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Abstract: The current paper investigates the role of fiscal and monetary policies on inflation in Sudan for the period (1970-2014). The study assessed the impact of money supply, exchange rate, gross domestic product (GDP), budget deficit and government expenditure on inflation. It has adopted a descriptive and analytical method to achieve the goal. In particular, it has relied on empirical investigation based on descriptive statistic and econometric modelling.

The results shows that several monetary, fiscal and structural factors, namely, money supply, budget deficit and shrinking of gross domestic product are simultaneously influencing inflation in Sudan. While exchange rate and government expenditure are found to be with no effect on inflation rate, these findings may explain the fact that inflation depends on the way government expenditure is financed rather than the magnitude of the expenditure itself.

The study recommends that the government should depend on real sources in financing budget deficit rather than monetizing deficit by and borrowing from the central Bank, which have significant impact on increasing money supply. It has to ensure effective role in financing budget deficit and controlling inflation. Moreover, it is important to prepare an appropriate environment for investment and best utilization of Sudan’s national resources that stimulate gross domestic product (GDP) and reduce inflation rates.

Keywords: Monetary Policy, Inflation Rates, Economic Performance

I. INTRODUCTION

Inflation is a phenomenon experienced satisfactory most modern economies, especially developing countries and different theories that explain this phenomenon in different economic policies to eliminate them. Inflation is a case of economic imbalances that have been caused by strong inflationary working on the continuing rise in the general level of prices, as long as those strong influence on the course of economic activity. That is why inflation in its broadest sense occupies a prominent place in macroeconomic studies for the following reasons:

1. The economic concepts and classic theory, link the increase in the quantity of money and the increase in the general level of prices, in the absence of increased production to meet the increase in the quantity of money.
2. Constant fear of the impact of the inflation on various economic and social activities resulting from the continuing rise in the general price level.
3. The need to minimize the risk of inflation through fiscal and monetary policies, as a real phenomenon and an ongoing economic problem.

The importance of this paper lies in determining inflation, which is considered one of the most important economic phenomena. Fiscal and monetary policies are elucidated for possible control. We also hope to enrich the studies in this aspect of knowledge, and access to the results of the deep understanding of the causes and treatment of inflation in Sudan. Moreover, it is well known that the goal of economic policy in general is to achieve economic stability, which requires stable prices level (stable inflation rates). Inflation also is one of the most important economic problems faced by developing countries. Sudan is an example that witnessed high rates of prices since the nineties. The problem with this paper is identifying factors affecting the rate of inflation in Sudan, thus defining the role of effective economic policies that work on the set, and therefore, the paper will answer the following questions:
1. What are the factors affecting the rate of inflation in Sudan?
2. What are the appropriate economic policies used by competent authorities to control inflation?
3. The impact and effectiveness of monetary and fiscal policies used by the competent authorities in controlling inflation.
4. The ability of the competent authorities to choose an appropriate method works to control inflation.

Besides that, we will go through:
1. Literature on factors affecting inflation in Sudan.
2. Knowledge of fiscal policy tools used in the Sudan and their effectiveness in controlling inflation.
3. The monetary policy tools used in the Sudan and their effectiveness in controlling inflation.

II. FACTORS AFFECTING INFLATION

It is intended to formulate the model in the form of probability equation according to the econometric methodology used in the characterization of models. A model has been formulated based on the economic theory, and previous studies in addition to the fact of variables of same phenomenon. However, there are other factors that cannot be ignored which the paper has not delved in, e.g., corruption. High government expenditure, allocation of high percentage of the resources to security and military expenditure and the characteristic low quality of the essential available services for the people, e.g., health, education, water and electricity. It is feasible that such resources’ mismanagement can be potential factors that negatively impacts economic performance and henceforth generate inflation. Additionally, mismanagement and the resulting corruption are both catalysts and effective recipes for civil conflicts, dissentions and wars.

III. THE MODEL

We introduce an analytic model to reach specific results.

Dependent variable: inflation (INF) expresses the continued rise of the general level of prices with low purchasing power.

Independent variables: are as follows:
1. Money supply (M2) which refers to money supply in a broad sense (M2) which includes currency the public and demand deposits plus time deposits.
2. Exchange rate (ER): is the mean rate of the local currency (Sudanese Pound) against the foreign currency.
3. Growth Domestic Production (GDP): GDP is the total market value of final goods and services produced by the national economy during a specific time period, usually a year.
4. Budget Deficit (DF): It is a borrowing from the banking system (Bank of Sudan) to cover the deficit in the budget without funding coverage of real resources, by monetary issuance.
5. Government Expenditure (G): The intended State expenditure on wages, salaries, and management, in the provision of services (health, education, defense, etc.) to contribute to the capital of various companies and institutions, and spending on development programs.

