



Assessment of some economic factors affecting inflation in Sudan: An econometric study

Almahdi Musa Attahir Musa *

Department of Econometrics and Social Statistics. Economics College, University of Bakht Al -Ruda, Sudan.

Open Access Research Journal of Engineering and Technology, 2023, 05(01), 022–029

Publication history: Received on 17 June 2023; revised on 26 August 2023; accepted on 29 August 2023

Article DOI: <https://doi.org/10.53022/oarjet.2023.5.1.0066>

Abstract

The paper aimed to Assessment of Some Economic Factors Affecting Inflation in Sudan; an econometric study (1996-2021). The study focused on the exchange rate (EX), the unemployment rate (UR), and the money supply (MS). The study is based on the following main hypotheses: There is a positive effect between the inflation rate (INF), the exchange rate (EX), and the money supply (MS), and that there is a negative effect between (INF) and (UR). The study revealed the following conclusions: The devaluation of the currency exchange rate leads to an increase in the inflation rate, but the increase in the unemployment rate leads to a decrease in the inflation rate in Sudan. The study recommended that the state adopt an effective fiscal and monetary policy to reduce the rate of inflation in order to increase the employment rate and improve the level of the country's national product.

Keywords: Inflation Determinants; Exchange Rate; Monetary Supply; Sudan

1. Introduction

Inflation is that too much money chasing too few goods, and it is the constant rise in prices. On the other hand, a moderate level of inflation characterizes a good economy and if the rate of inflation is in the range 2 to 3%, then it is inflation Good for the economy because it encourages people to buy And borrowing, in times of low inflation goes down The interest rate will benefit consumers by purchasing goods and services and enhancing welfare, while high inflation makes it difficult for consumers to buy Commodities in daily life leading to decline The functioning of the market economy [2]. The study attempts to evaluate the determinants of inflation in Sudan from building econometric model that include the rate of inflation was a dependent variable and each of the exchange rate, unemployment and money supply as independent variables and relying on annual data obtained from the Central Bank of Sudan, the Central Statistical bureau and the Ministry of Finance and National Economy. The study contains the theoretical framework, the analytical framework, results and recommendations [1],[2].

2. Empirical Studies

Dhakal, et al (1994) investigates major determinants of the inflation rate in the United States. For this investigation, we use a vector autoregressive model that includes major variables interacting with the price level in the macro economy. Our results suggest that changes in the money supply, the wage rate, the budget deficit and energy prices are important determinants of the inflation rate in the United States. Further, the relative contribution of these factors to the variance of the forecast error of the price level is consistent with a more dominant impact for monetary changes on the inflation rate. This presents a channel through which Fed officials can counter successfully demand and supply shocks that have potential inflationary effects on the United States economy.

(Iya, I.B. and Aminu, U., 2014) investigates the determinants of inflation in Nigeria (1980-2012). The import results of Causality suggested causation between inflation and some of the included variables. The Johansen cointegration result

* Corresponding author: Almahdi Musa Attahir Musa

shows that there existed long run relationship between inflation and the included variables. The VEC error correction result also confirmed the existence of long run relationship between the variables of the model with only money supply and exchange rate causing interest rate. The OLS results revealed that money supply and interest rate influenced inflation positively, while government expenditure and exchange rate influenced inflation negatively. Therefore, a good performance of the economy in terms of price stability may therefore, be achieved by reducing money supply and interest rate and also increasing government expenditure and exchange rate in the country. A major policy implication of this study is that concerted effort should be made by policy makers to stabilize prices (inflation) by reducing money supply and interest rate as well as increasing government expenditure and exchange rate; most importantly increasing exchange rate and reducing interest rate. (Lim and Sek, 2015) Examines factors affecting inflation in two groups of countries (high inflation group and low inflation group) using annual data from 1970 - 2011.

