# Counter-factual Analysis of the Nigerian Economy: A Test of the Relative Potency of Monetary and Fiscal Policies

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## Abstract

*There has been a prolonged and heated debate or controversy among economists and policy makers over the degree and relative superiority of monetary and fiscal policies on counter-cyclical output stabilization in an economy. This study examines, estimate, and evaluate the relative impact of monetary and fiscal policies on some macroeconomic aggregates in the Nigerian economy. It equally specifies and constructs a structural model of the Nigerian economy. Using the techniques of ordinary least squares, historical and policy simulation, it concludes that monetary policy is more potent for counter-cyclical output stabilization in Nigeria. In the long-run fiscal policy is more germane than monetary policy because monetary policy weakens as the time progresses.*

**Keywords:** Monetary Policy, Fiscal Policy, Counter-Cyclical Output Stabilization, Policy Simulation, Historical Simulation, and Macro-econometric Model.

## *I. Introduction*

**U**sing historical and policy simulation, this study evaluates the relative impact of monetary policy of interest rate and fiscal policy of government spending on some macroeconomic aggregates in the economy.

Another objective of this study is to specify, and construct a structural model of the Nigerian economy, which will enable us study the working of the economy. Specifically, policy simulation enables the researcher to evaluate overtime the performance of some policy variables in the economy especially as it regards policy forecast and policy analysis. This actually provides effective tools for sound macroeconomic management of the economy. Our major policy variables in this study are interest rate and government expenditure. In this light, there has been a prolonged and heated controversy among economists and policy makers over the degree and relative superiority of one of these policy measures over the other in influencing economic activities. Therefore, various economists in order to establish the relative potency of monetary and fiscal policies in counter-cyclical output stabilization have carried out several studies.

Anderson and Jordan (1968), presented a model relevant in resolving the debate and the result of the study indicated support for the monetarist position i.e monetary policy has greater and faster impact on economic activities, thus, suggesting that greater reliance be placed on monetary policy measures than fiscal measures in the conduct of stabilization policy. De Leew and Kalchbreuner (1969), Provided empirical results, which cast doubts on the position of Anderson and Jordan. Their results revealed that fiscal policy exerts a more significant influence on economic activities than monetary policy.

Friedman(1963), in his study found that when the original data of st. Louis (1933-1968) used in the Anderson and Jordan study was extended to 1976, the government expenditure coefficient rose from 0.6 to 1.4 and had a significant statistics. Carlson (1978), challenged Friedman's result by arguing that the result suffered heteroscedasticy problem. He suggested that instead the equation should now be estimated in percentage first difference form.

Apparently, this controversy may be far from being resolved, the debate has concentrated largely on the United States of America. Baten and Hater (1983) tried resolving whether the St. Louis approach can be used universally in evaluating the economic impact of fiscal and monetary actions on economic growth by applying it on other countries viz: Canada, Frances, Germany, Japan, and the United Kingdom. They concluded that the St. Louis equation can be applied to a number of other countries and that monetary dominates fiscal action in determining the pace of economic activities in these countries.

In determining the relative impact of monetary and fiscal policy on economic activity, Ajayi (1974) and Aigbokhan (1985) using the original version of the St. Louis equation were the first among the earliest studies to extend the debate to developing countries. Ajayi found evidence, which support the monetarist position while Aigbokhan, using the elasticity version of the equation found evidence, which support the fiscal position. Hence there is a little modification that monetary policy is more powerful in some countries. The conclusion, therefore, is that the St. Louis model does not have universal generality; the particular situation in each country has to be understood, before appropriate stabilization and growth policy is to be implemented**.**

## *II Literature Review*

### The Role of Government Expenditure in an Economy

The basic function of government in an economy is to allocate, distribute resources and stabilize economic activities. In a free market system, allocation of scarce resources is effected through the market system. In effect, the action of the buyers and sellers allocate these scarce resources in the economy but imperfection exists in the market. As a result of this, the government intervenes. Also in a free market economy redistribution of income is determined by the marginal productivity of factor input. As a result of the imperfection in the system too, the government uses fiscal policy or income policy to redistribute income from certain individuals to others. Basically, government's progressive tax system performs their distribution function. The government equally performs the duty of stabilizing economic activities by using monetary and fiscal policies to regulate them.

