

# Causes of Inflation In The Sudan: An Empirical Analysis

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## Abstract

*The objective of this study is to analyze the factors that led to inflation in the Sudan by applying the cointegration<sup>1</sup> model over the period 1994-2016. The ADF results show that all variables stationary at first difference except the GDP. The finding of the study show long run equilibrium between the variables. The result shows that a one-percentage appreciation of nominal exchange rate causes inflation to fall while a similar increase in money supply or in real GDP causes inflation to rise. A one-percentage increase in openness of the economy will not cause an increase in domestic inflation.*

**Keywords:** *inflation, money supply , exchange rate, cointegration.*

## Introduction

The history of the Sudan economy from its independence to the present witnesses fluctuations of the trend of the economy . During 1950s and 1960s the economy grew at increasing rate and inflation and exchange rate were stable. During (1970-2000) Sudan faced many macroeconomic disequilibrium. The growth rate of GDP fluctuated widely and, in some times, turned into negative.

Since the discoveries of oil in 1999 up until 2010(the oil boom period) the country has witnessed an improvement in the economy

After the secession of South Sudan in 2011the Sudan had experienced severe difficulties and had lost most of oil production and half of its fiscal and about two- thirds of its international payments. However , the impact of the secession and of the lack of agreement on oil transit fees are negatively affecting economy activities, causing serious economic disequilibrium

Throughout the past few years Sudan has been facing shortage of foreign currency and an increasingly black market for foreign currency and as a result the Sudanese pound deteriorated to the dollar on the black market. This has rendered the ability of the country to import the basic goods and medicines and made prices rising. The efforts made by the government to restore the economy have not been much successful yet .

## Literature Review

Understanding the sources of inflation is of utmost importance for policymakers in order to formulate effective policies which can control inflationary pressures without hindering growth of the economy. Economists do not agree about the sources of inflation in developing countries. According to the monetarist view, inflation is a purely monetary phenomenon and can be controlled by curbing excessive growth of money supply.

According to the quantity theory of money, under monetarist model, Milton Friedman (1969) said that excess supply of money in an economy leads to domestic inflation. That is, inflation is always and everywhere a monetary phenomenon and argued that the changes in overall price level are only brought about by the changes in monetary stock or money supply.

On the other hand, structural theory of inflation has been put forward as an explanation of inflation in the developing countries, structuralists argue that inflation is caused by four structural rigidities foreign exchange bottlenecks; inelastic supply of food; the government budget constraint; and sectional disequilibria

Sudan 's inflation is caused by many factors. These factors either caused by internal or external factors. Sudan. Safi eldin (1979) examined inflation in Sudan over the period ( 1960-1978). He concluded that observed variations of inflation have been explained by four explanatory variables of monetarists model namely growth rate of money supply , growth rate of money supply lagged one year, growth rate of real GDP and rate of inflation lagged one year . Zakaria (1994) studied the impact of money supply on inflation in Sudan over the period (1989-94). His findings show that inflation in Sudan in not a monetary phenomenon. Ibrahim (1995) also examined the impact of money supply on inflation in Sudan during the period (1989-94). His findings reveal that monetary factors were not decisive in explaining inflation in Sudan. Ibrahim and Zakaria analysis of inflation in Sudan shows that inflation was mainly caused by cost- push factors.

Hussain (1986) studied inflation in the Sudan over the period (1967-1975) using annual data. The main result reveals that imported inflation is the most important variable in his study. Saeed (2004) examined inflation in the Sudan over the period 1980-2000. His study shows that money supply and exchange rate are the most important variables in explaining inflation in the Sudan and that inflation is mainly a fysical phenomenon

Kabbashi M. Suliman (2012) studied inflation in the Sudan over the period . The main results were that inflation in Sudan is determined in the long run by the exchange rate and foreign price. Inflation is also propagated in the short run by the pass-through from the exchange rate as well as from foreign price; the contemporaneous and lagged money growth; and by the deterioration in expectations. Mahran and Gangi (1996) examine the causes of inflation in the Sudan over the period 1971–1991 .The model was estimated by two-stage least squares method . The results reveal that government borrowing from the banking sector and the imported inflation contribute significantly to domestic price growth. In addition, the continuous depreciation in the free exchange rate is the most significant single variable contributing to inflation in Sudan . They concluded that expansion in credit made available to the private sector, which is mostly used for speculative purposes in the foreign exchange market has great influence on the free exchange rate.

Ahmed & Sharif (2015) studied inflation in the Sudan over the period (1977-2015). Their study assumed that inflation is determined by money supply, GDP, budget deficits, imported inflation and exchange rate. using . The study applied cointegration and error correction models to empirically examine long-run and short-run dynamics of the inflation. The study findings revealed that long run relationship between inflation and the explanatory variables and money supply is most important variable that responsible of inflation.

