The Determinants Factors of Balance of Payments: An Investigation from Sudan through the Period 1980-2016

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Abstract

This paper investigates the determinants of Sudan balance of payments using annual data on balance of payments (BOP), foreign debt (ED), exchange rate (EX), inflation (INF), gross domestic product (GDP) during the period (1980 - 2016). The paper elaborates the problem regarding the impact of foreign debt on the balance of payments. The paper built on the fundamental assumption that the foreign debt linked to a positive relationship with the balance of payments by running VECM Approach. Results of the study indicate that there is a direct correlation between the balance of payments and foreign debt, and an inverse relationship between the balance of payments and all of the inflation, gross domestic product and exchange rate during the forementioned period. The paper recommends that Sudan should not totally dependes on foreign aid in solving its economic problems which entails to transfer big amount of the national product to meet the commitments towards those foreign countries, the need for coordination between macroeconomic policies and domestic economic policies in order to increase output domestic product, economic policies are functioning to reduce the ratio of foreign debt and the reduction of inflation and bring about stability in the exchange rate which leads to improving the balance of payments to be adopted by Sudan.

Keywords: VECM; Balance of Payment; GDP; Inflation; Exchange Rate; Sudan.

1. Introduction

As far back as 1970, Sudan initiated the first wave of economic reforms to try and address economic deterioration.

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The measures agreed to were not fully implemented and a second wave of measures were initiated under the umbrella of the salvation programme, which was merged with the national Comprehensive Plan of 1992-2002. This programme was also not successful and there was a deterioration in balance of payments, escalating inflation rates and persistent macroeconomic imbalances. Another reform programme was introduced 1997-2001 with a sharpened focus on macroeconomic and price stabilization. The programme encompassed four basic elements including: (1) introduction of stabilization measures and macroeconomic environment that focuses on fighting escalating inflation by way of increasing collection of revenues, reduction of public expenditure and following balanced monetary policy; (2) pursuance of market friendly measures and policies to abolish controls and provide incentives for domestic production and export; (3) introduction of structural reforms to limit role of government by privatizing enterprises and rendering opportunities for the private sector in such areas as health, education and other utilities and (4) encouragement of savings by stabilizing the economy and introduction of reforms in the banking sector [1].

The balance of payments is a statistical statement that systematically summarizes, for a specific time period, the economic transactions of an economy with the rest of the world [2] For the some decades now, the question of whether balance of payments is a monetary phenomenon has been a long-standing issue in the literature of monetary and international economics. Perspectives on the question have been influenced, in part, by developments in monetary theory, and in part by interpretations of monetary history. Although there are alternative theories of balance of payments adjustments, namely; the elasticities and absorption approaches (associated with Keynesian theory), this study is delimited to empirical studies on the monetary approach to the balance of payments [3].

Balance of payment is needed in a country because it will give an account of import of a country and this will act as signal for some domestic policies. For example, if the amount spent on importation of consumable goods is too high, domestic policies may be needed towards restriction or setting up of import substitutions industry. On the export side, BOP tells us our export composition and the extent to which a country depends on certain commodities for our foreign exchange earnings. Moreover, it provide basis for comparison of trade relations among countries so as to know if a country is incurring deficit or surplus. Furthermore, it provides historical data on import and export overtime and this could be used for planning purposes. It also provides statistics for the net foreign investment component of the national income [4].

This paper therefore attempts to analyze empirically and quantitatively what macroeconomic variables determine the movements on the overall balance of payments (BOP) accounts with a view to provide valuable policy recommendations necessary to ensure a sustainable and stable BOP for the foreseeable future. Such policy recommendations will be analyzed within the context of the predictable future declines in the Sudan's receipts and what effect it will have on the overall BOP of Sudan. The paper will specifically focus on the following research objectives:

- To analyze the trends of the BOP and identify significant factors during the period 1980 till 2016.
- To identify the economic variables influencing overall balance of payments in Namibia, using both theoretical and empirical frameworks.

- To ascertain which determinants are significant for BOP stability and which may be useful as a policy recommendation.

It is clear that monetary approach to the balance of payments considers the fact that a country with balance of payments deficit (surplus) would experience a change in its monetary stock. In the light of this consideration, we want to investigate the relationship between the Sudan balance of payments and domestic credit expansion and to verify its importance relative to other variables such as government expenditure, gross domestic product in determining the Sudan balance of payments position. The main question of the research is: to what extent the monetary approach explains the behavior of Sudan's balance of payments?

2. Empirical Literature

Within the international economic literature, there have been three principal approaches to analyzing the balance of payments problems. These are the elasticity approach, absorption approach, and monetary approach. The first two approaches analyze devaluation and its effects on the balance of payments. However, devaluation can temporarily improve the balance of payments but cannot, on its own sustain, the improvement unless complemented by an appropriate domestic monetary policy [5].

