MONETARY POLICY AND INFLATION STABILIZATION IN TURKEY

Fatih ÖZATAY

Central Bank of the Republic of Turkey

December 1992

The views expressed here solely belong to the author and do not necessarily represent those of the Central Bank of the Republic of Turkey.
I. INTRODUCTION

The Turkish economy has undergone through adjustment policies together with a set of major reforms since 1980.\(^{(1)}\) In this continuously changing financial environment, the Central Bank prepared its first monetary program for 1986 as an internal document. However, the Central Bank discontinued this approach after 1988 due to very large differentials between the targeted and realized values. In January 1990, just after various institutional arrangements in the financial markets, the Central Bank publicly announced its "first" monetary program which aimed at decreasing the prevailing uncertainties and controlling inflation. The Central Bank refrained from announcing a monetary program for 1991 mainly because of the Gulf war and uncertainties on the fiscal side. In January 1992, a second program was made public. In the last two of these programs, the Central Bank did not target a conventional monetary aggregate. Rather, targeted variables were chosen from the Central Bank's balance sheet.

A necessary condition for a successful implementation of a monetary program is the validity of significant and stable relationships between money-income and money-price variables. Furthermore, it is an additional asset, should movements in the monetary variables have any information content for subsequent movements in income and prices. However, a successful implementation of any monetary program needs stronger conditions to be met. Validity of stable and significant money-income and money-price relationships are, though necessary, not sufficient: The relevant monetary aggregate should be under the control of the monetary authority. This necessity brings the problem of the co-ordination of fiscal and monetary policies into focus.

If the government budget is persistently in deficit as in many developing countries, and furthermore a tight monetary policy is being implemented, then the famous "unpleasant monetarist arithmetic" of Sargent and Wallace comes to the stage.\(^{(2)}\) Financing the persistent government budget deficit through issuing domestic debt causes interest rates to rise. This further increases the fiscal deficit, and consequently the economy enters a vicious circle. In an open economy with rising interest rates domestic currency becomes under pressure to appreciate which has negative effects on the current account balance. If instead of reducing the deficit, the persistent deficits are monetized, then an inflationary process is inescapable. In such an environment, it is extremely difficult for a monetary authority to adhere to its targets.

---

\(^{(1)}\) These are discussed in Saracoglu (1987), Aricanh and Rodrik (1990) and Bayazitoglu, Ersel and Ozturk (1991).

\(^{(2)}\) Sargent and Wallace (1981).
This paper, in an open economy context, analyzes these problems for the Turkish economy. Section II is devoted to a detailed analysis of the stationarity properties of the variables used throughout the study. In the third section of the paper, it is shown that growth rates of some of the monetary aggregates, such as M2, reserve money, currency issued and currency in circulation have predictive power for the fluctuations of nominal income and the GNP deflator. In Section IV, the validity of a stable long-run money demand function is questioned. It is shown that, despite the changing financial environment, it is possible to find stable long-run money demand functions which are homogeneous with respect to nominal income. The difference between money supply and the estimated long-run money demand is taken as the excess money supply. Moreover, it is shown that excess money supply plays an important role in explaining the short run dynamics of price, interest rate and exchange rate variables, which are the key equations of the model introduced in the following section. In Section V, a macroeconomic model for analyzing the fiscal and monetary policy coordination problem is developed and by making use of this model some counterfactual simulations are provided. Section VI concludes.

II. MODELLING NONSTATIONARITY

Since stationary series are needed for model building, the degree of integratedness of the univariate series should be investigated. The right identification of the degree of integratedness of time series under investigation is at up-most importance for the Granger causality tests to which we will turn at the following section. The results of the Granger causality tests are very sensitive to the types of filters used for making the series stationary.\(^{(3)}\) Since we are going to test the predictive power of various monetary indicators for the fluctuations in price and output series in the following section, the degree of integratedness of the series is analyzed in detail here.

If a series needs first-differencing \(d\) times and seasonally differencing \(D\) times to become stationary, it is said to be integrated of order \((d,D)\) and denoted by \(I(d,D)\). That is, for quarterly series, \((1-B)^d(1-B^4)^Dx_t\) is stationary.\(^{(4)}\) Here \(B\) is the lag operator and \(B^kx_t = x_{t-k}\). Note that when \(d = D = 1\), \((1-B)^d(1-B^4)^Dx_t = (1-B)(1-B)(1+B)(1+B^2)\). Hence, in this case there are five unit roots; two for the zero frequency, one for the biannual frequency, and two for the annual frequency. Engle, Granger and Hallman (1988) give an alternative definition of seasonal integration. They define a variable \(x_t\) to be seasonally integrated of orders \((d, d_s)\), if \((1-B)^dS(B)^{d_s}x_t\) is stationary. Consequently, \(x_t\) is denoted by \(SI(d, d_s)\). For quarterly series, \(S(B) = (1+B+B^2+B^3)\).

\(^{(3)}\) See for example Stock and Watson (1989).
\(^{(4)}\) See for example Osborn et al. (1988).
Note that, as shown by Hylleberg et. al. (1990), when \( d = d' = 1 \), \((1-B)S(B) = (1-B^4)\). Note further that, \( S(2,1), S(2,0), S(1,1), S(1,0), S(0,1) \) and \( S(0,0) \) are all nested in \( I(1,1) \). In the case of multiple unit roots, Dickey and Pantula (1987) suggest to start the testing sequence from the maximum number of unit roots under consideration.

Inspection of the figures for the log levels and first differences of the series indicate a very strong seasonal pattern especially for real GNP, nominal GNP, GNP deflator, industrial production index, currency in circulation, and M1 (Figures 1-5). Maximum order of integration for the economic time series is generally equal to or less than \( I(1,1) \). Since seasonally unadjusted series is used throughout the study, we start to check the order of stationarity of the series from the null hypothesis of \( H_0 \) which states that \((1-B)(1-B^4)x_t \) is stationary. In the notation of Engle et. al., this is equivalent to the null hypothesis of the stationarity of \((1-B)(1-B)S(B)x_t \). When it is failed to reject the null hypothesis, the series is classified as \( I(1,1) = S(2,1) \). When the seasonal unit roots are rejected, the series is tentatively classified as \( S(2,0) \). Then, this new hypothesis is further tested. For this purpose, the conventional zero frequency unit root tests are applied according to the approach advocated by Dolado, Jenkinson and Rivero (1990). They advocate estimating the most unrestricted model \([(1-B)Y_t = a + bt + cY_{t-1} + \text{lags of } (1-B)Y_t] \) initially. If the null hypothesis of a unit root is not rejected and the trend term is insignificant, then the above model without the trend term is estimated. If again, the null hypothesis of a unit root is not rejected, then the most restricted model is estimated. The critical values for the null hypothesis of a unit root is tabulated in Table 8.5.2 of Fuller (1976). Relevant blocks are the third, second and the first blocks for the first, second and the third steps, respectively.

