of Nigeria during period of 1980-2014. The results revealed that there is a positive and significant relationship between oil price and economic growth. Based on the findings, the researchers concluded that oil price volatility does not have a positive impact on the economy. In the light of the above findings, the researchers recommended that, the country should diversify its export revenue base as a means of minimizing reliance on crude oil and petroleum products, such as fiscal prudence, reform in budgetary operations, export diversification, revival of the non-oil sector of the economy, accountability and corporate governance.

In related study, Elder (2018) examined the effect of oil price volatility on disaggregated measures of industrial production namely indexes for industrial production excluding technology and motor vehicles, energy-related special aggregates, and non-energy-related special aggregates. Empirical results showed that the effects of oil price volatility are concentrated in activities related to primary energy generation and oil and gas drilling relative to other energy-related market groups. Furthermore, oil price volatility affects a broad range of special aggregates among the non-energy-related market groups, including aggregates sorted by consumer goods and business equipment.

Chiweza and Aye (2018) applied structural vector autoregressive methodology, to investigate the link between oil price uncertainty shocks and key macroeconomic indicators for South Africa. The study used quantitative monthly data covering the 1990-2015. Generalised impulse response functions analysis revealed oil price uncertainty shock has an adverse and persistent effect for most of the variables of interest. On the other hand, the generalised forecast error variance decomposition indicated that oil price uncertainty shocks contribute substantially to variations in inflation, real output and various macroeconomic variables of South Africa. Based on the findings, the researchers emphasised the significant role of exogenous oil prices on South African economy, in the presence of price uncertainty shocks.

In another study, Umoru et al. (2018) contributed to the oil price volatility-growth nexus. The paper analyses the influence of oil price volatility on Exchange Rate Variability, External Reserves, Government Expenditure, and real Gross Domestic Product. Empirical results of the Vector AutoRegressive (VAR) econometric techniques showed that volatile oil price exerts varying degrees of deleterious effect on exchange rate, external reserves, Government expenditure and real gross domestic product (GDP). Based on the findings of the study, we recommend the need for the country to diversify its revenue sources. This will further shield the adverse effect of the fluctuation in prices of oil. Serious policy attention should be attached to agricultural reformation, industrial policy drives, mines and mineral development to diversify Nigeria's economy following the downward slide in the oscillations in oil prices to address the problem of excessive dependence on crude oil exportation. This will help to achieve sustainable economic growth and development in Nigeria.

To support the findings of the previous studies, Rahim and Hamid (2020) examined the effects and relationship between economic growth and selected variables which are oil price volatility, stock price, real exchange rate and real interest rate in Malaysia. With the aid of ARDL empirical results showed that stock price and real exchange rate are positively related whilst a negative relationship between oil price volatility and interest rate was confirmed. Causality tests results indicated that stock price and interest rate have an impact on Malaysian economy. Based on the findings, policy recommendations are suggested to address oil price volatility in a forward-looking manner as well as monetary friendly measures to further support Malaysian economic growth.

Mgbame et al. (2015) conducted a conceptual study with the aim to examine the impact of oil price volatility on Nigerian economic growth. The study used exploratory approach entailing review of conceptual and empirical literature. Based on the empirical review of various studies, this study agrees with the reviews that oil price volatility exhibits positive relationship with economic growth in Nigeria. By implications, oil price changes influence government expenditure level, rate of inflation, level of unemployment, which in turn determines the growth of the Nigerian economy. Considering the destabilizing effects of oil price fluctuations on economic activity and government spending in Nigeria, the study makes policy suggestions such as the country should diversify its export revenue base as a means of minimising reliance on crude oil and petroleum product thereby diversifying to agriculture, operations of budgetary, fiscal prudence and encourage domestic savings.

Saha et al. (2018) empirically examined the impact of oil price volatility on the growth of the and food security in Bangladesh. The study employed the GARCH (2,1) model for data analysis. The co-integration test and error correction model short that increasing oil price affected the growth of the economy for the period 1991-2015. Furthermore, the three stage least squares estimator revealed that an increase in oil price decreases the rate

of economic growth and food security simultaneously. The results of the study suggest that oil price volatility is not beneficial for the economy of Bangladesh.