There are many theoretical approaches to analyze the balance of payments. In order to discern such analysis, it would be useful to distinguish such theoretical approaches on the two components of BOP, namely the current and capital account. In the current account, the first common theoretical approach to mention is based on the competitive nature of the economy thus termed the competitiveness approach, based on the elasticity or sensitivity of trade. This approach is viewed from an explicit premise of an economy in equilibrium in terms of trade. This means that in equilibrium, exports of Namibia is equal to its imports. Exports depend positively on the exchange rate (defined as number of units of domestic currency to a unit of foreign currency), whereas imports depend negatively on it (exchange rate). The competitiveness approach clearly shows that the terms of trade can be influenced by a change in exchange rate. The size of the swing in the trade balance depends on the export and import elasticity [6]. but this approach was developed within a framework of the fixed exchange rates, such as the Bretton-Woods system and cannot operate under a free floating regime as the exchange rate change is completely endogenous. Namibia follows a fixed exchange rate pegged to the South African Rand, of which its Reserve Bank has a fair degree in principle to influence the exchange rate using political means [7].

Reference [8] Using co-integration and error-correction modeling observed that net foreign assets, exchange rate and inflation rate positively whereas money supply and domestic credit were negatively related to balance of payments and significant. Interest rate was found to be insignificant and negative. He further declared that balance of payments as a monetary phenomenon was not the good criteria because other factors also affected the balance of payments.

Reference [9] Empirically investigated the effects of fiscal policy (or government budget deficit shocks) on the current account and the other macroeconomic variable such as real output, interest rate and exchange rate in Pakistan over the period 1960-2009. The analysis is performed through the structural Vector Autoregressive

(VAR) approach. The exogenous fiscal policy shocks were identified after controlling the business cycle effects on fiscal balances. In contrast to the predictions of the most theoretical models, the results suggested that an expansionary fiscal policy shock (or a government budget deficit shock) improves the current account and depreciates the exchange rate. The private saving rises initially then fall and the investment falls contributory to the current account improvement while the exchange rate depreciates. The twin divergence of fiscal balances and current account balances is also explained by the prevalence of output shocks.

Reference [10] used the monetary approach to the balance of payments in West African Monetary Zone, by taking panel data, using the generalized methods of moments (GMM) estimation technique within the country and cross country effects. It was found that GDP was positively related to net foreign assets. The co-efficient of domestic credit was negative and statistically significant. Interest rate was found to be negatively related to net foreign assets and inflation rate was found to be insignificant and negligibly affected the balance of payments.

Reference [11] worked on the import-export demand functions and its effects on Nigerian balance of payments, utilizing the co-integration and error correction modeling (ECM). It was found that coefficients of GDP, foreign reserves and index of openness positive and significant. Whereas the coefficients of exchange rate and import capacity were negative and insignificant. As far as export demand function was concerned, it was found that coefficients of exchange rate, index of openness were positive and significant, whereas coefficient of GDP was negative and significant.

Reference [12] Investigated the effect of budget deficit on the current account balance in Nigeria covering the period from 1973 to 1993 using Ordinary Least Square (OLS) regression model and Simulation model. This econometric model captures the principal interactions between budgetary developments, money supply, price level, domestic absorption and the current account balance. Quantitative evidence suggested that budget policy developments affect the current account balance in Nigeria. There is also the finding that there exists a strong relationship between the budget deficit and the current account balance in Nigeria. In particular, dynamic simulation experiments was used to show that budget deficit, engendered by increased expenditure, leads to a deterioration of the current account, whether it is financed through central bank credit or foreign borrowing. He therefore asserted that budget discipline is necessary for the achievement of foreign balance in Nigeria.

Reference [13] Investigated the balance of payment concern of a country's constricted on the most crucial of double-entry book-keeping. Such payment is entered on the debit and credit score ranking aspect of the balance part, but balance of payments accounting differs from business accounting in one respect. In business accounting debits are display on the left surface and credit score ranking on the right aspect of the balance piece. But in balance cope accounting to the practice is to demonstrate credits on the left aspect and debits on the right aspect of the balance piece. When a transaction is received from overseas it is a credit score transaction. The major items display on the money ranking aspect are exporters of products or services, unrequited (or transfer receipt in the form of gift etc. from individuals from other countries borrowing from abroad, investment strategies by individuals from other countries in the country, and official sale of source resources including gold to worldwide countries and worldwide agencies). The major item on the charge aspect include imports of products or services, transfer transaction to individuals from other countries lending to worldwide countries,

investment strategies by resident to foreign countries and global institutions. These debit and credit score ranking items are shown vertically in the balance of transaction concern of a country according to the most crucial of charge access bookkeeping. Horizontally they are divided into three categories: the current concern, the capital concern and the official settlement concern or the official source resources account.