The results of the unit root tests are given in Tables 1, 2, and 3. These results indicate that currency issued, current GNP and the GNP deflator are \( S(2,1) \) series. Industrial production index is found to be \( S(1,1) \). The rest of the series analyzed do not have any seasonal unit roots. However, most of them have deterministic seasonality. Both average bond rate and real GNP have deterministic trends. Yield of M2 is stationary. Aside from currency issued and the yield of M2, all of the monetary aggregates and various yields are integrated of order \( S(1,0) \). Note further that all of the models for zero-frequency unit root tests are also estimated recursively, and by making use of one-step Chow tests constancy of their parameters are questioned. If there are break points, models advised by Perron (1989) are employed. Perron shows that if there are break points in the data, then classic unit root tests erroneously do not reject the null hypothesis.

---

(5) Osborn (1990) investigates the order of integratedness of macroeconomic time series of the U.K. and finds that most of the time series are integrated of orders less than \( I(1,1) \).

(6) The \( t \)-ratios of the parameters of seasonal dummies are not shown.
hypothesis when it is false. The results, which are not given here, are in line with the classic unit root tests. Having determined the stationarity properties of the series, we now turn to the role of monetary aggregates in explaining the movements of income and price series.

III. PREDICTIVE POWER OF MONEY FOR OUTPUT AND PRICES

For monetary policy to play any role in the anti-inflationary process, it has to have some information content for subsequent movements in nominal income and prices. Hence, if some of the monetary variables have a predictive power for the fluctuations in these variables, then the monetary authorities can make use of this power. In this section, we turn to this issue and present the results of various Granger "causality" tests. We have already mentioned the sensitivity of Granger causality tests to the stationarity properties of the data. When the filters are not properly used, the conclusions reached may be wrong. The detailed stationarity analysis of the preceding section minimizes this risk. However, the Granger-causality results are also sensitive to the number of lags used in the analysis as shown by Thornton and Batten (1985). Keeping this point in mind, instead of an ad-hoc choice of lags, relevant number of lags of the variables are found according to the Akaike's final prediction error (FPE) criteria. Note that this is not an exact solution to the problem. Should another criteria be applied, the number of lags could differ. Nonetheless, to decrease the dimensionality of the predictive power tests, we continued with lags chosen according to the FPE criteria.

Firstly, we looked at the predictive power of various monetary aggregates for fluctuations of nominal income that are not already predictable by the past fluctuations of nominal income. A F-test from the below regression equations is formed.

\[ Y_t = a_1 + b_1 Y_{t-1} + \ldots + b_m Y_{t-m} \]  
\[ Y_t = a_2 + c_1 Y_{t-1} + \ldots + c_n Y_{t-n} + d_1 M_{t-1} + \ldots + d_k M_{t-k} \]  

The maximum number of lags are chosen as 5. Then, Akaike's final prediction error criteria is employed to obtain m, n and k. Note that n is not constrained to be equal to m; thus, non-nested tests may arise. Y is the appropriately filtered nominal GNP. That is, it is passed through a filter of the form \((1-B)(1-B^4)\). All of the monetary aggregates, except currency issued, are first differenced. The filter for currency issued is \((1-B)(1-B^4)\). The null hypothesis of "no causality from monetary aggregates to nominal income" is rejected at the five percent level for M2. currency issued, currency in circulation and reserve money. We are not able to reject the null hypothesis for M1, central bank
money, monetary base, domestic liabilities of the Central Bank and net domestic assets of the Central Bank. (Table 4).

Secondly, the predictive power of monetary aggregates for the GNP deflator is tested. For this purpose, the information set is enlarged to include three variables, namely GNP deflator(def), real GNP and a monetary aggregate. In the restricted equation, (1-B)(1-B^2)def is explained by its lags and by the lags of detrended real GNP. Unrestricted equation, in addition to these variables, has the lags of the relevant monetary aggregate as well. Table 5 reports the F statistics for tests of the null hypothesis of "no Granger-causality from monetary aggregates to the GNP deflator." That is, it tests whether all of the coefficients on the relevant lagged monetary variable are zero or not. In this case, the null hypothesis is rejected for M2, currency in circulation, currency issued, reserve money, monetary base and net domestic assets of the Central Bank. Note that, for nominal GNP equations, the last two variables are found to have no predictive power.

Thirdly, the same analysis is carried for the detrended real GNP. Now, restricted equation is a distributed lag of detrended real GNP and the GNP deflator, whereas the unrestricted equation has the lags of the relevant monetary aggregates as well. Interestingly enough, none of the monetary aggregates with an exception of M1 has any predictive power for the detrended real GNP. (Table 6).

Based on these results, we can say that monetary variables are not useful for predicting the detrended real GNP. Contrary, some of the monetary aggregates have predictive power for fluctuations of nominal income and the GNP deflator that are not already predictable by their past values. Hence, for the period analyzed, the first necessary condition of a successful monetary policy is met, provided that it is aimed at minimizing price increases. Should the other conditions be satisfied, this can be achieved by controlling the growth rates of either the currency in circulation, or the currency issued, or M2, or reserve money. Controlling the growth rates of base money and the net domestic assets of the Central Bank may also prove useful.

IV. THE LONG-RUN STRUCTURE

Figure 6 demonstrates the downward trend in the inverse velocity of currency issued and M1. Validity of a stable long-run money demand function is essential for the implementation of monetary policy. As emphasized in the introduction section, the Turkish economy has undergone through a set of major financial and nonfinancial reforms. Hence, there are various sources of potential regime changes which question the validity of a stable money demand function. We now turn to this issue.
When nonstationary variables are differentiated to make them stationary, useful long-term relationships among them are lost. As shown by Engle and Granger (1987), in general, any linear combination of nonstationary variables integrated of the same order is also nonstationary. However, there can exist a stationary linear combination. If this is the case, then these variables are said to be cointegrated by Engle and Granger and making use of this relationship improves the specification. An alternative method which takes into consideration the possibility of a multiplicity of cointegration relationships was developed by Johansen (1988) and Johansen and Juselius (1990). First, they consider a k'th order vector autoregressive process

$$x_t = A_1 x_{t-1} + \cdots + A_k x_{t-k} + u + bD_t + e_t, \quad t = 1, \ldots, T,$$

where the \((p \times 1)\) vector of \(SI(1,0)\) variables is denoted by \(x\), \(u\) is a vector of constants, \(D_t\) are centered seasonal dummies, \(e_t\) is a vector of white noise variables. Taking the first differences, one can write this model in the following error correction form

$$(1-B)x_t = B_1 (1-B) x_{t-1} + \cdots + B_k (1-B) x_{t-k+1} + P I x_{t-k} + u + bD_t + e_t, \quad t = 1, \ldots, T,$$

where \(PI = \alpha x beta'\) and \(\alpha, beta\) are \(p \times r\) matrices. Here if rank of the matrix \(r = 0\), then variables are not cointegrated. If \(r = p\), then the PI matrix is stationary. In the other cases, that is when \(0 < r < p\) there are \(r\) cointegrated vectors and thus \(r\) \(beta x\) relationships can be interpreted as \(r\) stationary combinations among \(SI(1,0)\) variables. The null hypothesis of \(H_0(r) : PI = \alpha x beta'\) is testable, and the critical values are provided by Johansen and Juselius (1990).