In addition to this basic function, the government revenue-expenditure activities serve as fiscal instrument for expanding and contracting the balance of payment surplus and deficit and it is equally used in increasing the gross domestic product in an economy (Ikpeze 1978). Traditionally, public expenditures are often divided into two categories, thus, recurrent and capital expenditure. This is so for the different tiers of government (Fajingberi and Odusola 2003). Recurrent expenditure include all consumption items such as salaries and wages, administrative expenses and so on, while capital expenditure include all expenses which contribute to long-run development such as expenses on social and economic infrastructures. The distribution between capital and recurrent expenditure is common to both developed and developing countries. However, there exists sharp controversy on their distribution as it relates, for instance, to recurrent cost arising from capital expenditure. In order to resolve this controversy attempts have been made in the literature to clarify public expenditure into economic and functional categories. Economic composition comprises such outlays as capital, wages and salaries, overhead and interest due, while functional categories include spending on education, health care, defense and so on.

Government expenditure serves as an engine of growth. There is, however, a controversy on the role of public expenditure in contributing to the growth of an economy ( Qusson Kouassy 1992, Fajingbesi and Odusola 2003). According to Fajingbesi and Odusola (2003), there is a distinction between productive and unproductive expenditure. There is the tendency to categorize capital budget as productive and recurrent expenditure an unproductive consumption spending. First, capital expenditures are very essential for growth. Capital expenditure on such items as physical infrastructure, human capital development and (Dancing sited in Fajingbesi and Odusola 1999) are engine for growth. In another sense, capital expenditure now is a future consumption which is better than current unproductive consumption.

A closer look at developing countries shows that recurrent spending like wages and salaries are regarded as sacrosanct while a large number of white elephant projects are regarded as political gains rather than economic gains. To this end, recurrent expenditure has suffered a large cut in spending than capital expenditure. In another view, current expenditure has been argued to contribute more to economic growth than capital expenditure ( Ogiogio 2005). According to him, growth is associated with an increase in capital per head, but capital is not the only requirement for growth. In this way, if capital is made available without providing a framework for its use, it will be wasted. To this end, adequate funding of public sector recurrent budget makes for effective and functional civil service and, therefore, setting the basic framework for capital expenditure usage. In conclusion, therefore, public expenditure contributes to growth. It is the composition of public expenditure rather than the level that is important. The distinction between capital and recurrent expenditure can be misleading. Thus, the focus should be the distinction between productive and unproductive expenditure.

Another area of conflict in government expenditure is the relationship between public expenditure and private spending or more specifically, the public sector versus private sector. Until recently, economists virtually ignored the effect of government spending on economic activities. The first to establish a link between public spending and economic growth was J.M Keynes in 1936. Keynes established the multiplier effect of public spending. This traditional approach has been improved upon by (Musgrave 1973), Blinder and Solow (1973) and Choudhry (1976). The Keynesian approach neglected the impact of government spending on private spending. The recent approach argued about the crowding-out-effect on growth. This recent approach became known as the neoclassical tradition; since the crowding-out-effect was suppose to come from the pressures exerted on financial market by the public sector borrowing requirements.

**Money Supply and Economic Activities**

The theoretical root of monetary theory, according to visser (1991) is traced to the quantity theory of money. The quantity theory states that, a change in the money supply all things being equal results in a proportional change in the price level. This assertion came under attack by Keynes when he introduced into the money demand function, speculative demand for money or the liquidity preference, the channels by which money supply influences economic activities. In the Keynesian tradition, monetary policy operates through changes in interest rate sensitivity and this will result in a change in the interest rate, as interest moves to bring the demand for money into equality with the new level of money supply. Thus, new level of interest rates in turn influences both consumption and investment spending, hence the level of output.

How will changes in the rate of interest affect economic activity? The Keynesian economists argued that since inflation is a sign of an economy overheating, a rise in interest rates tend to lower it by checking investment and hence, overall economic demand. Thus, the Keynesian economists argued that the level of activity is determined by the level of injections and withdraws in the economic system. The Keynesian economists assume that investment expenditure is influenced by changes in interest rate since capital formation results mainly through the issues of equities or borrowing from banks and this is more attractive when interest rates are low. They argued that monetary policy will be more effective if the aim is to control interest rate directly rather than money supply.