Meanwhile, Odhiambo and Nyasha (2019) investigated the dynamic causal relationship between oil price and economic growth in Kenya. The study utilised autoregressive distributed lag (ARDL) approach to cointegration and the error correction-based Granger causality. Estimation results indicated the presence of unidirectional causality, running from economic growth to oil price. These results are confirmed both in the short and long run.

In addition, Renee et al. (2019) undertook a study to analyse the impact of real oil volatility of 17 member countries of the Organisation for Economic Co-operation and Development (OECD) over 144-year time period from 1870 to 2013. The study employed panel model estimators. The findings show that oil price volatility has a negative and statistically significant on economic growth. Furthermore, oil producing countries such as Canada and Norway are significantly negatively affected by oil price uncertainty.

To corroborate the findings of Chiweza and Aye (2018), Sekati et al. (2020) modelled oil price volatility and macroeconomic variables for the period 1990Q1- 2018Q2. The study used the ARCH, GARCH and EGARCH. The results revealed that exchange rate and interest rate have a negative effect on the oil price, whereas GDP and inflation have a positive effect on the oil price. Additionally, EGARCH (1.1) model indicated that oil price is negatively affected by all the selected macroeconomic variables.

Agheyisi (2018) investigated the effect of oil price volatility on the business cycle in Nigeria. Time series data covering the period from 1970 to 2015was analysed using the ARDL bounds approach to cointegration. Empirical results suggest that in the short-run oil price volatility has a positive and significant effect on GDP and no significant long-run effect. This could be attributed to the dependency of the country on oil exports.

Considering selected recent empirical literature on the determinants of foreign direct investment inflow in South Africa, Van Der Berg et al. (2021) found that internal stakeholder intervention and external stakeholder intervention have a positive relationship with FDI. The results imply that stakeholder intervention is of paramount importance in influencing the Multinational corporations to embark on FDI. Mutliple regression empirical results also reveals existence of positive relationship between government considerations and FDI in South Africa. These findings are viewed in the context that government supplies most resources available to FDIs.

Motivated by low FDI inflows in South Africa, Majavu and Kapingura (2016) examined factors determining FDI inflows in South Africa. The study employed the Johansen test for cointegration using quarterly data for the period from 1980 to 2012. The study estimated Gross Domestic Product, Openness, Real Exchange Rate Consumer Price Index, Gross Capital Formation and Corporate Tax as independent variables and foreign direct investment was treated as dependent variable. Empirical results of the study confirmed a positive and significant relationship between GDP, openness, inflation, and corporate tax.

Selected empirical literature on the determinants of foreign direct investment inflows in South Africa have not given enough consideration of the effect of oil price changes. Oil is one of the intermediate inputs in the production process, price fluctuations need significant consideration for policy formulation.

3. RESEARCH METHOD AND ESTIMATION TECHNIQUES

This section explains the econometric methodology used to establish how changes in oil price affect foreign direct inflows in South Africa. The study relied on secondary quantitative data covering the period 1980-2020. Annual data for gross domestic product, foreign direct investment, real exchange rate, inflation and price of crude oil was obtained from the South African Reserve Bank online database as well as the World Bank Development Indicators. The study regarded Foreign Direct Investment as the dependent variable.

3.1. Model Specification

Based on selected reviewed empirical literature on the determinants of foreign direct inflows in South Africa, the study estimated the following equation

$$FDI = f\left(POC, RER, INF, GDP\right) \quad (1)$$

Where:
FDI = Foreign direct investment
POC = Price of crude oil,
RER = real exchange rate
INF = is inflation rate (proxy by CPI).
GDP = real gross domestic product

The study estimated the following long-run econometric equation:

$$\Delta FDI = \alpha_1 + \beta_1 POC + \beta_2 RER + \beta_3 INF + \beta_4 GDP + \mu \quad (2)$$

Where α_1, β_1, β_2, β_3, and $\beta 4$ are estimated coefficients.