Reference [14] Empirically investigates result is the BOP shortfall or excess. On account of floating exchange rate direction, a modification occurs through sequence in exchange rate and not through the accumulate stream or BOP. At long last, under the supervision of managed floating, slithering peg or creeping band, modifying occurs both through the foreign reserve (BOP) and exchange rate changes. Under this circumstance, the powers mediate time to time in the foreign exchange souk to control the discrepancy in the exchange rates and to keep the rate in the steadiness level. Additionally they have to prefer the proportionate measure of exchange rate burden, instigate through disequilibrium in the money market, ought to be assuaged through the exchange rate expansion and through the reserve streams. Thus, both the variables will change and help the restoration of economic equilibrium.

3. Theoretical Review

3.1 Keynesian view of Fiscal Policy

Reference [1] argues that the Keynesian advances strong argument for the primary role of fiscal action and suggested that active government policy could be effective in managing the economy. They argued that fiscal actions exert a strong and rapid force on aggregate demand. They believe that an increase in government spending adds directly to aggregate demand. Also, a reduction in tax rate increases disposable income, thereby increasing aggregate demand. Thus, they conclude that increase in government spending and tax reduction work through the multiplier effect. Furthermore, the Keynesians traditionally see fiscal policy also, as the key tool of economic management. They see the role of government as maintaining the economy at full employment. The way to do this was to manage the level of aggregate demand until the economy was at or close to full employment. If the economy was growing too fast, then fiscal policy should be essentially deflationary, and vice-versa when below full employment. Monetary policy should, in their view, simply be used as a backup to fiscal policy. However, they would argue that direct interest rate changes could be used to control aggregate demand. Their main objection to monetary policy has always been that there is a weak link between the money supply and aggregate demand, and that the money supply is difficult to control anyway. Keynesians do not believe in the direct link between the supply of money and the price level that emerges from the classical quantity theory of money. They reject the notion that the economy is always at or near the natural level of real GDP so that Y in the equation of exchange can be regarded as fixed. They also reject the proposition that the velocity of circulation of money is constant.

3.2 The Monetarists View of Fiscal Policy

The monetarist argued that the empirical evidence that government expenditure multiplier with a constant money stock is positive for a few quarters but in the long run is zero. This is supported by the "crowding out

effect" argument. In the absence of changes in money supply, government expenditure must be financed by taxes or borrowing from the private sector. In both cases, there is no net addition to purchases, since resources are only being transferred from private to the public sector. Government expenditure can increase aggregate demand permanently only if it is financed by continual creation of money stock. Moreover, monetarists do not believe that the government should intervene by trying to manage the level of aggregate demand. They argue that this type of interventionist policy will be destabilizing in the long run and should therefore be avoided. A key problem with discretionary aggregate demand management policies is the time lags, which monetarists believe, make fiscal policy too difficult to use to manage the economy effectively. The best thing therefore, is to take a long-run view of price stability and use monetary policy to achieve this.

3.3 Theories of Balance of Payment (BOP)

Within the international economics literature, there have been two approaches to analyzing devaluation and BOP. They are the fiscal approach (which includes elasticity and the absorption approaches) and the monetary approach.

3.3.1 Keynesian or Fiscal Approach

The Keynesian approach (KA) to balance of payments was developed and based basically on the work of John M. Keynes in the twentieth century. The most well-known theories are 'elasticity theories' and 'absorption theories' of balance of trade and payments. The elasticity approach provides an analysis of how devaluations of exchange rate and price level will affect the balance of trade depending on the elasticity of supply and demand for foreign exchange and foreign goods. The theory of elasticity leads to what is called the "J-curve effect", which refers to the pattern of the balance of trade following devaluation. The absorption approach to the balance of trade is a theory that emphasizes how domestic spending on domestic goods changes relative to domestic output. In other words, the balance of trade is viewed as the difference between what the economy produces and what it takes for domestic use or absorbs.

The traditional Keynesian models, optimizing real business cycle models and new open economy macro models are mostly come up with similar conclusions described as a transitory fiscal expansion is likely to lead to a fiscal deficit, a current account deficit, and an appreciation of the real exchange rate in the short run. The effects on the real exchange rate may be reversed in the long run and even the current account may revert over time to insure the solvency of the country's foreign liabilities. However, the impact and short-term effects of the fiscal shock are likely to be a worsening of the current account and a real appreciation. To achieve foreign balance, especially to eliminate balance of payments deficit, the government increase tariff on non-essential goods and goods that can be locally produced as a means of reducing import volume. Also, it gives tax reliefs and concessions to local entrepreneur so as to stimulate and promote greater exports to pay for increased imports.