We hypothesize a standard long-run money demand function (\(M^d\)) which is a function of price level (\(P\)), real income (\(Y\), own yield (\(R_m\)), and opportunity cost of holding money (\(R_o\)).

$$M^d = f(P, Y, R_m, R_o); f_1 > 0, f_2 > 0, f_3 > 0, f_4 < 0.$$

For the money demand variable, we alternatively use two different measures of money, namely currency issued (\(C\)) and \(M_1\). Since cointegration relationship is valid only for variables of the same order or integration and real GNP seems to have a deterministic trend, we cannot use real GNP for testing cointegration. Unfortunately, at the time of preparation of the study, the expenditure side of GNP has not been available yet. This made impossible to make use of series such as real domestic expenditure as a proxy for the volume of transactions. To overcome this problem, instead of searching for a long-run relationship among money demand, price level, real GNP and various yields, a

---

(7) For a recent survey on the demand for money see for example Goldfield and Sichel (1990).

(8) \(f_i\)'s denote the partial derivatives with respect the \(i\)th argument.
relationship among money demand, nominal GNP (CGNP), and the relevant yields is investigated. Regarding the own yield, obviously for currency issued, there is not a yield; for M1, since the demand deposits portion is interest-bearing, a weighted interest rate is calculated. Opportunity cost of holding money is represented by various variables. The first one is the annual rate of inflation as measured by the producers price index. The second cost variable is the rate of return of holding foreign currency. The market value of domestic currency against US dollar is the relevant variable. For currency issued and M1, although we decided to use interest rate of time deposits alternatively, since it is a stationary variable, we could not. If the model is taken to be log-linear, the below model, where lower case letters indicate the logarithm of the relevant variable, is obtained:

\[ m^d = a_1 \text{cgnp} + a_2 r_m + a_3 r_o. \]  

From the results of the Section II, we know that \( c_l, m_1, r_m, r_o \) (both yield on holding foreign currency (\( r_{fe} \)) and annual rate of inflation (inf)) are SI(1,0) variables; whereas, cgnp and ci are SI(2,1). Hence, to transform them to SI(1,0) form, they are passed through a filter of the \((1-B)^d\) type. So, for ci, the VAR corresponding to (4) above is formed among \((1-B)^d ci, (1-B)^d cgnp, \) and \( r_{fe} \). After various trials, it is considered to use 3 lags for each of the variables. Some diagnostics from the estimation of (4) by 3 lags are provided in Table 7. The results are satisfactory. For none of the models the null hypothesis of normal and white noise residuals are rejected. Second panel of Table 7 gives the results of eigenvalue and trace tests for reduced rank. Based on these results, \( r = 1 \) at the five percent significance level. The estimated beta and alpha vectors are provided in the second panel of Table 7. Note that the coefficient of \( r_{fe} \) is negative, as expected. The estimated long-run currency in circulation demand function takes the following form:

\[ (1-B)^d ci = 1.18(1-B)^d cgnp - 0.43r_{fe}. \]  

In addition to the test for reduced rank, we also want to test the homogeneity of currency in circulation demand with respect to nominal income, which is our first hypothesis (\( H_1 \)). In other words, \( H_1: \beta_1 = -\beta_2 \). The estimated beta vector under the null hypothesis and the test result are shown in Table 7, Panel 3. The likelihood ratio test value is 0.26. When compared to CHI^2(1), \( H_1 \) is not rejected at any conventional level of significance. Finally, the stationarity of this relationship is questioned. Hence, \( H_3: [1, -1, 0] \). The results are again given in the third panel of Table 7. The test value is 0.29 and when compared to CHI^2(2), it is not rejected at the five percent significance level. These results show that there is a stationary long-run
currency demand function. Moreover, this function is homogeneous with respect to
nominal income:

\[(1-B^4)\phi c^d = (1-B^4)\phi gnp - 0.12r_{fc}\]  

(8)

The estimated long-run \(c_i\) demand, \(c_i\) supply, and the excess \(c_i\) supply are shown in
Figure 7.

Now, we investigate if there exists a stable long-run \(m1\) demand equation. In addition
to the variables used above, we also use the own yield of \(m1\), namely \(r_{m1}\). Both \(m1\) and
\(r_{m1}\) are \(S1(1,0)\) variables. Number of lags used in the estimation of model (4) is three.
Relevant diagnostics are provided in Table 8. The results are satisfactory. For none of
the models, the null hypothesis of normal and white noise residuals are rejected. The
second panel of Table 8 gives the results of eigenvalue and trace tests for reduced rank.
Based on these results \(r=2\) at the five percent significance level. The estimated beta
and alpha vectors are provided in the second panel of Table 8. The second beta vector
seems to resemble a long-run money demand equation. All of the signs of the variables
are as expected a priori:

\[m1^d = 9.54 + 3.46(1-B^4)\phi gnp + 1.80r_{m1} - 13.51r_{fc}\]  

(9)

We tested the same hypothesis with those for \(c_c\). Firstly, the validity of the restrictions
of the type \(\beta_1 = -\beta_2\) on both of the beta vectors are tested. The test value is 0.90.
When compared to \(\chi^2(2)\), the homogeneity of nominal \(m1\) demand with respect to
nominal income is not rejected at the five percent level. The second beta vector
resembles a long-run money demand equation:

\[m1^d = 12.48 + (1-B^4)\phi gnp + 2.28r_{m1} - 20.55r_{fc}\]  

(10)

Secondly, we tested if one of the beta vectors is of the \([-1, 1, 0, 0, 0]\) form. The
likelihood ratio test value is 4.22, and when compared to \(\chi^2(2)\), it is not rejected
(Table 8). The estimated long-run \(m1\) demand, \(m1\) supply, and the excess \(c_c\) supply are
shown in Figure 8.