Jaka Sriyana (2018) analyzes the determinants of inflation rate in the local economy. It uses co-integration and vector error correction to capture the long and short run relationship between inflation rate and other economic variables. We find that the determinants of inflation rate in Yogyakarta are minimum wage, economic growth, and monetary variables indicated by BI-rate. More finding, exchange rate also contributes to the price change. This research finds evidence of long-run causality between minimum wage and inflation and unidirectional relationship from wage to inflation in the short run. This finding confirms the proposition of non-neutrality wage on price changes. The inflation rate in the local economy depends not only on the regional indicator but also depends on international changes reflected in the exchange rate. Monetary variable indicated by BI- rate also partially contributes to the price changes at the local level. Overall, the local government has successfully managed the price changes.

(Al-Hassan, Tamadur Jaber Al-Bashir, 2017) They identified the factors affecting inflation in Sudan. The study concluded that there is a statistically significant relationship between the inflation rate and each of: real gross domestic product, exchange rate, money supply and government spending, and that the indicator of economic openness is ineffective and has been replaced by the variable of imports. The existence of a relationship in the long and short term between inflation and its factors. The study recommended controlling the parallel exchange rate to achieve balance in the exchange market.

(Attahir, Yousif, 2018) modeling the determinants of inflation in Sudan via GMM method for the period 2017-2000 to help in formulating an effective decreasing inflation rate policy. The paper focused on Gross Domestic Product (GDP), Government Expenditure (GE), Exchange Rate (EX), Consumer Price Index (CPI), Unemployment Rate (UR), and Money Supply (MS) as they are the most important determinants of inflation in Sudan. The paper is based on the following assumptions: the Gross Domestic Product, Unemployment Rate and Government Expenditure well effect negatively on inflation rate, and also there is effect positively between the Inflation Rate and Exchange Rate, Money Supply, and Consumer Price Index. The paper has reached the following conclusions: that the increase in money supply and Consumer Price Index lead to an increasing inflation rate. The reduction of the exchange rate leads to a high rate of inflation. However the increasing in Gross Domestic Product, Unemployment Rate, and Government Expenditure lead to decreasing inflation rate in Sudan. The Generalized Method of Moment is the best Method for estimating the determinants of inflation in Sudan. The paper recommended that the state should adopt effective financial and monetary policy for reducing the increasing in inflation rate and increased production for exporting. (Kinlaw, et al, 2022) apply a Hidden Markov Model to identify regimes of shifting inflation and then employ an attribution technique based on the Mahalanobis distance to identify the economic variables that determine the trajectory of inflation. Their analysis enables policymakers to focus on the most effective tools to manage inflation, and it offers guidance to investors whose strategies might benefit from knowledge of the prevailing determinants of inflation. Their analysis reveals that as of February 2022, the most important determinant of the recent spike in inflation was spending by the federal government.

(Owusu, 2020) conducted based on three main objectives. Firstly, to investigate determinants of inflation using Granger causality approach. The second objective of this study was to determine the impulse reactions of government expenditure, exchange rate, population, broad money, and crude oil prices to inflationary shocks using impulse response analysis. Finally, the study sought to ascertain the proportion of variability in inflation that is caused by the independent variables using variance decomposition analysis. Data spanning 1990 to 2018 were used to run the autoregressive distributed lag (ARDL) model and the results were reported. The findings from Granger causality tests show that, population and government expenditure determine inflation in both the short-and long-run. Another finding from the impulse response analysis reveal that the exchange rate, broad money supply, and population react negatively to inflationary shocks in the long-term while government expenditure and crude oil prices react positively to inflationary shocks in the long-term. In addition, the variance decomposition analysis shows that inflation explains about 80% of the variability in itself and 20% was explained by government expenditure, the exchange rate, population, broad money, and crude oil prices. Based on these findings, the study recommends that in order to control inflation, government should pay attention to both population and government expenditure.

All of the above empirical studies and theses were aimed at To study the determinants of inflation, no one has attempted to evaluate them Factors affecting inflation that can help in the design of an economic policy that stimulates economic growth, Therefore, this study seeks to evaluate some of the factors affecting inflation in Sudan.