In the Nigerian environment, the limit of monetary policy can be seen in the various institutional and legal framework of the country. Teriba (1976), examined the striking features in the structure and development of the various monetary policy instruments. To him, the Nigerian economy is largely a subsistence production economy and the level of subsistence production to gross domestic product is very large. This subsistence sector in Nigeria does not entirely fall outside the scope of monetary exchange, but it is subject to very limited exchange. Another feature of the economy can be seen from the high ratio of currency to total money supply and this reflects the underdeveloped nature of the banking habit. All these factors limit the effectiveness of monetary policy in Nigeria.

## *III Methodology*

**Sources of Data**

Data used in this study were obtained from various issues of Central Bank of Nigeria (CBN) Statistical Bulletin. They span the period 1970 to 2009. This gives a considerable degree of freedom to capture the effect of government spending and interest rates on aggregate output in Nigeria. CBN data are in annual frequency.

**Technique of Analysis**

The techniques of analysis are in three stages. First, we estimate the model using the ordinary least square. Secondly, historical simulation of the model is presented and lastly policy simulation is presented.

**Model Specification**

This study presents a macro-economic model of an open economy, allowing for lagged adjustment or predetermined variables. Thus, it is basically a dynamic formulation. The model is cast in the basis IS\LM curve, that is, the general equilibrium solution to output determination. The following system of eight equations, six behavioral and technical equations and two identities assume the open economy to be specified. The behavioral and technical equations assumptions are implied in the coefficient of the explanatory variables, which is equally the partial differential of the variable equation (see Atta 1981 and 1994).

1 $C_i = a_1 + a_2 y_1 + a_3 C_{1-1} + u_{ct}$

$a_2, a_3 > 0, U_{ct} = 0$

2 $1_1 = C_1 - C_2 R_1 + C_3 Y_1 + C_4 1_{1-1} + U_{it}$

$C_2 > o, C_3 C_4 > o, U_{it} = O$

3 $M_{st} = L_o + L_1 Y_t + L_3 R_t + L_4 M_{t-I} + UM_{ot}$

$L_I, L_4 > L_3 < O, Um_{st} = O$

4 $IMPt = go + gi Y_t + g_2 Res + g_3 PIMP_t + g_4 imp_{t-I} + UIMP_t$

$g_i, g_2, g_4 > O, g_3 < O, UIMP_t = O$

5 $Xoil = H_o + H_1 P X Poil + h_2 FY + H_3 Xoil_{t-1} + Ux oil$

$H_1, H_2, H_3 > O, Uxoil = O$

6 $Xno = No + N_1 XYAP + N_2 P X NO + N_3 XYIP_t + UXNo$

$N_1, N_2, Ns > O, UXN_o = O$

7 $TXP = Xpoil + XPNO$

8 $Y_t = Ct + It + Gt (TXPt - IMPt)$

The variables used in the model are defined as followings

$C_t$= Aggregate Consumption
$I_t$=Aggregate Investment
$M_{st}$=Money Supple
$G_t$=Government expenditure
$Y_t$=Goss Domestic Product or Aggregate output
$R_t$=Interest rate
$TXP_t$=Total Export
$YAP_t$=Agricultural output
$YIP_t$=Industrial output
$L_t$=Labour input
$K_t$=Capital stock
$Impr_t$=Total Import Spending
Res=International Reserves
$Pimp_t$=Import price
Xoil=Oil export
Pxoil=Price of oil export
Fy=foreign export GNP
XNo=Non-oil export

XPAP= Agricultural export
PXNo=Price of non-oil export
$XYIP_t$=Industrial export

$C_{t-1}$, $I_{t-1}$, $YAP_{t-1}$, $YIP_{t-1}$, $K_{t-1}$, $Ms_{t-1}$, $IMP_{t-1}$, $Xoil_{t-1}$, $XNO_{t-1}$ are all lagged adjusted variables already defined.

Uct, Uit, Umst, UYAPt, Ukt, Uimpt, Uxpoil, and UXPNot are all stochastic disturbance terms, which are expected to be equal to zero.

**Assumption of Model Specification**

The model consists of three sectors, thus, domestic, monetary, and foreign sectors.