The long-run model was used to generate residuals to develop a short-run model which includes an error-correction term. If a long-run relationship exists amongst the variables, then there must be an associated adjustment model. The short-run error correction equation is specified as follows:

$$\Delta FDI = \alpha_1 + \Delta\beta_1 POC + \Delta\beta_2 RER + \Delta\beta_3 INF + \Delta\beta_4 GDP + \pi\Delta EC_{t-1} + \varepsilon_1 \quad (3)$$

Where Δ is the first difference operator, EC_{t-1} is the lagged error correction term and π is the adjustment parameter of the lagged error correction term. The purpose of the ECM is to establish the dynamics and speed of adjustment of oil price towards equilibrium.

3.2. Autoregressive Distributed Lag Cointegration

This study used the autoregressive distributed lag (ARDL) bounds testing approach to co-integration proposed by Pesaran et al. (2001) and expanded by Pesaran et al. (2001). The ARDL approach to co-integration for long-run relationship between time series variables gained popularity in econometric analysis. It provides advantages over co-integration techniques such as Johansen Juselius (JJ) co-integration and the dynamic ordinary least squares (DOLS). In comparison to the Johansen co-integration approach, ARDL allow co-integration analysis to be carried out regardless of the order of integration of the underlying regressors. In other words, whether the regressors are integrated of zero order I (0) or order one I (1) or mixed order of integration, (Amusa and Moyo, 2013, Amusa, 2014, Nkoro and Uko, 2016). Nkoro and Uko (2016) further pointed out that ARDL co-integration technique is not applicable when the underlying variables of the study are integrated of order two I (2).

The issue of sample size is removed in the ARD bounds- testing approach, this makes it suitable for determining long-run relationship in small sample size as it yields unbiased estimators (Nkoro and Uko, 2016, Bolarinwa and Obembe, 2017). Amusa (2014) argued that ARDL bounds-testing approach is appropriate even when the specified model have regressors that are endogenous. Consequently, ARDL provides unbiased long-run estimators and valid t-statistics. Obradovic et al. (2017) asserted that the ARDL approach to co-integration helps in identifying the co-integrating vectors, thus each of the study variables are dealt with as a single long-run relationship equation. The ARDL bounds testing approach is based on the estimation of the dynamic error correction representation of the individual variables. Nkoro and Uko (2016) indicated that when ARDL model is reparameterized, the results give the long-run relationship and the short-run dynamics of the variables under consideration.

In order to ascertain the existence of long-run relationship between the variables of the study, the estimated ARDL equation is as follows:

$$FDI_t = \varphi_0 + FDI = \varphi_0 \sum_{i-1}^{m} \varphi_{1i} FDI_{t-i} + \sum_{j=0}^{n} \varphi_{2j} \Delta POC_{t-j}$$
$$\sum_{k}^{p} \varphi 3k \Delta_{t-k} RER + \sum_{l=o}^{r} \varphi 4lINF_{t-l} + \sum_{l=o}^{r} \varphi 4lGDP_{t-l}$$
$$+\varphi\varphi_{li} FDI_{t-1} + \sum_{j=0}^{n} \varphi_{2j} \Delta POC_{t-j} + \sum_{k}^{p} \varphi_{3k} \Delta_{t-k} RER +$$
$$\sum_{l=o}^{r} \varphi_{4l} \mathrm{INF}_{t-1} + \sum_{l=o}^{r} \varphi_{4l} \mathrm{GDP}_{t-1} + \phi_1 \mathrm{FDI}_{t-1} + \phi_2 \mathrm{POC}_{t-1}$$
$$+\phi_3 \mathrm{RER}_{t-1} + \phi_4 \mathrm{INF} + \phi_5 \mathrm{GDP}_{\varepsilon t} \quad (4)$$

The F- statistic is carried out on the joint null hypothesis that the coefficients of the lagged are zero, $\phi_1 - \phi_4$ represent the long-run relationship, $\varphi_1 - \varphi_4$ correspond to the short-run dynamics of the model, Δ indicates the first difference, t-1 stands for one period lag, while $\sum_{i-1}^{m}$ shows the sum of i=1,2,3…m, $\sum_{j=0}^{n}$ denotes the sum of j=1,2,3,…n.

The ARDL approach to co-integration requires determination of the null hypothesis of non-existence of long –run relationship.