3. Inflation

Inflation occurs when there is a significant increase in the prices of goods and services, not just individual items; this means that you can buy fewer goods for one euro today than you could yesterday. In other words, inflation reduces the value of a currency over time. During the 1970s, the government of Sudan compiled monthly data on consumer prices, based on data collected in the capital area's three cities, Omdurman, Khartoum, and Khartoum North. At the beginning of the 1970s, annual inflation was moderate, between 9 and 10 percent [2]. From 1973 onward, the inflation rate grew because of continuing worldwide inflation, an increase in the money supply resulting from the central government's deficit financing and from borrowing by state corporations, shortages of consumer goods, problems of supply caused by transport deficiencies, and increased private-sector borrowing. By 1989 prices were increasing by 74 percent annually. Inflationary pressures continued into the 1990s. Prices increased by more than 100 percent a year during 1991–94, with the rate reaching a high of 130 percent in 1996 [2]. Implementation of the International Monetary Fund reform program in 1997, along with monetary reforms of the central bank and declining prices of imported non-oil commodities and manufactured goods, slowed inflation to less than 47 percent in that year, less than 20 percent in 1998 and 1999, and to single digits by 2000 [2]. Inflation was 7.2 percent in 2006. Although other countries in the region experienced recession-led declines in inflation in 2009, a surge in prices in the final months of that year pushed the rate of inflation in Sudan to an annual average of 11.2 percent and to 13 percent in 2010, Prices continued to rise, and the inflation rate reached (18.1) in 2011, then continued to rise until it reached (382.8) percent in 2021 [9],[11].

4. The Unemployment Rate

The unemployed are people of working age who are without work, are available for work, and have taken specific steps to find work. The uniform application of this definition results in estimates of unemployment rates that are more internationally comparable than estimates based on national definitions of unemployment. This indicator is measured in numbers of unemployed people as a percentage of the labour force and it is seasonally adjusted. The labour force is defined as the total number of unemployed people plus those in employment. Data are based on labour force surveys (LFS). For European Union countries where monthly LFS information is not available, the monthly unemployed figures are estimated by Eurostat. Unemployment rate can be defined by either the national definition, the ILO harmonized definition, or the OECD harmonized definition [3]. The OECD harmonized unemployment rate gives the number of unemployed persons as a percentage of the labor force (the total number of people employed plus unemployed). [OECD Main Economic Indicators, OECD, monthly] As defined by the International Labour Organization, "unemployed workers" are those who are currently not working but are willing and able to work for pay, currently available to work, and have actively searched for work. In 2021, unemployment rate for Sudan was 28.3 %. Unemployment rate of Sudan increased from 15.9 % in 2002 to 28.3 % in 2021 growing at an average annual rate of 3.65% [8],[10].

5. Money supply

Money supply means the total means of payment circulating in an economy during a specific period of time. Monetary basis: means the source money issued by the central bank only other than the money supply which is controlled by factors other than the central bank, Economists used to define several definitions of money supply, the most important of which are the following [4], [5],[6] ,[8]:

- **Narrow money supply (M1):** is all the physical or liquid form of money circulating in an economy. Typical examples of money that fall under this category include paper currency, coins, demand deposits, and other checkable deposits. It is a key indicator of money supply in an economy and hence paves the way for determining a nation's economic performance. Its primary advantage is that it facilitates immediate monetary transactions and hence is a key measure of the purchasing power of people in an economy. Tracking narrow money helps authorities regulate the overall money supply in the economy through its monetary policies. Narrow money is just one end of the total money supply spectrum. The other is broad money which includes less liquid financial assets.
- **Money Supply (M2):** is the U.S. Federal Reserve's estimate of the total money supply including all of the cash people have on hand plus all of the money deposited in checking accounts, savings accounts, and other short-term saving vehicles such as certificates of deposit (CDs). Retirement account balances and time deposits above \$100,000 are omitted from M2. The Federal Reserve tracks a separate money supply number, called M1, that

includes currency that is in people's pockets or in checking accounts. The money that is deposited in savings accounts, certificates of deposit, and money market funds is not counted in M1. For the Fed's purposes, this is "near money." That is, the funds cannot be used as a medium of exchange and they are not instantly convertible to cash [6], [8].

