APPLICATION OF KHAN AND KNIGHT'S MODEL TO TURKISH ECONOMY FOR THE PERIODS 1964-1980 AND 1980-1985

by

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ABSTRACT

The present study is an application to the Turkish economy of a model formulated by Khan M.S. and Knight M.D. where output, prices, international reserves, government spending and expenditures, money, and domestic credits are simultaneously determined. The prediction of these variables are made available through the estimated reduced form of this model. It is observed that only four out of seven equations provide an acceptable error. This can not be interpreted as a brillant fit. The worst results are obtained from the international reserves equation. Estimation of orice level and real income were succesful since those variables had a predictable trend over time. Nevertheless, the outcomes of ex-post simulations made available from the reduced form, indicate that obtaining the structural form parameters by a further stage of least squares estimation ca-lead to interesting results. Before going into the mentioned procedure, however, it is essential that the international reserves equation should be examined thoroughly.

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I. INTRODUCTION

The stabilization measures of January 1980 are in general taken to mark the shift towards liberalization by greater reliance on market forces and external demand. It is aimed at giving Turkey an outward oriented market economy and involves important structural changes on dealing with the twin problems, reducing inflation and improving the balance of payments.

Liberalization measures, which are defined as any policy actions that reduce the restrictiveness of controls —it may be their complete removal or the replacement of a restrictive set of controls with a less restrictive one— (Krueger A.O., 1983) have been combined with policies aimed at decelerating inflation, rather than at freeing the individual markets while permitting inflationary pressures to continue. Such a policy (measures to deal with high rate of inflation) was inevitable because of the adverse economic and social consequences of persisting inflation.

Turkish economy exhibits strong and simple interactions between the macroeconomic processes —the government budget deficit and the determination of the money supply and domestic credit— and control conditions in individual markets. This macroeconomic process will be treated in the model which will be described within the context of stabilization policy.

Broadly defined, a stabilization program is a package of policies designed to eliminate the disequilibrium between aggregate demand and supply in the economy, which typically manifests itself in balance of payments deficit and rising prices (Robichek, 1967). The question of how stabilization policies affect economic development has been a subject of controversy since the monetarist/structuralist debate of 1950's and 1960's. Generally, the "monetarist" view has been that inflation and balance of payments difficulties are usually caused by allowing aggregate demand to run ahead of supply; therefore, stabilization can only be approached in a model in which demand is restrained within the economy's supply capacity. In that sense, the assertions that "inflation is always and everywhere a monetary phenomenan" (Friedman, 1970) and "The balance of payments deficit is essentially a monetary phenomenon" (Johnson, 1975) can hardly be disputed. According to monetarists, stabilization policy should seek a growth rate of money that closely approximates the long term rate of growth of real, productive capacity (Friedman, 1968). They attribute to money supply a, strategic role, affecting income directly, they regard interest rates in response to monetary expansion as a temporary effect. Monetarists are careful to distinguish nominal from real changes. Prices are a function of "demand pressure", determined by how close to full employment the economy is operating, and the long-run insensitivity of real variables to changes in money supply and the predominant short-run influence of money on real output and employment are consistent (Friedman, 1968; David I.Fand, 1970). The monetary approach of determining exchange rates concentrates on the "purchasing power parity" as an important mechanism, given a domestic price level. Another feature of this approach is the "uncovered interest parity" arising from "perfect capital mobility assumption"(1) (Shafer,R.J. and Loopesko B.E., 1983).

On the other hand, structuralists assert that rigidities in the pattern of production and demand, prevent the monetary measures taken by policymakers from being smoothly reflected in a moderation of inflationary pressures. Demand restraint is reflected in the short-run mainly in a drop in domestic output, this drop discourages investment which reduces economy's longrun capacity to earn foreign exchange (Findlay,E.R., 1973). This assessment leads to the conclusion that economic policy should focus on removing "supply bottlenecks" (Diamand,M., 1978) and other structural rigidities, so that all the capacity output can be raised. In this way, excess demand would be reduced and resources generated for a balance of payments improvement with less need to cut domestic absorption. Meaningful monetary analysis in developing countries require a structural model complete with a financial sector in the spirit of the Keynesian income/expenditure theory. (Branson, 1983) points out that while substantial parts of the real sector of the Keynesian system

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(1) For a discussion of purchasing power parity and uncovered interest rates, under the framework of a monetary model, see Durnbush R., 1980.

could be carried over, the supply side should be given much greater emphasis in the models for developing countries. However, he does not discuss the relevance of the Keynesion monetary theory to developing countries. Some authors have suggested that the essential difference between monetarism and Keynesianism is that of the time horizon. In particular, it has been suggested that steady state of a properly specified Keynesian model should resemble the equilibrium of a monetary model (Ando,A., 1974), and recent analytical work has introduced prices into Keynesian models as endogenous variables (Benavie,A., 1972). Both the structuralists and the monetarists see a general portfolio balance mechanism at work in the economy, but agreement seem to stop there.

Another view is that a choice between two mutually exclusive theories does not have to be made, and that inflation is a complex interactive process in which the level of aggregate demand and the economic structure (including the structure of expectations) within which that demand operates both play important roles (Crockett,D., 1983). Indeed, with a given structure of output and relative prices, the succes of an economy in achieving stabilization, depends largely on how domestic demand is restrained. Here, the extent of the rigidities that exist in the economy play a crucial role. The more economic structure is improved, the more the demand restraint is reflected in a moderation of pressures on prices and a shift of output toward the external sector and liberalization, so that the loss of output associated with stabilization will be reduced. Over the long-run, inflation can persist only if the monetary authorities continually permit nominal demand to rise faster then real supply. But, when the structure of the economy is such that certain economic agents have substantial market power, or when expectations of inflation have become firmly established, pressures on prices can persist for a long time even when conventionally used indicators show no overall excess demand. Existance of strong inflationary expectations, doubtless increases the degree of monetary restraint required to achieve a moderation of those pressures. As even monetarists agree (Friedman,M., 1977), in the long run structural factors determine the intensity of factor use that is consistent with price stability.

Even though it is possible, in principle to reconcile the monetarist and structural views of stabilization, a continually discussion will persist about the relative importance of excess demand and structural rigidities in generating inflation and causing balance of payments difficulties (Cline,R.W., and Weintraub,S., 1981). The more an imbalance between demand and supply in an economy results in undesired inflation and payments deficits, the more structural improvements in supply capacity are an appealing way of dealing with the situation than simply reduce demand. And indeed, the last decade has witnessed an increased recognition of the role of the supply side in the design of stabilization programs (Mookerjee, 1980).

The issue of how stabilization policies should be designed has acquired added practical importance in Turkey as a result of the hyperinflation and a big balance of payments deficit problem. This was a common feature of non-oil developing countries where little can be done to narrow the aggregate current deficit and difficulties may arise in narrowing this deficit quickly without adverse economic and social consequences.

The broader question of whether liberalization is in some sense beneficial (or not), and whether a particular type of liberalization aimed stabilization strategy may be optimal for Turkey, is purposely excluded. Issues of this nature, although extremely important, are outside the scope of the approach adopted here.

The purpose of this work —considered that a stabilization program is built-up on the base of one or more models— is to test a formal framework proposition (Khan and Knight, 1981) in order to examine the interrelationships between economic variables in Turkey for two different periods (1964-1980 annually, 1980/2-1985/2 quarterly). Khan and Knight's model includes seven simultaneous equations, therefore it is highly aggregated and simple in structure. The price level, government expenditures and revenues, international reserves, nominal money supply, domestic credit and national income which are the endogenous variables of this model will simultaneously be determined. No change in the structure of the model is done before the estimation of it's reduced form. The application of the model to Turkish economy forthe two periods mentioned above will be made available through the reduced form of this model.

The plan of this paper is as follows. In section II the structure of the model is treated, equation by equation. In section III, ex-post simulations and the derived reduced form estimations taken place. The econometric process of obtaining the reduced form from the structural form of the model, and the problems arising in this process can be found in Appendix I. The conclusion is presented in section IV.

II. SPECIFICATION OF THE MODEL

A. STRUCTURE OF THE MODEL

The model which will be represented is highly aggregated and simple in structure, and stresses the crucial role played by the demand for money and monetary equilibrium in the behaviour of prices, output and the balance of payments. Thus, the analysis can be considered as a generalization of the models developed in the context of monetary approach to the balance of payments (IMF, 1977). While monetary factors are assigned a dominant role, money supply may not be under the close control of the authorities. In Turkey, which lacks a developed capital market, the growth of domestic credit may be closely linked to the government's borrowing requirements and hence to its fiscal policy. In this model, monetary (with fiscal) policy is the instrument by which the authorities seek to achieve their objectives and it is the domestic component of the money stock which will be used to this end. This gives a demand oriented flavour to the model which considers a small and open economy, operating under a system of fixed exchange rates.

The Turkish economy of 1964-1980 and post-1980 partially fits the assumptions of this model. Maintenance of fixed exchange rates can be considered as realistic for the 196401980 period and the "open economy" assumption for post-1980. How well the model questioned here explaines the macroeconomic variables of the Turkish economy and the simulation results, will be treated in the Conclusions part.

a) Inflation Equation

An extension of the monetary disequilibrium model (Goldman, 1972) is used to specify the price changes for an open economy. The domestic inflation rate is assumed to be a positive function of the excess supply of real money balances and a negative function of the deviation of domestic prices from their equilibrium (purchasing power parity) level. Excess supply of real money balances is specified in the equation as $(\log m_{t-1} - \log m_t^d)$. An excess supply of money balances exists when this term is positive, and an excess demand for money balances exists when it is negative.

$$\begin{aligned} \Delta \log P_t : \ & \gamma_1 (\log m_{t-1} - \log m_t^d) \\ & -\gamma_2 (\log P_{t-1} - \log(\varepsilon_{t-1} \cdot P_{ft-1}) - \beta_o) \\ & +\gamma_3 (\Delta \log(\varepsilon_t \cdot P_{ft})) \end{aligned}$$

where, P: domestic price level

ε: exchange rate, in units of domestic currency (TL) per unit of foreign currency (US dollar)

P_f: foreign price level

m: stock of real money balances (nominal stock of money M, deflated by the domestic price level).

The superscript "d" denotes demand, and Δ is a difference operator, so that $\Delta \log P$ is domestic rate of inflation, and $\Delta \log \varepsilon_t$ and $\Delta \log P_{ft}$ are the proportionate rates of change in the exchange rate and the foreign price level, respectively.