4. EMPIRICAL FINDINGS AND INTERPRETATION OF RESULTS

The study subjected all four variables for unit root tests to examine the nature of variables as I (0) or I (1). It is important to test time series data for stationarity before determining any possible long-run relationships between the variables of interest. If one ignores, the stationarity test stage, and uses non-stationary data it can be misleading when by spurious regression with high R^2 value is obtained.

4.1. Stationarity

The ADF and the PP tests were used to determine the stationarity properties of the series. The ADF and PP tests assumed that unit root is present in the series. As mentioned above that the PP test is advantageous in that it deals with serial correlation and heteroscedasticity in the residuals. The PP test supports the ADF test. The results of the two tests are depicted in Table 1.

Based on Table 1, real exchange rate (RER) is stationary at levels, meaning it is integrated of order zero I (0). Whilst, foreign direct investment, real domestic product (GDP), crude oil prices (POC) and inflation rate (INF) are not stationary at levels, meaning they have a unit root. These variables had to be differenced once to make them stationary. The results show that first differencing all that was required to bring FDI, GDP, PCO and INF to stationarity. This suggest that FDI, GDP, PCO and INF are I (1).

The alternative test of PP reveals that all variables of the study are not stationary at levels, however after first differenced they become stationary. A conclusion is reached that the variables are not integrated of the same order. Stationarity test is a necessary but not a sufficient condition for cointegration, testing for the existence of cointegration is still necessary. Given that, the variables are integrated of different orders, stationarity test results suggest the use of the ARDL Bounds test for cointegration. Co-integration test is conducted to validate existence of long-run relationship between variables.

4.2. The VAR Lag Order Selection Criteria

The conclusion that the time series variables are cointegrated allows us to proceed with cointegration test, albeit the appropriate lag length of the VAR that will be suitable for the study need to be determined to ensure that the error term was white noise (Table 2).

The number of lags that minimizes the value of information criteria is chosen. Based on the results of the lag length determination lag 1 was selected as indicated by the sequential modified LR test statistic (LR), the final prediction error (FPE), Akaike information criteria (AIC), the Schwarz information criteria (SC) and the Hannan-Quinn (HQ) criteria in building the model specifically to avoid some misspecification problems. We choose SIC over AIC for the purpose of this study as AIC is known to suggest more lags than necessary, resulting in loss of degrees of freedom and model

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

Variables	Augmented Dickey-Fuller		Outcome	Phillips-Perron		Outcome
	Level	1st deference		Level	1st deference	
FDI	−1.930	−3.559	I (1)	−1.223	−3.988	I (1)
RER	−3.769**	−5.573	I (0)	−2.781	−6.661	I (1)
POC	−2.181	−5.250	I (1)	−4.304	−6.493	I (1)
INF	−1.129	−5.257	I (1)	−2.045	−10.972	I (1)
GDP	−2.367	−4.620	I (1)	−1.693	−4.621	I (1)

Source: Author's computation, FDI: Foreign direct investment, RER: Real exchange rate, POC: Price of crude oil, INF: Inflation rate, GDP: Gross domestic product

Table 2: Partial results of the lag selection test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−375.84	NA	17176.89	21.10	21.27	21.16
1	−230.26	250.73*	12.92*	13.90*	14.78*	14.21*
2	−215.69	21.85	14.51	13.98	15.56	14.53
3	−207.19	10.86	24.15	14.39	16.68	15.19

Source: Author's computation, note: (*, **, ***) denote significance at the 1%, 5% and 10%, respectively, FPE: Final prediction error, AIC: Akaike information criteria, HQ: Hannan-Quinn

Table 3: ARDL bounds cointegration

Test statistics	Values	K
F-statistics	6.59**	3
Critical value bound		
Significance	I0 Bound	I1 Bound
10%	2.44	3.90
5%	2.98	3.78
2.5%	3.22	4.13
1%	4.87	5.90

Source: Author's computation, note: (*, **,) denote significance at the 1%, and 5% respectively

