The important determinants of Inflation in Sudan and the effectiveness of monetary and fiscal policy in inflation reduction

During the period 2000-2014 with focusing on the period 2008-2014

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Abstract

Inflation is regarded as main problem that faced the countries in a whole world, and Sudan has been suffering of this problem especially in specific period of time such as beginning of 1990s and also since 2008 until 2014, so this study focuses on this period of a time.

The paper aims to study the inflation in Sudan during the period 2000- 2014 with focusing on the period during 2008-2014 because of this period has suffered of sharp increasing in inflation and also deterioration in the economy, and determine the performance of the macro-economic variables therefore the impact of that in inflation.

The study used the descriptive analysis additional to the quantitative analysis through the simultaneous equations model that includes two equations.

The paper puts some hypotheses which are the external debt is an important factor that increases the inflation rates rapidly during the period 2000-2014, the financial deficit of public budget has a role in increasing the inflation rates rapidly during the study period, the decreasing of real GDP leads to increase the inflation rate during the study period, and the monetary and fiscal policies are ineffective to reduce the inflation during the period 2008-2014.

The study accepted the four hypotheses that reached to results can be briefed in determining the important determinants of inflation during the period 2000-2014 in the external debt, the financial deficit of public and the real GDP and the last result is an ineffective monetary and fiscal policy to achieve the inflation reduction during the period 2008-2014. And the descriptive analysis of the study reached to other results that there is some reform in monetary and fiscal policy in 2013 and 2014, but it is not sufficient to reduce the inflation, because the reformatory needs to structural and strong procedures with consistency between the both monetary and fiscal policy.

The main recommendations focus on the reform should be applied strong and structural procedures with incremental implementation; with essential issue that is the consistency between the monetary and fiscal policies to achieve the goal of inflation reduction.

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المستخلص

يعتبر التضخم مشكلة رئيسية تواجه كل دول العالم، والسودان واجه هذه المشكلة خاصة في فترات زمنية محددة مثل بداية التسعينات وأيضاَ منذ 2008 وحتى 2014، لذا فالدراسة تركز على هذه الفترة الزمنية.هدفت الدراسة إلى دراسة التضخم في السودان خلال الفترة 2000– 2014 مع التركيز على الفترة 2008–2014 وذلك لأن هذه الفترة عانت من ارتفاع حاد في التضخم مع تدهور في الاقتصاد، وتحديد أداء المتغيرات الاقتصادية الكلية و كذا أثر ذلك على التضخم. كما استخدمت الدراسة التحليل الوصفي إضافة إلى التحليل الكمي بإستخدام نظام المعادلات الآنية الذي يتضمن معادلتين.وضعت الدراسة بعض الفرضيات وهي أن الدين الخارجي هو أهم عامل يزيد معدل التتضخم بتسارع خلال الفترة 2000– 2014، العجز المالي للموازنة العامة له دور في زيادة معدل التضخم بتسارع خلال فترة الدراسة وإنخفاض الناتج المحلي الإجمالي الحقيقي يزيد معدل التضخم خلال فترة الدراسة وأن السياسات النقدية والمالية غير فعالة في تخفيض التضخم خلال الفترة 2008–2014.   قبلت الدراسة الفرضيات الأربعة والتي توصلت إلى نتائج لخصت في تحديد أهم محددات التضخم خلال 2000–2014 في الدين الخارجي، العجز المالي للموازنة العامة والناتج المحلي الإجمالي الحقيقي و النتيجة الأخيرة هي عدم فعالية السياسة النقدية والمالية في تخفيض التضخم خلال الفترة 2008–2014. وقد توصلت التحليل الوصفي للدراسة إلى نتائج أخرى مفادها وجود بعض الإصلاح في السياسة النقدية والمالية في 2013 و 2014 لكنها غير كافية لخفض التضخم، وذلك لأن الإصلاح يحتاج إلى إجراءات قوية وهيكلية مصاحبة للتنسيق بين السياستين المالية والنقدية.

ركزت التوصيات على أن الإصلاح ينبغي أن يطبق بإجراءات قوية وهيكلية مع التطبيق التدريجي، والقضية المهمة هي التنسيق بين السياسة النقدية والمالية للوصول إلى هدف تخفيض التضخم.

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Introduction:

Inflation can be defined as the continuous rising in prices of a whole goods and services, so this rising in prices causes negative effects in economy.