If the country's equilibrium real exchange rate (the one which is determined by the purchasing power parity) is not changing secularly, β_o may be taken as a parameter rather than varying over time. It represents the equilibrium ratio of domestic prices to prices in the rest of the world. This ratio depends on such factors as domestic and foreign tastes and levels of productivity.

Suppose there is no excess demand for real money balances and domestic prices are at their equilibrium level β_o, then, with fixed exchange rates, domestic inflation will be equal to the rate of inflation prevaling in the rest of the world. This assumption which comes to take $\gamma_3 = 1$, is one of the main features of the monetary approach to balance of payments (Pentti,J.K., 1976). Divergences from this equilibrium relationship may arise from two sources. First, any increase in money stock that results in an excess supply of real money balances, will create inflationary pressures in the next period that tend to eliminate the disequilibrium in the money market. Second, if domestic prices are pushed away from their equilibrium level, they will move in the direction that restores the relationship. The second variable $(\log P_{t-1} - \log(\varepsilon_{t-1} \cdot P_{ft-1}) - \beta_o)$ represents a type of "catch-up" effect to any distortion occuring in the country's international competitiveness(1).

The stock demand for real money balances,

$$\log m_t^d = \beta_1 - \gamma_4 \log y_t - \gamma_5 \pi_t$$

will be fed into the equation. This formulation is typically used for developing countries (Khan, 1980), it differs from other models in excluding the interest rates on other financial assets(2), because the relevant substitution in developing countries is between money and goods, or real assets, with the opportunity cost being the expected rate of inflation. Substituting $\log m_t^d$ into the equation we set:

$$\begin{aligned} \Delta \log P_t = & (\gamma_2 \beta_o - \gamma_1 \beta_1) - \gamma_1 (\log m_{t-1} - \gamma_4 \log y_t + \gamma_5 \pi_t) \\ & - \gamma_2 (\log P_{t-1} - \log \varepsilon_{t-1} - \log P_{ft-1}) \\ & + \gamma_3 (\Delta \log \varepsilon_t + \Delta \log P_{ft}) \end{aligned}$$

Interest rates appear in models built for industrial countries as an explanatory variable. Inflation is formulated as follows in the exchange rate determination model of Rudiger Dornbush:

$$\begin{aligned} \Delta \ln P_t = a . \ln \frac{D_t}{y_t} = & a . (u + \delta \ln (\frac{P_t}{\varepsilon_t . P_{ft}}) \\ & + (\phi - 1) \ln y_t - \sigma i_t) \end{aligned}$$

where $\Delta \ln D_t = u + \delta \ln(\frac{P_t}{\varepsilon_t \cdot P_{ft}}) + \phi \ln y_t - \sigma i_t$ represents the demand for domestic output, y_t denotes real GNP, i_t the interest rate, P_t domestic price level, P_{ft} price level in the rest of the world, ε_t the exchange rate, u, δ, φ and σ are the coefficients.

$\delta \ln(\frac{P_t}{\varepsilon_t \cdot P_{ft}})$ represents the deviation from purchasing power parity (Dornbush,R., 1978).

This formulation differs from Khan and Knight's model only in the way that interest rate replaces expectations of price increases and a coefficient appearing before the "deviation from the purchasing power parity" term.

b) Government Sector Equations

In developing countries, fiscal policy and the government's budgetary position play a crucial role in the money supply process and in overall economic sectors. It is the deficits of the public sector which stimulates excess demand and consequently stabilization programs are so designed to eliminate or reduce fiscal deficits.

The model of the government sector is taken from Aghlevi and Khan (1978). Nominal government expenditure adjusts proportionately to the difference between the target government spending and the actual level of expenditures in the previous period

$$\Delta \log G_t = \gamma_8(\log G_t^* - \log G_{t-1})$$

where G and G* are the actual and the desired levels of nominal government expenditures, respectively, and γ_8 is the coefficient of adjustment varying from zero to one. The desired level of expenditures is specified as

$$\log G_t^* = \beta_2 - \beta_9 \ (\log y_t + \log P_t)$$

It is probably resonable to assume that in the long run the government whishes to increase its expenditure in line with the growth of nominal income ($\log y_t \cdot P_t$). Substituting the desired level of government expenditures into the first equation above, and solving for the (logarithmic) level of government expenditures, one obtains

$$\log G_t = \gamma_8\beta_2 + \gamma_8\gamma_9(\log y_t + \log P_t) + (1-\gamma_8)\log G_{t-1}$$

Same procedure is applied to government revenues (T) which adjusts to the difference between planned revenues (T*) and the actual revenues obtained in the previous period.

$$\Delta \log T_t = \gamma_{10}(\log T_t^* - \log T_{t-1})$$

$$0 \leqq \gamma_{10} \leqq 1$$

Desired nominal revenues are a function of nominal income:

$$\log T_t^* = \beta_3 - \gamma_{11} \ (\log y_t + \log P_t)$$

Substituting from this equating for T* gives

$$\log T_t = \gamma_{10}\beta_3 - \gamma_{10}\gamma_{11}(\log y_t + \log P_t) + (1-\gamma_{10})\log T_{t-1}$$

This is the final form of government revenues equation.

c) Money Stock and Domestic Credit Equations

The model described by Khan and Knight considers a small open economy where the domestic component of the money stock (the net level of domestic credit extended by the banking system) is taken to be the basic monetary tool. The need to determine the link between government fiscal operations (mainly deficit compensation) and the supply of money, is the reason why domestic credit is allowed to be determined endogenously.

Any change in domestic credit (DC) occurs because of changes in the banking system's claims on the government (ΔCG) and on the private sector (ΔCP).

$$\Delta DC_t = \Delta CG_t + \Delta CP_t$$

$$DC_t = \Delta CG_t + \Delta CP_t + DC_{t-1}$$

If $CG_t = G_t - T_t$, which is a reflexion of the government fiscal deficit (expenditures - tax revenues), so,

$$DC_t = G_t - T_t + \Delta CP_t + DC_{t-1}$$

This conclusion arises with the assumption that the government finances it's deficit by borrowing from the banking system.

The borrowing from the banking system may be by using it's cash balances held with banks, or by borrowing abroad. The lack of a sufficiently developed financial market leads Khan and Knight to assume the government beeing unable to borrow domestically from the non-bank sector (by selling or buying bills and bonds). It is only after 1984 that the Turkish government made such an attempt; the revenue dividents of the Bosphorus Bridge and the Keban dam were partially sold to banking and nonbank sector. The amount of money collected was negligible with compared to the huge government deficits.

The money supply is taken as the broadly defined version which includes currency in circulation, demand deposits, time and savings deposits.

The money supply is identically equal to the net stock of international reserves (expressed in domestic currency terms) and net domestic credit extended by the banking system:

$$M_t = R_t + DC_t$$

One of the different approaches to money supply equation is that which is used in various models built for Turkey, and which expresses the money supply as a money base multiplied by a factor (money multiplier). The money base in these models, contains assets of the Central Bank and it's credits extended to the government sector. Money supply, after it's definition, is linked to other economic variables through the same channels.

d) Balance of Payments Equation

The monetary approach to the balance of payments has proven to be very attractive way to organize thinking about the balance of payments and stabilization policy in open economies operating under fixed exchange rates. It is probably widely used as a basis for the formulation of short - run stabilization policy in many of the countries that continue to maintain an exchange rate parity (Montiel,P., 1985).

Proportionate changes in international reserves (expressed in terms of domestic currency) is defined as a positive function of the excess demand for nominal money balances and a negative function of the deviation of the domestic price level from it's equilibrium level (purchasing power parity).

$$\Delta \log R_t - \Delta \log {}_t = \gamma_6(\log M_t^d - \log M_{t-1})$$
$$-\gamma_7(\log P_{t-1} - \log(\varepsilon_{t-1} \cdot P_{ft-1}) - \beta_o)$$

Here, R: net stock of international reserves

M: nominal stock of money

ε: exchange rate (domestic currencies per US dollar)

P: domestic price level

P_f: foreign price level

Superscript "d" notes demand, subsript "t" denotes time and "Δ" is a difference operator.

$\Delta \log \varepsilon_t$ has been subtracted from the left hand side of the equation in order to get rid of superficial increases in international reserves due to the depreciation of the domestic currency.

A monetary approach to balance of payments is built on the assumption that the demand for money is a stable function of a limited of arguments and this demand for money constraints the equilibrium size of the money supply i.e. the size which matches this given demand for money (Mussa,M., 1976). Under a system of fixed exchange rates, where governments are commited to buy or sell foreign exchange to maintain the per value of their national money, the foreign source component (R) of the money supply (M) is endogenous, similarly to the approach adopted here. If there is an increase in money demand due to the foreign source component of the money supply, the monetary approach predicts that the country will experience an appreciation of exchange rates. On the other hand, if the monetary authority were to increase the domestic source component of the money supply without any change in the arguments in the money demand function, the result would be an excess of money supply over demand. This would lead to a downward pressure on the exchange rate, forcing the monetary authority to contract the foreign source of the money supply by the amount of the increase in the domestic source component (Mussa,M., 1976).

This specification of balance of payments is a dynamic version of the monetary approach to balance of payments. Whether domestic residents increase expenditure relative to output (absorption) to get rid of excess money balances(1) or buy financial assets abroad, is not considered. Even $(\log P_{t-1} - \log(\varepsilon_{t-1}.\log P_{ft-1} - \beta_o)$ does not reflect current account factors alone, since a decline in a country's competitive position may induce domestic asset holders to export capital by expecting a future devaluation (Laidler,D.E.W. and O'Shea,P., 1980). Therefore, this statement of balance of payments is consistent with the neglect of a developed financial market in the economy. It is also consistent with the broad framework of the monetary approach, but it includes a degree of dynamic adjustment as measured by the parameter γ_6.