Table 4: ARDL error correction model short run dynamics and Long-run dynamics

Dependent variable: LFDI				
Variable	Coefficient	Standard error	t-Statistic	Prob
Short run coefficients				
D (RER)	−0.003	0.003	−0.825	0.416
D (INF)	−0.094	0.001	−0.695	0.002
D (PCO)	0.047	0.001	2.988	0.005
D (GDP)	0.089	0.000	3.949	0.009
ECM	−0.228	0.045	−6.890	0.000
Long run coefficients				
RER	−0.004	0.009	−2.466	0.031
INF	−0.040	0.004	−4.908	0.000
PCO	−0.005	0.000	5.128	0.000
GDP	0.004	0.001	4.930	0.000
C	10.093	0.409	60.090	0.001

Source: Author's computation, RER: Real exchange rate, GDP: Gross domestic product

overfitting. SIC recommends one lag, supported by HQ. After lag length selection, the study proceeded to ascertain presence of long-run relationship between the model variables.

4.3. ARDL Bounds Test for Cointegration

After discovering the stationarity of the series, it was necessary to estimate the long run relationship between, FDI, POC, RER, INF and GDP. Table 3 presents the results of the ARDL bounds test.

The ARDL bound test confirms that the variables in question have a long-run relationship. This came because of the 6.59 F-statistic, which is higher than the lower (2.98) and upper (3.78) boundaries at 5% level of significance.

4.4. Short Run and Long Run Error Correction Model

From the Engle-Granger residual test of cointegration, the results revealed the existence of the long-run behaviour among variables, thus suggesting that there is cointegration. Since the long- run relationship has been determined between the variables, the short run and long run dynamics were established within ECM. This is done to distinguish between the long run and short run impact of variables to ascertain the extent of influence that oil price has on FDI inflows in South Africa (Table 4).

In the short-run, inflation and exchange rate emerged insignificant in influencing FDI inflows in South Africa for the period under review. The empirical results suggest an increase in oil prices adversely affect foreign direct investment. A 100% increase in oil price will results in 4.7% decrease in foreign direct investment inflows via the inflation channel. It is worth mentioning that the main concern is to determine which variable have the greatest influence on foreign direct investment rather than how all the variables affect each other. Obviously, oil price changes pose a threat on South African government campaign to attract USD 100 billion of foreign direct investment by 2023 according to (FDI Intelligence, 2021).

The error correction term (ECMt-1) is stable and statistically significant at 1%. The significance of the ECM implies that a long-run relationship exists between the variables of the study. The coefficient of the error correction term (ECMt-1) of −0.22815 implying that roughly 13% of the errors made in the previous period (period t-1) are corrected in the current period. This implies that the model converges towards equilibrium position though at a low speed of adjustment. In the long run oil prices coefficient was found to have a negative and significant influence in foreign direct investment inflows. A coefficient of 0.004905 means that a 100% increase in oil prices will in turn to reduce inflow of FDIs by 0.4 percent. While on the other hand inflation rate and exchange rate in the long run shows a negative and significant relationship with foreign direct investment. The results imply that macroeconomic stability is a pre-requisite for FDI inflows in South Africa. The estimated macroeconomic variables, inflation and real exchange rate emerged to have a dampening effect on GDP, which is the size of the market. As alluded to earlier FDIs do take into consideration the size of the market to take advantage of economies of scale.

4.5. Diagnostic and Stability Tests

For robust policy recommendations, the estimated model was subjected to rigorous diagnostic tests. This is to ascertain the reliability and validity of the findings, the following stability tests are conducted, Multicollinearity, Normality, Serial correlation, test Ramsey RESET, CUSUM and CUSUMSQ.

4.5.1. Pairwise correlation

The pairwise correlation matrix was carried out in order to check if there is a strong correlation between variables in model. This is to avoid the existence of multicollinearity, which may result in the wrong signs for the estimated parameters. From the results, as can be seen in Table 5 all the partial correlation coefficients are less than absolute 0.8 implying that there is no serious multicollinearity. Hence, all the variables are linearly independent.

4.5.2. Normality test

The Jacque-Bera statistic was found to be 0.540 with a probability value of 0.763. This probability value is >0.05, therefore, we fail to reject the null hypothesis that the errors are normally distributed at 5% level of significance. We can safely say that the OLS estimators are the best linear unbiased estimators (Figure 1).