3.3.2 The Elasticity Approach

In its simplest form, the elasticity approach focuses on the current account of the balance of payments and is concerned with the condition under which exchange rate changes can compensate for price distortions in

international trade, which are assumed to be the major cause of the value of imports exceeding exports. The Marshallian partial equilibrium analysis is applied to markets for exports and imports. Capital movements are assumed away and the domestic price level varies with respect to the world price level.

3.3.3 The Income - Absorption Approach

As seen that in the elasticity approach to the analysis of devaluation, the effect of exchange rate adjustments on the balance of payments depends principally on the elasticity of imports for home and foreign goods. In this analysis, income is assumed fixed. Thus, the income multiplier effects of devaluation are ignored. Alexander (1952) criticizes the elasticity approach as a partial equilibrium analysis and developed an alternative approach, which is known as the income absorption or the aggregate spending approach, to analyze the effect of devaluation on the trade balance. This approach takes into account the effects of changes in both price and income following devaluation. The central tenet of the absorption approach is that a favorable configuration of price elasticity may not be sufficient to produce a positive balance of payments effect resulting from devaluation, if devaluation does not succeed in reducing domestic absorption.

3.3.4 The Monetary Approach

The monetary approach views imbalances in the balance of payments in terms of imbalances between the demand for and supply of money stock. The approach focuses its analysis on the monetary account of the balance of payments in the context of a general equilibrium analysis. Thus, the balance of payments is a monetary and not a real phenomenon and balance of payments disequilibria are stock and not flow disequilibria.

4. Model Specification

Empirically exploring the main determinants of balance of payments in Pakistan by estimating the model that may help the long run and short run behavior of such determinants is set as the objective of the present study. The three different theories mentioned earlier demonstrate that a country's balance of payments may be affected by changes in the GDP, inflation rate, and exchange rate etc. Making use of all three theoretical backgrounds, the present study is an effort to develop a model that integrates all three approaches simultaneously and uses it to analyze Sudan's balance of payment. The justification for including all three approaches in a single equation model is to verify their empirical implication and validity and minimize the residual unexplained variation in the balance of payments in terms of VECM model which has been selected for the study since it is the fittest model among ARCH family models.

4.1 The Model

$$\ln(BOP_t) = \beta_0 + \beta_1 \ln(ED) + \beta_2 \ln(EX_t) + \beta_3 \ln(GDP_t) + \beta_4 \ln(INF_t) + \varepsilon_t \ldots\ldots\ldots\ldots(1)$$

Where

β_0: The intercept.

$\beta_1, \beta_2, \beta_3 \dots \beta_4$: are the slope parameters.

t : Time period of sample data.

BOP_t : Sudan's balance of payment in time t.

ED_t : Eternal debts in the time t.

EX_t : Exchange rate in time t.

GDP_t : Gross Domestic Product in time t.

INF_t : Inflation rate (INF) in time t.

ε_t : Stochastic error term in time t.

4.2 Data Description

In this study annual time series data is used for the period of 1985 to 2015. The data has been collected from Central Bank of Sudan, Central Bureau of Statistics, World Bank Estimates, International Financial Statistics and International Monetary Fund.

Table 1: Variables included, their description and sources 1980-2016

Variable	Symbol	Description	Source
Balance of Payment	BOP	Million SDG	World Bank Estimates
Inflation Rate	INF	Million SDG	Central Bureau of Statistics
Gross Domestic Product	GDP	Million SDG	Central Bureau of Statistics
Exchange Rate	EX	Million SDG	Central Bureau of Statistics
Foreign Debts	ED	Million SDG	Central Bureau of Statistics

Central Bureau of Statistics & World Bank Data

** SDG means Sudanese Pound

5. Empirical Evidence

5.1 Vector Error Correction Results

Since the existence of co integration are found among the variables of interest, the study proceed to estimate the long-run relationship between BOP and its determinants – ED, EX, GDP and INF. VECM (Vector Error Correction) is run to estimate the long-run and short run relationship model of adjusted savings in Sudan. The first VECM C(1) is negative -3.631432 and P value is 0.0005 which is significant, meaning there is long run causality run form ED, EX, GDP and INF independent variables to BOP dependent variable. Then after running Wald test the P value 0.4928 which is not significant and more than 5%, meaning we cannot reject NULL hypothesis, that is there is no short run causality running from Independents variables ED, EX, GDP and INF to dependent variable BOP. The second VECM C (1) is positive 0.053650 and P value is 0.8186 which is not significant. Also after running Wald test the P value 0.0001 which is significant and less than 5%, meaning we can reject NULL hypothesis and accept alternative hypothesis, that is there is a short run causality running from Independents variables ED, EX, GDP and INF ED, EX, GDP and INF to dependent variable BOP. Concluding that there exist short and long run causality run form ED, EX, GDP and INF independent variables to BOP dependent variable. In sum, the speed adjustment is -0.267464 as annual data that is the whole system is getting back to long run to equilibrium at the speed up of -0.267464 annually.