Substitution of

$$\log M_t^d = \log m_t^d + \log P_t \text{ and}$$

$$\log m_t^d = \beta_1 + \gamma_4 \log y_t - \gamma_5 \pi_t$$

into the equation gives us the final structural form of

(1) Excess money balances are the idle part of the income which can be a combination of bonds, cash, goods, corporate stocks, gold, etc. In hyperinflation periods in particular, that is at the time the cost of holding money is high, individuals take the attitude of consumption or of buying some other positive return earning assets rather than holding their excess money balances as cash.

international reserves equation,

$$\Delta \log R_t = \gamma_6(\beta_1 + \gamma_4 \log y_t - \gamma_5 \pi_t + \log P_t - \log M_{t-1})$$
$$- \gamma_7(\log P_{t-1} - \log \varepsilon_{t-1} - \log P_{ft-1} - \beta_o)$$
$$+ \Delta \log \varepsilon_t$$

The fundamental equation of the monetary approach expresses the balance of payments as the difference between the demand for money and the flow supply of credit, which is under the control of the authorities(2). Because the derivation of this equation relies only on a balance-sheet identity and the assumption of flow equilibrium in the market, this equation does not in itself constitute a model of the balance of payments (Montiel,P., 1985). As Rosenberg and Heller (1977) have put it: "The apparent simplicity of the monetary approach to the balance of payments is...somewhat deceptive. Even though for many purposes the demand for money can be conveniently expressed as a function of a small number of variables, it is still just as much the resultant of all the influences that come to bear on the economy as national income and expenditure... These considerations do not invalidate the monetary approach, they nerely draw attention to the possibility that il will be seen, on further examination, to be not quite so superior in terms of simplicity of application as had first been thought". In other words, an explanation of

(2) It can be critisized as an equation before it's implementation into the general model.

how the variables that affect the demand for money are themselves determined is also required - that is, implementation of monetary approach to the balance of payments requires a structural general model of the economy be appended.

e) Real Income Equation

Deviations of actual output from its full capacity level is determined rather than capacity output itself, so the equation reflects the short term perspective of a stabilization program.

$$\Delta \log y_t = \gamma_{12}(\log m_{t-1} - \log m_t^d) + \gamma_{13}(\log y_t^* - \log y_{t-1})$$

Basically the concept here is that the rate of growth of output is positively related to the excess stock of real money balances $(\log m_{t-1} - \log m_t^d)$, and the so-called output gap $(\log y_t^* - \log y_{t-1})$. Knight and Wymer (1978), provides an example of such a model. Keller (1980) also examines the relationship between monetary factors and the supply side of the economy in developing countries. One would also like to include the effects of fiscal policy and relative prices on the flows of real aggregate demand and output. The introduction of the term $-(\log P_{t-1} - \log \varepsilon_{t-1} - \log P_{ft-1} - \beta_o)$, (devaiation from the purchasing power parity) in order to determine the direct impact on output of a change in the relation between domestic and foreign prices at 29 developing countries has been unsuccesful (Khan and Knight, 1981). Many developing countries as Turkey are commodity producers and the prices included in the model are consumer price indices. At the same work, to catch the stimulative effect of an increase in real government spending on output, $(\log G_t - \log P_{t-1} - \log h^*_t)$ was added to the equation. h^*_t was taken to be the anticipated level of government spending as y^*_t is the anticipated level of real income. Therefore, this term reflects the effect of an unanticipated government spending increase on real income. As noted before, Khan and Knight were using data which were cross-country time series. The ratio of government spending to output varies widely accross the countries of the sample. And the coefficient obtained by Khan and Knight proved to be insignificant and contrary to its expected sign.

This counterintuitive result suggests that the relation between real government spending and the rate of fiscal policy capacity utilization in developing countries is more complicated than standard Keynesian macrotheory suggests. This means that the conclusions of this model are based on the linkage between fiscal policy and the rate of monetary expansion.

y^* is the normal, or cyclically adjusted level of output, proxied by the trend of real income.

$y^*_t = y^*_o . e^{g.t}$ y^*_o represents the base level, "g" the trend growth rate of real income.

The formulation of real output is close to that outlined by Laidler and O'Shea (1980). This equation states that any disequilibrium in the money market results in an expansion of real income, and any decrease in money supply that results in a fall in real money balances has output consequencies through hoarding effects on the level of real expenditure. The parameter γ_{12} measures the degree to which this occurs. The real income equation also hypothesizes that when actual real income is below its normal capacity level, current output will tend to expand. If γ_{13} would be equal to one (a one-to-one relationship between growth and this gap), than current real income would deviate from capacity level only when there was monetary expansion. Substituting m_t^d into the equation gives

$$\Delta \log y_t : \gamma_{12}(-\beta_1 + \log m_{t-1} - \gamma_4 \log y_t + \gamma_5 \pi_t) + \gamma_{13}(\log y_t^* - \log y_{t-1})$$

or, in terms of real income,

$$(1-\gamma_{12}\gamma_4) \log y_t : \gamma_{12}(-\beta_1 + \log m_{t-1} + \gamma_5 \pi_t) + \gamma_{13} \log y_t^* + (1 - \gamma_{13}) \log y_{t-1}$$

f) Expected Inflation

During recent years, increasing attention has been devoted to analysing the role of inflationary expectations in macroeconomic problems. On the one hand, there is the growing body of literature dealing with the role of inflationary expectations in wage and price determination, secondly, many economists have been concerned with analysing the relationships between the nominal rate of interest and anticipated inflation (this goes back to Fisher) (1930).

Impact of inflationary expectations on the economy occur through three channels:

1- the investment demand function,

2- the money demand function,

3- the price adjustment process.

In general, changes in inflationary expectations do exert an influence on the real behaviour of the economy. Moreover the nominal rate of interest does not in general adjust exactly to changes in inflationary expectations. Thirdly, the total effect of the anticipated rate of inflation on the actual rate of inflation generally differsfrom (and usually exceeds) the partial response determined from the expectations coefficient $\partial P/\partial \pi$ of the Phillips Curve, where p and π denote the price level and its expectations respectively.

The usual procedure in estimating expectations effects is to construct (often only implicitly) proxy expectations variables by taking weighted sums of past actual inflation, with weights summing to unity. The coefficient of this constructed variable, is then interpreted as an expectations coefficient. Sargent points out that it is not necesserily rational to assume that these weights add to unity and indeed under certain conditions it is most reasonable to assume that they add to less than unity. In this case, the expectations coefficient estimated on the basis that these weights add to unity will be an underestimate of the true effect (Turnovski, S.J., 1977).

To estimate an equation where expected rate of inflation π_t is included, we have to assume that expectations are generated by distributed lags on past values of the rate of inflation. In general terms, one postulates

$$\pi_t = \sum_{i=0}^{\infty} \phi_i \cdot P_{t-i} \qquad , \qquad \sum_{i=0}^{\infty} \phi_i = 1$$

Now the expectations of the rate of inflation is expressed in terms of observable variables. In practice, in order to reduce the number of lagged variables in $\sum_{i=0}^{\infty} \phi_i = 1$, we can impose restrictions on the lag structure described by the ϕ_i. This can be done in various ways. One method is to hypothesise some simple relationship for π_t involving only one or two parameters which can be estimated from the data.

Two simple and widely used hypothesis include,

$$\pi_t = P_{t-1} + \theta(P_{t-1} - P_{t-2}) \qquad (a)$$

$$\pi_t = \pi_{t-1} + \gamma(P_{t-1} - \pi_{t-1}) \qquad (b)$$

Hypothesis (a) is often described as the extrapolative hypothesis. Hypothesis (b) is the adaptive expectations hypothesis, according to which the forecast for the past period is corrected by some fraction of that period's forecast error.

In this work, expected inflation is assumed to be generated by the extrapolative hypothesis. It is very simple, and useful given the limited availability of data. For the sake of simplicity and to be closer to a monetarist approach, full adjustment in the expectations $\gamma = 1$ formula has been adopted. Furthermore, when considered as an exogenous variable, it is a realistic and simplifying assumption that the inflation expectations at a given period should be taken as equal to the previous period's inflation rate.

$$\pi_t = P_{t-1} + (P_{t-1} - P_{t-2})$$

$$\gamma = 1 \qquad \pi_t = 2.P_{t-1} - P_{t-2}$$

Let the price level be 100 at the time (t-1), and 80 at the time (t-2).

$$P_{t-1} = 100 \qquad\qquad P_{t-2} = 80$$

Expected inflation at the time t will be

$$\pi_t = 200 - 80 = 120$$

$$\Delta\pi_t = 120 - 100 = 20\%$$

B. THE STRUCTURAL FORM OF THE MODEL DEFINITION OF VARIABLES

Inflation

$$\Delta \log P_t = (\gamma_2\ _o - \gamma_1\beta_1) + \gamma_1(\log m_{t-1} - \gamma_4 \log y_t + \gamma_5\pi_t)$$
$$-\gamma_2(\log P_{t-1} - \log\varepsilon_{t-1} - \log P_{ft-1}) + \gamma_3(\Delta\log\varepsilon_t - \Delta\log P_{ft})$$

Balance of Payments

$$\Delta \log R_t = \gamma_6(\beta_1 + \gamma_4 \log y_t - \gamma_5\pi_t - \log M_{t-1} + \log P_t)$$
$$-\gamma_7(\log P_{t-1} - \log(\varepsilon_{t-1}.P_{ft-1}) - \beta_o) + \Delta\log\varepsilon_t$$

Government Sector

$$\log G_t = \gamma_8\beta_2 + \gamma_8\gamma_9(\log y_t + \log P_t) + (1-\gamma_8)\log G_{t-1}$$

$$\log T_t = \gamma_{10}\beta_3 + \gamma_{10}\beta_{11}(\log y_t + \log P_t) + (1-\gamma_{10})\log T_{t-1}$$

Real Income

$$(1-\gamma_{12}\gamma_4)\log y_t = \gamma_{12}(-\beta_o + \log m_{t-1} + \gamma_5\pi_t) + \gamma_{13}\log y_t^* + (1-\gamma_{13})\log y_{t-1}$$

Domestic Credit

$$DC_t = G_t - T_t + \Delta CP_t + DC_{t-1}$$

Money Supply

$$M_t = R_t + DC_t$$

Real Money Balances

$n_t = M_t/P_t$

Definition of Variables:

- 1964-1980 period

Endogeneous variables

P_t : price level

R_t : international reserves

G_t : nominal government expenditures

T_t : nominal government revenues

y_t : real income

π_t : expected price level

M_t : nominal stock of money

DC_t : domestic credit of the consolidated banking system

- Predetermined variables

Exogenous

ε_t : exchange rate, index of units of TL per unit of US dollar

P_{ft} : foreign price level

y^*_t : trend value of real income

CP_t : change in net claims of the banking sector on the domestic private sector, and other items (net) in the banks' consolidated balance sheet

m_t : real money stock (expressed in 1964 base level)

Lagged endogenous

P_{t-1}, P_{t-2}, R_{t-1}, G_{t-1}, T_{t-1}, y_{t-1}, DC_{t-1}, π_{t-1}

- 1980/2 - 1985/2 quarterly period

Endogenous variables

P_t : price level

R_t : international reserves

G_t : nominal government expenditures

T_t : nominal government revenues

y_t : real income

M_t : nominal stock of money

DC_t : domestic credit of the consolidated banking system

Predetermined variables

Exogenous

ε_t : exchange rate, index of units of TL per unit of US dollar

P_{ft} : foreign price level

π_t : expected price level

y_t^* : trend value of real income

CP_t : change in net claims of the banking sector on the domestic private sector, and other items (net) in the banks' consolidated balance sheet

Lagged endogenous variables

P_{t-1}, G_{t-1}, R_{t-1}, T_{t-1}, Y_{t-1}, M_{t-1}, DC_{t-1}

III. ESTIMATION AND RESULTS

A. METHODOLOGY

A simple application of the model developed by M.S. Khan and M.D.Knight on the Turkish economy is performed in this work.