Sudan economy suffered of inflation since 1978 and the worst period was in 1996 when the inflation reached 166% in August, then the inflation began to decrease to record 47% in 1997.

The inflation rate reached one digit during the period 2000- 2008, and then began to increase, so this study focuses on this period to pursue the general trend of inflation and to know the inflation influenced by the performance of economy that presented by the performance of macroeconomic variables such as the growth rate of real GDP, financial deficit of public budget, growth rate of money supply, money supply, deficit of balance of payments and the external debt.

The study importance:

This study regard as contribution to the library in inflation field in Sudan, and also the study has attempted to understand the behavior of Sudan economy.

The study problem:

Sudan economy has faced high rates of inflation since1990 that reached 66.9% while it recorded the highest rate 130% in 1996 but it began to decrease in the second half of 1990s until reached 16.2% in 1999, and during the period 2000-2007 recorded one digit with relative stability then began to increase since 2008 with 14.3% and continued to record sharp increasing during 2008-2014, so that can be reflected as deterioration in economy.

The study problem can be demonstrated in sharp and high rates of inflation that occurred with deterioration in economy performance so the study pursues to determine the inflation determinants and disclose the effectiveness of monetary and fiscal policy in inflation reduction.

The study hypotheses:

1-   The external debt is an important factor that increases the inflation rates rapidly during the period 2000-2014.
2-   The financial deficit of public budget has a role in increasing the inflation rates rapidly during the period 2000-2014.
3-   The decreasing of real GDP leads to increase the inflation rate during the period 2000-2014.
4-   The monetary and fiscal policies are ineffective to reduce the inflation during the period 2008-2014.

The study objectives:

1-   To present the history of inflation in Sudan during the period 1990-2014.
2-   To pursue the performance of inflation and economy performance during the period 2000-2014.
3-   To disclose the determinants of inflation during the period 2000-2014.

4-   To disclose the effectiveness of monetary and fiscal policies in inflation reduction during the period 2008-2014.

The study limitation:

The place limitation: the macroeconomic in Sudan.

The time limitation: the period during 2000-2014 with focusing on 2008-2014 that recorded sharp and high inflation rates.

The study methodology:

The study uses the descriptive analysis, and additional quantitative analysis through simultaneous equations model to describe the inflation phenomena during the period 2000-2014 with focusing on the period 2008-2014, because of the inflation achieved sharp and high rates during this period.

The previous studies:

The first study: Robert E. Hall, "Inflation: Causes and effects", University of Chicago Press, Volume ISBN: 0-226-31323-9, 1982.

The paper reviews the aspect of twelve papers without giving any advocating for these aspects from the author.

The second study: QuamrulAshraf, Boris Gersham, Peter Howitt, "How inflation affects macroeconomic performance: An agent-based computationl investigation, 2013.

This paper aims to know how inflation affects macroeconomic performance. The paper uses the quantitative analysis, and the main finding is that the rising of inflation rate more than 3 percent has negative effects on macroeconomic performance (i.e. reduce the average annual level of GDP in the median simulation by 6.8 percent) also the paper has no support for notion that inflation targets below 3 percent can yield any gains in output or employment.

The third study: Raja Azyz Bander," Inflation targeting: case study of developing countries experience through monetary policy, Central Bank of Iraq.

The study focuses on inflation targeting as a policy using for reducing the inflation, and the study proofed that the inflation targeting policy is the best policy to reduce the inflation through offering the experience of some developing countries.

The fourth study: Republic of Sudan, Central Bank of Sudan, " Determining the responsibility Lag for general level of prices to change in Money Supply in Sudan (1995-2007)".

The study aimed to determine the responsibility Lag of monetary policy against general level of prices through which can be increased the effectiveness of monetary policy in order to achieve the inflation reduction. The study used the econometrics analysis through using two methods, one of them is Impulse Response analysis and the other is CARCH Model.

The study reached to result that is the responsibility Lag about seven to twelve month. And the CARCH parameter is insignificant that means the effect of money supply changing on the general level of prices doesn't stable for long period. And the main recommendation is that the implementation of monetary policy should be began before twelve month at least and the evaluation of performance after seven month at least.