5.2 Unit Root Results

Economic time-series data were often to be containing unit root (i.e. non-stationary) when they were observed at levels' order of integration. Regression on the data which are not stationary at levels might resulting in 'spurious' regression' and thus, is not favorable. Therefore, it is an essential exercise to conduct a unit root test on each variable before proceeding to estimation of the co-integration models.

First we developed unit root test, let start with BOP as dependent variable, the guidelines is that the NULL hypothesis is there is unit root and ALT there is no unit root, meaning that data is stationary, the Corresponding P value is 0.0001, which is less than 5%, meaning we can reject NULL hypothesis, meaning BOP variable doesn't have unit root at level, Now we convert BOP into first difference, P value is 0.000 meaning it is less than 5%, so we can reject the NULL hypothesis and accept the ALT hypothesis, meaning BOP at first difference does not have unit root. Then we run the unit root for ED, the NULL hypothesis is there is unit root and ALT there is no unit root, meaning that data is stationary, the Corresponding P value is 0.4630, which is more than 5%, meaning we cannot reject NULL hypothesis, meaning ED variable have unit root at level, Now we convert ED into first difference, P value is 0.000 meaning it is less than 5%, so we can reject the NULL hypothesis and accept the ALT hypothesis, meaning ED at first difference does not have unit root. Then we run the unit root for EX, the NULL hypothesis is there is unit root and ALT there is no unit root, meaning that data is stationary, the Corresponding P value is 0.3731, which is more than 5%, meaning we cannot reject NULL hypothesis, meaning EX variable have unit root at level, Now we convert EX into first difference, P value is 0.001 meaning it is less than 5%, so we can reject the NULL hypothesis and accept the ALT hypothesis, meaning EX at first difference does not have unit root. Then we run the unit root for GDP, the NULL hypothesis is there is unit root and ALT

there is no unit root, meaning that data is stationary, the Corresponding P value is 0.0459, which is less than 5%, meaning we can reject NULL hypothesis, meaning GDP variable doesn't have unit root at level, Now we convert GDP into first difference, P value is 0.000 meaning it is less than 5%, so we can reject the NULL hypothesis and accept the ALT hypothesis, meaning GDP at first difference does not have unit root. Then we run the unit root for INF, the NULL hypothesis is there is unit root and ALT there is no unit root, meaning that data is stationary, the Corresponding P value is 0.3601, which is more than 5%, meaning we cannot reject NULL hypothesis, meaning INF variable have unit root at level, Now we convert INF into first difference, P value is 0.000 meaning it is less than 5%, so we can reject the NULL hypothesis and accept the ALT hypothesis, meaning INF at first difference does not have unit root.

5.3 Johansen Co-Integration Results

Having achieved stationarity, accordingly, as Johansen cointegration indicates, there should be a co-integration test. The existence of co-integration between the variables is an indication that there is a long run relationship between the variables. The co-integration test is performed using Johansen cointegration two-step residual based test for the entire test statistics used. In the case of BOP and the independents variables where it is found that they are co-integrated at 5% level of significance. Therefore, when Granger causality is run on these variables in their levels, the results may be unreliable and misleading. The Johansen cointegration test in appendix 1 result in presented with the variables in their first differences and second one. The result of the cointegration means that there is no long run relationship among the variables. In view of the absence of cointegration between the variables, we accept the ALT hypothesis that the variable are cointegrated in the study, which mean that time series have long run equilibrium relationship.

6. Discussion

This study investigated the various determinants of balance of payment in Sudan. A VECM approach of long-run and short-run model of relationship among foreign debt, balance of payments, exchange rate, inflation, gross domestic product .The variable of interest employed in this study, BOP is perceived as the proxy for balance of payment. However in the long-run, all of the variables have a strong impact on balance of payment in Sudan. The findings from this study have provided some insight to the researcher in terms of more in depth knowledge of saving and income theory. It can be generally concluded that firmed macroeconomic policy should be carefully designed by policymaker in order to ensure a balance of payment progress in economic progress aspects, especially for a country like Sudan. The follows are the major findings of the study:

- The foreign debt has strong positive impact on Sudan balance of payment through the study time period.
- There is a negative relationship between Sudan balance of payment and exchange rate through the study time period.
- There is a negative relationship between Sudan balance of payment and gross domestic product through the study time period.
- There is a negative relationship between Sudan balance of payment and inflation through the study

time period.