4.5.3. Residual diagnostic

Homoscedasticity is tested using the ARCH test and if the probability value is >0.05 it means there is homoscedasticity, or the error term has a constant mean and variance. Results of ARCH test of heteroscedasticity are given in Table 6. The ARCH test gives a Chi-squared P=0.6421 which is above the 5% critical value indicating that there is no problem of heteroscedasticity in our model. That is, the standard errors, t-statistics and F-statistic are reliable. They are the best linear unbiased estimators (BLUE).

For auto correlation, the decision is based on the probability value of 0.6543, which is more than 5%, indicating null hypothesis acceptance. Because the model has no serial correlation, this model is desirable

4.5.4. CUSUM and CUSUM of squares tests (Figure 2)

The results of the stability test validate that the model is stable, as reported in Table 7 panels (a) and (b). This is indicated in the figures by a movement of blue lines within the critical lines (two-red dotted lines). Therefore, the CUSUM and CUSUM of Squares stability tests confirm the good performance of the model at a meaningful level of 5%. A conclusion is reached that performed diagnostic tests confirm that the model is well specified and suitable for policy recommendations.

4.5.5. Granger causality test

Granger (1969) holds the fact that the test of Granger causality considers the causal connection between the variables that are dependent and independent. However, the causation does not mean the existence of relationship among variables, but rather the variables predict each other

The results indicate bi-causality among crude oil and economic growth, but the presence of a short or long-run connection is not confirmed. In this instance, the question of how an increase in crude oil prices becomes crucial, because if there is a rise in crude oil prices, the inflow of foreign direct investment decreases, then economic growth will decline. Similarly, the findings of Granger causality indicate that inflation rate (INF) can Granger cause FDI. The findings likewise show that exchange rate (RER) is not associated with economic growth because the probability value is above 5%. In quest to attract foreign direct investment, South African government and policy makers need to take fiscal and monetary policy interdependency into consideration. Policy interventions that are hindering economic growth need to be accounted for so as to create an investor friendly environment. Granger causality result shed some light on the fact that oil price and economic growth are interdependent in one way or another. The increase in oil price affects the economy through a number

Table 5: Correlation matrix

Variables	FDI	RER	INF	PCO	GDP
FDI	1.00000				
RER	−0.68766	1.00000			
INF	−0.4335	0.67021	1.00000	1.00000	
PCO	0.80659	−0.32030	−0.47124	−0.69303	1.0000

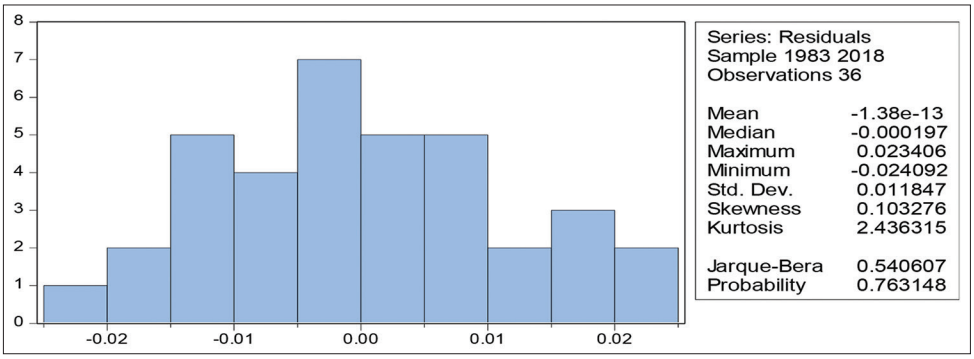
Source: Author's computation, FDI: Foreign direct investment, RER: Real exchange rate, GDP: Gross domestic product

Table 6: Residual analysis and stability

Residual test	Chi-square	P-value
Auto Correlation LM	1.923	0.654
Heteroskedasticity Test	34.025	0.642