IV. MATHEMATICAL FORMULATION OF THE MODEL

Intended to determine the mathematical form of the relationship under study, researcher suggested model in the form of a linear equation as follows:

\[ INF = f(M_2, ER, GDP, G, DF) \]

This equation can be written in the form specified as follows:

\[ INF = \beta_0 + \beta_1 M_2 + \beta_2 ER - \beta_3 GDP + \beta_4 G + \beta_5 DF + e \]

Where:
- INF: Inflation
- \( \beta_0 \): Constant
- \( \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \): the model’s Parameters.
- M_2: Money Supply.
- ER: Exchange Rate.
DF: Budget Deficit.
GDP: Growth Domestic Productions.
G: Government Expenditure.
e: Random Error.

That means that some factors that affect the inflation were not included in the model. The expected signals prior to the parameters are according to economic theory. The coefficient of money supply ($\beta_1$) expresses the positive proportional relationship between inflation and money supply. Exchange rate coefficient ($\beta_2$) reveals the positive relationship between inflation and the exchange rate. GDP coefficient ($\beta_3$) is expected to express the negative inverse relationship between inflation and GDP. Government expenditure coefficient ($\beta_4$) reveals the positive relationship between inflation and expenditure. Budget deficit coefficient ($\beta_5$) expresses the positive tendency and possible direct relationships between inflation rate and the budget deficit.

The method used in the estimation is Ordinary Least Squares method (OLS).

To improve the accuracy of the capabilities of the model are preliminary examination of the data, especially if the time series data and preliminary analysis of the data include:

Stillness and test of the stability of the series:

Time series data has often general trend factor, which reflects certain circumstances affect all variables, either in the same direction or in opposite directions, in other words, there is a general trend for singles of the model’s variables reflecting instability in the recipe all existing data. Thus, the decline that we get between variables time series is often a false (spurious), also features statistical regression analysis lacks when using chains is static, addition, the general trend in the time series data makes it difficult to rely onto the average value of the prediction. So in the case of the general trend increasing reliance on the average value gives values less than the reality in the case of the general trend decreasing reliance on the average value gives values higher than reality, for this reason we must discover the extent of the presence of the general trend in the data string variables of time, and get rid of it to ensure stability.

The unit root test is one of the most widely used tests in practical applications and use in most analysis programs. The concept of this test that if the regression coefficient for the proposed standard formula equal one, this leads to a problem unit root which means instable series data.

The proposed standard formulas for the test is in the following formula:

$$X_t = \beta_0 + eX_{t-1} + E + E_{\Delta} = 0 + eX_{t-1} + E_{\Delta}$$

Through equations following hypotheses are tested

$$H_0: e = 1 \quad \text{and} \quad H_1: e \neq 1$$

Appropriate statistical test is the (t) test, which is equal to $T = p / (\text{Var}(p))$.

We will reject the null hypothesis ($H_0$) if ($T$) greater than calculated (TC) spreadsheet, which represents the critical value.

To get rid of the problem of lack of stability in the time series in practical we use the following statistical methods:

1. Adding time factor to multi-factor analysis to remove the general trend, or a dummy variable to remove the seasonal effects.
2. The use of mathematical methods to remove the general trend by converting the data (exponential conversion) this method is one of the best methods used in the case of non-linear trend.
3. The use of differences concept of the series, where differences are obtained from the first or second level and so on, until we get a static string, in this case it is called an integrated series class.

The concept of this test is that if the value of statistical test results are greater than the value of significance at the level of a particular mental (5%), the series is considered stable, and vice versa, and it will be stable variable by statistical test in either, Level, First difference, Second difference or third difference, (Level) means the current level of variable, (first difference) first difference of values resulting from the launch of the original values of some of them, but (Second difference) second difference is a resulting values of the first difference of the first difference data series. The use of the process of finding the first difference of the series may lead to the stability of the variable, so we should re-apply tests of the stability of the chain, until reach stable time series.