### **Research Methodology and data**

The objective of this study is to investigate the fundamental determinants of inflation in Sudan by applying the cointegration and error-correction model. The following model will be estimated as follows

$$INF = \beta_0 + \beta_1 MS + \beta_2 GDP + \beta_3 EXR + \beta_4 OPN + \mu$$

Where,

INF = inflation

MS = money supply

EXR = exchange rate

GDP = real GDP

OPN = openness of the economy

$\mu$  = Error that obtained from the data that collected

$\beta_0$  = Intercept

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$\beta_0$  = Intercept

$\beta_1$  ,  $\beta_2$  ,  $\beta_3$  and ,  $\beta_4$  = Partial coefficient to MS, GDP, EXR and OPN.

Based on this econometric model, the dependent variable is inflation and the independent variables are money supply, exchange rate, real GDP and openness of the economy

### Unit Root / Stationary Test

Prior to conducting the cointegration test, the series are subjected to unit root tests to make sure that they are stationary. The Augmented Dickey-Fuller unit root tests were employed. The study tests the variables for the time series 8 properties of stationary using the Augmented Dickey-Fuller (ADF) test. A time series that is not stationary is known as a series that contains unit root and it can be made stationary by differencing . The result of the Augmented Dickey Fuller (ADF) test is presented in Table (1). The table reports the no unit root test results for the series in their level and first difference forms considering the constant and trend option. The ADF results show that all variables stationary at first difference except the GDP integrated in level.

**Table (1) Stationary Test**

variable	CONSTANT		Order of Integration
	Level p.valve	First Diff p.valve	
gdp	0.0393	0.3357	I(0)
exr	0.9086	0.0090	I(1)
inf	0.7826	0.0000	I(1)
logms	0.2978	0.0028	I(1)
opn	0.9102	0.0021	I(1)

### Lag Selection Structure

Table (2) presents lag order selection result on the variables considered in this study. The lag length selection criteria of the VAR start with the specification of maximum lag of 2.. Based on the sequential modified FPE test statistic AIC and HQ, we considered the lag length of 2 as the optimal lag length.

**Table (2)** lag order selection result

VAR Lag Order Selection Criteria						
Endogenous variables: INF GDP EXR MS OPN						
Exogenous variables: C						
Date: 05/01/19 Time: 23:34						
Sample: 1994 2016						
Included observations: 21						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-480.2344	NA	8.09e+13	46.21280	46.46149	46.26677
1	-365.0935	164.4870*	1.64e+10	37.62795	39.12012*	37.95179
2	-332.5839	30.96144	1.32e+10*	36.91276*	39.64841	37.50646*
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

**Cointegration Test**

Table (3) presents cointegration test result on inflation and GDP , EXR,MS and OPN. The test statistic indicates that the hypothesis of co-integration (Ho) among the variables can be rejected. It shows that there is at most 1 cointegrating relation in our model, p.value = 0.0052. One cointegrating relation is enough to prove that long-run relationship exists in the model. This implies that the study can proceed to estimating VECM model and the impulse response analysis to see the effectiveness of that variables on the inflation variability in Sudan .

**Table (3) Cointegration Test**

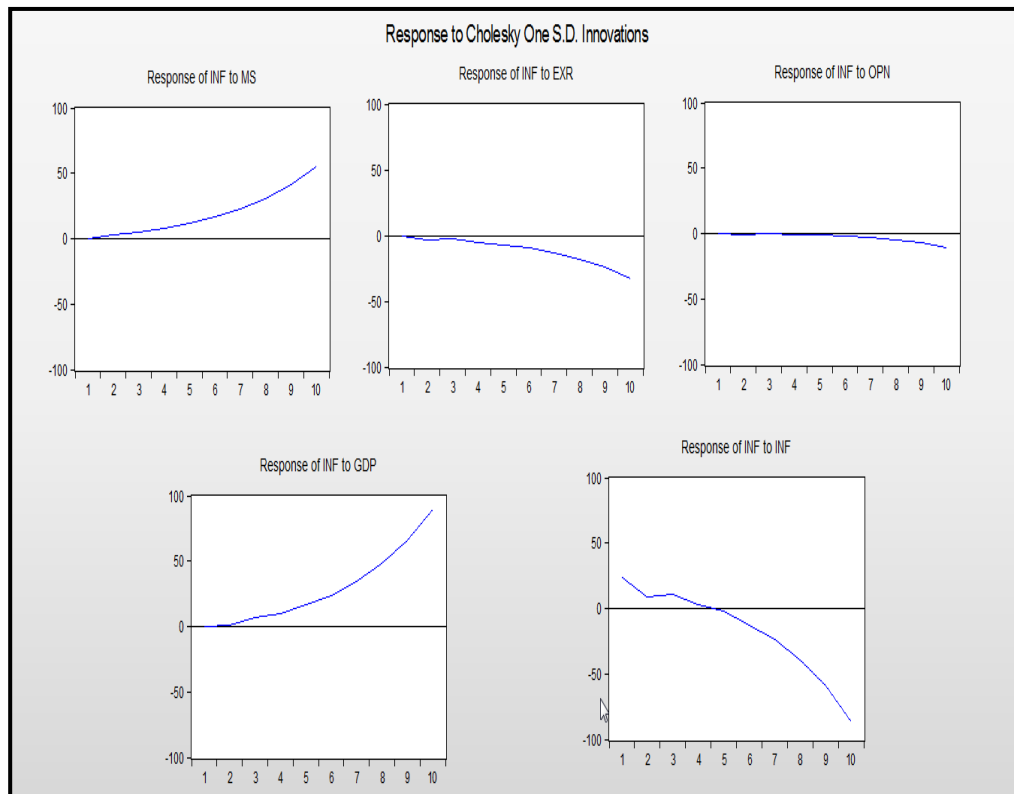
Sample (adjusted): 1996 2016				
Included observations: 21 after adjustments				
Trend assumption: Linear deterministic trend				
Series: INF GDP EXR MS OPN				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.806389	80.71818	69.81889	0.0052
At most 1	0.554676	46.23818	47.85613	0.0704
At most 2	0.484710	29.25018	29.79707	0.0577
At most 3	0.373738	15.32665	15.49471	0.0530
At most 4 *	0.230377	5.498951	3.841466	0.0190
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