The study structure:

1.   Inflation literature.
2.   The Inflation history in Sudan during the period 1990-2014.
3.   Inflation and economy performance in Sudan during the period 2000-2014.
4.   The quantitative analysis.
5.   Conclusion**.**

1. Inflation literature.

1.1 Inflation definitions.

There are many definitions of inflation and majority of them agree that; Inflation is an ongoing general rise in prices (1). Also; inflation raises all nominal prices and wages in the economy (2). The rate of inflation is the percentage change from one year to the next one.

1.2 Consequences of inflation.

There are some studies; underlying the view that monetary policy should aim at low inflation as its contribution to a well-functioning economy is the proposition that there are many costs that flow from an environment of high inflation (5).

Inflation, as a sustained and significant increase in the general price level, does cause serious economic, social, and political problems (3).

The costs of expected inflation are especially small, but unexpected inflation does have significant and worrisome costs(2). These costs are the following:

1- The most serious consequences of inflation arise when a price-level-change factor has to be included in most of the day-to-day decisions that guide the operation of the economy (3). Unexpected inflation leads to uncertainty that can influence the investment negatively.

2- Unexpected inflation redistributes wealth from creditors to debtors (2).

3- The decline of purchasing power of the national currency.

4- A substantial body of evidence suggests that sustained high rates of inflation can have adverse consequences for real economic growth even in the long run(6).

5- Also another side of inflation consequences that the inflation influences the consumption and saving negatively.

6 - Unexpected inflation redistributes wealth from holders who own money to those who own estate and gold.

1.3. Theories of inflation.

The main theories of inflation are:

1-   Cost push inflation.
2-   Demand pull inflation.

1.3.1. Cost push inflation:

In this case the inflation is caused through the increasing of production factors prices which can occur due to the pressure of labor unions in order to increase the wages and salaries or increase the price of fuel, so for all these causes and others the output decline, that means the general level of prices increase.

1.3.2. Demand pull inflation:

Demand pull inflation is the one type of inflation that occur when the aggregate demand rise with rate more than aggregate supply.

An economy started in equilibrium, demand then shifted to the right perhaps because war was declared, so because there was a massive increase in the money supply or because new investment opportunities were discovered (4).

This type of inflationary trend result due to the following reasons (4):

1- Increase in the salary of the workers.
2- Reduction in the tax structure of the economy.
3- Increase in government expenditure.

2. The Inflation history in Sudan during the period 1990-2014.

Table No.(1) shows the inflation rates during the period 1990-2007 as the following:

Table No.(1)

Rate of inflation during the period 1990-2007

Year	Rate of inflation%
1990	66.9
1991	120.4
1992	119.4
1993	101.1
1994	116.8
1995	69.4
1996	130
1997	46.6
1998	16.9
1999	16.2
2000	8.1
2001	4.9
2002	8.3
2003	7.7
2004	8.5
2005	8.5
2006	7.2

2007	8.1

Source of the period during 1990-1999: Zeinab Bashir Ali, Published research, Complementary research for awarded Master in Economics, "Impact of economic liberalization policy on poverty in Sudan through the period 1983-2008", Republic of Sudan, University of Bakht Elreda,2012, P.56.

Source of the period during 2000-2005: Republic of Sudan, "Ministry of Finance and National Economy", Report:" The Performance of Macroeconomic and Microeconomic during the period 2000-2005", Arabic version, P.35.

Source of the period during 2006-2007: Prepare by researcher depending on Internet website, Central Bank of Sudan, the annual report of 2011.

The rate of inflation began to increase since 1990, and then reached to high rate in August 1996 with rate 166%, but this rate began to decrease until a record 47.2% in 1997 and continue to reduce, this reduction occurred through implementing the reform program specifically in fiscal policy. In 1999 the rate of inflation recorded 16.2%, and the salient matter in this year is beginning the exporting of petrol in the last quarter of a year. The rate of inflation reached to one digit since 2000 to 2007 with relative stability that appear in table no. (1).

Table No.(2)
Rate of inflation during the period 2008-2014

Year	2008	2009	2010	2011	2012	2013	2014
Rate of inflation%	14.3	11.2	13.1	18.1	35.1	37.1	36.9

Source: Prepare by researcher depending on Internet website, different annual reports from 2010-2014, Central Bank of Sudan.

According to table no.(2), the rates of inflation continue to achieve rapid increase during the period 2008-2014 inspite of a little decrease in 2014. And this decrease didn't represent high importance because there was high variation between actual and planned rate of inflation in 2014.