The data parameters were estimated by ordinary least squares (OLS) as follows:
\[(\text{INF}) = f (M_2, \text{ER}, \text{GDP}, G, DF) D\]

The results of the assessment were as follows:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>7.58</td>
<td>5.32</td>
<td>1.42</td>
<td>0.16</td>
</tr>
<tr>
<td>M</td>
<td>0.00</td>
<td>5.47</td>
<td>2.25</td>
<td>0.03</td>
</tr>
<tr>
<td>(ER)</td>
<td>0.33</td>
<td>0.27</td>
<td>1.21</td>
<td>0.23</td>
</tr>
<tr>
<td>(GDP)</td>
<td>0.00</td>
<td>2.57</td>
<td>4.15</td>
<td>0.00</td>
</tr>
<tr>
<td>G</td>
<td>0.00</td>
<td>0.00</td>
<td>1.16</td>
<td>0.2572</td>
</tr>
<tr>
<td>DF</td>
<td>0.20</td>
<td>0.06</td>
<td>3.02</td>
<td>0.0060</td>
</tr>
<tr>
<td>AR(1)</td>
<td>0.27</td>
<td>0.22</td>
<td>1.23</td>
<td>0.2295</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.62</td>
<td>Mean depender var</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>17.93</td>
<td>Akakia info criterion</td>
<td>8.81</td>
<td></td>
</tr>
<tr>
<td>Sum squared residuals</td>
<td>7395.38</td>
<td>Schwarz criterion</td>
<td>9.13</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>125.17</td>
<td>F-statistic</td>
<td>6.49</td>
<td></td>
</tr>
<tr>
<td>Durbin-Watson stat</td>
<td>2.01</td>
<td>Prob (F-statistic)</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

**Table (1): unit root test results:**

1. Results and the Economic Criterion

1. Ms has positive signal, confirms the economic theory, there is a positive relationship between inflation and money supply.
2. ER has positive signal, confirms the economic theory; there is a direct correlation between inflation and the exchange rate.
3. GDP has negative signal, confirms the economic theory, there is an inverse relationship between inflation and GDP.
4. G has negative signal, and contrary to economic theory, there is no direct correlation between inflation and government expenditure.
5. DF has positive signal, confirms to economic theory; there is a direct correlation between inflation and the budget deficit.

We can identify significant landmarks in the probabilistic terms considered significant parameter if the value of \(t\) equal probability \(2\), that means it is statistically significant. That is expressed as the following:

1. Money supply is significant factor \(2.25\), which confirms the existence of a causal relationship between inflation and money supply.
2. Exchange rate coefficient was not significant, which confirms that there is no causal relationship between inflation and the exchange rate.
3. The coefficient of GDP was significant \(4.15\), which confirms the existence of a causal relationship between inflation and GDP.
4. The coefficient of government expenditure is significant \(1.16\), which confirms that there is a causal relationship between inflation and government expenditure.
5. The significant budget deficit coefficient \(3.02\), which confirms the existence of a causal relationship between inflation, and budget deficit.

Adjusted R-squared = 53%

The money supply, GDP, and the budget deficit explains 53% of the change in inflation in the Sudan during the period of study, while 47% belong to other factors not included in the equation.

Since the value of Durbin Watson equals \(2.01\) then, the model does not suffer from the problem of auto-correlation. From the above analysis, we find the intercept, coefficient of government expenditure and the exchange rate is not significant. Hence, we will re-estimate the model categorical exclusion, government expenditure, and the exchange rate of the equation.
Table 2: The tabulated results of the analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>5.90</td>
<td>1.61</td>
<td>3.66</td>
<td>0.00</td>
</tr>
<tr>
<td>D(GDP)</td>
<td>-9.38</td>
<td>1.91</td>
<td>-4.92</td>
<td>0.00</td>
</tr>
<tr>
<td>DF</td>
<td>0.13</td>
<td>0.03</td>
<td>3.81</td>
<td>0.00</td>
</tr>
<tr>
<td>AR(1)</td>
<td>0.35</td>
<td>0.17</td>
<td>2.01</td>
<td>0.05</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.55</td>
<td>Mean dependent var</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.51</td>
<td>S.D. dependent var</td>
<td>24.72</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>8959.86</td>
<td>Schwarz criterion</td>
<td>8.82</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>143.00</td>
<td>Durbin-Watson stat</td>
<td>2.07</td>
<td></td>
</tr>
</tbody>
</table>

From the table above, we find that all variables are identical signals with economic theory, results also shows that all parameters are statistically significant. Also there is decrease of the value of the coefficient of determination rate where total (51) compared to (53) of the initial result. The demonstrated statistical Durbin-Watson of the model does not suffer from the problem of autocorrelation (2.07).