Since \(gnp\) and \(c_i\) are \(S1(2,1)\) series, they may be seasonally cointegrated. That is, when
they are passed through a filter of the \((1-B^2)\), the resulting series may be cointegrated.
Note that in Turkey almost 20 percent of the nominal GNP is created in agriculture.
Note further that the Central Bank extends credit to the Soil Products Office and the
Sugar Company, which purchase two important agricultural products: wheat and sugar.
Hence, the possibility of a long-run seasonal relation between currency issued and
nominal GNP also makes sense institutionally. Now, we investigate this possibility by
making use of the Engle and Granger's two-step procedure. The results are given below.

\[(1 - B^2)c_t = 0.0018 + 0.1834(1 - B^2)c_{gap}\] \hspace{1cm} (11)

When a seasonal unit root test is applied to the time series of the residual of this regression; the null hypothesis of a unit root at the zero-frequency is rejected, whereas the null hypothesis of seasonal unit roots is not.\(^9\) Hence, we conclude that there is a seasonal cointegration between currency issued and nominal GNP.

V. CONTROLLING MONETARY AGGREGATES AND THE COORDINATION OF FISCAL AND MONETARY POLICY

In the preceding sections, we have shown that the two necessary conditions for the implementation of a successful monetary policy are met. First, monetary aggregates such as currency in circulation, currency issued, reserve money and M2 are shown to have a significant predictive power to explain the nominal income and price movements. Second, the existence of a stable long-run money demand function is verified. Although these are the necessary conditions to be met for a successful monetary policy, they are by no means sufficient. The final issue is the controllability of the money supply. In order to control money supply, two further conditions have to be met. First, a central bank should have the necessary tools to control monetary aggregates. What are these tools? To start with, there must be an efficient and simple reserve requirement system, presumably applied to all kinds of deposits. Secondly, rediscount facilities may help a central bank to arrange properly the maturity structure of its liabilities and assets. Thirdly, a central bank has to be able to regulate reserve position of the banks also with open market operations. Interbank money market and foreign exchange market can be added to this list which can be further extended. However, these elements are the most important and essential ones for the necessary physical infrastructure. Major steps in construction of this infrastructure were being taken starting from 1984. Between 1984 and 1988, the Central Bank simplified the reserve requirement system by unifying and reducing the reserve ratios and made it more effective by shortening the reserve reporting frequency and reducing the fulfilling lag. The Central Bank began to auction government securities in 1985 and established an interbank money market in 1986. Open market operations were started at the beginning of 1987. Foreign exchange market was opened at the end of 1988.\(^10\) Hence,

---

\(^9\) The t ratios for the parameters of the zero frequency, bi-annual frequency and two annual frequency unit roots are respectively 6.62, 3.10, 1.45 and 2.67. Only a constant term is added to the equation 3.6 of Hylleberg et. al. (1990).

\(^10\) For a more detailed discussion see for example Akyüz (1990) and Bayazıoğlu, Ersel and Öztürk (1991).
we can conclude that the necessary tools to control the monetary aggregates were at the Central Banks' disposal especially towards the end of 1980s. Now, we come to the second condition of controllability.

The second condition to be satisfied is the necessity of a well coordination of fiscal and monetary policy. As Sargent and Wallace showed some time ago, should public sector continue to give deficit, it is impossible for a central bank to implement an independent monetary policy. \(^{(11)}\) This arises because domestic debt finance of the deficits causes interest rates to rise, which further increase the deficits. Sooner or later, central bank finds itself in a position to finance the deficits to prevent the "bankruptcy" of the government.

When government budget is in deficit, there are three obvious ways to finance it: either through money creation or by external/domestic borrowing. Of course, a combination is the most likely way to finance the deficits. Developing countries (DCs) are generally highly indebted countries. To finance their foreign debt service, they usually try to increase their foreign exchange reserves through over depreciation of their domestic currency. There is no doubt that this has some important inflationary impacts on the domestic economy. First, imported intermediate goods are important inputs to the production process. Thus, exchange rates are considerable elements of the cost vector. Second, depreciation of the domestic currency further increases budget deficits by advancing the foreign debt service burden of the public sector. \(^{(12)}\)

Obviously, there is a limit for foreign borrowing. If deficits are persistent and increasing, a rising portion of them thus has to be financed by domestic borrowing either from the central bank or from the private sector. When the central bank implements an independent and tight monetary policy, domestic debt finance is asked for. Rising domestic debt means that the pressure on the financial system becomes increasingly greater. This reflects itself as interest rate increases, declines in the maturity periods of debt, and contractions in the resources supplied to the economy. The first two factors increase the cost of domestic borrowing; consequently, the system enters a vicious circle. There is an inflationary effect of the rising interest rates. Note that in DCs most firms use short-term loans to finance their operational capital needs. Hence, rising interest rates affect the cost structure of firms. On the other hand, rising interest rates means, given other things being equal, an incentive for foreign capital inflow. This causes domestic currency to appreciate in real terms; therefore, has an anti-inflationary effect.

\(^{(12)}\) For this final issue in the case of Turkish macroeconomic management, see Rodrik (1990).
When the third route is chosen, that is, central bank credit is asked for, there are at least two inflationary effects. First, economic agents begin to abstain from holding domestic currency and the excess liquidity injected into the economy increases the foreign currency demand. This causes a pressure to depreciate the domestic currency. Second, part of the excess liquidity reflects itself as demand increases on the goods and services markets. Provided that there is not an effective demand failure prior to the injection of the liquidity, demand increase causes prices to rise.

From the discussion so far, it is by now clear that alternative mechanisms of financing the public deficits have various and sometimes counter-working effects especially on inflation, interest rates and exchange rates. It is now time to build a simple macroeconomic model which explicitly takes these factors into account. To do so, we first write the government budget deficit identity, that is,

\[(G-T)_t + \epsilon eBO_{t-1} = (CRTR_{t-1} - CRTR_{t+1}) + (BO_{t-1} - BO_{t-1}) + (\epsilon BO_{t-1} - \epsilon BO_{t-1}). \tag{12}\]

where \((G-T)\) represents the operational deficit, \(i\) stands for the domestic interest rate, \(BO\) is the domestic debt stock, \(e\) is the exchange rate and \(crtr\) is the credit given to the Treasury. Foreign variables are represented by a superscript \((f)\). \(CRTR\) denotes the credit extended to the Treasury by the Central Bank. We assume that the government desires to keep the operational deficit and the amount of net domestic borrowing at a certain level of nominal GNP. Hence,

\[(G-T)_t = C_1_t \cdot CGNP_t, \tag{13}\]

\[(BO_{t-1} - BO_{t-1}) = C_2_t \cdot CGNP_t, \tag{14}\]

where \(C_1_t\) and \(C_2_t\) are the time varying shares of operational deficit and net domestic borrowing in nominal GNP. Foreign borrowing and foreign interest rate are exogenous. Now, we can rewrite equation 12 to determine the change in credit supplied to the Treasury as,

\[(CRTR_{t-1} - CRTR_{t+1}) = C_1_t \cdot CGNP_t + \epsilon BO_{t-1} - C_2_t \cdot CGNP_t + e \cdot [\epsilon BO_{t-1} - (BO_{t-1} - BO_{t-1})]. \tag{15}\]

