



**The role of monetary models on describing the behaviour of the balance of payments in Sudan during the period (1989-2009)**

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ARTICLE INFO	ABSTRACT
<p>Article history Received: 20February2014 Accepted: 7April 2014 Available online: 5 May 2014</p>	<p>The study examined the analysis of the behaviour of the balance of payments in Sudan during the period (1989- 2009). The study explored the effect of the monetary variables on the behaviour of the balance of payments during the period (1989-2009), the study aimed to identify these variables and their effect on Sudan's balance of payment. The study main hypotheses included the following: The Sudan balance of payments behaviour can be explained through real factors specifically gross domestic product and aggregate expenditure within a monetary frame work, Also an increase of the stock of net domestic assets my lead to an expansion in monetary policy this would tend to worsen the balance of payments through affecting nominal aggregate expenditure, nominal income, imports and exports. The study adopted a statistical approach using E-views programme to prove these hypotheses (Unit Root Test – Co integration – Vector analysis regression), and depended on secondary sources of data which include references, IMF reports, and bank of Sudan annual reports. The study main results include the following: The GDP and government expenditure are the main variables which explain the behavior of BOP in Sudan, and adopting an expansionary monetary policy will affect negatively the performance of BOP in the short run. The study call for the government to finance its budget deficit from real recourses instead of resorting to bank of Sudan to fill in the deficit by printing money since this policy may increase liquidity and money supply, thus affecting negatively both inflation and the performance of balance of payment.</p>
<p>KEYWORDS: Balance of payment, Monetary Model, Gross Domestic, Product (GDP),Aggregate expenditure</p>	
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## **INTRODUCTION:**

During most of the period (1989-2009), Sudan ran a current account and overall balance of payments deficit. This suggests that the management of the external imbalance has been one of the most serious economic problems facing the country.

A country faces balance of payments problems for many reasons, among which: fiscal expansion, expansionary monetary policies, deterioration in terms of trade, price distortion, high debt servicing, or a combination of these factors. To solve these problems, many countries including Sudan, seek balance of payments support from external sources including the international Monetary Fund (IMF), and debt relief from creditors in the framework of a planned adjustment process. Exchange rate adjustment (devaluation) is essentially part of this adjustment process.

Within the international economic literature, there have been three principal approaches to analyze the balance of payments problems: the elasticity approach, absorption approach, and monetary approach. The first two approaches analyze the devaluation of the domestic currency 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 is complemented by an appropriate domestic monetary policy (Manual Giuliani, 1973).

The empirical analysis of this research will investigate the relationship between the balance of payments and the rate of domestic credit expansion i.e. the study is an attempt to explain the main proposition of the monetary approach to balance of payments i.e., the balance of payments is a monetary phenomenon, Furthermore, the study will ascertain the importance of the credit expansion relative to other variables like the exchange rate, debt servicing, government expenditure, and gross national

product, in determining the Sudan balance of payments outcomes.

## **PROBLEM OF THE STUDY**

The monetary approach to the balance of payments considers the fact that a country with balance of payments deficit (or surplus) would experience a change in its monetary stock. In the light of this consideration, the study investigates the relationship between the Sudan balance of payments and domestic credit expansion and verifies its importance relative to other variables such as government expenditure, debt servicing, 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 behaviour of Sudan's balance of payments?

## **OBJECTIVES OF THE STUDY**

It included the followings:

- Understanding the relationship between monetary and real variables, including domestic credit expansion, money supply, aggregate expenditure, gross domestic product, and balance of payments performance.
- Demonstrate to what extent the monetary variable, i.e. domestic credit, explains the behaviour of Sudan balance of payments by empirically testing the monetary approach to balance of payments mechanism.
- To draw some policy implications and prescriptions regarding monetary and fiscal policy formulation in Sudan.

## **IMPORTANCE OF THE STUDY**

The importance of this study stems from the field of study “monetary model of exchange rate for Sudan BOP “as both exchange rate and BOP have been regarded as major economic indicators. Moreover to fill in the gap in the previous studies.

## **SOURCES OF DATA**

Annual-time series data on the variables under study will be collected from International Financial Statistical reports (IFS- IMF), Ministry of Finance and National Economy, annual reports issued by the Central Bank of Sudan, and the Central Bureau of Statistics.