V. DISCUSSION

From the results, we conclude that inflation in Sudan can be explained by several factors (structural, monetary, fiscal) structural factors are the most important factors affecting inflation, which can be described inflation in Sudan as structural inflation as it considered inadequate or deteriorating gross domestic of the most important sources of inflation in Sudan, which is the rigidity of the overall width, which means that the supply of goods and services is less than the required goods and services. This is consistent with the ideas of Structural School, which believes that one of the most important causes of inflation, especially in developing countries is due to structural factors of the most important palaces or rigidity of GDP. In Sudan, we find that economic activity has seen a noticeable decline was in negative rates. This result confirmed the findings of some studies says that: GDP in that period was also behind the phenomenon of inflation, where the shortcomings of the GDP to cover the state treasury from real resources, thereby increasing the money supply that are not offset by an increase in output, exacerbating the problem of structural inflation.

Monetary factors reveal that excessive that there is money issuance and can be one of the main causes of inflation in Sudan. That is consistent with the theory that cash of the main causes of inflation is to increase the money supply. This factor is demonstrated in the Sudanese economy, where we found that the country has resorted to issuing money to finance its expenditures, especially in the period of war and discourage economic boycott in the nineties, which led to an increase of inflation rates significantly which reached the following conclusion:

That the main causes of inflation in Sudan in the period of study was the increase of the money supply, which was the main cause of deficit financing. Also, we found that the most important causes of inflation in Sudan is the budget deficit (borrowing from the banking system), where the country resorted to cover the deficit borrowing from the banking system, which called deficit financing, as one of the easiest solutions without a consideration of what the negative consequent effects on economic activity. The most important of these results include:

1. Substantial increase in government borrowing from the Bank of Sudan affected negatively on increased cash version and then increase of the money supply led to higher inflation rates during the periods that have been examined.
2. Inflation rate remained high in through years of the study due to heavy reliance on deficit financing (borrowing from the banking system).
3. There is a strong correlation between government borrowing to finance the budget deficit and inflation, which hit the economy during the first half of the nineties, which has been proven that the more government borrowing from the banking system inflation rate will increase significantly.
4. The total deficit financing of the public sector in Sudan depends on internal sources (borrowing from the banking system) more than from external sources, and reliance on internal sources has led to high rates of inflation.

These results also agreed with study presented by Mohamed (2011) that the problem for inflation in Sudan causes and treatments.
The model defines the relationship between inflation and all of deficit financing the money supply and GDP, but the exchange rate did not approve of the relationship that economic theory assumed existence, shown by the results of the analysis. The model explains the phenomenon of inflation in Sudan that it combines the various factors driving inflation, it also explains some of the contradictions experienced by the Sudan’s economy, which we do not find it is one explanation based on the theories of inflation.

VI. CONCLUSIONS

The purpose of this paper was assessing the role of fiscal and monetary policies to control inflation in the Sudan during the period (1975-2014) through the data under study. The researcher concluded that there is a group of interrelated factors (structural – monetary - financial) led to high inflation in the Sudan; the most important of these factors are structural factors which were represented in the deterioration of GDP; structural factors considered one of the most important factors affecting inflation in Sudan. We can consider inflation in Sudan (structural). As exemplified by monetary factors of the increase of the money supply, as represented financial factors in the increase in the budget deficit (borrowing from the banking system). Also study concluded on the exchange rate and government expenditure is not statistically significant, which confirms the absence of a causal relationship between inflation, government expenditure, and the exchange rate., Which may be due to inflation is not affected by government expenditure, but the way that funded by this spending, or to include budget deficit as a variable in the model.

Accordingly, the paper recommends the following:
1. First: The government must rely on real sources to finance the budget deficit, even reduce reliance on monetary issuance and borrowing from the banking system. That has a significant role in increasing the money supply and lead to higher inflation.
2. Second: It is important to activate the role of government participation in public bonds granted by the central bank, which plays a key role in the process of financing the budget deficit and controlling inflation.
3. Third: Encourage investment and give it the necessary facilities, work on the exploitation of natural resources which abounds in Sudan and that leads to an increase of gross domestic product (GDP), by which inflation rates are falling.
4. Non-interference by the political authorities in the policy of the Ministry of Finance and give autonomy to be able to control the budget deficit and reducing it.

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