Table No.(3)
Planned rates of inflation during the period 2009-2014

Year	2009	2010	2011	2012	2013	2014
Planned rates of inflation %	9	9	12	17	20-22	20.9

Source: Prepare by researcher depending on Internet website, different annual reports from 2010-2014, Central Bank of Sudan.

Table no.(3) shows the planned rates of inflation through the period 2009-2014, and when compared them with the actual rates of inflation for the same period, can notice high variation between the planned and actual rates. And these variations are negative, because the actual rates are very high.

The inflation is regarded as one of the important problems in Sudan that the inflation can influence the performance of economy negatively.

3. Inflation and economy performance during the period 2000- 2014.

The inflation rate has begun to decrease since 1997 after implementation of reforming program targeting the inflation reduction, and then decrease to one digit during the period 2000- 2007,andthe growth rate of real GDP achieved range from 6-10.2% during this period.

Table No.(4)
Growth rate of real GDP during the period 2000-2007

Year	2000	2001	2002	2003	2004	2005	2006	2007
Growth rate of real GDP%	8.3	6.4	6	6	9.1	8.1	9.3	10.2

Source: Preparing by researcher depending on Internet website, various annual reports, Bank of Sudan.

The inflation rate recorded 14.3% in 2008 and continuous to two digit during the period 2008-2014 to reach 36.9% in 2014. During this period 2008- 2014 the Sudanese economy has been suffering of deterioration in the macroeconomic variables. From table No.5 the growth rate of real GDP faced rapid reduction in 2011with the main reason was falling of petrol sector production from 2.2 million SDG in 2010 to 1.6 million SDG in 2011. And then the petrol sector production continues to decrease in 2012 with 0.9 million SDG by which the growth rate of real GDP falls to 1.1%, then achieved 4.4 , 3.6% in 2013 and 2014 respectively.

Table No.(5)
Growth rate of real GDP during the period 2008-2014

Year	2008	2009	2010	2011	2012	2013	2014
Growth rate of real GDP%	6.4	5.9	5.2	1.9	1.1	4.4	3.6

Source: Preparing by researcher depending on Internet website, Different annual reportsfrom 2010-2014, Bank of Sudan.

This reduction in growth rate of real GDP in 2011 and 2012 occurred at the same events of rising of inflation rates from 13.1, 18.1 to 35.1% in 2010, 2011, and 2012 respectively.

Sudan has been suffering from public budget deficit that is regarded the main reason of inflation in the economy. Sudan faced the serious case of inflation in its history in August 1996 with a rate of inflation reaching 166%, this high rate occurred with high deficit in public budget 210 million SDG that is regarded as high value during 1990-1998.

According to table No.(6), the financial deficit of public budget continued to increase during the period 2000-2007 unless the reducing in 2003 and 2007.

Table No.(6)
Total financial deficit of public budget during the period 2000-2007
Million SDG

Year	2000	2001	2002	2003	2004	2005	2006	2007

Total financial deficit of public budget	(182)	(250)	(456)	(326)	(799)	(1,660)	(3,180)	(2,208.8)

Table No.(7)

Total financial deficit of public budget during the period 2008-2014

Million SDG

Year	2008	2009	2010	2011	2012	2013	2014
Total financial deficit of public budget	(1,277.7)	(4,895.5)	(7,586.1)	(9,121.2)	(7,653.4)	(6,457)	(4,417)

From table no.(7) ,the financial deficit of public budget recorded rapid rising during the period 2009-2011, and then began to fall until reached (4,417) million SDG in 2014, inspite of the financial deficit of public budget was falling, the inflation rate raise.

Table No.(8)

Growth rate of money supply during the period 2000-2007

Year	2000	2001	2002	2003	2004	2005	2006	2007
Growth rate of money supply%	24.6	33	26	18	51.4	46.1	27.4	10.3

From table no.(8), the growth rate of money supply achieved highest rates in 2004 and 2005.

Table No.(9)

Growth rate of money supply during the period 2008-2014

Year	2008	2009	2010	2011	2012	2013	2014
Growth rate of money supply%	16.3	23.5	25.4	17.9	40.2	13.3	17.0

From table no. (9), the growth rate of money supply began to control the rising relatively in 2013 and 2014.