## **HYPOTHESES OF THE STUDY**

It included the followings:

- The Sudan balance of payments behaviour can be explained through real factors gross domestic product and aggregate expenditure within a monetary framework.
- An increase of the stock of net domestic assets may lead to an expansion in monetary policy; this would tend to worsen the balance of payments position through affecting nominal aggregate expenditure, nominal income, imports and exports.

## **ORGANIZATION OF THE STUDY**

The first part contains problem of the study, objectives of the study, Importance of the study, Hypothesis of the study, Methodology of the study and sources of data, Organization of the study and Literature review. The second part deals with literature review and theoretical frame work while the third part reviews Sudan balance of payments and policy development during (1989 - 2009). The fourth part presents the analysis of regression results, conclusion, main results and recommendations.

## **PREVIOUS STUDIES:**

This section reviews a number of articles written about the BOP monetary approach. Anthony J. Makin (Anthony J. Makin: A monetary model of exchange rate and balance of payments adjustment, (IMF,

2005) his article proposes an attentive monetary model for examining the effects of domestic monetary shocks on the exchange rate and the balance of payments. Using an output – expenditure frameworks, it shows that domestic monetary shocks can drive a wedge between national expenditure and production and generate incipient current account imbalances with exchange rate and balance of payments implications. Contrary to previous monetary approaches, the model suggests a new chain of causality that runs from domestic money to the exchange rate to the price level, rather than from money to the price level to the exchange rate. It also shows that under fixed rates external adjustment is consistent with money market equilibrium and price level stability.

Irfan Civcir(2003) in his paper examined four versions of the monetary model for Turkish Lira – Dollar exchange rate. The analysis centered on two issues. First, testing whether the exchange rate is co integrated with long – run determinants predicted by the economic theory. The sticky price versions of the monetary model results support the hypothesis of co integration. Then, constructing simultaneous equation systems, which incorporate the long -run equilibrium relationship and complex short – run dynamics. Second issue is the ability of the monetary models to forecast future exchange rate. it show that fully dynamic out – of – sample forecast from the equilibrium correcting monetary models significantly outperforms those of random walk models and Differenced vector autoregressive models.

## **THE MODEL**

The model specified is a six – equation one , containing three behavioural relationships - for import , exports , and aggregate expenditure , and three identities – for nominal income , the balance of payments (change in net foreign asset ), and the money

supply. Each of these variables will be defined in the following pages.

### IMPORTS

Import demand is thus specified as a linear function of the level of net foreign assets and aggregate expenditure at time period (t):

$$M^d(t) = a_0 + a_1 NFA(t) + a_2 AE(t) + \alpha(t), \quad a_1 > 0; a_2 > 0 \dots (1)$$

Actual imports in period t are assumed to adjust to excess demand for imports that is, to the difference between demand in period (t) and actual supply in the same period:

$$DM(t) = \alpha(M^d(t) - M^s(t)) \dots (2)$$

Substituting (1) into (2), the estimated equation becomes:

$$DM(t) = \alpha a_0 + \alpha a_1 NFA(t) + \alpha a_2 AE(t) - \alpha M(t) + \alpha \alpha(t)$$

### EXPORTS

In a small – country case, exporters are generally price takers in the world market and can sell whatever they produce. The volume of exports is therefore determined by supply conditions present in the export sector. An increase in the capacity to produce in the export sector should lead to an increase in exports.

Capacity to produce in the export sector is related directly to the capacity to produce in the entire economy, and an increase (decrease) in the latter capacity would lead to an increase (decrease) in exports. If income is considered a suitable indicator of capacity to produce, exports can be specified as a positive function of domestic income. Whether exports will increase more than in proportion to income will depend on the supply elasticity of domestic relative to the supply elasticity of exports.

An indicator of the capacity to produce that would be more appropriate than current income is ‘permanent,’ or expected, income. Exports are specified as a function of this long – run concept, rather than the short – run concept of current income:

$$X(t) = b_0 + b_1 Y^*(t) + v(t) \dots (3)$$

The parameter  $b_1$  is expected to be positive. Permanent income is generated in the following way:

$$D Y^*(t) = \beta (Y^*(t) - Y(t)) \quad \beta < 0 \dots (4)$$

Permanent income in time period t adjusts to the difference between permanent income and actual income (Y) in period t.