The best way of estimation of a simultaneous equations system would be to use some asymptotically efficient estimation method such as full-information maximum likelihood or three-stage least squares method. Unfortunately, the facilities were not available to let me use one of these methods.

The problem in applying least squares directly to estimate each equation of the structural form is the presence of explanatory endogenous variables appearing on the right-hand side of the system, which are correlated with the stochastic disturbance terms. A direct application of least squares to estimate the structural form parameters would give biased and inconsistent estimators. In order to get rid of this problem, explanatory endogenous variables must bu substituted by instrumental variables that are uncorrelated with the stochastic disturbance terms. The method of two-stage least squares accomplishes this by using the estimated reduced form to replace explanatory endogenous variables by their estimated values.

The size of our sample is not large enough to make use of two-stage least squares. Consequently, the reduced form is estimated by the use of ordinary least squares which give the best linear unbiased estimators, however, converting the reduced form estimators to the structural form estimators do not result in unbiased estimators. If a particular equation is exactly identified, then the estimators will be consistent, otherwise it would not be.

Zero restrictions have been imposed on the reduced form parameters originating from the structural form, hence the biasedness of the estimators are reduced. As it can be observed from the elements of the π matrix presented in appendix 2, some of these elements corresponding to a particular equation are equal to each other. The omitted restrictions which should be imposed on such coefficients are as follows:

$$\pi_{10,1}=\pi_{12,1}=\alpha_6$$
$$\pi_{10,3}=\pi_{12,3}=\alpha_6\cdot\alpha_{11}$$
$$\pi_{10,4}=\pi_{12,4}=\alpha_6\cdot\alpha_{14}$$
$$\pi_{1,5} = \pi_{9,5}= \alpha_{18}$$
$$\pi_{10,6}=\pi_{12,6}=\alpha_6(0,169\alpha_{11}-0,155\alpha_{14})$$
$$\pi_{11,6}=\pi_{13,6}=(\alpha_4-\alpha_6)(0,169\alpha_{11}-0,155\alpha_{14})$$
$$\pi_{10,7}=\pi_{12,7}=\alpha_6(0,098\alpha_7+0,243\alpha_{11}+0,233\alpha_{14})$$

Here, the α coefficients are the structural form coefficients. The above mentioned restrictions can be interpreted as follows: In the estimated coefficients of the exchange rate variable (ε_t) and of foreign price level (P_{ft}) should be equal to each other at all the equations except the international reserves (R_t) equation, coefficient of the lagged exhchange rate variable (ε_{t-1}) should be equal to the coefficient of the lagged foreign price level variable (P_{ft-1}) at the domestic credit (DC_t) equation, and the coefficient of the lagged price level (P_{t-1}) should be equal to the negative value of the coefficient of the nominal money stock variable (M_{t-1}) at the national income equation (y_t).

Because of time limitations and the lack of facilities reduced form estimates are directly used. The purpose adopted, as indicated in the Introduction, was to examine the applicability of Khan M.S. and Knight M.D.'s model to Turkish economy by comparing the actual and predicted values of its endogenous variables. These predicted endogenous variables-although some restrictions on the reduced form are omitted- can be employed to estimate the structural form coefficients of the model. This will be the second stage of two-stage least squares method. After the estimation of the structural form parameters, it will be possible to make a multiplier analysis such as observing the effect of a money supply increase on national income.

During the estimation of the reduced form of the model for 1964-1980 period, π_t (expected price level) is considered endogenous as

$\log\pi_t : 2.\log P_{t-1} - \log P_{t-2}$

$(\log M_t - \log P_t)$ is substituted instead of $\log m_t$ which was mentioned as an endogenous variable, and it's lagged value is considered as exogenous.

Especially P_{t-2} and some other variables for each equation which are warned to be irrelevent in the 10^{-4} tolerance level are excluded from the estimation. The tolerance is defined as $1-R_i^2$ and is the proportion of variability which is not explained by other variables in the equation. Here, R_i^2 is the multiple correlation coefficient computed for the regression including only the independent variables except the i'th independent variable which is considered as a dependent variable.

For the estimation of the reduced form of the model for 1980/2-1985/2 quarterly peiord, π_t (expected price level) is considered to be an exogenous variable. $(\log M_t - \log P_t)$ is substituted by $\log m_t$, as well as $(\log M_{t-1} - \log P_{t-1})$ by $\log m_{t-1}$.

B. 1964-1980 PERIOD

Inflation

R^2:.99529 F: 211,415 $\bar{R}^2$=0,99058

$logP_t$:16,825+1,974$logP_{t-1}$-0,307$logy_{t-1}$-2,467$logy^*_t$-0,107$log\pi_{t-1}$ +
(2,645)*(6,383)* (-0.677) (-3.169)* (-0,491)

1,194 $logm_{t-1}$-0,879log $_t$+$log\varepsilon_t$+$log\varepsilon_{t-1}$-0,631$logP_{ft}$+0,308$logP_{ft-1}$
(2,786)* (12,688)* (-0,632) (0,485)

International Reserves

R^2:.87663 $\bar{R}^2$=0,71801 F:5,527

$logR_t$:-30,700-3,716$logP_{t-1}$+$logR_{t-1}$-5,548$logy_{t-1}$+8,323$logy^*_t$ +
(-0,461) (-0.996) (-1,196) (0,983)

4,607$log\pi_{t-1}$+0,365$logm_{t-1}$+1,095$log\varepsilon_t$-0,821$log\varepsilon_{t-1}$ -
(1,911) (0,079) (1,468) (-0,789)

13,760 $logP_{ft}$+11,084$logP_{ft-1}$
(-1,351) (1,682)

Government Expenditures

R^2:.99944 F:1067,475 $\bar{R}^2$=0,99850

$logG_t$:-14,471+0,096$logP_{t-1}$-0,515$logG_{t-1}$+0,275$logy^*_t$ +
(-1,453) (0,127) (-1,167) (2,061)*

0,271$logy_{t-1}$+0,146$log\pi_{t-1}$-0,752$logm_{t-1}$+0,269$log\varepsilon_t$+0,640$log\varepsilon_{t-1}$ -
(0,383) (0,379) (-1,102) (2,428)* (3.273)*

1,661 $logP_{ft}$ + 4,145 $logP_{ft-1}$
(2,804)* (-0.950)

Government Revenues

R^2:.99919 F:740,061 $\bar{R}^2$=0,99784

$$\log T_t : -28{,}115 + 0{,}990 \log P_{t-1} - 0{,}910 \log T_{t-1} - 1{,}432 \log y_{t-1} + 3{,}514 \log y^*_t -$$
(-2,125)* (1,326) (-2,218)* (-1,543) (2,17)*

$$0{,}448 \log \pi_{t-1} - 1.061 \log m_{t-1} + 0{,}322 \log \varepsilon_t + 0{,}818 \log \varepsilon_{t-1} -$$
(-1.059) (-1.271) (2,518)* (3,091)*

$$3{,}386 \log P_{ft} + 4{,}587 \log P_{ft-1}$$
(-1,624) (3,094)*

National Income

R^2:.9884 F:141,527 $\bar{R}^2$=0,98138

$$\log y_t : -10{,}586 - 0{,}302 \log P_{t-1} - 0{,}011 \log P_{t-2} + 0{,}968 \log y_{t-1} + 1{,}629 \log y^*_t -$$
(-1,520) (-0,802) (-0,019) (3,136)* (1,587)

$$0{,}062 \log \pi_{t-1} - 0{,}590 \log m_{t-1}$$
(-0,155) (-1,085)

Domestic Credit

R^2:.9018 F:4,172 $\bar{R}^2$=0,68566

$$\log DC_t : -0{,}660 - 1{,}142 \log P_{t-1} - 0{,}449 \log G_{t-1} + 0{,}341 \log T_{t-1} - 0{,}396 \log y_{t-1} +$$
(-0,060) (-1,548) (-0,889) (0,847) (-0,513)

$$0{,}867 \log y^*_t + 0{,}678 \log \pi_{t-1} - 0{,}647 \log DC_{t-1} - 0{,}419 \log m_{t-1} +$$
(0,642) (1,804) (-0,538)

$$0{,}158 \log \varepsilon_t + 0{,}210 \log \varepsilon_{t-1} - 0{,}307 \log P_{ft} - 1{,}599 \log P_{ft-1} - 0{,}277 \log CP_t$$
(1,444) (0,940) (-0,171) (1,094)

Money Supply

R^2:.9858 F:31,648 $\bar{R}^2$=0,95469

$\log Y_t$:227,428-6,303 $\log G_{t-1}$+0,638 $\log T_{t-1}$-9,368 $\log y_{t-1}$-19,461 $\log y^*_t$-

(2,492)*(-1,575) (0,197) (-1,509) (-1,794)

2,613 $\log \pi_{t-1}$ + 1,281 $\log DC_{t-1}$+15,739 $\log Y_{t-1}$-3,018 $\log m_{t-1}$

(-0,883) (2,737)* (-0,486)

0,915 log $_t$-2,290 $\log \varepsilon_{t-1}$-18,934 $\log P_{ft}$+24,537 $\log P_{ft-1}$

