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THE IMPACT OF STRUCTURAL DISEQUILIBRIUM ON INFLATION IN THE SUDAN (1994-2016)

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Abstract

The main objective of this study is to examine the factors that contributed to inflation in the Sudan by applying the cointegration model on annual data over the period 1994-2016. The study tested the variables for the time series 8 properties of stationary 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. LM Test for Serial Correlation or Portmanteau Test for Autocorrelation indicates the absence of serial correlation or autocorrelation in the residual at lag 12. The 10-year impulse response is also conducted .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, impulse response

INTRODUCTION

The evolution of the Sudan economy from its independence to the present shows fluctuations of the trend of the economy. During 1950s and 1960s the economy grew at increasing rate and inflation and exchange rate were stable. Since independence up to 1970s one Sudanese pound was equivalent to 3$. During (1970-2000) Sudan faced many macroeconomic disequilibrium . The growth rate of GDP fluctuated widely and in some years turned into negative. On the internal side , there had been an increasing fiscal deficit that had led to inflationary pressure .

On the external side ,there was an increasing balance of payment deficit that led to domestic inflation and accumulation of foreign debts.

Since the discoveries of oil in 1999 up until 2010(the oil boom period) the country witnessed a radical improvement when it began to export crude oil. For nearly a decade, the economy boomed, driven by rising oil production and prices and significant inflows of foreign direct investment related to the oil sector. The pre-secession Sudan was one of the fastest-growing oil-led economies in Africa until the advent of the global financial and economic crisis in 2007. Real GDP growth, which had been increasing at a declining rate, from its peak of 10.9 percent in 2007 to its low of about 5 percent in 2010 further decelerated to 2.5 percent and 1.4 percent in 2011.

After the secession of South Sudan in 201 1the Sudan had experienced severe difficulties and had lost three quarters of oil production and half of its fiscal and about two-thirds of its international payments. The IMF has noted that the secession has left the country facing “daunting challenges”. The sudden loss of oil income led to rising inflation, soaring food prices and a weakened currency. 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 and increasing hardship for the population, in particular for the poor. According to IMF 2012 "the secession of South Sudan in July 2011 resulted in a major permanent external shock to Sudan, leading to a deterioration in economic condition similar to that of the early 1990s. and hit the real sector as well as the fiscal and external sector and left Sudan with roughly half of its previous fiscal revenues and a third of export proceeds".

According to the World Bank current account in Sudan , after a substantial surplus of US$ 2.7 billion during Jan-June 2011 prior to the secession, the current account balance drastically turned into a large deficit of US$ 1.2 billion during July-September 2011, and further aggravated into a US$ 1.5 billion deficit during October-December 2011, due to the loss of oil exports. The loss of oil revenue and increasing uncertainty over the economic prospects have been putting significant depreciation pressure on the local currency, and foreign exchange reserves have been dwindling

Throughout the past few years Sudan has been facing shortage of foreign currency and an increasingly expensive black market for foreign currency and as a result the Sudanese pound weakened 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 severe downturn comes despite the United States has lifted 20-year old economic sanctions, a move that was expected to help Sudan to restore its deteriorating economy .But Demand for hard currency—in the form

of US dollars—has surged, crippling the value of the Sudanese pound and eroding the purchasing power of most ordinary Sudanese..

The efforts taken by the government to restore the economy have not been much successful yet in tackling the deteriorating economic situation, and the substantial loss of oil revenues is now being translated into serious external and internal deficits i.e. austerity measures brought in to help address this situation have in turn, further ignited inflation, forcing prices to soar further. The aim of this study is to investigate the fundamental structural factors that contributed to inflation in Sudan over period (1994-2016).

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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 compromising growth of the economy. Economists disagree about the sources of inflation in developing countries. This debate pitches the supporters of monetarist approach to inflation against those who argue that inflation results from structural rigidities. According to the monetarist view, given stable demand for money, 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) the father of monetarism and Nobel laureate in economics 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 especially of Latin America. The well-known economists, Myrdal and Straiten who have proposed this theory have analyzed inflation in these developing countries in terms of structural features of their economies. Kirkpatrick and Nixon have generalized this structural theory of inflation as an explanation of inflation prevailing in all developing countries. Therefore, structuralists argue that inflation is caused by four structural rigidities foreign exchange bottlenecks; inelastic supply of food; the government budget constraint; and sectional disequilibria

Over the last five years inflation became one of the problem facing Sudan economy. According to UNDP Sudan "general inflation has been on the rise since the second half of 2011 and reached 35.6 percent by the end of 2012. The food component, which accounted on average for 53 percent of household expenditure, drives overall inflation in Sudan followed by housing (14 percent) and transport (eight percent)".