Equation1 and 2 describe the domestic sector; equation (1) is the consumption function, which expresses consumption spending as a function of income ($Y_t$) lagged consumption $C_{t-1.}$ Equation 2 is the investment function, which states that investment spending is negatively related to Interest Rate ($R_t$) and positively to output or income ($Y_t$) and lagged investment $I_{t-1.}$

Equation 3 is the money market equilibrium. At equilibrium Md (money demand) is equal to money market (Mst).This is basically a Keynesian specification in the sense that interest rate is determined by the forces of money supply and demand. In this work, interest rate is assumed exogenous in this specification. This is similar to Attah(1994), which has an exogenous interest rate. An exogenous interest rate allows for a unique determination of monetary equilibrium.

Equation 4,5,6 describe the foreign sector.Equation,4, describes import as positively related to income ($Y_t$), international reserves (Res) and negatively to import prices ($Pimp_t$). Equation (5) is the oil export function, which relates oil export to price of oil, foreign sector GNP, (FY) and lagged oil export. Equation (9) is the non-oil export equation. It relates price of non-oil export (PXNo) to exchange rate and lagged non-oil output (XNot-1). Equation 5 and 6 are closed by equation (7) with an identity specification that total export $TXP_t$ is the sum of equation 5 and 7.

Equation (8) is the expenditure of an open economy, with a balance of trade component (TXP- $Imp_t$).It states specifically that at equilibrium, $Y_t$ is the sum of consumption spending, investment spending, government spending and balance of trade.

**Solution of the model specification**

There are 8 equations of which 6 are stochastic equations and 2 identities. The solution is carried out within the traditional IS\LM framework. We assume that all the lagged adjustments are equal to zero. In this case the models are specified in their static status with no lagged adjustment

**IS (Expenditure Equilibrium)**

We derived the expenditure equilibrium by substituting into equation (8), equations 1,2,4 and 7. We have the solution in the traditional Yt-Rt plane. By total differentiation of equation 8,we have

$$\frac{dY_t}{dR_t} = \frac{C_2}{1-a_2-C_3+g_1} < O \qquad (a)$$

the slope of the IS curve is negative; an increase in the rate of interest ($R_t$) will lead to a fall in output if the expenditure equilibrium is to be maintained.

**LM Equation (Monetary Equilibrium)**

From equation 3, we have the monetary equilibrium; if we differentiate totally, we have

$$\frac{dy_t}{dR_t} = \frac{L_{3-}}{-L_1} > O \qquad (b)$$

Thus, the LM equation has a positive slope since $L_3 < 0$, the negative comes out to be positive.

**Policy Analysis**

We now analyse the response of output (Yt) and interest rate (Rt) to changes in the various policy instruments. Specifically, how changes in monetary variables, fiscal variables and foreign trade variables affect changes in output and interest rate.

**Monetary Policies**

This involves manipulation of monetary variables such as Ms, (money supple) and autonomous money demand. From equation 3, we have

$$\frac{dR_t}{dL_o} = \frac{-1}{L_3} > 0 \quad (c)$$

$$\frac{dRt}{dMs_t} = \frac{1}{L_3} > 0 \quad (d)$$

In equation 3 an increase in money demand will increase interest rate, thus there is a positive relationship. From the two sector equations (3 and 8), we have these solutions.

$$\frac{dR_t}{dL_o} = \frac{(1-a_2-c_3+g_1)}{\triangle} > 0 \quad (e)$$

$$\frac{dR_t}{dMs_t} = \frac{(1-a_2-c_3+g_1)}{\triangle} > 0 \quad (f)$$

$$\ldots\ldots\ldots \quad \frac{dR_t}{da_2} = \frac{dR_t}{dc_2} = \frac{dR_t}{dG_t} = \frac{-C_2}{\triangle} > 0 \quad (g)$$

In equation (e) and (g), there is a positive multiplier relationship between interest rate and the autonomous component. But in equation (f), an increase in money supply results in a fall in interest rate. The following multiplier gives the relationship between monetary variables and output,from equations 3 and 8.

$$\frac{dY_t}{dM_t} = \frac{C_2}{\triangle} > O \quad (L)$$

$$dY_t = \frac{-C_2}{\triangle} > 0 \quad (i)$$

Where $\triangle = L_3 (1-a_2-c_3+g_1) + C_2 L_2$

A change in money supply has a positive change on output, while a change in autonomous money demand results in a negative change in output.