Equation (4) can be rewritten as:

$$Y^*(t) = \beta / (D + \beta) Y(t) \dots (5)$$

Substituting (5) into (3):

$$X(t) = b_0 + \beta b_1 / (D + \beta) Y(t) + v(t)$$

And solving for  $\Delta X(t)$  the estimating equation becomes:

$$DX(t) = b_0 (D + \beta) + \beta b_1 Y(t) - \beta X(t) + \epsilon_t$$

Where  $\epsilon_t = (D + B)$ ,  $v(t)$  is a moving – average process of order one.

### AGGREGATE EXPENDITURE

In the standard Keynesian model of a closed economy, aggregate expenditure (consumption plus investment) depends on the level of domestic income and the domestic interest rate. The familiar IS – LM framework considered within a disequilibrium framework shows how a change in monetary policy affects expenditure, through the impact of changes in the interest rate on investment expenditure. Rather than introducing the rate of interest, which represents the yield on only one asset, it may be more appropriate to include in the expenditure function the stock of liquid assets that the public desires to hold directly. Given this stock, an increase in the money supply would raise it above the desired level. This would create an excess demand for goods and services and would lead to higher expenditure as the public attempts to reduce its excess cash balance. Increases in nominal income could also be expected to increase nominal expenditure.

The equation for ‘desired’ expenditure can be specified as follows:

$$DAE(t) = \gamma c_0 + \gamma c_1 M_0(t) + \gamma c_2 Y(t) - \gamma AE(t) + \gamma w(t)$$

**NOMINAL INCOME**

Nominal domestic income is equal to nominal aggregate domestic expenditure plus nominal exports minus nominal imports:

$$Y(t) = AE(t) + X(t) - M(t)$$

This identity must hold, ex post.

**BALANCE OF PAYMENTS**

The balance of payments in nominal terms is equal to the trade balance (export minus imports) plus all other items in the balance of payments account; it is also equal to the change in a country's net foreign asset

$$\text{Since } NFA(t) = \int B(t) dt, DNFA \equiv B(t)$$

Therefore, the identity can be written as:

$$B(t) \equiv DNFA(t) = X(t) - M(t) + DK(t)$$

The purpose of the model, this item (i.e. DK) is assumed to be determined outside the system.

**MONEY SUPPLY**

The stock of money in an economy is equal to the stock of net foreign assets and domestic credit of the consolidated banking system:

$$M_o(t) = NFA(t) + C(t)$$

**METHODOLOGY OF THE STUDY**

The study used Mohsin Khan (1972) Model which was summarized by the following equations:

$$DM(t) = \alpha a_0 + \alpha a_1 NFA(t) + \alpha a_2 AE(t) - \alpha M(t) + \alpha \epsilon(t) \dots (1)$$

$$DX(t) = b_0(D + \beta) + \beta b_1 Y(t) - \beta X(t) + \epsilon(t) \dots (2)$$

$$DAE(t) = \gamma c_0 + \gamma c_1 M_o(t) + \gamma c_2 Y(t) - \gamma AE(t) + \gamma w(t) \dots (3)$$

$$Y(t) = AE(t) + X(t) - M(t) \dots (4)$$

$$DNFA = X(t) - M(t) + DK(t) \dots (5)$$

$$M_o(t) = NFA(t) + C(t) \dots (6)$$

Where the variables are defined in domestic currency term as follows:

*M* = Nominal value of imports.

*X* = Nominal value of exports.

*AE* = Aggregate nominal domestic expenditure.

*Y* = Nominal domestic income.

*NFA* = Change in net foreign assets of the consolidated banking system (Balance of payments).

*M<sub>o</sub>* = Nominal money supply.

*DK* = all items in the balance of payments other than the trade balance.

*C* = Domestic credit of the consolidated banking system.

The Models will be estimated for the period (1989-2009). The methodology employed in this study is co-integrated VAR to account for problems of non-stationary and endogenously in order to estimate relevant coefficients and parameters that describe short and long-run interaction of monetary and balance of payments variables.