- **Money Supply (M3):** is a measure of the money supply that includes M2 as well as large time deposits, institutional money market funds, short-term repurchase agreements (repo), and larger liquid assets. Broad money (M3) includes currency, deposits with an agreed maturity of up to two years, deposits redeemable at notice of up to three months and repurchase agreements, money market fund shares/units and debt securities up to two years [8]. M3 is measured as a seasonally adjusted index based on 2015=100.
- **Money Supply in Sudan:** Money Supply M2 in Sudan averaged 483031.21 SDG Million from 2001 until 2023, reaching an all-time high of 5058727.00 SDG Million in February of 2023 and a record low of 4269.00 SDG Million in November of 2001 [7].
- **Empirical Evidence**
Appendix (1) shows the descriptive statistics of inflation Rate (INF), Unemployment Rate (UN), exchange rate (EX) and Money Supply (Ms). Table (1) shows the results of unit roots for root tests based on the ADF and PP Test where (INF), (UN), (EX) and (Ms) are stationary with an intercept in level, 1st difference and 2nt difference. Table (2) shows Johansson Co Integration Test, Trace test indicates 2 co integrating eqn (s) at the 0.05 level, indicates the presence of four equations among these variables at a 5% significance level i.e. Annex (3) Model Output and Annex (2) shows the Graph of the study Variable.
- **Stability Test**
Results of the practical application of the stability test according to the study data (Inflation Rate, exchange rate and unemployment rate) (1997 - 2021);
- **Model Specification**

$$INF_t = \alpha_0 + \beta_1 UN_t + \beta_2 EX_t + \beta_3 MS_t + \xi_t$$

Where:

INF : Inflation rate.

UN : Unemployment rate.

EX : Exchange rate.

MS : Money Supply.

α : Constant.

$\beta_1, \beta_2, \beta_3$: Parameters.

ξ : Random error.

t : Time period.

Model Estimation

$$INF_t = 168.32 + 9.72 UN_t - 0.01 EX_t + 132.8 MS_t$$

Std. Error (36.4) (2.4) (0.00) (28.1)

$R^2=0.78$

$F=17.45$

$F(Prop)=(0.000)$

$DW=1.59$

Table 1 Dickey Fuller & Philips Peron tests for Inflation, Unemployment, Exchange and Money Supply

Variables	Dickey Fuller Test			Philips Peron test		
	level	1df	2df	level	1df	2df
Inflation Rate	0.000	0.000	0.0000	0.0000	0.0000	0.000
Unemployment Rate	0.000	0.000	0.0000	0.0000	0.0000	0.000
Exchange Rate	0.000	0.000	0.0000	0.0000	0.0000	0.000
Money Supply	0.000	0.000	0.0000	0.0000	0.0000	0.000

Table (1) Shows that the value of ADF is greater than 1%, meaning that the inflation rate variable is stable at the level, first difference, and second difference, the ADF value of the Unemployment Rate was greater than 1%, meaning that the Unemployment Rate was stable at the level, first difference, and second difference . The ADF value of Exchange Rate was greater than 1%, meaning that the exchange rate variable is stable at the level, first difference, and second difference, and the ADF value of Money Supply was greater than 1%, meaning that Money Supply is stable at the level, first difference, and second difference.

Table 2 Johanson cointegration test

Date: 04/19/23 Time: 23:57				
Sample (adjusted): 1998 2021				
Included observations: 24 after adjustments				
Trend assumption: Linear deterministic trend				
Series: INF UR EX MS				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
	0.05	Trace		Hypothesized
Prob.**	Critical Value	Statistic	Eigenvalue	No. of CE(s)
0.0001	47.85613	69.75109	0.810598	None *
0.0497	29.79707	29.81788	0.543420	At most 1 *
0.2114	15.49471	11.00207	0.277369	At most 2
0.0734	3.841466	3.205509	0.125028	At most 3

Table (2) shows Johansson Co Integration Test, Trace test indicates 2 co integrating eqn (s) at the 0.05 level