**Fiscal Policies**

Fiscal policy involves the manipulation of government spending in the economy. From equation (8), we have

$$\frac{dY_t}{dG_t} = \frac{dY_t}{dC_2} = \frac{dY_t}{da_1} = \frac{1}{1-a_2-C_3+g_1} > 0 \quad (j)$$

…… An increase in $G_t$, $C_2$ and $a_1$ will lead to an increase in output $Y_t$. From the two sector's equations, equation 3 and 8 we have these solutions.

$$\frac{dYt}{dGt} = \frac{dYt}{da2} = \frac{dYt}{dc_2} = \frac{L1}{\triangle} > 0 \quad (K)$$

$$\frac{dR_t}{dG_t} = \frac{dR_t}{da_2} \quad \frac{dY_t}{dc_2} = \frac{L_1}{\triangle} > 0 \quad (L)$$

A change in any of the autonomous components will have a positive impact on the level of output and interest rate.

**Foreign Trade Policies**

In the expenditure sector equation (8), we obtained the multiplier for the balance of trade variables, thus:

$$\frac{dY_t}{dpXpoil} = \frac{H_1}{1-a_1-c_3+g_1} > 0 \quad (m)$$

$$\frac{dY_t}{dRes} = \frac{g_1}{1-a_2-c_2+g_1} < 0 \quad (n)$$

$$\frac{dY_t}{dPIMP_t} = \frac{g_3}{1-a_2-c_3+g_1} > 0 \quad (0)$$

$$\frac{dY_t}{Dpxno} = \frac{N_2}{1-a_2-c_3+g_1} > 0 \quad (p)$$

$$\frac{dY_t}{dFy} = \frac{N_2}{1-a_2-c_3+g_1} > 0 \quad (q)$$

Equations (M), (O), (P) are positive multipliers. An increase in oil price, import price, price of non-oil and foreign GDP will increase output but in the case of reserve, a reduction in external reserve will reduce output.

## *IV. Regression Results of the Stochastic Equations*

**Model Estimation**

$$C_t = 52.7+0.35Y_t+0.58C_{t-1}$$

t-ratio (0.9) (3.9) (0.23) (3.1)

$R_2$ =0.96 $R_2$ = 0.95 F (2,26) =300.51

DW=1.3

$It = -1.78 + 0.47R_t + 0.04Y_t + 0.341_{t-1}$

t-ratio (-0.24) (1.93) (2.3) (3.2)

$R_2$ = 0.979 $R^2$ =0.976 F (3,26) =345.89

DW = 1.3

$M_{st}$ = 1.78 + $0.02Y_t$ + $1.18R_t$ + $1.01Ms_{t-1}$

t-ratio (0.37) (1.61) (0.24) (5.3) (3.3)

$R^2$ = 0.982 $R^2$ = 0.980 F(3.31) = 425.87

DW =1.3

$Imp_t$ = -20.2 + $0.29Y_t$ -0.23Res + 0.11 $PIMp_t$ (3.4)

t-ratio (-0.28) (1.8) (-7.50) (0.14)

$R^2$ = 0.96 $R^2$ = 0.95 F (3,31) = 178.62

DW =3.2

Xoil = -1371.75 + 7.03 pxoil + 15.96Fy +0.59Xo $il_{t-1}$ (3.5)

t-ratio (-2.85) (1.48) (2.8) (3.37)

R2 = 0.85 R2 = 0.83 F (3,23) = 37.34

DW = 2.0

Xno = -22 +1.45 PXNo +0.39EXR + 0.44Xnot-1 (3.6)

t-ratio (-023) (1.45) (3.14) (2.22)

$R^2$ = 0.87 $R^2$ =0.86 F(3,31) =62.73 DW = 2.0

All the a priori expectations are correctly signed in all equations except interest rate in investment equation, which showed a positive relationship. The only problem in the result is that the "a priori" sign of the intercept is confirmed negative in most of the equation but since the model is basically used to validate factual analysis, the negative does not affect the structure of the model The t-ratio and the F-statistics are in their conventional levels in all the equations. The coefficient of determination and adjusted coefficient of determination are very impressive in all the equations ranging from 0.982 and 0.98, 0.85 and 0.83 respectively. This shows a very impressive causal relationship between the dependent variables and the independent variables. In this case, all independent variables explain over 80 percent variation in the dependent variables. The Durbin-Watson statistic in most of the model shows either the presence of positive or negative autocorrelation. Since the variables are basically macro-econometric in nature, changes in one variable can easily affect the other.