Sudan's inflation is caused by many factors. These factors either caused by internal or external factors. These factors are divided into monetary and non-monetary factors as well. Under the monetary factors, the money supply is one of the economic factors that caused inflation in Sudan. Safi eldin (1979) examined inflation in Sudan over the period (1960-1978). His statistical analyses of inflation has shown that the 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. Safieldin concluded that monetarist model performed very well in explaining inflation in Sudan over the said period. Zakaria (1994) studied the impact of money supply on inflation in Sudan over the period (1989-94). His study concluded 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 fiscal phenomenon

Abdel-Rahman (1997) uses a variant of the autoregressive distributed lag (ADL) model for money (M1), price (CPI) and real GDP, along with a set of deterministic variables—these are impulse and interaction dummies. The results of the estimation of the model over the period 1970–1994 using annual data in rates of growth indicate that nominal money correlates positively with inflation in an almost one-to-one basis, whereas real output serves to depress inflation. However, the diagnostic tests indicate the presence of the ARCH effect, and the cumulative sum of residuals shows a number of possible breakpoints. The re-estimation of the model, with interaction dummies included, in error correction form improves the fit and confirms the depressing effect of income regardless of the breaks. While nominal money was found to be insignificant before 1982, its effect has increased sharply since then

Marial Awou studied (2010) inflation in Sudan over the period 1970-2008 .The study aims to identify the fundamental determinants of inflation and examine the direction of causality among the variables. The study applies the cointegration and error correction model on annual data from Sudan over period 1970- 2008. The results can be summarized as follows: first, the series were found to be stationary at the first difference and bound by at least two cointegrating relations. Second, the results of the long run model indicate that all the included variables carry

correct 38 signs and significant at least at the 5% level except the coefficient of nominal exchange rate. The elasticity of domestic inflation with respect to foreign inflation and real output growth are the largest, respectively, implying that these are the most influential determinants of domestic inflation in the Sudan, reinforcing the growing fear that inflation in Sudan is both cost-push and demand pull phenomenon in the long run.

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. His study suggest that the policy of defending the exchange rate reform, although it contributed to bringing inflation down, may not be sustainable in the long run due to the sluggish adjustment of the real exchange rate towards equilibrium, the authorities need to develop sound indirect monetary instruments to supplement the policy of exchange rate anchoring .He concluding that fighting inflation depends on the ability of policy to reduce the effects of supply shocks emanating from droughts and foreign price movements as reflected in the costs of imported inputs.

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. 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.

Rabiul Islam, Ahmad Bashawir and others (2017) examined Inflation in Malaysia. they found that inflation is a major problem everywhere and it will not only affect a country's economic growth but, will affect the CPI, labor market, investors on investment and etc. The study recommends that the government should try to decrease the unnecessary expenditure on non-development activities in order to overcome the problem of high inflation in Malaysia..

RESEARCH METHODOLOGY

The objective of this study is to investigate the fundamental determinants of inflation in Sudan by applying the cointegration and error-correction model on annual data over period 1994-2016. The empirical analysis is carried out using annual data from Sudan on domestic nominal money supply (MS), real GDP (GDP) nominal exchange rates (EXR), consumer price index (INF) and openness of the economy (OPN). The data were obtained from the Central Bank of Sudan and the IMF International Financial Statistics (IFS) database. Based on the economic and econometric literature, the following model will be estimated as follows-

$INF = ß0 + ß1\ MS + ß2\ GDP + ß3\ EXR + ß4\ OPN + \mu$

Where,

INF = inflation

MS = money supply

EXR = exchange rate

GDP = real GDP

OPN = openness of the economy

μ = Error that obtained from the data that collected

ß0= Intercept

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ß0 = Intercept

ß1 , ß2 , ß3 and , ß4 = 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

ANALYSIS AND RESULTS

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 for that purpose. 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 unit root tests based on 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 evidently show that all variables stationary at first difference except the GDP integrated in level.