Table 3 Estimation of the inflation model

Dependent Variable: INF				
Method: Least Squares				
Date: 04/19/23 Time: 23:37				
Sample (adjusted): 1997 2021				
Included observations: 25 after adjustments				
Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.0002	-4.625160	36.39862	168.3495	C
0.0005	4.132199	2.352721	9.721909	UR
0.0379	-2.223201	0.002769	-0.006155	EX
0.0002	4.581831	28.98145	132.7881	@PCH(MS)
0.0330	2.290420	5.02E-07	1.15E-06	MS(-1)
41.80800	Mean dependent var		0.777315	R-squared
77.05801	S.D. dependent var		0.732778	Adjusted R-squared
10.38417	Akaike info criterion		39.83399	S.E. of regression
10.62795	Schwarz criterion		31734.94	Sum squared resid
10.45179	Hannan-Quinn criter.		-124.8022	Log likelihood
1.593371	Durbin-Watson stat		17.45325	F-statistic
0.000003				Prob(F-statistic)

Annual data were used for the study variables for the period (1997-2021) and due to the nature of the dependent variable (qualitative), the linear model was used in the estimate by relying on the multiply regression through the Eviews-10 computer package, so the following estimated economic stability model was reached (Table (3)):

5.1. Economic criterion

The model fulfilled the economic criterion of the signal and magnitude of the estimated parameters.

5.2. Statistical Criterion

Individual significance (T-test): We find that the probability value of the model parameters (0.00, 0.00, 0.04, 0.00,0.003), respectively, is less than (0.05), and this indicates that all independent variables are important in explaining inflation rate in Sudan.

F-test: we note that the probability value of F (0.00) is less than (0.05), and this indicates that the model is significant and that the variables of UN, EX, and MS important variables in explaining Inflation in Sudan and that the estimated model can be applied.


(R-square): We find that the probability value of the coefficient of determination is (0.77) and this indicates that (77%) of the independent variables that explain economic stability in Sudan are present and included in the model, and that only (23%) are independent variables that explain economic stability, but they are not Inline in the model and inline in the random variable.

6. Conclusion

Evaluating some of the economic factors affecting inflation from an econometric study of view was one of the important issues in the development of economic policy. The study reached many conclusions, the most important of which are: The depreciation of the local currency exchange rate would lead to an increase inflation rate and thus an increase economic deterioration, and the steady increase in the unemployment rate leads to a decrease in the inflation rate in the Sudanese economy. Finally These results would benefit decision makers in working to reduce the inflation rate by creating job opportunities for graduates and supporting the local currency exchange rate depreciation through production.

References

- [1] Yen Chee Lim and Siok Kun Sek (2015) An Examination on the Determinants of Inflation, Journal of Economic Business and Management, Vol.3(7): 678-682 ISSN: 2301-3567, DOI: 10.7763/JOEBM.2015.V3.265
- [2] Almahdi M. Attahir M, Faroug M. Khalid Y. (2018) Modeling the Determinants of Inflation in Sudan using Generalized Method of Moments (2000-2017), International Journal of Information Research and Review Vol. 05, Issue, 02, p1.
- [3] Iya, I.B. and Aminu, U. (2014) An Empirical Analysis of the Determinants of Inflation in Nigeria, University of Technology, Yola, Adamawa State, Nigeria.
- [4] Jacqueline Darko Owusu (2020) An empirical investigation on the determinants of inflation in Ghana.
- [5] William Kinlaw, Mark Kritzman, Michael Metcalfe, and David Turkington, (2022) the Determinants of Inflation, MIT Sloan Research Paper No. 6730.
- [6] Jaka Sriyana (2018) Determinants of inflation rate in the local economy, Faculty of Economic and Business, University of Islam Negeri Syarif Hidayatullah Jakarta, Journal Economy, Volume 17, No.1, DOI: 10.15408/etk.v17i1.7146
- [7] Dharmendra Dhakal, Magda Kandil, Subhash C. Sharma, Paul B. Trescott (1994) Determinants of the inflation rate in the United States: A VAR investigation, the Quarterly Review of Economics and Finance, Volume 34, Issue 1, Spring 1994, Pages 95-112 doi.org/10.1016/1062-9769(94)90055-8
- [8] Al-Hassan, Tamadur Jaber Al-Bashir (2017) Factors Affecting Inflation in Sudan 1980-2015 - Journal of Economic Sciences.