7. Conclusion

This study has been an attempt to find out the determinants factors of balance of payments. Money foreign debt, balance of payments, exchange rate, inflation, and gross domestic product during the period (1980 - 2016) are found to be major determinants of balance of payments. The analysis was done by taking annual time series data for the period of the aforementioned period, using VECM testing approach. The study has proved that the balance of payments and its determinants keep both long run and short run relationship.

Any policy that will successfully eliminate a balance of payments deficit on current account must either increase national income more than it increases aggregate expenditure, or else decrease aggregate expenditure more than it decreases national income On the other hand; a surplus on current account requires aggregate expenditure to be smaller than domestic national income. This implies that domestic saving and taxes are larger than domestic investment and government expenditure and the difference is spent on net acquisition of foreign assets. The net acquisition of assets by private sector which is stable liner function of disposable income is not greatly changed by an increase in income, then; this implies that any change in government budget deficit or surplus will be mirrored in the balance of current account. Hence any increase in the government budget deficit or surplus will result in deterioration in the balance on current account.

In view of the major findings of the study we recommend the following:

- The state should seek to solve the foreign debts through poor countries initiative that over burden of debts and reschedule it in line of broad movement of constitutional and executive authorities.
- The state should adopt economic policies that reduce the foreign debts percentage, inflation rates and create stability in exchange rates which lead to enhance the balance of payments, and subsequently improve the economic situation of Sudan.
- The formalization of foreign relationship with regional and international organizations, to ensure the influx of foreign loans and utilize it for the productive sectors, by controlling its administration and financial aspects as a whole.
- Central bank of Sudan has to be vigilant towards its monetary policy and has to take some favorable measures to control the money supply. It has to keep an eye on interest rate and charge low interest rate to encourage the new internal investor.

The major drawback from this study is that it should have estimated separately the determinants of current and capital accounts. This would have allowed one to get a sense of how variables behaved on one account to the other in order to relax some of the a priori assumptions to run the balance of payment estimation. This study is however ground breaking and pioneering since it has come up with a theoretical and empirical framework of the determinants on the balance of payments in Sudan and has furthermore quantitatively assess their relationships. The use of advanced econometric methodologies requires availability of longer and consistent time series data. Without consistent and longer time-series data, the number of feasible econometric methodologies will be

limited. There is no doubt that future studies on balance of payments flows and determinations will enormously benefit from the results of this study in order to extend the empirical and quantitative analysis of determining separately the current and capital account as a basis for the overall balance of payments for Sudan.

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Appendices

Appendix 1: Unit Root Test

```
Null Hypothesis: BOP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)
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		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.283698	0.0001
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

*MacKinnon (1996) one-sided p-values.

```
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BOP)
Method: Least Squares
Date: 02/22/17   Time: 11:29
Sample (adjusted): 1980 2016
Included observations: 30 after adjustments
```

Variable	Coefficient	Std. Error	t-Statistic	Prob.

```
Null Hypothesis: D(BOP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)
```

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.284809	0.0000
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

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Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BOP,2)
Method: Least Squares
Date: 02/22/17   Time: 11:29
Sample (adjusted): 1980 2016
Included observations: 29 after adjustments
```

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BOP(-1))	-1.509665	0.162595	-9.284809	0.0000
R-squared	0.754833	Mean dependent var		0.338793
Adjusted R-squared	0.754833	S.D. dependent var		22330.23
S.E. of regression	11056.67	Akaike info criterion		21.49333
Sum squared resid	3.42E+09	Schwarz criterion		21.54048
Log likelihood	-310.6533	Hannan-Quinn criter.		21.50810
Durbin-Watson stat	2.346415			

Null Hypothesis: ED has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.567429	0.4630
Test critical values:	1% level		-2.644302	
	5% level		-1.952473	
	10% level		-1.610211	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ED)
Method: Least Squares
Date: 02/22/17   Time: 11:30
Sample (adjusted): 1980 2016
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ED(-1)	-0.026140	0.046068	-0.567429	0.5748

R-squared	0.009547	Mean dependent var	0.224600
Adjusted R-squared	0.009547	S.D. dependent var	5.999948
S.E. of regression	5.971238	Akaike info criterion	6.444551
Sum squared resid	1034.015	Schwarz criterion	6.491257
Log likelihood	-95.66826	Hannan-Quinn criter.	6.459493
Durbin-Watson stat	2.263678		

Null Hypothesis: D(ED) has a unit
Exogenous:
Lag Length: 0 (Automatic - based on SIC,

			t-	
Augmented Dickey-Fuller test			-	
Test critical	1%		-	
	5%		-	
	10%		-	

*MacKinnon (1996) one-sided p-

Augmented Dickey-Fuller Test
Dependent Variable:
Method: Least
Date: 02/22/17   Time:
Sample (adjusted): 1980
Included observations: 29 after