**Historical Simulation Result (Model Evaluation)**

The basic reasons for historical simulation are model validation, evaluation and counter factual analysis. In this case, historical simulation enables the researcher compare the simulated series obtained from a dynamic series with the actual series.

To evaluate the performance of these models in the economy, this study used the root-mean square simulation error (RMSE), root-mean square percent error (RMPE), Theil's inequality coefficient and the correlation coefficient between the actual and simulated values of key endogenous variables.

The table 3.1 below presents the summary of the statistics for the historical simulation for the period 2004-2009 using the time series processor TSP 4.3 (an econometric software for PCs).

**Table 3.1 Historical Simulation Results**

| Dependent Variable | Correlation Coeficicient | RMPE | RMPE | Thiel equality coefficient 1961 | 1966 |
|---|---|---|---|---|---|
| GDP | 0.94 | 62.36 | 0.15 | 0.9 | 0.18 |
| Consumption | 0.55 | 921.6 | 0.26 | O.20 | 0.36 |
| Investment | 0.82 | 43.3 | 0.07 | 0.11 | 0.22 |
| Money supply | 0.96 | 74.3 | 0.08 | 0.09 | 0.19 |
| Import | 0.57 | 207.0 | 0.18 | 0.14 | 0.27 |
| Oil Export | 0.60 | 55.2 | 0.16 | 0.17 | 0.33 |
| Non Oil Export | 0.03 | 9.42 | 0.25 | 0.20 | 0.36 |
| Total Export | 0.60 | 450.0 | 0.13 | 0.17 | 0.35 |

In table 3.1 above, the eight endogenous variables performed very well as all with the exception of non-oil export simulated very well. It shows that the macro-econometric model of the economy actually evaluated the performance of the structure of the economy. The GDP has the coefficient between the actual and simulated series to be 0.94 showing that there is a perfect simulation. The theil's 66 lie between 0 and 1, theil 61 is 0.18 which is less than 20% indicated a good tracking of the actual series by the predicted series.

All the other variables perform equally very well except non-oil export which reflect the nature of Nigerian economy to be basically a mono-product economy, relying mostly on oil export.

**Policy Simulation (Model Policy Evaluation)**

Policy simulation according to Iyoha (2001) is a "term given to experimentation with a macro econometric model using alternative policy scenario" In this case; we examined how changes in government autonomous expenditure and interest rate affect the endogenous variables.

**Table 3.2 Policy Simulations: Dynamic Multiplier Effect of a Unit Increase in Government Expenditure on GDP**

| Years | Dynamic GDP Multiplier |
|---|---|
| 2004 | 1.12 |
| 2005 | 1.39 |
| 2006 | 1.61 |
| 2007 | 1.79 |
| 2008 | 1.93 |
| 2009 | 2.05 |

A look at table 3.2 shows that the impact multiplier of government spending is 1.12 while the dynamic multiplier of the end of the six-year period is 2.05. This suggests that in developing countries fiscal policy is an effective instrument for counter-cyclical income stabilization.

**Table 3.3 Policy Simulation Dynamic Multiplier of 10 Unit Change in Interest Rate on GDP 1995-2000**

| Years | Dynamic Gdp Multiplier |
|---|---|
| 2004 | 42.42 |
| 2005 | 34.69 |
| 2006 | 28.20 |
| 2007 | 22.79 |
| 2008 | 18.33 |
| 2009 | 14.05 |

Monetary policy has greater impact on GDP than fiscal policy. The impact multiplier at the beginning of the period is 42.42 but this deteriorates as time progresses and finally gave a dynamic multiplier of 14.05. In this case, the long-run impact is not effective.

## *V. Conclusion*

The results obtained are very impressive and generally satisfactory. The results conform to our a priori expectation except for interest variable in investment equation and non-oil export in the historical series. The empirical evidence from policy simulation shows that fiscal policy and monetary policy are the main policies for counter-cyclical output stabilization in Nigeria. But monetary policy of interest rate is more potent and dependable than fiscal policy of government spending in counter-cyclical management of the economic output. A useful observation is that fiscal policy of government spending is consistent over a long period in managing the economy. Monetary policy weakens as time progresses and as such deteriorates over a long run period.

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