**DATA AND ECONOMETRICS PROCEDURE**

The essence of regression analysis is to estimate long- run (and short – run) meaningful economic relationships in order to test theoretical postulates. Conducting parameters estimation and hypotheses testing without appropriate investigation of data generating processes underlying variables may lead to false conclusions about the existence and significance of economic relationships. A combination of variables that contain time trend (no stationary) may therefore lead to spurious correlation. The severity of non-stationary stems from the high likeliness of the time series data to be subject to autocorrelation. Classical linear regressions assume that the error terms from successive observations are uncorrelated  $E\{\alpha_s, \alpha_{1-s}\} = 0, s \neq 0$ . Such assumptions are frequently violated in time series data, where the residuals exhibit autocorrelation, which is a likely cause for non-stationary. A non-stationary series is

one where the moments (mean, variance) of the distribution from which series observation were drawn are not constant, depending on the time ordering of the data and consequently change over time. Fitting regression equations by regressing one non stationary variable on another is very likely to result in spurious regression.

One way to remedy non stationary is by differencing variables. However, by examining differenced data, information about the fundamental long – run equilibrium of the model is contained in the error – correction term, however, so co integration analysis is the appropriate technique for examining potential long – run relationships. Endo – exogenous division of the variables and non-stationary problems may be overcome by adopting a system of equations such as the vector autoregressive (VAR) system, a modelling technique introduced in the seminal work of sum (1980). The central feature characterizing the VAR technique is that it poses less restrictive structural modelling as it imposes no a prior endow – exogenous division of variables: all variables entering equations system are assumed to be endogenous. Moreover, no – zero restrictions are imposed on individual variables to attain identification, which is the case under simultaneous equation modelling. Also, under VAR modelling the variable stationary is not a prerequisite for obtaining accurate estimate and reliable hypothesis testing. Although VAR modelling poses the problem that it underlies no strict economic theory since all variables affect, and in turn are being affected by, all variables, it can provide a sensible, economically meaningful relationship when combined with the causality analysis.

The co integration techniques try to estimate the long run (Stationary) relationship between non stationary series rather than differencing variables in a system of

equations or in a single equation. The dependent variables in such relationships may depend not only on the level of the explanatory variables but also on the extent of deviation of the explanatory variable from the equilibrium relationship with the dependent variable. In the short – run there may be disequilibrium, this sort of behaviour is usually captured by the error correction models (ECMs) which describe the interaction between short – run and long – run impacts in a given relationship.

The methodology employed in this study is nonintegrated VAR to account for problems of non stationary and endogeneity in order to estimate relevant coefficients and parameters that describe short and long – run interaction of monetary and balance of payments variables.

### UNIT ROOT TEST

The stationary tests on this study are based on Dicky – Fuller test (DF) test used to test the null hypothesis that series contain a unit root (i.e. it is non stationary) against the alternative hypothesis of stationary. The DF test assumes data generating process of autoregressive AR (1) of order one and residual are white noise.

$$Y_t = \delta_0 + \delta_1 t + \alpha Y_t$$

$$\alpha Y_t = \alpha Y_{t-1} + \varepsilon_t$$

We need to test the null hypothesis that  $H_0: \alpha = 1$ . If we combine two equations and find the first difference we get

$$\Delta Y_t = (\delta_0 (1 - \alpha) + \delta_1 (1 - \alpha) t + \gamma Y_{t-1} + \varepsilon_t \dots (a)$$

Where  $\gamma = (\alpha - 1)$ ,  $Y_t$  is the variable in question,  $t$  is the time trend, and  $\varepsilon_t$  is a random variable assumed to be white noise.

The null hypothesis now is  $H_0: \gamma = 0$

If we don't reject the hypothesis, we accept that  $\alpha = 1$  and there is a unit root. The equation (a) reduces to  $\Delta Y_t = \delta_1 + \varepsilon_t$  (random walk model with drift and thus non-stationary). The ration

$$\frac{\hat{y}}{s.e. \hat{y}}$$

Neither follows the standard (t) distribution, nor asymptotically normal distribution N (0,1) so we have inference problem. This problem was solved by Fuller who obtained limiting distribution for this ratio in several importing cases. These distributions were approximated empirically by Dicky, so it is called Dicky – Fuller test (Connolly and Taylor (1976))

Also in the second model we need to test stationary where there is no linear trend which can be derived by setting  $\delta_1 = 0$  in equation (a) to obtain.

$$\Delta y_t = \delta_0 (1 - \alpha) + \gamma y_{t-1} + \varepsilon_t \quad \dots\dots\dots (b)$$