(-1,037) (-1,273) (-1,320) (2,104)*

C. 1980/2-1985/2 QUARTERLY PERIOD

Inflation

$\log P_t$:1,975 + 0,087 $\log M_{t-1}$+0,047 $\log \pi_t$+0,936 $\log P_{ft}$ + 0,525 $\log \varepsilon_t$ +

(3,324)*(2,126)* (0,440) (1,351) (2,905)*

0,303 $\log P_{t-1}$-2,467 $\log P_{ft-1}$+0,197 $\log \varepsilon_{t-1}$

(2,345)* (-3,542)* (0,925)

R^2: 0,9989 F:1703,768 $\bar{R}^2$=0,9983

International Reserves

$\log R_t$:81,487+$\log R_{t-1}$+7,055 $\log P_{ft-1}$+3,828 $\log y_{t-1}$-0,646 $\log M_{t-1}$

(0,223) (0,829) (0,648) (-0,862)

0,656 $\log \pi_t$-0,166 $\log \varepsilon_{t-1}$+0,980 $\log P_{t-1}$-1,681 $\log P_{ft}$-10,622 $\log y^*_t$

(-0,447) (-0,077) (0,577) (-0,178) (-0,383)

R^2: 0,1817 F:0,305 $\bar{R}^2$=-0,4135

Government Expenditures

$$\log G_t: 147{,}19 - 10{,}355 \log y_{t-1} - 0{,}610 \log G_{t-1} + 0{,}358 \log M_{t-1} + 14{,}125 \log P_{ft}$$

(1,541) (-1.333) (-1,558) (0,632) (1,373)

$$2{,}403 \log P_{t-1} - 0{,}771 \log \varepsilon_t - 0{,}331 \log \pi_t - 19{,}841 \log P_{ft-1} +$$

(1,495) (-0,346) (-0,162) (-2,067)*

$$2{,}510 \log \varepsilon_{t-1}$$

(0,024)

R^2:0,9048 F:11,615 $\bar{R}^2$=0,8269

Government Revenues

$$\log T_t: 155{,}69 - 6{,}460 \log P_{ft-1} - 2{,}037 \log y_{t-1} - 0{,}523 \log T_{t-1} + 0{,}171 \log M_{t-1}$$

(0,460) (-1,097) (-0,300) (-1,052) (0,231)

$$0{,}982 \log \pi_t + 0{,}420 \log \varepsilon_t + 2{,}851 \log P_{t-1} + 7{,}900 \log P_{ft} - 9{,}812 \log y^*_t$$

(-0,791) (0,256) (2,553)* (1,243) (-0,429)

R^2:0,9530 F:22,509 $\bar{R}^2$=0,9106

National Income

$$\log y_t: 0{,}500 - 0{,}095 \log \pi_t - 0{,}015 \log M_{t-1} - 0{,}218 \log y_{t-1} - 0{,}746 \log y^*_t -$$

(0,056) (1,414) (-0,686) (0,841) (1,101)

$$0{,}036 \log P_{t-1}$$

(-0,451)

R^2:0,9768 F:117,793 $\bar{R}^2$=0,9682

Domestic Credit

$\log DC_t$:$-82,308+0,887 \log DC_{t-1}+0,102 \log CP_t-0,122 \log M_{t-1}-0,114 \log G_{t-1}$

(-1,006) (-1,114) (-0,789)

$+0,495 \log y_{t-1}+1,172 \log P_{ft}+0,386 \log T_{t-1}-0,139 \log P_{t-1}+6,300 \log y^*_t-$

(0,669) (2,432)* (0,337) (-1,166) (1,115)

$0,028 \log \pi_t-2,993 \log P_{ft-1}-0,205 \log\ _t$

(0,583) (-0,772) (-1,258)

R^2:0,9377 F:37,505 $\bar{R}^2$=0,79365

Money Supply

$\log M_t$:$-317,45+0,005 \log R_{t-1}+0,119 \log DC_{t-1}-0,147 \log \Delta CP_t-0,653 \log M_{t-1}$

(-0,984) (-0,898)

$0,425 \log G_{t-1}+2,342 \log y_{t-1}+17,018 \log P_{ft}+0,103 \log T_{t-1}+$

(-1,191) (0,367) (2,477)* (0,159)

$0,333 \log P_{t-1}+23,222 \log y^*_t+0,928 \pi \log\ _t-4,295 \log P_{ft-1}-3,320 \log \varepsilon_t$

(0,314) (1,049) (0,723) (-0,715) (-1,975)

R^2:0,9790 F:42,019 $\bar{R}^2$=0,9557

D. ACTUAL AND ESTIMATED VALUES OF ENDOGENOUS VARIABLES

Year	Actual P_t	Estimated P_t	% Error	Actual R_t (10^6 TL)	Estimated R_t (10^6 TL)	% Error
1964	102,0	107,39	5,28	361,6	310,45	-14,14
1965	108,0	111,94	3,64	226,0	243,22	7,61
1966	114,6	119,39	4,01	262,1	227,51	-13,19
1967	130,7	130,31	-0,29	198,9	325,09	63,44
1968	138,5	146,89	6,06	235,0	295,30	25,37
1969	145,4	148,93	2,42	1157,1	769,13	-33,52
1970	155,6	99,31	-36,17	4538,7	4830,58	6,41
1971	185,[illegible]	199,52	7,73	8857,9	8810,49	- 0,53
1972	213,8	222,84	4,22	16880,9	12560,30	-25,59
1973	246,5	262,42	6,45	26729,3	34040,32	27,35
1974	285,6	301,30	5,49	22649,8	24547,09	8,37
1975	340,4	314,77	-7,52	13422,9	11939,38	-11,04
1976	399,3	401,79	0,62	15953,2	10568,17	-33,75
1977	507,9	447,71	-11,85	12052,8	16330,52	35,49
1978	737,7	584,79	-20,72	21033,2	20701,41	- 1,57
1979	1170,4	847,22	-27,61	27113,4	34514,37	27,29
1980	2460,0	1006,93	-59,06	114851,1	96605,09	-15,88
			12,30			20,64

Year	Actual $G_t(10^9$ TL)	Estimated $G_t(10^9$ TL)	% Error	Actual $T_t(10^9$ TL)	Estimated $T_t(10^9$ TL)	% Error
1964	13,53	13,30	- 1,69	12,92	13,00	0,61
1965	14,48	14,35	- 0,89	13,58	14,28	5,15
1966	17,25	16,86	- 2,21	16,55	17,53	5,92
1967	20,29	18,11	-10,74	20,38	18,92	- 7,16
1968	21,32	21,28	- 0,18	20,63	21,28	3,15
1969	25,39	25,29	- 0,39	23,56	24,60	4,41
1970	32,86	31,40	- 4,44	33,12	33,03	- 0,27
1971	46,27	44,46	- 3,91	46,63	44,97	- 3,55
1972	50,92	50,23	- 1,35	56,95	54,20	- 4,82
1973	64,28	65,46	- 1,83	61,43	63,97	4,13
1974	77,77	74,13	- 4,68	73,57	74,13	0,76
1975	114,23	110,40	- 3,35	112,82	111,68	- 1,01
1976	155,03	161,43	4,12	150,71	151,70	0,65
1977	240,20	229,08	- 4,62	196,17	201,37	2,65
1978	347,70	337,28	- 2,99	323,60	340,40	5,19
1979	611,41	568,88	- 6,95	545,19	522,39	- 4,18
1980	1101,69	1086,25	- 1,40	942,64	977,23	3,66
			3,27			3,36

Year	Actual $y_t(10^9$ TL)	Estimated $y_t(10^9$ TL)	% Error	Actual $DC_t(10^9$ TL)	Estimated $DC_t(10^9$ TL)	% Error
1964	69,91	71,45	2,20	23,8	23,28	2,075
1965	71,04	74,72	5,18	28,1	29,51	5,01
1966	79,77	78,88	- 1,11	33,9	35,97	6,10
1967	77,64	87,09	12,17	38,2	37,93	- 0,70
1968	81,22	88,71	9,22	44,4	43,15	- 2,81
1969	85,89	94,84	10,42	52,7	54,32	3,07
1970	94,97	102,09	7,49	57,7	73,11	26,70
1971	103,99	109,14	4,95	62,5	58,88	- 5,79
1972	112,63	122,46	8,72	76,0	79,06	4,02
1973	125,69	129,71	3,24	92,2	99,31	7,71
1974	149,54	145,21	- 2,89	127,4	127,35	- 0,03
1975	157,39	171,00	8,64	205,8	207,49	0,82
1976	169,04	177,82	5,19	291,5	307,61	5,52
1977	171,86	191,86	11,63	411,6	416,86	1,27
1978	175,13	192,23	9,76	551,2	547,01	- 0,76
1979	187,93	199,52	6,16	879,9	899,49	2,22
1980	180,29	197,24	8,90	1616,6	1655,77	2,42
			6,93			4,53

Year	Actual $M_t (10^9$ TL)	Estimated $M_t (10^9$ TL)	% Error
1964	16,08	14,71	- 8,51
1965	19,10	18,83	- 1,41
1966	23,52	19,90	-15,39
1967	27,18	25,06	- 7,79
1968	31,34	35,97	14,77
1969	36,47	29,30	-19,65
1970	46,49	53,70	15,50
1971	56,81	57,01	0,35
1972	71,88	60,53	-15,79
1973	91,96	146,21	58,99
1974	115,45	82,22	-28,78
1975	149,46	125,02	-16,35
1976	183,50	262,42	43,00
1977	245,80	187,06	-23,89
1978	325,21	389,04	19,62
1979	541,07	592,93	10,32
1980	902,92	833,68	- 7,66
			17,60