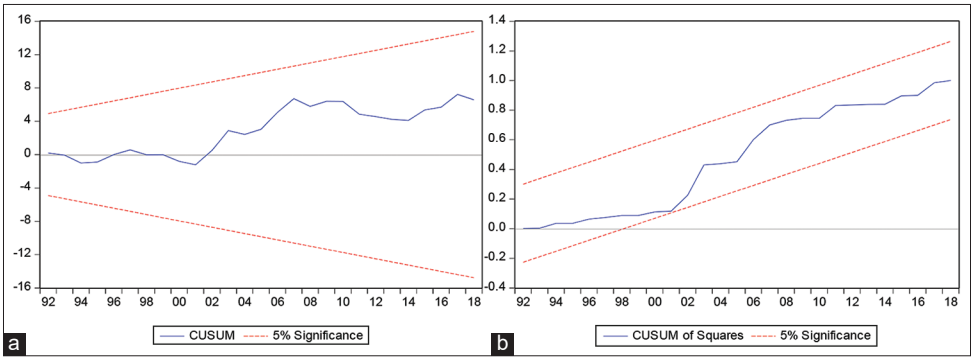
Source: Author's computation

Figure 1: Jacque-Bera test



Source: Author's own computation

Figure 2: CUSUM (a) test and CUSUM of squares (b)



Source: Author's computation

Table 7: Granger causality test results

Null hypothesis	df	F-statistic	P-value	Decision
PCO does not Granger cause FDI	1	0.332	0.480	Do not reject
FDI does not Granger cause PCO	1	5.672	0.010	Reject
RER does not Granger cause FDI	1	9.902	0.000	Reject
FDI does not Granger cause RER	1	2.563	0.206	Do not reject
INF does not Granger cause FDI	1	3.653	0.433	Do not reject
FDI does not Granger cause INF	1	0.403	0.845	Do not reject
GDP does not Granger cause FDI		1.293	0.766	Do not reject
FDI does not Granger cause GDP		4.099	0.830	Do not reject

Source: Author's computations, GDP: Gross domestic product

of channels. Hence, guarding against adverse effect of oil price changes is of utmost importance in the context of South Africa. The role of FDIs in the South African economy is important more than before to achieve economic recovery.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The aim this study is to determine the impact of oil price changes on FDI inflow in South Africa from 1980-2020. Quantitative time series data for real economic growth, real exchange rate, price of crude oil and inflation was estimated. The empirical results of the estimated model provide practical implications for South Africa, as oil importing country can hedge the crude oil price fluctuations to maintain the future quantity of crude oil to be imported. Oil price is expressed in foreign currency in South Africa, implying that exchange rate and oil price are linked. Theoretically, exchange rate can affect the domestic economy price level through export, imports and production channels.

Empirical results therefore support the theoretical underpinnings as evidence by a marginal impact of GDP in attracting FDI in South Africa. Exchange rate, inflation rate and oil prices have statistically significant impact on FDI inflows in South Africa for the period under review. Specifically, exchange rate and inflation emerged to adversely affect FDI inflows in South Africa. Oil price fluctuations negatively affect FDI in the short run through the inflation channel. South Africa is a developing country, faced with unemployment, inequality, and high levels of poverty. FDIs as a source of development finance can assist in addressing the triple challenges daunting the South Africa economy.

Based on the strength of diagnostic tests the model results can be used for policy formulation. It is concluded that expanding renewable energy sources can reduce South Africa's vulnerability to oil price fluctuations. Moreover, since oil prices are exogenously determined, the study recommends setting up forward-looking institutions such as sovereign wealth and short- term stabilization funds.

The study further recommends disaggregation of FDIs inflows in South Africa in order to attract and entice FDIs in industries that will support industrialization and rural development. Furthermore, decomposition of FDI inflows will aid the country to create industry- specific investor-friendly environment. Policy makers should ensure that inflow of FDI is sustainable and able to contribute to domestic savings mobilization. Policies aiming to stimulate economic growth should incorporate strategies to deal with oil price changes. The South African economy is in dire situation worsened by COVID-19 pandemic; therefore, the study calls on to government to ramp up in terms of ensuring that skills shortage is dealt with to ensure investor safe environment. Policy makers should make sure that what we put on the table to attract FDI inflows is to the advantage of the country.

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