If we accept the null hypothesis, the equation reduces to  $\Delta y_t = \varepsilon_t$  (Random walk model without drift and thus no stationary). In the third model we need to test stationary where there is no linear trend, no intercept which can be derived by setting  $\delta_0 = \delta_1 = 0$  in equation (a) to obtain.

$$\Delta y_t = \gamma y_{t-1} + \varepsilon_t \quad \dots\dots\dots (c)$$

If we accept the null hypothesis, the equation reduces to  $\Delta y_t = \varepsilon_t$  (Random walk model without drift and thus no stationary).

Therefore, there are three possible test regression (a, b, c) and have same dependent variables. If data generating process was AR (P), where  $P > 1$ , the error term will be auto correlated due to misspecification of dynamic structure of variable in concern. In this case DF test be invalid, and lagged differences of dependent variable should be added or augmented to test models in order to mitigate autocorrelation problem in disturbance term. This is basically incorporated in Augmented Dicky – Fuller test (ADF).

$$\Delta y_t = \alpha + \gamma T + \beta y_{t-1} + \sum \lambda_i \Delta_{t-i} + \varepsilon_t \quad \dots\dots\dots (a1)$$

Where  $y_t$  is the variable in question, T is the time trend, and  $\varepsilon_t$  is a random variable assumed to be white noise. We employ

Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) to determine the lag length k in the above equation. The two criteria produce the same lag length for all variables. We estimate the ADF t – statistic in order to test that  $H_0: \beta = 0$

(Nonstationary) against  $H_0: \beta < 0$  (stationary) ( $\beta$  in absolute value). The joint hypothesis  $\beta = \gamma = 0$  is also treated using F – test. Accepting of  $\beta = 0$  and rejection of  $\beta = \gamma = 0$  implies that series is no stationary with a significant trend. Significance of the trend variables may also be tested using individual t – statistic. This test would yield four categories of variables: no stationary with a significant trend, stationary with insignificant trend, stationary with significant trend, no stationary with insignificant trend. Equation (a1) is applied to variables GDP, Ex, IM P, NDC,  $M_2$  and NFA defined as:

- GDP, = Nominal Gross Domestic Product.
- Ex = Export
- Imp = Import
- NDC = Net Domestic Credit.
- $M_2$  = Money Supply
- NFA = Net Foreign Asset.

Unit roots test results are reported in table (1) where

$$\frac{\hat{B}}{s.e \hat{B}}$$

ADF t - statistic                      lag length k , t - statistic for trend

Variable and constant is reported. The result indicates that all variables in level are no stationary with a significant trend. Using ADF tests for change in variables indicates that all variables are integrated of order two this means that they need to differentiate one or two to attain stationary.

Table1: Unit root test using ADF test).