**The impulse response analysis**

The 10-year impulse response functions presented in Figure 1 describes the response of domestic inflation to an initial shock of one standard deviation (S.D) to other variables. A shock in any variable is expected to exert a permanent and long-lasting effect on the system, which gradually adjusts to a new equilibrium. In this respect, the Figure traces out the

impact effect of a one-percentage increase in nominal exchange rate, M2, real GDP and Openness of the economy. For example, a one-percentage appreciation of nominal exchange rate causes inflation to fall while a similar increase in M2 or in real GDP causes inflation to rise. A one-percentage increase in openness of the economy will not cause an increase in domestic inflation. These findings are consistent with those reported by Moriyama (2008)

**Figure (1) The impulse response analysis**



### **Diagnostic Test Result:**

The model is also examined by applying Residual Serial Correlation LM Tests with the null hypothesis of no serial correlation no residual autocorrelations at/up to lag h, and Residual heteroscedasticity Tests with the null hypothesis of no heteroscedasticity in the error term and the results are presented in Table( 4) and table (5). The results of LM Test for Serial Correlation or Portmanteau test for Autocorrelation indicate the absence of serial correlation or autocorrelation in the residual at lag 12. Heteroscedasticity test result (chi-square = 188.0074; p.value = 0.3260) suggests the acceptance of the null hypothesis implying that of no heteroscedasticity in the error term.

Table (4) Diagnostic Test Results - a

VEC Residual Serial Correlation LM Test		
Null Hypothesis: no serial correlation ...		
Date: 05/01/19 Time: 23:56		
Sample: 1994 2016		
Included observations: 21		
Lags	LM-Stat	Prob
1	12.27601	0.9842
2	33.30126	0.1237
3	16.03787	0.9137
4	27.59878	0.3267
5	37.78045	0.0486
6	19.69832	0.7625
7	25.69093	0.4242
8	31.76262	0.1650
9	40.94314	0.0233
10	24.90299	0.4678
11	23.71153	0.5361
12	21.33511	0.6738
Probs from chi-square with 25 df.		

Table (5) Diagnostic Test Results – a

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)		
Date: 05/01/19 Time: 23:57		
Sample: 1994 2016		
Included observations: 21		
Joint test:		
Chi-sq	df	Prob.
188.0074	180	0.3260

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The main objective of this study is to examine the fundamental factors that contributed to inflation in the Sudan by applying the cointegration model on annual data over the period 1994-2016. The study tests the variables using the Augmented Dickey-Fuller (ADF) test.

The ADF results evidently show that all variables stationary at first difference except the GDP integrated at level. However, prior to conducting the cointegration test, the Akaike information criterion (AIC), HQ and Schwarz Bayesian criterion (SBC) were employed for the lag selection. Based on the sequential modified FPE test statistic AIC and HQ, we considered the lag length of 2 as the optimal lag length.

Test results for Serial Correlation or Portmanteau Tests for Autocorrelation indicate the absence of serial correlation or autocorrelation in the residual at lag 12. The obtained results suggest the existence of the long-run in the model. The 10-year impulse response is conducted. The result shows that a one-percentage appreciation of nominal exchange rate causes inflation to fall while a similar increase in M2 or in real GDP causes inflation to rise. A one-percentage increase in openness of the economy will not cause an increase in domestic inflation. The study recommends control of money supply and stability of exchange rate. Since budget deficit financing is an important factor that responsible for growth of the money in many developing countries, curbing inflation requires avoiding financing budget deficit by money printing. Finally, Central Bank of Sudan should have to adopt a monetary and fiscal policy that targets inflation.

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