Time	Actual P_t	Estimated P_t	% Error	Actual $R_t(10^9$ TL)	Estimated $R_t(10^9$ TL)	% Error
1980/2	100,00	100,23	0,23	63,0	71,4	13,33
1980/3	106,04	105,51	- 0,49	96,1	75,7	-21,22
1980/4	113,92	114,55	0,55	114,8	131,5	14,54
1981/1	125,80	122,29	- 2,79	106,5	118,3	11,07
1981/2	130,94	132,46	1,16	95,4	131,5	37,84
1981/3	141,58	137,46	- 2,91	180,4	121,89	-32,43
1981/4	147,98	151,46	2,35	171,7	223,35	30,08
1982/1	165,05	161,36	- 2,23	190,9	185,35	- 2,90
1982/2	175,94	173,42	- 1,43	179,5	232,81	29,69
1982/3	180,66	182,47	1,00	217,4	224,90	3,44
1982/4	193,12	193,11	- 0,005	172,4	245,47	42,38
1983/1	210,79	205,78	- 4,27	218,1	238,23	- 6,64
1983/2	220,50	223,51	1,36	255,2	235,50	- 7,71
1983/3	231,27	235,94	2,01	276,1	243,22	-11,90
1983/4	260,43	256,98	- 1,32	358,1	299,91	-16,24
1984/1	285,97	291,20	1,82	389,2	379,31	- 2,54
1984/2	328,67	326,21	- 0,74	429,9	451,85	5,10
1984/3	359,34	355,06	- 1,19	400,0	527,22	31,80
1984/4	359,54	401,14	1,41	565,3	421,69	-25,40
1985/1	444,60	441,26	- 0,75	506,3	561,04	10,81
1985/2	473,42	474,79	0,28	633,7	609,53	- 3,81
			1,44			17,18

Time	Actual $G_t(10^9$ TL)	Estimated $G_t(10^9$ TL)	% Error	Actual $T_t(10^9$ TL)	Estimated $T_t(10^9$ TL)	% Error
1980/2	225,6	225,4	- 0,08	185,8	186,2	0,21
1980/3	198,9	224,4	12,82	200,1	209,8	4,84
1980/4	318,9	338,8	6,24	273,2	304,1	11,31
1981/1	370,0	378,4	2,27	335,6	306,9	- 8,55
1981/2	325,0	298,5	- 8,15	339,5	323,6	- 4,68
1981/3	313,2	316,2	0,95	342,6	329,6	- 3,79
1981/4	438,3	539,5	23,08	445,2	413,0	- 7,23
1982/1	473,3	434,5	- 8,19	372,5	410,2	10,12
1982/2	442,8	382,8	-13,55	427,1	466,6	9,24
1982/3	433,8	472,1	8,82	450,6	480,8	6,70
1982/4	704,2	696,6	- 1,07	565,9	566,2	0,05
1983/1	407,6	475,3	16,60	502,3	532,1	5,93
1983/2	574,4	706,3	22,96	656,8	594,3	- 9,52
1983/3	597,2	586,1	- 1,85	572,9	562,3	- 1,85
1983/4	1134,5	868,9	-23,30	796,0	706,3	-11,26
1984/1	559,8	737,9	31,88	599,0	704,6	17,62
1984/2	703,7	1104,1	56,89	796,8	916,3	14,99
1984/3	904,0	959,4	6,12	837,4	835,6	- 0,21
1984/4	1857,5	1348,9	-27,38	1347,2	944,0	-29,92
1985/1	1079,6	1039,9	- 3,67	867,3	914,1	5,39
1985/2	1373,7	1563,1	13,78	1353,7	1499,7	10,78
			13,79			8,29

Time	Actual $y_t(10^9$ TL)	Estimated $y_t(10^9$ TL)	% Error	Actual $DC_t(10^9$ TL)	Estimated $DC_t(10^9$ TL)	% Error
1980/2	2991,8	2687,8	-10,16	1251,6	1238,8	- 1,02
1980/3	2990,5	3019,2	0,95	1371,3	1442,1	5,16
1980/4	2973,0	2983,3	0,34	1616,6	1698,2	5,04
1981/1	3060,2	3010,2	- 1,63	1706,0	1811,3	6,17
1981/2	3063,5	3072,5	0,29	1887,7	2290,8	21,35
1981/3	3052,4	3073,2	0,68	2194,4	3184,2	45,10
1981/4	3095,8	3104,5	0,28	2409,9	2766,9	14,81
1982/1	3157,6	3114,6	- 1,36	2566,8	2660,7	3,65
1982/2	3170,5	3193,0	0,70	2803,8	2999,1	6,96
1982/3	3169,8	3205,5	1,12	3028,3	3427,6	13,18
1982/4	3219,3	3208,5	- 0,33	3523,1	3981,1	12,99
1983/1	3339,9	3257,6	- 2,46	3608,5	4295,3	19,03
1983/2	3274,5	3309,0	1,05	3854,4	4508,1	16,95
1983/3	3255,4	3307,5	1,60	4185,2	5046,6	20,58
1983/4	3302,7	3348,1	1,37	4882,8	5520,7	13,06
1984/1	3422,6	3414,3	- 0,24	5437,1	6966,2	28,12
1984/2	3489,0	3470,1	- 0,54	5929,9	7568,3	27,62
1984/3	3530,5	3939,1	11,57	6351,0	8184,6	28,87
1984/4	3582,2	3607,4	0,70	8650,9	11091,7	28,21
1985/1	3671,0	3653,4	- 0,47	9376,3	12189,8	30,00
1985/2	3703,4	3685,5	- 0,48	10564,4	14454,4	36,82
			1,82			18,36

Time	Actual $M_t (10^9$ TL)	Estimated $M_t (10^9$ TL)	% Error
1980/2	605,6	625,1	3,21
1980/3	746,1	765,6	2,61
1980/4	902,9	717,8	-20,50
1981/1	907,2	1069,0	17,83
1981/2	1097,6	1253,1	14,16
1981/3	1307,0	1106,6	-15,34
1981/4	1706,2	1595,8	- 6,47
1982/1	1645,9	1790,6	8,79
1982/2	1826,8	1923,1	5,27
1982/3	2109,8	2094,1	- 0,74
1982/4	2563,0	2642,4	3,09
1983/1	3547,2	3047,9	-14,07
1983/2	3933,1	3681,3	- 6,40
1983/3	2692,2	2685,3	- 0,25
1983/4	3297,9	3221,0	- 2,33
1984/1	3547,2	2971,6	-16,22
1984/2	3933,1	4405,5	12,01
1984/3	4285,0	4236,4	- 1,13
1984/4	5220,5	6095,3	16,75
1985/1	5572,3	6095,4	9,38
1985/2	6348,2	6412,1	1,00
			8,45

IV. CONCLUSIONS

The purpose adopted on this paper has been the testing of a model formulated for developing countries (Khan,M.S., and Knight,M.D., 1981) where output, prices, international reserves, money, government taxing and government expenditures are determined simultaneously.

Several things, such as opening up the economy, stabilization efforts and their various effects, structural and institutional changes etc. tend to occur simultaneously during the period of interest (Khan,M.D. and Zahler,R., 1985). It is only with a simultaneous equations systems that one can realistically hope to identify and isolate the effects of different factors. In other words, by using a model, one is able to make suitable assumptions for other things being equal, something that historically is not possible.

The model developed here interprets the theory underlying the typical stabilization programs implemented by the authorities in developing countries to combat problems of inflation and an adverse balance of payments. Its failure is in ignoring the specific features of the Turkish economy. This is a general framework, obviously some realism is sacrified by overlooking the special characteristics of individual developing countries like Turkey.

Ex-post simulations of the model are made available through the periods which represent important structural differences. The pre-1980 economic policy was mainly; fixed exchange rates, a system of allocated quota on imports, a manufacturing sector based on import substitution, and interest rates and price policy which are under the control of the authorities. Towards the late 70's inflation rate rised to 100 percent, the balance of payments deficit reached an important amount. Overall aspects of pre-1980 Turkish economy is in conflict with the "open economy" assumption of the model.

The main objectives, of the decisions taken on January 25, 1980 and June 4, 1980 were to motivate exports, to curb inflation, to establish equilibria and to increase the amount of deposits. Te decontrol the interest rates brought about major changes in the Turkish economy. A tight monetary policy was implemented and tax reforms were made. This economic policy was the outcome of the implementation of a stabilization program which is liberalization oriented and in line with the assumptions of the herein treated.

Although the structural form with its parameters estimated had not yet been established and some restrictions in the estimation of reduced form had been omitted, ex-post simulations of the endogenous variables based on through the reduced form gives ample opinion on the validity of the model altogether. All the omitted restrictions in the estimation process are allready discussed in the Methodology part.

Table 1 and Table 2 represents a valuation of the R^2's and % errors of ex-post simulations which stemmed from the model. It should be noted that the R^2s are those obtained with the logarithmic values of the variables, and that the logarithm operation makes the data converge. Considering that our concern is on the current values of the variables, % errors of ex-post simulations gives a more accurate idea about how well the model fits to the data. An error between zero and five percent is a sound result, which is to be verified by domestic credit (DC_t), government revenues (T_t) and government expenditures (G_t) equations for 1964-1980 period, prices (P_t) and real income (y_t) equations for 1980 - 1985 quarterly period. An error of between five and ten percent is to be considered as acceptable. The real income equation (y_t) for 1964-1980 period, money supply (M_t) and government revenues (T_t) equations for 1980-1985 quarterly period are in that range. Only four out of seven equations for each period provides an acceptable error, which can not be interpreted as a brillant fit. The worst results are obtained from the international reserves equations for both of the periods. One of the reasons might be the exclusion of the funds contributed by Turkish workers abroad which is a significant item improving the balance of payments. Contributions as such, are very much affected by the administrative arrengements concerning the exchange rate regime, the interest rates etc.. Fluctuations of international reserves showing an unpredictable trend is mainly due also to the exogenous supply shocks such as increasing oil prices, expectations of foreign capital owners on investing in Turkey.

TABLE 1

R^2	1964-1980 Period	Quarterly 1980/2-1985/2 Period
0,95 - 1	5	4
0,90 - 0,95	1	2
0,80 - 0,90	1	-
Less than 0,80	-	1
Total number of equations	7	7

TABLE 2

% Error of Simulations	1964-1980 Period	Quarterly 1980/2-1985/2 Period
% 0 - % 5	3	2
% 5 - % 10	1	2
% 10 - % 15	1	1
% 15 and more	2	2
Total number of equations	7	7

The results of a further study carried out by Khan and Zahler (1985) showed that the most important determinant of the current account balances was the terms of trade, followed by foreign real interest rates, fiscal deficits and real effective exchange rates which are all roughly equal in importance. GNP growth in industrial countries played a relatively minor role, but the effect of this variable can be captured to some extent in the terms of trade and foreign real interest rate variables. Above mentioned statements are to be taken into consideration in extension of this study.

Estimation of price level and real income were succesfull since those variables had a predictable trend over time. Price level estimation for 1964-1980 period was not that succesfull, mainly due to the fact that logarithmic data of regression variables was leading the current price level data variation to converge from (100-2460) to (2-3,3909).