When the inflation rate is positive, equation 15 means that the fiscal authorities are adjusting to the changes in the price level. Hence, the pre-announced budget deficit is not binding, and as long as prices keep increasing so does the deficit. When the fiscal program is binding equations 13 and 14 are no longer valid. If this fiscal discipline also applies to non-operational deficit, then the new budget deficit identity can be stated as,

\[(CRTR_{t-1} - CRTR_{t+1}) = DEFICIT_t - (BO_{t-1} - BO_{t-1}) - e \cdot (BO_{t-1} - BO_{t-1}). \tag{16}\]
Through equation 15 or equation 16, the government budget deficit can be related to high powered money creation. Hence, in a simple accounting framework and making use of the Central Bank’s balance sheet, reserve money can be written as:

\[ \text{RM}_t = \text{NFA}_t + \text{CRTR}_t + \text{REVA}_t + \text{OTHA}_t - (\text{OMO}_t + \text{PUBDEP}_t + \text{OTH}_t). \]  

(17)

where NFA denotes the net foreign assets of the Central Bank, REVA denotes the revaluation account, OTHA is for the other domestic assets of the Central Bank. OMO denotes the open market operations, and it is on the liability side of the balance sheet. Hence when OMO > 0, the Central Bank is the debtor. PUBDEP denotes the public sector deposits at the Central Bank. OTHL represents the foreign exchange liabilities of the Central Bank in domestic currency terms to residents. Foreign liabilities in foreign currency terms to non-residents (FL) can be taken as exogenous, whereas the foreign asset accumulation of the Central Bank (FA) is a function of total foreign exchange earnings of the country (TFEE). Hence, net foreign assets of the Central Bank (NFA) can be written as,

\[ \text{NFA}_t = e\{ (C3_t \cdot \text{TFEE}_t) - \text{FL}_t \}. \]  

(18)

where C3_t is the time varying surrender requirement. Total foreign exchange earnings of the country can be endogenized. It can be decomposed into two parts; first one is the total exports (TE), which can be taken as a function of exchange rate, foreign prices relative to domestic prices and real GNP. Thus, it is a supply function. The second one (OTFEE) is the summation of various items such as workers’ remittances, tourism revenues, etc. They can be safely taken as exogenous to the system:

\[ \text{TFEE}_t = \text{TE}_t + \text{OTFEE}_t, \]  

(19)

\[ \text{TE}_t = f(e_t, p_t, p_r n p, t r), f_1 > 0, f_2 < 0, f_3 < 0. \]  

(20)

Re-valuation account (REVA) increases when NFA < 0 and furthermore when the domestic currency depreciates. Ersel and İskenderoğlu (1990) express REVA by the following identity:

(13) In the first publicly announced monetary program, the Central Bank set quantitative targets on four items chosen from its balance sheet; namely, the size of the total balance sheet, the total domestic liabilities, the total domestic assets and the Central Bank Money (CBM). The priority was given to CBM which is the sum of reserve money, open market operations and public sector deposits at the Central Bank. In this study, we choose preferred to use reserve money mainly because it is the only item of the balance sheet that has predictive power on nominal GNP. Note further that reserve money is an important part of CBM, where the extent of importance mainly depends on the sign and size of open market operations.

(14) See, for example, the quarterly macroeconomic model of the Central bank developed by Uygur (1989).
\[ \text{REVA}_t = \left( e_t/e_{t-1}\right)^* (\text{FL}_{t-1} - \text{FA}_{t-1} + \text{OTH}_{t-1}) \]  

(21)

As can be seen from the system of equations developed so far, the key variables are the exchange rate, interest rate and the domestic prices. Both the government budget deficit and the balance sheet of the Central Bank highly depend on these variables. We now specify models for these variables.

For the GNP deflator we specify a cost plus mark-up equation as specified in Bruno (1979). Mark-up depends upon excess money supply.

\[ \text{DEF} = f(w, e, p_i^f, i, \text{exci}^s, \text{exseas}^s_1, f_j > 0 \text{ for all } j) \]  

(22)

where \( w \) is the wage rate, \( i \) is the interest rate, \( \text{exci}^s \) is the excess supply of currency and \( \text{exseas}^s_1 \) is the seasonal excess supply of currency. We take real GNP as exogenous and calculate nominal GNP through an identity.

\[ \text{CGNP}_t = \text{RGNP}_t * \text{DEF}_t \]  

(23)

By making use of equation 7, \( \text{exci}^s \) can be written as,

\[ \text{exci}^s_t = (1-B^4)c_t^s - [1.18(1-B^4)\text{cgnp}_t - 0.43R_{\text{fcit}}] \]  

(24)

Hence, excess supply of money is defined as the difference between the supply of currency and the long-run demand for currency. Note that when the rate of depreciation of the domestic currency (\( R_{\text{fcit}} \)) increases, the demand for currency decreases, and hence excess supply of money rises. One can suspect deriving excess supply of money by making use of currency issued instead of high powered money and may further argue that since the government revenue from seigniorage is created by supplying reserve money, reserve money is the appropriate aggregate. However, note that demand and supply of a part of reserve money, that is required reserves, can be always taken as in equilibrium: Whenever the supply of required reserves fall short of the demand for it, the Central Bank can increase the required reserve ratio to eliminate the shortage. Hence, this feature makes an excess reserve money supply definition unfeasible. Seasonal excess supply of currency can be derived from equation 11 and given below.

\[ \text{exseas}^s_1_t = (1-B^2)c_t^s - 0.0018 - 0.1834(1-B^2)\text{cgnp}_t \]  

(25)

Domestic interest rate \( i \) is the average Treasury bond rate and it is an increasing function of domestic bond issue (\( \text{BO}^5 \)) and deflator and a decreasing function of excess money supply.
\[ i = f(\text{def}, BO^5, exc_i^5, exseasc_i^5), f_1 > 0, f_2 > 0, f_3 < 0, f_4 < 0. \] (26)

Exchange rate is a function of \( exc_i^5, exseasc_i^5 \) the difference between domestic and foreign prices \((\text{def} - \text{def}^f)\), the difference between domestic and foreign interest rates \((i - i^f)\) and the difference between domestic and foreign real gross national products \((\text{rgnp} - \text{rgnp}^f)\). Note that this is an eclectic approach to the exchange rate determination. (15)

\[ e = f(exc_i^5, (\text{def} - \text{def}^f), (i - i^f), exc_i^5, (\text{rgnp} - \text{rgnp}^f)), f_1 > 0, f_2 > 0, f_3 < 0, f_4 > 0, f_5 > 0. \] (27)