- [9] DeLancey, Virginia (2015). "Prices and inflation" (PDF). In Berry, LaVerle (ed.). Sudan : a country study (5th ed.). Washington, D.C.: Federal Research Division, Library of Congress. p. 150. ISBN 978-0-8444-0750-0.  This article incorporates text from this source, which is in the public domain.
- [10] Report for Selected Countries and Subjects". Archived from the original on September 3, 2018.
- [11] Abdelaziz, Khalid (2018-07-19). "As Sudan currency continues descent, inflation hits 64 percent in June". Reuters. Retrieved 2020-10-27. "Sudan: Annual inflation tops 200% in Sept as food prices soar". www.aljazeera.com. Retrieved 2020-10-27.

Appendix

Annex 1 Data of the study variables

Obs	INF	UR	EX	MS
1996	132.8	14.0	1460.0	1166000
1997	47.1	13.5	1989.0	1597100
1998	24.6	13.0	2520.0	2069500
1999	17.2	12.5	2572.3	2579200
2000	7.1	15.2	2574.0	3466700
2001	1.9	15.0	2584.0	4322100
2002	22.2	15.9	2637.0	5632700
2003	6.5	15.8	2602.0	7340900
2004	9.7	16.2	2586.0	9604500
2005	8.5	17.0	2456.0	14031400
2006	7.2	17.5	2171.0	17871800
2007	14.8	16.8	2016.0	19714600
2008	14.3	16.0	2091.0	22933200
2009	11.3	14.9	2325.0	28314500
2010	12.1	13.7	2305.0	35497900
2011	18.1	12.0	2660.0	41853100
2012	35.6	14.8	3573.0	56663300
2013	36.5	15.2	4754.0	66445700
2014	36.9	19.8	5200.0	77739000
2015	16.9	21.6	6730.1	93642.60
2016	17.8	20.6	6598.6	120800.1
2017	32.4	19.6	7149.2	203367.5
2018	63.3	19.5	18000.0	430986.0
2019	50.1	22.1	3360.0	689797.6
2020	150.3	26.8	5527.0	1302229.6
2021	382.8	28.3	4486.0	3296958.8

Annex 2 Study Variable Graph

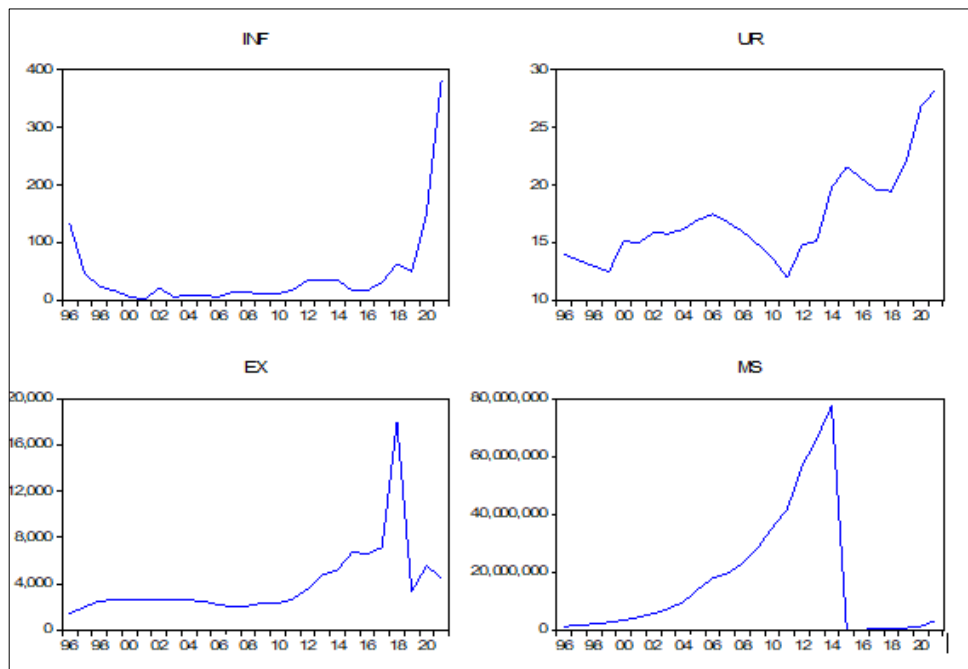


Figure Graph of the study variables