<b>F-statistic</b>	<b>ADF</b>	<b>K</b>	<b>Variable</b>
2.26(0.12)	-0.634	0	<i>GDP(level)</i>
6.543 (0.081)	-2.211	0	<i>D(GDP, 1)</i>
12.231 (0.0000)	-2.719	0	<i>D (GDP,2)</i>
32.214 (0.0000)	-4.119	1	<i>D(GDP, 2)</i>
2.432(0.046)	-1.663	0	<i>EX (level)</i>
5.457 (0.002)	-2.416	0	<i>D(EX, 1)</i>
17.342(0.0000)	-3.029	0	<i>D(EX, 2)</i>
22.211(0.0000)	-5.423	1	<i>D(EX, 2)</i>
27.614 (0.0000)	-5.349	2	<i>D(EX, 2)</i>
33.487 (0.0003)	-7.225	3	<i>D(EX, 2)</i>
2.022 (0.121)	-1.539	0	<i>IMP (level)</i>
6.133 (0.001)	-3.133	0	<i>D( IMP, 1)</i>
20.013(0.0000)	-6.324	0	<i>D (IMP, 2)</i>
25.117(0.0000)	-8.321	1	<i>D (IMP, 2)</i>
5.741(0.017)	-0.214	0	<i>M2 (level)</i>
9.115(0.000)	-1.451	0	<i>D(M2, 1)</i>
27.641(0.0000)	-1.596	0	<i>D(M2, 2)</i>
15.231(0.0000)	-2.662	1	<i>D(M2, 2)</i>
26.345(0.0000)	-4.321	2	<i>D(M2, 2)</i>
2.082(0.006)	-1.261	0	<i>AE (level)</i>
5.652(0.112)	-1.217	0	<i>D(AE, 1)</i>
27.938(0.0000)	-3.332	0	<i>D(AE, 2)</i>
18.038(0.0000)	-4.067	1	<i>D( AE, 2)</i>
22.542(0.001)	-7.872	2	<i>D(AE, 2)</i>
5.102(0.000)	-2.431	0	<i>DK(level)</i>
20.356(0.0043)	-4.097	0	<i>D(DK, 1)</i>
20.044(0.0000)	-5.231	0	<i>D(DK, 2)</i>
18.718(0.0000)	-7.325	1	<i>D( DK, 2)</i>
<b>F-statistic</b>	<b>ADF</b>	<b>K</b>	<b>Variable</b>
3.476(0.0087)	-0.098	0	<i>NDC(level)</i>
12 (0.0006)	-1.165	0	<i>D(NDC, 1)</i>
19.992(0.0000)	-4.646	0	<i>D(NDC, 2)</i>
17.342(0.007)	-4.987	1	<i>D(NDC, 2)</i>
15.322(0.0000)	-6.321	2	<i>D(NDC, 2)</i>
3.012(0.234)	-0.243	0	<i>(NFA) (level)</i>
7.80(0.076)	-2.132	0	<i>D(NFA, 1)</i>
21.00(0.0000)	-4.747	0	<i>D(NFA, 2)</i>
18.72(0.0000)	-7.873	1	<i>D(NFA, 2)</i>

Source: researcher. e- Views.

Given the evidence of a single unit root in the variables under study, we use co integration analysis to investigate the long run relationship among import, net foreign asset, aggregate expenditure, export, gross domestic product, money supply using Johansen and Juselius (1990) procedure. The procedure is based on a maximum likelihood estimation of error correction model (ECM):

$$\Delta x_t = \alpha + \Gamma_1 \Delta x_{t-1} + \Gamma_2 \Delta x_{t-2} + \dots + \Gamma_{k-1} \Delta x_{t-1+k} + \pi x_{t-1} + \varepsilon_t \quad (1)$$

Where  $x_t$  is an (n. 1) vector of I (1) variables,  $\alpha$  an n-dimensional vector of parameters,  $\Gamma_1 \dots \Gamma_{k-1}$ ,  $\pi$  are (n. n) matrix of parameters and  $\varepsilon_t$  is an (n. 1) vector of white noise errors. The matrix  $\pi$  contains long run information in the system.



If  $xt$  is I (1), then  $\Delta xt$  is I (0). If some linear combinations of are stationary, that is, there are some co integrating relationships among the variables in  $xt$ , then the matrix  $\pi$ , should have a rank  $r > n$ . Also this matrix can be written as  $\pi = \alpha\beta$ . Where the columns of  $\alpha$  are known as the loading factors since the load the co integrating vectors in to various equations of the system and the rows  $\beta$  are the co integrating vectors. The Johansen and Juselius procedure employs two test statistics for testing the number of co integrating vectors: the trace test and the maximum eign value. The null hypothesis of the trace statistic is that there are r of fewer

co integrating vectors, where  $r = 0, 1, 2, 3, 4$ . Here the null hypothesis of  $r \leq 0$  is testing against the general hypothesis of  $r \leq 1, r \leq 2$  and so on. The maximum eign value tests the null  $r = 0$  against the specific hypothesis of  $r = 1, r = 2$  and so on. Johansen and Juselius (1990) recommend the use of both tests because the power of the trace test is lower than the maximum eign value test.

### EMPIRICAL RESULTS

To test the number of co integrating vectors r, the Johansen (1998) trace tests are applied. The result reported in table (2):

Table 2: Co integration rank and unrestricted co integration vector

NULL H0	ALTERNATIVE H1	Co integrating vector of (LIM, LEXP, LM2, LNFA, LAE, LGDP).		
		STATISTIC	95%	90%
$r=0$	$r \geq 1$	92.55	79.1642	75.44
$r \leq 1$	$r \geq 2$	54.134	44.275	49.24
$r \leq 2$	$r \geq 3$	43.47	31.77	30.96
$r \leq 3$	$r \geq 4$	20.212	22.05	19.32
$r \leq 4$	$r \geq 5$	7.634	10.73	8.22
$r \leq 5$	$r \geq 6$	1.243	6.16	2.013

Source: researcher e- views.