Now, we have to disaggregate reserve money:

\[ CR_t = RM_t - (RR_t + OTHR_t). \] (28)

where \( RR \) is the required reserves, and \( OTHR \) denotes other items in the reserve money which have minor weight and taken as exogenous. Required reserves can be determined through an identity:

\[ RR_t = C_t (TD_t + DD_t). \] (29)

where \( TD \) and \( DD \) denotes respectively time and demand deposits in the banking sector. \( C_t \) is the time varying required reserve ratio. For \( TD \) and \( DD \), supply functions can be specified. They are assumed to depend on nominal income, own yield \((R_{own})\) and yield of alternative assets \((R_{alt})\) as in the money demand function:

\[ TD^d = f(CGNP_t, R_{own}, R_{alt}), f_1 > 0, f_2 > 0, f_3 < 0. \] (30)

\[ DD^d = f(CGNP_t, R_{own}, R_{alt}), f_1 > 0, f_2 > 0, f_3 < 0. \] (31)

We now write one identity to determine the formation of the domestic debt stock:

\[ BO_t = BO_{t-1} + BO_t^5 - BO_t^f. \] (32)

where \( BO_t \) is the domestic debt stock, \( BO_t^5 \) is the issue of domestic debt and \( BO_t^f \) is the repayment of domestic debt, all at time \( t \). Finally, an equation to determine repayments as a function of lagged debt issues are specified:

\[ BO_t^f = f(BO_t^5), f_1 > 0. \] (33)

Having designed the model, we now turn to the estimation issue of the key variables of the system. First, we briefly summarize our modelling approach. Economic theory does not say much on the dynamic structure of the models given above. In most of the cases,

(15) For this issue, see for example Meese and Rogoff (1983).
the maximum number of lags is constrained to four since quarterly data is used. Then, this overparametrization is simplified based on the information contained on the data sample. A tentative more parsimonious model is obtained by omitting insignificant variables. In order to design a final and a parsimonious specification, several diagnostics are utilized. The first three are the tests for qth order residual autocorrelation (AR1, AR1-4) based on Godfrey (1978). Under the null hypothesis, residuals are white noise and the distribution of the test statistics is $F(q,T-k-q)$, where there are $T$ observations and $k$ regressors. The next two are the tests for qth order autoregressive conditional heteroscedasticity (ARCH1, ARCH4) based on Engle (1982). Under the null hypothesis, variance of residuals are not autocorrelated, and the distribution of the test statistics is $F(q,T-k-2q)$. qth order RESET based on Ramsey and Schmidt (1976) is a test for specification error. Under the null hypothesis of no specification error, the test statistics is distributed as $F(q,T-k-q)$. The null hypothesis of normally distributed residuals are tested by a test based on Jarque and Bera (1980) and the distribution of the test statistics is $CHI^2(2)$. All of the variables are logged. The numbers given in parenthesis under each parameter are t-ratios. DiC is a centered seasonal dummy for the $i$th quarter. $\text{FOP} = e + p^T$, in other words, denotes the foreign prices in domestic currency terms. $1^{dtr}$ is the detrended Treasury bond rate.

\[
(1-B)(1-B^4)\text{def}_t = -0.04422 + 0.15645(1-B)(\text{fop}_{t-1} + \text{fop}_{t-2}) + 0.120511^{dtr}_t \\
(2.8) \\
+ 0.50924(1-B)(1-B^4)\text{def}_{t-3} + 0.27852(\text{exc}^8_{t-1} + \text{exc}^8_{t-2}), \\
(3.7) \\
(34)
\]

$R^2 = 0.66; \quad \sigma = 0.0389; \quad DW = 2.04; \quad 1984.1-1991.1V;$

AR1: $F(1.26)=0.01; \quad \text{AR1-4:} \quad F(4.23)=0.61; \quad F(4.23)=1.07;$

ARCH1: $F(1.26)=1.81; \quad \text{ARCH4:} \quad F(4.23)=1.07; \quad \text{CHI}^2(2)=0.59.$

RESET: $F(1.26)=0.13; \quad \text{NORM:} \quad F(4.23)=1.07; \quad \text{CHI}^2(2)=0.59.$

The equation passed from a battery of diagnostic tests given below the estimation results. Parameter constancy is also evaluated by recursive estimation. One-step Chow tests, which are not shown here, do not indicate any parameter inconstancy at the five percent significance level. Note that excess supply of currency has an important role in explaining the changes in GNP deflator. The next estimation results are for the Treasury bond rate. Excess supply of currency is also strongly significant in this equation:
\[ i_t = 2.7948 + 0.04155t + 0.40169t^{-1} - 0.41005t^{-2} + 0.80333(1-B)(1-B^4) + 0.40169t^{-1} - 0.41005t^{-2} + 0.80333(1-B)(1-B^4)(d_{ef_t} + d_{ef_{t-1}}). \]  
(4.2) \quad (1.9) \quad (2.8) \quad (1.9) \quad (3.4)

\[ R^2 = 0.61; \quad \sigma = 0.1000; \quad DW = 1.71; \quad 1985.1 - 1991.1; \]

**AR1:** F(1.22)=0.60;  
**AR1-4:** F(4.19)=1.26;  
**ARCH1:** F(1.22)=0.19;  
**ARCH4:** F(4.19)=1.03;  
**RESET:** F(1.22)=0.83;  
**NORM:** CHI²(2)=1.09.

Note that even though both the bond rate and bond issued are deterministic trend stationary series, we have used their levels in the specification. This is in accordance with the principle which states the left and the right sides of the equation should be balanced.\(^{(16)}\) The equation passed from all of the diagnostic tests. Moreover, one-step Chow tests, which are not shown here, do not indicate any parameter inconstancy at the five percent significance level. The next estimation results are for exchange rate (e). This equation is also passed from all of the diagnostic tests.

\[ (1-B)e_t = 0.081379 + 0.29451(1-B)(1-B^4)(d_{ef_t} + d_{ef_{t-1}} + d_{ef_{t-2}}) + 0.20740t + 0.5511t^{-1} + 0.02551(1-B)2C + 0.15545(excesca_{t-1} + excesca_{t-2}) \]  
(12.7) \quad (4.4) \quad (2.9)

\[ - 0.096066_{t-4} + 0.15545(excesca_{t-1} + excesca_{t-2}). \]

\[ (2.8) \quad (3.1) \quad (2.8) \]

\[ R^2 = 0.63; \quad \sigma = 0.03106; \quad DW = 1.66; \quad 1984.1 - 1991.1; \]

**AR1:** F(1.25)=0.86;  
**AR1-4:** F(4.22)=0.64;  
**ARCH1:** F(1.25)=0.61;  
**ARCH4:** F(4.22)=0.31;  
**RESET:** F(1.25)=0.66;  
**NORM:** CHI²(2)=1.30.