Variabl	Coefficien	Std.	t-	Prob
D(ED(-1))	-1.149435	0.186804	-6.153167	0.0000

R-squared	0.574860	Mean dependent var	-0.032759
Adjusted R-squared	0.574860	S.D. dependent var	9.263518
S.E. of regression	6.040071	Akaike info criterion	6.468583
Sum squared resid	1021.509	Schwarz criterion	6.515731
Log likelihood	-92.79445	Hannan-Quinn criter.	6.483349
Durbin-Watson stat	2.018201		

Null Hypothesis: EX has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.771745	0.3731
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EX)
Method: Least Squares
Date: 02/22/17   Time: 11:30
Sample (adjusted): 1980 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EX(-1)	-0.041656	0.053977	-0.771745	0.4467
R-squared	0.020828	Mean dependent var		0.121586
Adjusted R-squared	0.020828	S.D. dependent var		499.2189
S.E. of regression	493.9927	Akaike info criterion		15.27679
Sum squared resid	6832806.	Schwarz criterion		15.32394
Log likelihood	-220.5135	Hannan-Quinn criter.		15.29156
Durbin-Watson stat	1.662164			

Null Hypothesis: D(EX) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.459232	0.0001
Test critical values:	1% level	-2.650145	
	5% level	-1.953381	
	10% level	-1.609798	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EX,2)
Method: Least Squares
Date: 02/22/17   Time: 11:31
Sample (adjusted): 1980 2016
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EX(-1))	-0.848239	0.190221	-4.459232	0.0001
R-squared	0.424120	Mean dependent var		-0.061107
Adjusted R-squared	0.424120	S.D. dependent var		662.1590
S.E. of regression	502.4911	Akaike info criterion		15.31209
Sum squared resid	6817427.	Schwarz criterion		15.35967
Log likelihood	-213.3693	Hannan-Quinn criter.		15.32664
Durbin-Watson stat	2.000577			

Null Hypothesis: GDP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.992213	0.0459
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 02/22/17   Time: 11:31
Sample (adjusted): 1980 2016
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.240767	0.120854	-1.992213	0.0558

R-squared	0.120383	Mean dependent var	-511.7043
Adjusted R-squared	0.120383	S.D. dependent var	6751556.
S.E. of regression	6332141.	Akaike info criterion	34.19294
Sum squared resid	1.16E+15	Schwarz criterion	34.23965
Log likelihood	-511.8941	Hannan-Quinn criter.	34.20788
Durbin-Watson stat	1.892408		

Null Hypothesis: D(GDP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.608174	0.0000
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 02/22/17   Time: 11:32
Sample (adjusted): 1980 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.058058	0.188663	-5.608174	0.0000

R-squared	0.529029	Mean dependent var	-167.6085
Adjusted R-squared	0.529029	S.D. dependent var	9995247.
S.E. of regression	6859472.	Akaike info criterion	34.35403
Sum squared resid	1.32E+15	Schwarz criterion	34.40118
Log likelihood	-497.1335	Hannan-Quinn criter.	34.36880
Durbin-Watson stat	2.004637		

Null Hypothesis: INF has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.801415	0.3601
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 02/22/17   Time: 11:32
Sample (adjusted): 1980 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.066889	0.083464	-0.801415	0.4299
D(INF(-1))	-0.308121	0.182132	-1.691744	0.1022

R-squared	0.138377	Mean dependent var	0.444828
Adjusted R-squared	0.106465	S.D. dependent var	27.22412
S.E. of regression	25.73414	Akaike info criterion	9.399986
Sum squared resid	17880.64	Schwarz criterion	9.494282
Log likelihood	-134.2998	Hannan-Quinn criter.	9.429518
Durbin-Watson stat	1.948477		

Null Hypothesis: D(INF) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.611020	0.0000
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 02/22/17   Time: 11:32
Sample (adjusted): 1980 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-1.341292	0.176230	-7.611020	0.0000

R-squared	0.674101	Mean dependent var	0.510345
Adjusted R-squared	0.674101	S.D. dependent var	44.78944
S.E. of regression	25.56922	Akaike info criterion	9.354530
Sum squared resid	18305.98	Schwarz criterion	9.401678
Log likelihood	-134.6407	Hannan-Quinn criter.	9.369296
Durbin-Watson stat	1.964574		

Vector Error Correction Estimates
Date: 02/25/17   Time: 14:57
Sample (adjusted): 1980 2016
Included observations: 27 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
BOP(-1)	1.000000
ED(-1)	-1161.256
	(63.0028)
	[-18.4318]
EX(-1)	7.684351
	(0.65861)
	[11.6676]
GDP(-1)	5.77E-05
	(4.6E-05)
	[1.24304]
INF(-1)	139.7086
	[(12.9985])
C	8077.100