Although the significance of the reduced form coefficients does not carry much weight, the significant "t" values were identified when the estimated reduced form has been presented.

When reduced form equations are taken into consideration, the multitude of explanatory variables and some of their being irrelevent to endogenous variables which take place in the mentioned equation, can be observed. This comes into being from the fact that the reduced form is derived from the structural form. No multiplier analysis can be based on these equations. Nevertheless, the outcomes of ex-post simulations made available from the reduced form, indicates that obtaining the structural form parameters by a further stage of least squares estimation, can lead to valuable results. Before going into the mentioned procedure, however, it is essential that the international reserves equation should be examined thoroughly. Degrees of freedom relevent to post-1980 quarterly work will improve in time, thus bringing consequences of various nature.

Simulations of several types might be very interesting following the estimation of the structural form of the model. The way that money supply —basic tool of restrictive demand management policy— is used has been a subject of controversy (Aghlevi,B.B. and Khan,M.S., 1978). While considerable improvements on dealing with inflation and balance of payments deficits in developing countries which used a rather gradual restrictive monetary policy is observed, some which used a shock treatment like Chile were faced with severe and adverse economic and social consequences. A simulation of both of these policies mentioned above based on this model which has a monetarist flavour, might bring valuable outcomes.

It is hoped that this model can serve as a foundation of monetarist approach to several economic relationships on which more detailed structures can be built. The analysis can be extended by specifying the determinants of capacity output. $-(\log P_{t-1} - \log \varepsilon_{t-1} - \log P_{ft-1})$ term can be added to the real income equation in order to reflect the effect of changes in international competitiveness. The specification of the effect of government spending on real income can be made available by the inclusion of $(\log G_t - \log P_t - \log h_t^*)$ term, where h_t^* is the trend value of government expenditures, just as y_t^* was the trend value of real income. A more intensive investigation of the link between government spending, net investment and growth of capacity output is needed to increase the accuracy of the model.

Effects of developments in their external environment on the developing countries, influences especially the volumes of their imports and exports, their international reserve level and the cost of servicing their external indebtedness. These variables in turn, have certain consequences for the growth rates of GNP in the industrial countries, world commodity price developments, exchange rate developments among major currencies and trade restrictions in industrial countries. Growth rate of GNP in the industrial countries affects growth in the developing countries through the former group's demand for imports from the latter. It is well known that the nominal price of non-oil primary commodities is highly sensitive to fluctuations in output in industrial countries (Ke-Young,C. and Morrison,T.K., 1984), while prices of manufactures are much less sensitive. So, the growth of output in industrial countries affects the terms of trade for non-oil primary commodities. Statements as mentioned above might be enlightening the process of reconsideration of the international reserves equation and the extention of the model.

Finally, it is important to underline the fact that both the estimation and ex-post simulation outcomes are sensitive to the assumptions adopted by the model, particularly regarding the process of forming expectations and of specifying the effects of exchange rates on several variables. For many developing countries, exchange rate policies in recent years were an essential element of adjustment in the face of unsustainable current account deficits and external indebtedness, as well as high and rising rates of inflation (IMF, 1985). Thus, the need to endogenize the exchange rates variable in the model seems to be very significant. As well as fiscal and monetary policy, exchange rate policy also has a key role to play in the efforts of stabilization.

APPENDIX 1

DERIVATION OF THE REDUCED FORM FROM THE STRUCTURAL FORM

To establish the reciprocal and indirect effects of a variable carries as much great weight as to establish its direct effects on other variables towards achieving a sound valuation.

It is hardly possible to assess all the successive effects merely depending on statistics and forcing the limits of economic theory. These relations can have meaningful indications when they are resolved in the form of a simultaneous equations system. As the economic variables in question increase in number, the necessity of dependency on such a method becomes intensified. Any simultaneous equations system, should first be expressed in the structural form. Being self-expressive in definition, the economic structure under the model, the reciprocal influences and the theory can be observed definitely and clearly in this form.

An alternate way to layout the simultaneous equations is its reduced form which can be derived only from structural form.

The way that reduced form is derived as well as it's functions and means of applications will be discussed in this part. Some of the outcomes of these discussions allready took place in the conclusions.

a) The Process

The model treated in this work (Khan and Knight, 1981) is indeed a simultaneous-equations system, where a set of endogeneous variables are determined in terms of another set of variables, the predetermined variables (exogeneous and lagged endogenous). The linear simultaneous equations model can be written in the structural form as g simultaneous equations (Intriligator,M.D., 1978).

$$\underset{(Ixg)}{y_i}\underset{(gxg)}{\Gamma} + \underset{(Ixk)}{x_i} . \underset{(kxg)}{B} = \underset{(Ixg)}{\varepsilon_i}$$

y_i : vector of g endogenous variables at the i'th observation

x_i : vector of k predetermined variables at the i'th observation

ε_i : vector of g stochastic disturbance terms at the i'th observation

Γ and B : Coefficient matrices to be estimated

The index i ranges over the sample of observations, from 1 to n, where n is the sample size. For the first part of test which concerns annual observations from 1964 to 1980 n is equal to 17, for the second part where quarterly data of 1980/2 - 1985/2 is used, n is equal to 21.

The coefficient matrices to be estimated are Γ and B, representing respectively coefficients of endogenous and predetermined variables. Γ matrix is assumed to be non - singular, while B is generally not square since number of endogenous variables g, may not be equal to number of exogenous variables k.

Endogenous variables appearing in this model are:

P_t, R_t, G_t, T_t, y_t, DC_t, M_t

Exogenous variables appearing are:

π_t, m_{t-1}, ε_t, ε_{t-1}, P_{ft}, P_{ft-1}, y_t, ΔCP_t

Lagged endogenous variables:

P_{t-1}, R_{t-1}, G_{t-1}, T_{t-1}, y_{t-1}, DC_{t-1}, M_{t-1}

Equations of the structural form —by gathering the endogenous variables at the left side and the predetermined variables at the right side— can be arranged as follows for the period 1964-1980:

$$\log P_t + \alpha_1 \log y_t = \alpha_3 - (\alpha_4 - 1) \log P_{t-1} + \alpha_5 \log m_{t-1} + \alpha_6 \log \varepsilon_t$$
$$+ (\alpha_4 - \alpha_5) \log \varepsilon_{t-1} + \alpha_6 \log P_{ft}$$
$$+ (\alpha_4 - \alpha_6) \log P_{ft-1} + \alpha_2 \log \pi_t$$

$$\log R_t - \alpha_7 \log P_t - \alpha_8 \log y_t = \alpha_9 - \alpha_{10} \log P_{t-1} - \alpha_7 \log M_{t-1}$$
$$+ \log \varepsilon_t + (\alpha_{10} - 1) \log \varepsilon_{t-1} + \alpha_{10} \log P_{ft-1}$$
$$+ \log R_{t-1}$$

$$\log G_t - \alpha_{11}\log P_t - \alpha_{11}\log y_t = \alpha_{12} + \alpha_{13}\log G_{t-1}$$

$$\log T_t - \alpha_{14}\log P_t - \alpha_{14}\log y_t = \alpha_{15} + \alpha_{16}\log T_{t-1}$$

$$\log y_t = \alpha_{17} + \alpha_{18}\log m_{t-1} + \alpha_{19}\log \pi_t + \alpha_{20}\log y_t + (1 - \alpha_{20})\ \log y_{t-1}$$

$$\log DC_t - 0{,}642.\log G_t + 0{,}569.\log T_t = 0{,}647.\log DC_{t-1} + 0{,}277.\Delta\log CP_t - 2{,}852$$

$$\log M_t - 0{,}152.\log R_t - 1{,}411.\log DC_t = -0{,}083.\log R_{t-1} - 1{,}281.\log DC_{t-1} + 0{,}839.\log M_{t-1} + 0{,}152.\log \varepsilon_t - 0{,}083.\log \varepsilon_{t-1} + 1{,}0772$$

The structural form was: $y_i\Gamma + x_i\ .\ B = \varepsilon_1$

$$y_i\Gamma = -x_i\ .\ B + \varepsilon_i$$

Solving this equation for the vector of endogenous variables y_i, by multiplying each side by Γ^{-I} leads to

$$y_i = -x_i B\Gamma^{-1} + \varepsilon_i\Gamma^{-1} \quad \text{or}$$

$$y_i = x_i.\pi + u_i \quad \text{where} \quad \pi = -B\Gamma^{-1}$$

$$u_i = \varepsilon_i\Gamma^{-1}$$

$y_i . x_i\pi + u_i$ is the reduced form, which expresses each of the endogenous y_i as a linear function of all predetermined variables x_i and the stochastic disturbance terms u_i. The coefficient matrix π defined above, is known as the matrix of reduced form coefficients. Since ε_i's were assumed to be normally distributed with a zero mean value, it follows that

$E(u_i) = 0$ for all i, so that the average value of the reduced-form of the model is correct in that $E(y_i) = x_i$.

Vector of endogenous variables is

$$y = (P_t \; R_t \; G_t \; T_t \; y_t \; DC_t \; M_t)$$

Vector of exogenous variables, and lagged endogenous variables,

$$x = (P_{t-1} \; R_{t-1} \; G_{t-1} \; T_{t-1} \; y_{t-1} \; y_t^* \; \pi_t \; DC_{t-1} \; M_{t-1} \; \varepsilon_t \; \varepsilon_{t-1} \; P_{ft} \; P_{ft-1} \; \Delta CP_t \; 1)$$

The exogenous m_{t-1} and π_{t-1} are omitted because they were perfect combinations of other variables leading to the multicollinearity problem, which will be treated afterwards.

The major problem at the derivation of the reduced - form is the calculation of the inverse matrix Γ^{-1}.

Note that the same notation π is used for the matrix of reduced-form coefficients and the exogeneous variable representing expected inflation.

Calculation of Γ^{-1} is as follows:

$$\Gamma^{-1} = \frac{\Gamma^*}{|\Gamma|}$$

Γ^* is the cojugated matrix of Γ,
$|\Gamma|$ is the determinant of Γ.

The determinant $|\Gamma|$ is found equal to 1, for both of the periods (1964-1980 annually and 1980/2-1985/2).