The system composes of six variables (LIM, LEXP, LM2, LNFA, LAE, and LGDP) which construct six estimable equations whose variable are I (1). The order of the VAR or the lag length is set to two, VAR (2). Co integrating test statistics for the six

variables, VAR (2) indicate that three co integrating vector exists.

The unrestricted estimates for the co integrating vector are reported in the following table (3):

Table 3: Unrestricted co integrated vector (Co integration with no intercepts or trends in the VAR)

**List of variables included in the co integrating vector**

**LIM      LEXP      LM2      LNFA      LAE      LGDP**

List of imposed restriction(s) on co integrating vectors  
 b1=0; b2=1; b3=0; c1=0; c2=0; c5=1

a1=1; a2=0; a3=0;

	<i>Vector 1</i>	<i>Vector 2</i>	<i>Vector 3</i>
LIM	1.0000 (none)	0.00 (none)	0.00 (none)
LEXP	0.00 (none)	1.0000 (none)	0.00 (none)
LM2	0.00 (none)	0.00 (none)	.6413 (.0532)
LNFA	0.07447 (0.231)	0.56321 (0.3541)	.02866 (.012)
LAE	2.572 (0.743)	5.4316 (0.05)	1.0000 (none)
LGDP	1.621 (10.82)	6.7623 (0.88)	1.7342 (.0773)

Source: researcher e- views.

The estimated of unrestricted co integrating vector is:

$$LIM = 0.07447 LNFA + 2.572 LAE$$

(0.321)                      (0.743)

$$LEXP = 6.7623 LGDP$$

(0.881)

$$LAE = 1.7342 LGDP + 0.6413 LM2$$

(0.0773)                      (0.0532)

The estimated coefficient for the long-run effect of the variable in the question have the expected sign as Mohsin Khan predicted and sensible magnitude but not on the basis of monetary approach to the balance of payments theory. In the import equation, all estimated coefficient have the expected signs and one of them is significant at 5 and 1 percent level (aggregate expenditure). At the time that the net foreign assets have positive effect on the imports, the estimated coefficient is insignificant and imposes a very margin constraint on the change in imports. Aggregate nominal expenditure has positive effect on imports as expected in

the theory. It appears that to impose a large constraint on the change in imports.

Current nominal income has a positive effect on the change in the exports, and the estimated coefficient is significant at 1 and 5 percent level. Nominal income appears to impose a large constraint on the change in the exports.

In the aggregate expenditure equation, the estimated coefficients of the money stock and nominal income have the correct positive sign. However, the coefficients of current income and money stock are not significantly different from zero. This is an unusual result, particularly for current income, since it implies that neither consumption nor investment expenditure is influenced by current income. This may be due to a high degree of multi-co linearity between money stock and current income.

The co-integrated vector in table (4) constitutes a restricted long-run stationary relationship.

Table 4: A restricted long-run stationary relationship

List of variables included in the co integrating vector (LIM      LEXP      LM2      LNFA      LAE      LGDP)			
List of imposed restriction(s) on co integrating vectors: a1=1 a2=0 a3=0 b1=0 b2=1; b3=0 c1=0; c2=0 c5=1; a6=0; b4=0 a6=0; b4=0 ;b5=0 ; c4=0			
	<i>Vector 1</i>	<i>Vector 2</i>	<i>Vector 3</i>
IM	1.0000 (none)	.0000 (none)	.0000 (none)
EXP	.0000 (none)	1.0000 (none)	.0000 (none)
M2	.0000 (none)	.0000 (none)	1.051 (0.09)
NFA	.021 (.0543)	.0000 (none)	0000 (none)
AE	1.32 (.6521)	.0000 (none)	1.0000 (none)
GDP	.0000 (none)	3.221 (. 562)	2.91 (0.213)

Source: researcher e - views.

$$\text{LIM} = 0.021\text{LNFA} + 1.32\text{LAE}$$

(0.0543)      (0.652)

$$\text{LEXP} = 3.221\text{LGDP}$$

(0.562)

$$\text{LAE} = 2.91\text{LGDP} + 1.051\text{LM2}$$

(0.0213)      (0.091)

The restricted co-integrated vector confirms the result of unrestricted vector in addition to that all the significant coefficients transfer to be non significant.