Table No.(10)

Money supply during the period 2008-2014

Million SDG

Year	Money supply
2000	3,429.83
2001	3,466.71
2002	4,322.13
2003	6,342.27
2004	9,604.46
2005	14,031.38
2006	17,871.78
2007	19,714.6
2008	22,933.2
2009	28,314.5
2010	35,497.9
2011	41,853.0
2012	58,663.3
2013	66,445.7
2014	77,739.0

Source: Repairing by researcher depending on Internet website, the various annual reports, Bank of Sudan.

Table no.(7) illustrate that the fiscal policy was contractionary policy, but the monetary policy was expansionary policy (that appear in table no.(10)) by which the combating of inflation became so difficult.

Table No.(11)
Total situation of balance of payments during the period 2008-2014
Million Dollar

Year	Total situation of balance of payments
2000	165.5
2001	(70.3)
2002	300.03
2003	422.56
2004	730.18
2005	530.5
2006	(208.6)
2007	(282.0)
2008	21.1
2009	(502)
2010	(54.2)
2011	(644.5)
2012	(0.4)

2013	(17.6)
2014	(15.1)

Source: Repairing by researcher depending on Internet website, the various annual reports, Bank of Sudan.

Table no.(11) shows that the balance of payments achieved surplus during the period 2000-2005 unless 2001, and then recorded deficit during the period 2006-2014 unless 2008 but the deficit fell down during 2013-2014coparing with the deficit in 2009, 2010 and 2011.

Table No. (12)
The external debt during the period 2000 -2014
Billion Dollars

Year	The external debt
2000	20.52
2001	20.99
2002	23.61
2003	24.19
2004	26.78
2005	27.0
2006	28.4
2007	31.8
2008	33.5
2009	35.7
2010	37.8
2011	39.8
2012	41.4
2013	43.8
2014	46.6

Source: Repairing by researcher depending on Internet website, the various annual reports, Bank of Sudan.

Table no. (12) Illustrates that the external debt was continue to increase that caused inflationary pressure.

4. The quantitative analysis

The study describes the inflation phenomena through the simultaneous equation model includes two equations that covers the period during 2000-2014 with focusing on the period 2008-2014 because of the study assumes that the period during 2008-2014 has faced sharp increasing in inflation so the study discloses the effect of monetary and fiscal policies during this period through using the dummy variable.

4.1. Theoretical frame of the inflation model
The study describes the inflation model as follow:

$I_i = \alpha_1 RGDP_i + \alpha_2 T_i + \alpha_3 m_i + \alpha_4 ddI_i + \alpha_5 RGDP_{i-1} + \alpha_6 b_i + \alpha_7 r_i + \alpha_8 addm_i + \alpha_9 ddb_i + U_{1i}$ ……… (1)

$\alpha_1 < 0, \alpha_2 > 0, \ \alpha_3 > 0, \ \alpha_4 > 0, \ \alpha_5 < 0, \alpha_6 < 0, \ \alpha_7 > 0, \ \alpha_8 > 0, \ \ \alpha_9 < 0$

$RGDP_i = \beta_0 + \beta_1 I_i + \beta_2 r_i + \beta_3 M_i + U_{2i}$ ……………… (2)

$$\beta_0 > 0, \beta_1 < 0, \beta_2 < 0, \ \beta_3 > 0$$

$I \equiv$ Inflation rate.

$RGDP_i \equiv$ Real GDP in the current period.

$RGDP_{i-1} \equiv$ Real GDP in the previous period.

$T \equiv$ External debt.

m≡ Growth rate of money supply.

b≡ Financial deficit of public budget.

r≡ Exchange rate.

M≡ Money supply.

dd≡ Dummy variable ⟶ 0 for the period 2000- 2007

1 for the period 2008- 2014

ddm≡ dummy variable multiplies by the growth rate of money supply.

ddb≡ dummy variable multiplies by the financial deficit of public budget.

ddI≡ dummy variable multiplies by the inflation rate.

$U_{1i}, U_{2i} \equiv$ The error terms.

$\alpha_i's, \beta_i's \equiv$ parameters.

4.1.1. The first equation
The first equation includes the determinants of inflation in which the real GDP has negative relation with the inflation rate that means increasing of the real GDP in the current period can decrease the inflation rate, and the external debt has positive relation with the inflation rate and also the study assumes that it is important determinant.