Table (1) Stationary Test

Variable	CONSTANT		Order of Integration
	Level	First Diff	
	p.valve	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. An asterisk indicates the selected lag from each column of the criterion statistic. 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)

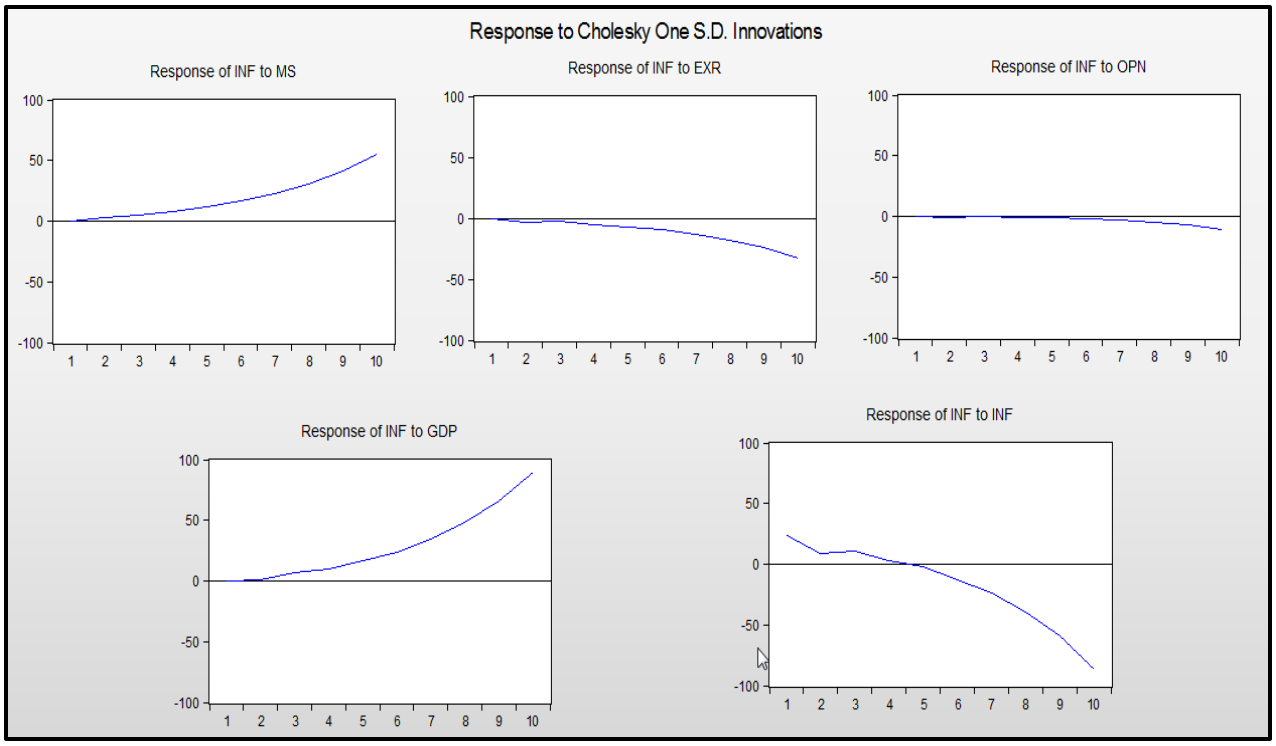
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.806389	80.71818	69.81889	0.0052
At most 1	0.554676	46.23818	47.85613	0.0704
At most 2	0.484710	29.25018	29.79707	0.0577
At most 3	0.373738	15.32665	15.49471	0.0530
At most 4 *	0.230377	5.498951	3.841466	0.0190

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 T...
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 - b

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 investigate 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 for the time series 8 properties of stationary 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.

This study examined inflation on the Sudan over the period 1994-2016. In 2019, new government was formed and economic embargo on Sudan is expected to be lifted. Therefore, further study of inflation is needed because causes and trends of inflation are expected to change.

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