Finally, we provide the estimation results for total deposits (time plus demand deposits). The logarithm of total deposits is denoted by \( \log{d_{tot}} \), whereas \( r_{fc,t} \) denotes the return on foreign currency. The return on total deposits is shown by \( r_{own,t} \).

\[ (1-B)logd_{tot} = 0.0626 + 0.4123(1-B)\log d_{tot_{t-1}} - 0.0551D1C - 0.0731(r_{fc,t} + r_{fc,t-1}) \]

\[ + 0.3586(r_{own,t} + r_{own,t-1}) \]

\( (5.0) \quad (4.0) \quad (7.9) \quad (1.9) \)

\( (3.3) \)

\[ R^2 = 0.63; \quad \sigma = 0.0309; \quad DW = 1.72; \quad 1980.11 - 1992.1; \]

**AR1:** F(1.41)=0.63;  
**AR1-4:** F(4.38)=0.56;  
**ARCH1:** F(1.41)=0.42;  
**ARCH4:** F(4.38)=0.28;  
**RESET:** F(1.41)=0.01;  
**NORM:** CHI²(2)=0.99.

\(^{(16)}\) For this issue see Pagan and Wickens (1989), especially pp.1002.
Some counterfactual policy simulations are done by making use of the model given above (equations 15-33, excluding 18, 19 and 20). In the first scenario, at time t budget deficit is decreased by 1 percent of nominal GNP. Domestic debt issue is also reduced by the same amount. From t+1, the historical values are retained. The results are given for GNP deflator, nominal exchange rate and the average bond rate as percentage deviations from the base simulations in Table 9. In the second scenario, as in the first one, budget deficit is reduced by one percent of nominal GNP at time t. Thereafter, it is kept at its historical values. However, this time credit extended by the Central Bank to the Treasury is reduced by the same amount, the results of which are provided in Table 10. Two alternatives are considered under each scenario. Firstly, it is assumed that the pre-announced fiscal policy is binding. In other words as the inflation rate changes, budget deficit and domestic debt financing do not accommodate. In this case, the relevant budget deficit identity is given by equation 16. Secondly, it is assumed that fiscal authorities respond to changes in the inflation rate. Hence, the relevant budget deficit identity is shown by equation 15.

Under non-accommodating fiscal policy, a policy mix which incorporates a reduction both in the deficit and credit extended to the Treasury is more efficient than a policy mix given under the first scenario in the sense that the response of the price vector is quicker and the amplitude is much higher. When the fiscal policy is accommodating, price vector does not respond to the first scenario. However, under the second scenario, the amplitude of the response of the price vector significantly increases. These results indicate that demonetization of the deficit is significantly disinflationary than domestic debt deaccumulation. Note that when the budget deficit does not change, shifting from domestic debt finance to monetary finance has severe inflationary effects, as shown in Table 11.

VI. CONCLUDING REMARKS

In this study, we investigated whether necessary conditions of a successful implementation of a monetary policy in Turkey are met between the period of 1980-1991. Moreover, a macroeconomic framework to analyze the impacts of government budget deficits on the balance sheet of the Central Bank and in the whole economy is developed.

In this context, firstly we have shown that growth rates of M2, reserve money, currency issued have predictive power both for the fluctuations of nominal income and the implicit GNP deflator. Secondly, despite the changing financial environment, validity of a stable long-run money demand function is verified. The difference between the money supply and the estimated long-run money demand is taken as the excess money
supply in the system. Excess money supply is defined in terms of currency issued. The reason why high powered money is not used in the excess money supply definition is the assumption that the demand and supply of part of the high powered money, that is required reserves, can be always taken as in equilibrium. This is a plausible assumption in the sense that whenever the supply of required reserves fall short of the demand for it, the Central Bank can increase the required reserve ratio to eliminate the shortage.

Since there are seasonal unit roots both in the currency issued and nominal GNP, the possibility of seasonal cointegration is also analyzed. Note that analyzing this possibility is more than a "technical curiosity." In Turkey, almost one fifth of the nominal GNP is realized by the agricultural sector. Moreover, the Central Bank extends credit to two public companies which are the main purchasers of two important crops, namely wheat and sugar. Hence, there is an institutional possibility of a long-run relation between currency issued and nominal GNP, which is proven in this study.

In the last part of the paper, it is verified that excess supply is highly significant in the key equations of the macroeconometric model, namely the price, exchange rate and the interest rate. By making use of this model, some counterfactual policy simulations are provided. The results of these simulations indicate that demonetization of the deficit is significantly disinflationary rather than domestic debt deaccumulation. Moreover, provided that the budget deficit does not change, shifting from domestic debt finance to monetary finance has severe inflationary effects.
References


Fig. 2: Log quarterly GNP deflator vs. \(\Delta\) Log quarterly GNP deflator.
Table 2: Results of Zero Frequency Unit Root Tests

Ho: (1-B)(1-B)X(t) is stationary

<table>
<thead>
<tr>
<th>Variables</th>
<th>a</th>
<th>b</th>
<th>d</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
<td>Ratios</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>5.34</td>
<td>-5.83*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>M2</td>
<td></td>
<td>-3.82*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>CBM</td>
<td>4.21</td>
<td>-4.44*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>RM</td>
<td>5.54</td>
<td>-5.89*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>RMY</td>
<td>5.43</td>
<td>-5.68*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>MB</td>
<td>4.82</td>
<td>-5.07*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>CSBA</td>
<td>3.81</td>
<td>-4.12*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>CSDB</td>
<td>4.13</td>
<td>-4.37*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>CSDBA</td>
<td>3.12</td>
<td>-3.63*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>CC</td>
<td>6.07</td>
<td>-7.19*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>WPI++</td>
<td>2.94</td>
<td>-4.54*</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>CPI++</td>
<td>3.75</td>
<td>-7.85*</td>
<td>+</td>
<td>0</td>
</tr>
</tbody>
</table>

Results of the model (1-B)(1-B)X(t) = a + b(1-B)X(t-1) +
d(1-B)(1-B)X(t-1) + ... + dk(1-B)(1-B)X(t-k). For the
definitions of the variables, see Table 1. * Denotes
significance at the five percent level. Estimation period
is 1980.1 1992.1. The exact beginning time depends on the
lags involved. + Denotes that the model is estimated with
centered seasonal dummies. ++ means that a trend term is also
added.
Table 6: Results of Granger Causality Tests (F ratios)