### SHORT RUN DYNAMICS: THE ERROR CORRECTION MODEL (ECM)

The results of the short-run dynamic are reported in the following equations

$$\text{DLIM} = -0.892 + 0.0522 \text{DNFA} + 0.6632 \text{DLAE} - 0.551 \text{ECMM}$$

$$\text{DLEXP} = -0.4312 + 0.3817 \text{DLGDP} - 0.156781 \text{ECMX}$$

$$\text{DLAE} = 0.13785 + 0.2563 \text{DLGDP1} + 0.20807 \text{DLM} - 0.724 \text{ECME}$$

The system is estimated by simultaneous equation model. This estimation is based on

the first differences, one lagged. The error-correction term is negative and statistically significant at the 5 percent for ECMM, ECMX while is significant at 10 percent for the ECME. The error-correction term is statistically significant and has the expected negative sign. The coefficient gives a measure of the average at which imports, exports and aggregate expenditure adjust to change in equilibrium conditions. The absolute value of the error-correction term indicates that about **55 percent, 15 percent and 72 percent** adjustment of imports, export and aggregate expenditure respectively occur in the first year after the change in the regressors variable under consideration. The coefficients of regressors of three equations (ECM) are significant at 5 and 10 percent level except the coefficient of DNFA and constant of AE equation. These coefficients show how the speed of adjustment may differ depending on the source of the shock. In the ECM, aggregate expenditure effect on the changes in imports

is larger than all coefficients **66 percent** following by the effect of GDP on the changes in exports **38 percent** and lastly the effect of GDP **25 percent** and money supply **20 percent** on the changes in aggregate expenditure.

From the above result we reached the following facts:

-The aggregate expenditure is considered to be the most effective variable on the change of the import (balance of payments) where the effective ratio reached about **66 percent** in the model of error correction with direct relation.

-The gross domestic product is considered to be second effective variable, (after the aggregate expenditure) on the balance of payments, the effective ratio reached **38 percent** on the export in the model of error correction with direct relation.

-From the above mentioned result we can prove the first hypothesis of the study which stated that: the gross domestic product and aggregate expenditure were the actual monetary variables which affect the performance of the balance of payments in Sudan during the period (1989-2009).

-The effect of the gross domestic product and the money supply reached **25 percent** and **20 percent** respectively, on the equation aggregate expenditure in the error correction model with direct relationship.

- The equation of the aggregate expenditure showed a direct relationship with the money supply where increasing the domestic assets will lead to increase on the aggregate expenditure, increase on the import, decrease of the export; and decrease in the nominal income and deterioration on the performance of the balance of payments.

- Also from the above mentioned result we can prove the second hypothesis of the study which assumed that the net increase in the domestic assets will lead to (an expansion in monetary policy) this would tend to worsen

the balance of payments position in Sudan during the period (1989-2009).

## CONCLUSION

To reduce balance of payments deficits, the International Monetary fund asks the countries to control domestic credit creation and to reduce budget deficits. The best way to assess this recommendation is to test the monetary approach to balance of payments. In our study we tested this approach by using reserves flow equation (Mohsin Khan Model). We estimate this model by co integration and error-correction modeling using annual data over period 1989 - 2009.

## RESULT

The study main result includes the following:

1- The (GDP) and the aggregate expenditure are the real monetary variables which affect the behaviour of (BOP) in Sudan.

2- Adopting an expansionary monetary policy will affect negatively the performance of BOP in the short run.

3- Most parameters of the example of studies had their expected signs.

4- All The variables of the study suffer from nonstationary on the data of time series.

5- The co-integration analysis showed that all variables are integrative.

## RECOMMENDATION

The study main recommendations include:

1- The government should finance its budget deficit from real resources instead of resorting to bank of Sudan to fill in the gap by printing money, as this policy may increase liquidity and money supply. and affect negatively inflation rate and balance of payment position.

2- Adoption of policies that one directed towards controlling money supply and inflation rate in the economy, which in turn would lead to stability in Sudan's exchange rate.

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