The growth rate of money supply has positive relation with the inflation rate. The central Bank of Sudan prepared study to determine the period of responsibility of price general level to change in money supply about eight to twelve month.

α_4 has positive sign that reflect the positive effect of the inflation during the period 2008-2014, the cause is sharp raise of inflation in this period. The sign of α_5 is negative that means the real GDP in previous period has negative relation with inflation rate. α_6 is the financial deficit of public budget parameter has minus sign that means the improvement in financial deficit of public budget leads to minimize the inflation rate and also α_7 has positive sign by which the decline in exchange rate (increase SDG/$) leads to increase in inflation rate. α_8 has positive sign and α_9 has minus sign are that the growth rate of money supply and the financial deficit of public budget parameters respectively.

4.1.2. The second equation
The second equation is the real GDP equation includes four parameters, β_0 is the independent parameter has positive sign, and β_1 has negative sign that means the increase in inflation rate leads

to decrease the real GDP, and also β_2 has negative sign that reflect the negative relation between the exchange rate (increase SDG/$) leads to decrease the real GDP. The β_3 parameter has positive sign that means the increasing in money supply leads to increase in real GDP.

4.2. Analytical frame of the inflation model

The estimated equation and analysis are the following:

4.2.1. The first estimated equation

$\hat{I}_i=$
$-0.7077RGDP_i+1.061440T_i+0.066m_i+0.58597ddI_i - 0.763665RGDP_{i-1} -$
$0.921829b_i+0.870293r_i+0.018220ddm_i+ 0.535347ddb_i$ ... ...(1)

  t_c(-2.633201) (2.569171) (2.520133) (6.332743) (-1.456382) (-2.408572) (1.464176) (0.268237) (1.357810)

  F_c= 66.03   , R^2= 0.99   , $\bar{R}^2$= 0.98   , d*= 2.70

4.2.1.1. The economic criteria
  α_1 has negative sign that coincident with economic theory by -0.7077 , and α_2 has positive sign that reflect the positive relation between the external debt and inflation rate and the external debt regarded as an important determinant in inflation because its parameter has a bigger magnitude equals 1.0614. And α_3 the growth rate of money supply parameter appears with positive sign that coincident with the economic theory. The α_4 appears with positive sign by which the inflation increase about 0.58597 according to effect of the period 2008-2014. The α_5 has negative sign that reflect the inverse relation between the real GDP and inflation rate, and also α_6 has negative sign that means the improvement of financial deficit of public budget minimize the inflation rate.
   The α_7 has positive sign that means the increasing of exchange rate SDG/$ (decline the Sudanese Pound) leads to increasing in the inflation rate. α_8 has positive sign that coincident with the economic theory which reflect the positive relation of the growth rate of money supply during the period 2008-2014 with the inflation rate. And α_9 the parameter of financial deficit of public budget during the period 2008-2014 has positive sign that cannot coincident with the economic theory but this effect can reduce the effect of fiscal policy during 2000-2014 from -0.921829 to -0.386482.
4.2.1.2. The statistical criteria
  F-test:
  F_c= 66.03 , $F_{0.05,9,6}$= F_t= 4.10
  F_c > F_t , so the model is significant and consistence statically.
  t-test:
  $H_0: \alpha_1 = 0$
  $H_1:\alpha_1 \neq 0$
  The probability of α_1 is 0.0174, less than the level of significance (10%) so α_1 is significant and important and also the real GDP is important as determinant of inflation.
  $H_0: \alpha_2 = 0$

$H_1: \alpha_2 \neq 0$

The α_2 has probability equals 0.0199 comparing with level of significance (10%) that means α_2 is significant so the external debt is significant and also is regarded as important determinant because it has a bigger effect on inflation equals 1.061440 .

$H_0: \alpha_3 = 0$

$H_1: \alpha_3 \neq 0$

The probability of α_3 equals 0.0220, so it is significant and the growth rate of money supply is significant as determinant of inflation.

$H_0: \alpha_4 = 0$

$H_1: \alpha_4 \neq 0$

α_4 has probability about 0.0000 that means α_4 is significant and also the inflation during the period 2008-2014 has positive effect on inflation and caused increasing in inflation.

$H_0: \alpha_5 = 0$

$H_1: \alpha_5 \neq 0$

The probability of α_5 equals 0.1635 so the α_5 and also the real GDP in previous period are insignificant.