Effect Variable: $(1-B)(1-B)S(B)DEF = y$

$x1 = $Detrended Real GNP$

**Restricted Model:** $y(t) = a0 + a1*y(t-1) + ... + ak*y(t-k) + b1*x1(t-1) + ... + bp*x1(t-p) + D$

**Unrestricted Model:** $y(t) = b0 + b1*y(t-1) + ... + bm*y(t-m) + c1*x1(t-1) + ... + cn*x1(t-n) + D$

+ $d1*x2(t-1) + ... + dr*x2(t-r)$

<table>
<thead>
<tr>
<th>$x2$</th>
<th>k</th>
<th>p</th>
<th>m</th>
<th>n</th>
<th>r</th>
<th>F ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(1-B)M1$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>$F(4,26) = 1.98$</td>
</tr>
<tr>
<td>$(1-B)M2***$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>$F(5,25) = 2.86*$</td>
</tr>
<tr>
<td>$(1-B)(1-B)S(B)CI$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>$F(5,25) = 4.96**$</td>
</tr>
<tr>
<td>$(1-B)CC$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>$F(3,25) = 3.37*$</td>
</tr>
<tr>
<td>$(1-B)CBM$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>$F(3,27) = 1.86$</td>
</tr>
<tr>
<td>$(1-B)CBTA$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>$F(1,29) = 0.16$</td>
</tr>
<tr>
<td>$(1-B)CBDL$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>$F(1,29) = 0.70$</td>
</tr>
<tr>
<td>$(1-B)CBDA$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>$F(1,29) = 4.48*$</td>
</tr>
<tr>
<td>$(1-B)RH***$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>$F(5,25) = 3.00*$</td>
</tr>
<tr>
<td>$(1-B)MB***$</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>$F(1,29) = 11.44**$</td>
</tr>
<tr>
<td>Detrended Rb</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>$F(1,29) = 0.01$</td>
</tr>
</tbody>
</table>

***: Lags chosen according to FPE criteria resulted at non-nested tests.

However, conclusion reached at does not change should non-nested tests be employed.

** Denotes significance at the 1 percent level.
* Denotes significance at the 5 percent level.
+ Denotes significance at the 10 percent level.
### Table 8: The Johansen Procedure: VAR with Three Lags, Centered Seasonal Dummies, and Two Intervention Dummies

#### Panel 1: Residual Misspecification Tests for the Long Run Model

<table>
<thead>
<tr>
<th>Equation</th>
<th>Normality CH12(2)</th>
<th>Box-Pierce CH12(12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>m1</td>
<td>2.37</td>
<td>7.68</td>
</tr>
<tr>
<td>(1-B4)cgrp</td>
<td>0.93</td>
<td>8.18</td>
</tr>
<tr>
<td>Rm1</td>
<td>2.69</td>
<td>10.66</td>
</tr>
<tr>
<td>Rfc</td>
<td>0.61</td>
<td>14.59</td>
</tr>
</tbody>
</table>

#### Panel 2: The test statistics for the number of cointegrating vectors

<table>
<thead>
<tr>
<th>r</th>
<th>Eigenvalues</th>
<th>Maximal Eigenvalue</th>
<th>Beta1</th>
<th>Beta2</th>
<th>Alpha1</th>
<th>Alpha2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.50</td>
<td>28.95*</td>
<td>71.08*</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-0.0163</td>
</tr>
<tr>
<td>2</td>
<td>0.43</td>
<td>23.84*</td>
<td>42.13*</td>
<td>(1-B4)cgrp</td>
<td>4.97</td>
<td>3.46</td>
</tr>
<tr>
<td>3</td>
<td>0.29</td>
<td>14.52</td>
<td>18.30</td>
<td>Rm1</td>
<td>-1.97</td>
<td>1.80</td>
</tr>
<tr>
<td>4</td>
<td>0.09</td>
<td>3.77</td>
<td>3.77</td>
<td>Rfc</td>
<td>-2.18</td>
<td>-13.91</td>
</tr>
<tr>
<td></td>
<td>Intercept</td>
<td></td>
<td></td>
<td></td>
<td>3.53</td>
<td>9.54</td>
</tr>
</tbody>
</table>

#### Panel 3: Testing restrictions on the eigenvectors (beta1 and beta2)

**H1:** beta1 = -beta2
beta2 = -beta2

<table>
<thead>
<tr>
<th>Test value</th>
<th>Beta1</th>
<th>Beta2</th>
<th>Test value</th>
</tr>
</thead>
<tbody>
<tr>
<td>m1</td>
<td>-1.00</td>
<td>-1.00</td>
<td>m1</td>
</tr>
<tr>
<td>(1-B4)cgrp</td>
<td>1.00</td>
<td>1.00</td>
<td>(1-B4)cgrp</td>
</tr>
<tr>
<td>Rm1</td>
<td>-10.49</td>
<td>2.28</td>
<td>Rm1</td>
</tr>
<tr>
<td>Rfc</td>
<td>8.65</td>
<td>-20.55</td>
<td>Rfc</td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.31</td>
<td>12.48</td>
<td>Intercept</td>
</tr>
</tbody>
</table>

**H2:** beta1 vector is as given below

<table>
<thead>
<tr>
<th>Test value</th>
<th>Beta1</th>
<th>Beta2</th>
<th>Test value</th>
</tr>
</thead>
<tbody>
<tr>
<td>m1</td>
<td>-1.00</td>
<td>-1.00</td>
<td>4.22</td>
</tr>
<tr>
<td>(1-B4)cgrp</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Rm1</td>
<td>0.00</td>
<td>-1.06</td>
<td>9.18</td>
</tr>
<tr>
<td>Rfc</td>
<td>0.00</td>
<td>9.18</td>
<td>3.73</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.00</td>
<td>-0.04</td>
<td></td>
</tr>
</tbody>
</table>

*: Denotes significance at the 95 percent critical value
Table 11: Credit Extended to Treasury Increases by 1% of Nominal GNP at Time T and Then Returns to its Historical Value. Percentage Deviations from Base Simulations

<table>
<thead>
<tr>
<th></th>
<th>Non-Adjusting Fiscal Policy</th>
<th>Adjusting Fiscal Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>def</td>
<td>e</td>
</tr>
<tr>
<td>T</td>
<td>-0.1</td>
<td>1.7</td>
</tr>
<tr>
<td>T+1</td>
<td>2.7</td>
<td>4.7</td>
</tr>
<tr>
<td>T+2</td>
<td>7.5</td>
<td>6.6</td>
</tr>
<tr>
<td>T+3</td>
<td>10.2</td>
<td>8.4</td>
</tr>
<tr>
<td>T+4</td>
<td>12.9</td>
<td>8.7</td>
</tr>
<tr>
<td>T+5</td>
<td>14.1</td>
<td>6.1</td>
</tr>
<tr>
<td>T+6</td>
<td>11.8</td>
<td>2.1</td>
</tr>
<tr>
<td>T+7</td>
<td>8.2</td>
<td>-4.0</td>
</tr>
</tbody>
</table>

def: GNP deflator; e: TL/$ exchange rate; i: average bond rate