Error Correction:	D(BOP)	D(ED)	D(EX)	D(GDP)	D(INF)
CointEq1	-2.196975	-4.62E-05	-0.030243	-919.2534	-0.003461
	(0.60499)	(0.00020)	(0.03189)	(500.809)	(0.00175)
	[-3.63143]	[-0.23014]	[-0.94835]	[-1.83554]	[-1.97891]
D(BOP(-1))	0.756334	8.30E-05	0.020337	523.1380	0.002564
	(0.44837)	(0.00015)	(0.02363)	(371.163)	(0.00130)
	[1.68684]	[0.55767]	[0.86048]	[1.40946]	[1.97798]
D(BOP(-2))	0.378340	6.02E-05	0.035386	294.8738	0.000919
	(0.28041)	(9.3E-05)	(0.01478)	(232.123)	(0.00081)
	[1.34924]	[0.64649]	[2.39398]	[1.27034]	[1.13322]
D(ED(-1))	341.6241	0.054583	-14.32636	59240.26	0.379202
	(343.112)	(0.11385)	(18.0864)	(284028.)	(0.99191)
	[0.99566]	[0.47942]	[-0.79211]	[0.20857]	[0.38229]
D(ED(-2))	240.5713	-0.113296	-2.237705	173072.7	0.264040
	(326.457)	(0.10833)	(17.2084)	(270240.)	(0.94376)
	[0.73692]	[-1.04589]	[-0.13004]	[0.64044]	[0.27977]
D(EX(-1))	22.36513	-0.002270	0.569660	9805.288	0.017144
	(6.65153)	(0.00221)	(0.35062)	(5506.13)	(0.01923)
	[3.36240]	[-1.02860]	[1.62472]	[1.78079]	[0.89156]
D(EX(-2))	28.69423	0.010967	0.144950	11851.03	0.041068
	(7.81802)	(0.00259)	(0.41211)	(6471.75)	(0.02260)
	[3.67027]	[4.22750]	[0.35173]	[1.83119]	[1.81706]
D(GDP(-1))	-0.000161	-1.55E-07	7.48E-06	-0.147239	-9.61E-07
	(0.00028)	(9.3E-08)	(1.5E-05)	(0.23183)	(8.1E-07)
	[-0.57665]	[-1.67210]	[0.50657]	[-0.63510]	[-1.18686]
D(GDP(-2))	8.39E-06	-9.87E-08	-2.80E-06	-0.067044	-3.38E-07
	(0.00028)	(9.3E-08)	(1.5E-05)	(0.23287)	(8.1E-07)
	[0.02982]	[-1.05788]	[-0.18880]	[-0.28790]	[-0.41553]
D(INF(-1))	73.61609	-0.042235	-1.174424	20622.19	-0.245863
	(83.7170)	(0.02778)	(4.41295)	(69300.9)	(0.24202)
	[0.87934]	[-1.52037]	[-0.26613]	[0.29757]	[-1.01588]
D(INF(-2))	177.4689	0.074819	-0.794400	22018.35	0.265940
	(91.6219)	(0.03040)	(4.82964)	(75844.5)	(0.26487)
	[1.93697]	[2.46098]	[-0.16448]	[0.29031]	[1.00403]
C	-9.645162	0.210151	3.168911	-65338.86	-0.137876
	(1889.58)	(0.62700)	(99.6048)	(1564191)	(5.46262)
	[-0.00510]	[0.33517]	[0.03181]	[-0.04177]	[-0.02524]
R-squared	0.687921	0.847561	0.426186	0.252993	0.402582
Adj. R-squared	0.459063	0.735773	0.005390	-0.294812	-0.035524
Sum sq. resids	1.44E+09	158.6688	4004153.	9.87E+14	12043.51
S.E. equation	9801.542	3.252371	516.6658	8113710.	28.33550
F-statistic	3.005886	7.581828	1.012809	0.461831	0.918915
Log likelihood	-278.5142	-62.21960	-199.0559	-459.9210	-120.6673
Akaike AIC	21.51957	5.497748	15.63377	34.95711	9.827210
Schwarz SC	22.09550	6.073676	16.20970	35.53304	10.40314
Mean dependent	98.63941	0.134667	0.056519	-1732.783	-0.266667
S.D. dependent	13326.65	6.327195	518.0638	7130437.	27.84523

Determinant resid covariance (dof adj.)	2.64E+30
Determinant resid covariance	1.40E+29
Log likelihood	-1097.524
Akaike information criterion	86.11292
Schwarz criterion	89.23253