$H_0: \alpha_6 = 0$

$H_1: \alpha_6 \neq 0$

α_6 has probability equals 0.0276 so the parameter is significant and the financial deficit of public budget is significant and important as determinant of inflation.

$H_0: \alpha_7 = 0$

$H_1: \alpha_7 \neq 0$

The probability of α_7 is 0.1614 so α_7 is insignificant and also the exchange rate.

$H_0: \alpha_8 = 0$

$H_1: \alpha_8 \neq 0$

α_8 has probability about 0.7917 so it is insignificant and also the growth rate of money supply during the period 2008-2014 so that means the monetary policy is insignificant and has no effect to target the inflation reduction.

$H_0: \alpha_9 = 0$

$H_1: \alpha_9 \neq 0$

0.1923 is the probability of α_9 that means α_9 is insignificant so the financial deficit of public budget during the period 2008-2014 is also insignificant that means the fiscal policy during 2008-2014 is ineffective to control the inflation.

The coefficient of determinant R^2:

$R^2 = 0.99$ that means 99% of the changing in inflation is explained by the external debt, financial deficit of public budget, real GDP in the current period, the effect of inflation during the period 2008-2014 and the growth rate of money supply, and $(1 - R^2)$ 1% of the changing in inflation unexplained but included in the error term.

Adjusted $\bar{R}^2$:

$\bar{R}^2$= 0.98 so that means the equation explains the determinant of inflation in a good manner so it included small inflation.

4.2.1.3. The econometrics criteria

d*= 2.70 , $d_{0.05,3,15}$= du = 3.216   , dl = 0.175 ,d* sets in uncertainty area.

4.2.2. The second estimated equation

The second estimated equation is:

$$\widehat{RGDP}_i = 20.990 - 0.280614I_i - 2.320273R_i + 0.000459M_i \ldots\ldots\ldots\ldots\ldots (2)$$

   t_c (26.07293) (-2.747230) (-4.971404) (11.40945)

F_c= 96.1   , R^2= 0.96   , $\bar{R}^2$= 0.94   , d*= 1.5

4.2.2.1. The economic criteria

The independent parameter has positive sign that coincident with the economic theory, β_1 has negative sign that coincident with the economic theory by which the increasing in inflation leads to decrease the real GDP.

β_2 has negative sign that reflect the inverse relation between the exchange rate and the real GDP and the exchange rate is more important on the real GDP because it has a big parameter equals -2.320273 ,And β_3 has positive sign that coincident with the economic theory that reflect the positive relation between the money supply and the real GDP.

4.2.2.2. The statistical criteria

F-test:

F_c= 96.1 , $F_{0.05,3,12}$= F_t= 3.49

F_c > F_t , so the model is significant and has statistical consistence.

t-test:

H_0: $\beta_0 = 0$

H_1:$\beta_0 \neq 0$

The probability of β_0 is 0.0000 that means the independent parameter is significant and important.

H_0: $\beta_1 = 0$

H_1:$\beta_1 \neq 0$

The probability of β_1 is 0.0137so $\beta_1$is significant and important and also the inflation variable is important as determinant of the real GDP.

H_0: $\beta_2 = 0$

H_1:$\beta_2 \neq 0$

The β_2 has probability equals 0.0001 that means β_2 is significant so the exchange rate is significant and also is regarded as important determinant because it has a bigger effect on the real GDP equals -2.320273.

H_0: $\beta_3 = 0$

H_1:$\beta_3 \neq 0$

The probability of β_3 equals 0.0000 so β_3 is significant and the money supply is significant as determinant of the real GDP but its effect is small that only equals 0.000459.

4.2.2.3. The econometrics criteria

d*= 1.5 ,d $_{0.05,3,15}$= du= 1.750 ,dl= 0.814 ,d* sets in uncertainty area.

5. Discussion of the hypotheses:

5.1. The first hypothesis

The study accepts the first hypothesis that said the external debt is an important factor that increases the inflation rates rapidly during the period 2000-2014. According to equation one the parameter of external debt is significant that means the external debt is an important determinant of inflation because it has the biggest parameter in the equation and equals 1.061440.

5.2. The second hypothesis

The study accepts the second hypothesis that said the financial deficit of public budget has a role in increasing the inflation rates rapidly during the period 2000-2014.According to equation one the parameter of the financial deficit of public budget is significant that means the financial deficit of public budget is important as one of inflation determinants because it has the big parameter equals 0.921829.

5.3. The third hypothesis

The study accepts the third hypothesis that said the decreasing of real GDP lead to increase the inflation rate during the period 2000-2014. According to equation one the parameter of the real GDP is significant that means the real GDP is important as one of inflation determinants and it has big parameter equals 0.7077.

5.4. The fourth hypothesis

The study accepts the third hypothesis that said the monetary and fiscal policies are ineffective to reduce the inflation during the period 2008-2014. According to equation one the parameters of the monetary and fiscal policies are insignificant that means the both policies are insignificant so ineffective in inflation.

6. Results

6.1 Findings

6.1.1. Special findings

1-   The external debt is an important factor that increases the inflation rates rapidly during the period 2000-2014.

2-   The financial deficit of public budget has a role in increasing the inflation rates rapidly during the period 2000-2014.

3-   The decreasing of real GDP lead to increase the inflation rate during the period 2000-2014.

4-   The monetary and fiscal policies are ineffective to reduce the inflation during the period 2008-2014.

6.1.2. General findings

1- The inflation rates increase rapidly during the period 2009- 2014.

2- There is some reform in monetary and fiscal policy, but it cannot resolve the inflation problem.

3- The reduction in inflation needs to structural and strong procedures with consistency between the both monetary and fiscal policy.

4- The external debt is very high and continues to rise during the study period by which the inflation rate influenced negatively.

6.2 Recommendations

1- The resolving of inflation should be applied quickly with rigid procedures, because it conveys negative effects to the entire economy.

2- The reformatory policies should be applied strong and structural procedures with incremental implementation.

3- The consistency between the monetary and fiscal policies is essential to achieve the goal of reduction the inflation.

4- The external debt needs to control and activate the productivity sectors in order to reduce its negative effects in inflation.

6.3 Conclusion

Inflation has negative effects on the economy so the increasing of inflation in Sudan requires consistency between monetary and fiscal policies with incremental implementation.

The study illustrates that there are little reform in some macro-economic indicators such as the financial deficit of public budget, growth rate of money supply, growth rate of real GDP, and deficit of balance of payments in 2013 and 2014, but that reform in some macro-economic indicators not structural and strong to resolve the inflation which appear in increasing the money supply and external debts. And the reforms in fiscal policy needs also to reform in monetary policy by which can reduce the inflation, with apply the consistent between the fiscal and monetary policies.

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Estimation Method: Three-Stage Least Squares
Date: 05/29/16   Time: 20:37
Sample: 2000 2014
Included observations: 15
Total system (balanced) observations 30

	Coefficient	Std. Error	t-Statistic	Prob.
C(2)	-0.707723	0.268769	-2.633201	0.0174
C(3)	1.061440	0.413145	2.569171	0.0199
C(4)	0.066156	0.026251	2.520133	0.0220
C(5)	0.585974	0.092531	6.332743	0.0000
C(6)	-0.763665	0.524358	-1.456382	0.1635
C(7)	-0.921829	0.382728	-2.408572	0.0276
C(8)	0.870293	0.594391	1.464176	0.1614
C(9)	0.018220	0.067924	0.268237	0.7917
C(14)	0.535347	0.394272	1.357810	0.1923
C(10)	20.99011	0.805054	26.07293	0.0000
C(11)	-0.280614	0.102144	-2.747230	0.0137
C(12)	-2.320273	0.466724	-4.971404	0.0001
C(13)	0.000459	4.03E-05	11.40945	0.0000

Determinant residual covariance	1.305987

Equation:
$C(2)*RGDP+C(3)*T+C(4)*MM+C(5)*DDI+C(6)*R+C(7)*B$
    $+C(8)*E+C(9)*DDMM+C(14)*DDB$
Observations: 15

R-squared	0.992040	Mean dependent var	15.01333
Adjusted R-squared	0.981427	S.D. dependent var	11.56700
S.E. of regression	1.576371	Sum squared resid	14.90968
Durbin-Watson stat	2.703148		

Equation: $RGDP= C(10)+C(11)*I+C(12)*E+C(13)*M$
Observations: 15

R-squared	0.955008	Mean dependent var	22.17467
Adjusted R-squared	0.942737	S.D. dependent var	5.793430

S.E. of regression	1.386345	Sum squared resid	21.14146
Durbin-Watson stat	1.512702		