Γ matrix for 1964-1980 annually period is:

$$\begin{vmatrix} 1 & -\alpha_7 & -\alpha_{11} & -\alpha_{14} & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & -0,152 \\ 0 & 0 & 1 & 0 & 0 & -0,642 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0,569 & 0 \\ \alpha_1 & -\alpha_8 & -\alpha_{11} & -\alpha_{14} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & -1,411 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{vmatrix}$$

The difference between those two Γ matrices, each corresponding respectively to 1964-1980 and 1980/2-1985/2 periods, is in their last two columns. Last two equations corresponding to those two columns were identities which are,

$DC_t = G_t - T_t + \Delta CP_t + DC_{t-I}$ and

$M_t = R_t + DC_t$

For purposes of estimation, the structural model had to be made linear in the logarithms of the variables. So, the linear identities mentioned above (domestic credit and nominal money supply) are approximated by a log-linear form, evaluated at the sample means of the relevent variables.

The domestic credit identity, was specified as

$$DC_t = G_t - T_t + \Delta CP_t - DC_{t-1}$$

The domestic credit identity is approximated as:

$$\log DC_t = \gamma_{15}\log G_t - \gamma_{16}\log T_t + \gamma_{17}\log CP_t + \gamma_{18}\log DC_{t-1} + \beta_4$$

where $\gamma_{15} = \dfrac{\bar{G}}{\overline{DC}}$ $\quad \gamma_{16} = \bar{T}/\overline{DC}$

$\gamma_{17} = \overline{\Delta CP}/\overline{DC}$ $\quad \gamma_{18} = \overline{DC}_{t-1}/\overline{DC}_t$

β_4 is the residual term

$$\beta_4 = \log\overline{DC}_t - \gamma_{15}\log\bar{G}_t + \gamma_{16}\log\bar{T}_t - \gamma_{17}\log\overline{CP}_t - \gamma_{18}\log\overline{DC}_{t-1}$$

For $M_t = R_t + DC_t$, the money supply identity, a first-order difference equation approximation has been chosen, which specifies that valuation effects of exchange rate changes do not influence the level of domestic money stock.

$$\gamma_{19}\log M_t = \gamma_{20}\log(\varepsilon_t \cdot R_t) - \gamma_{21}(\log\varepsilon_{t-1} \cdot R_{t-1})$$
$$+ \gamma_{22}\log DC_t - \gamma_{23}\log DC_{t-1} + \log M_{t-1}$$

where $\gamma_{19} = 1 + (\overline{\Delta\log R} - \overline{\Delta\log\varepsilon}) + \overline{\Delta\log DC}$

$\gamma_{20} = \bar{R}/\bar{M} + \overline{\Delta\log R} - \overline{\Delta\log\varepsilon}$

$\gamma_{21} = \bar{R}/\bar{M}$

$\gamma_{22} = \overline{DC}/\bar{M} + \overline{\Delta\log DC}$

$\gamma_{23} = \overline{DC}/\bar{M}$

Numeric values of those parameters for each of the two testing periods (1964-1980 and 1980/2-1985/2 quarterly) are represented in Appendix 4.

The inverse matrix of Γ, Γ^{-1} is obtained as follows:

(1964-1980 annual observations)

1	$-\alpha_7$	α_{11}	α_{14}	0	$0,642\ \alpha_{11}$ $-0,569\ \alpha_{14}$	$0,152\ \alpha_7 +$ $0,906\ \alpha_{11} -$ $0,803\ \alpha_{14}$
0	1	0	0	0	0	0,152
0	0	1	0	0	0,642	0,906
0	0	0	1	0	-0,569	-0,803
0	$\alpha_8-\alpha_1\alpha_7$	0	$\alpha_{14}(1-\alpha_1)$	1	$(1-\alpha_1)$. $(0,642\ \alpha_{11}-$ $0,569\ \alpha_{14})$	$0,152\ (\alpha_8-\alpha_7)$
0	0	0	0	0	1	-1,411
0	0	0	0	0	0	1

(1980/2 - 1985/2 quarterly observations)

1	α_7	α_{11}	α_{14}	0	$0,169\ \alpha_{11}$ $-0,155\ \alpha_{14}$	$0,098\ \alpha_7$ $+0,243\ \alpha_{11}$ $+0,223\ \alpha_{14}$
0	1	0	0	0	0	0,098
0	0	1	0	0	0,169	0,243
0	0	0	1	0	-0,155	-0,223
0	$\alpha_8-\alpha_1\alpha_7$	0	$\alpha_{14}(1-\alpha_1)$	1	$(1-\alpha_1)$. $(0,169\ \alpha_{11}-$ $0,155\ _{14})$	$0,098\ (\alpha_8-\alpha_7)$
0	0	0	0	0	1	-1,442
0	0	0	0	0	0	1

When the π matrix-π is equal to $-B.\Gamma^{I}$- is constructed, reduced form of the model is determined. Each column of the π matrix, corresponds to an equation which represents one endogenous variable in terms of all the predetermined variables(1).

Ordinery least squares (OLS) method is used for the estimation of the reduced form parameters. The way that the reduced form is obtained is described in the preceding pages. Its matrix form expession was,

$$y = x.\pi + u$$

here

$$y = (y_1 y_2 \dots \dots y_7),\quad x = (x_1 x_2 \dots \dots x_{14}\ 1)$$

$$\pi = \begin{vmatrix} \pi_{1,1} & \pi_{1,2} & \dots & \dots & \pi_{1,7} \\ \pi_{2,1} & \pi_{2,2} & & & \pi_{2,7} \\ \vdots & & & & \\ \vdots & & & & \\ \pi_{15,1} & \pi_{15,2} & \dots & \dots & \pi_{15,7} \end{vmatrix}$$

Ordinary least squares method estimates the reduced form coefficients (elements of π matrix) by minimizing $\sum_{i=1}^{7} u_i^2$ with respect to these coefficients. Each of the seven equations are estimated through the OLS method. As an example, the first equation can be written as

(1) 105 elements of π matrix corresponding 1980/2-1985/2 period are represented in the APPENDIX 2.

$$y_1 = \pi_{11}x_1 + \pi_{21}x_2 + \cdots \cdots \pi_{14}x_{14} + \pi_{15} + u_1$$

Matrix form of this equation where "n" is the number of observations and k is the number of explanatory variables, is as follows,

$$y_1 = \begin{vmatrix} y_{1,1} \\ \vdots \\ \vdots \\ y_{1,n} \end{vmatrix} \qquad x_1 = \begin{vmatrix} x_{11} & \cdots & \cdots x_{1,k} & 1 \\ \\ x_{n,1} & \cdots & \cdots x_{n,k} & 1 \end{vmatrix}$$

$$\pi_1 = \begin{vmatrix} \pi_{1,1} \\ \pi_{1,2} \\ \cdot \\ \cdot \\ \cdot \\ \pi_{1,k} \end{vmatrix} \qquad u_1 = \begin{vmatrix} u_{1,1} \\ u_{1,2} \\ \cdot \\ \cdot \\ \cdot \\ u_{1,k} \end{vmatrix}$$

$$y_1 : x_1 \cdot \pi_1 + u_1$$

Some of the $\pi_{i,j}$ values are imposed (some have a specified value obtained through the approximation process of the identities which were domestic credit and money supply identities (6th and 7th equation) and some are found to be equal to zero when reduced form was derived). If no specific value were imposed, fifteen coefficients for each equation would be estimated.

If the following assumptions are true, the OLS estimators are unbiased, consistent with least variance.

$E(u) = 0$ - sum of stochastic disturbance terms is zero.

$E(u,u') = \sigma_u^2 . I_n$ - stochastic disturbance terms are independent and have finite variance, σ_u^2.

Elements of the x matrix are fixed and the rank of this matrix $k < n$

$E(x'.u) = 0$ - Explanatory variables and stochastic disturbance terms are independent from each other.

The significance of the $\pi_{i,j}$ coefficients can be analysed with the help of the "t" ratio test. The "t" ratio is the ratio of the estimated regression coefficient to its standard error.

If we consider the j'th coefficient, in the i'th equation the null hypothesis (no dependence on the explanatory variable) to be tested is $H_o: \pi_j = 0$ for all j

$$H_1: \pi_j \neq 0$$

$$t_j: \hat{\pi}_j / \hat{s}_j$$

Here, $\hat{s}_j$ is the standard error of $\hat{\pi}$. The critical "t" values for a 95% confidence interval are given at the table which is represented below.

Degrees of Freedom	"t" Value	Degrees of Freedom	"t" Value
8	2,306	19	2,093
9	2,261	20	2,093
10	2,222	21	2,079
11	2,206	22	2,073
12	2,178	23	2,068
13	2,160	24	2,063

R^2 is the measure of the explanatory power of the relationship between the dependent and explanatory variables and is called the "correlation coefficient" varying between zero and one. An R^2 close to unity implies a strong relationship. R^2 is the proportion of the total variance that is explained by the regression equation, and each included explanatory variable will increase it's value. A value of 0,9 or higher is usually expected when time-series data are used in estimation.

The ratio of the explained to the unexplained variance is distributed as the F distribution with k-1 and n-k degrees of freedom.

$$F = \frac{R^2/(k-1)}{(1-R^2)/(n-k)} \sim F(k-1, n-k)$$

If this ratio exceeds the F(k-1, n-k) value for a particular level of confidence, then the null hypothesis of no dependence on the explanatory variables is rejected. If so, the evidence indicates that not all regression slopes are zero, and the model therefore has some explanatory power.

b) Identification Problem

Obtaining estimates of parameters of the structural form -after the estimation of the reduced form- is known as the problem of identification.

A structural equation is identified if and only if all parameters pertaining to it can be estimated given all the reduced form parameters. Otherwise it is not identified. The system is overidentified if there is more than one way to calculate its parameters from the reduced form parameters, leading to restrictions on the reduced form parameters.

For each equation to be just identified or overidentified the following order condition must be satisfied

$k-k_1 \geqq g_1-1$ or, equivalently $g_1-1+k_1 \geqq k$

g_1-1 is the number of explanatory endogenous variables

k is the total number of exogenous variables, here equal to 16

k_1 is the total number of included exogenous variables which differs from equation to equation,

so $k-k_1$ is the total number of excluded exogenous variables for each equation

In the system treated in this work, each and every equation is overidentified, thus a further study or attempt to achieve the structural form parameters through least squares estimation is required.

Equation	k	k_1	$k-k_1$	g_1-1	
Inflation	16	7	9	1	overidentified
Int. Reserves	16	6	10	2	overidentified
Gov. Exp.	16	1	15	2	overidentified
Gov. Rev.	16	1	15	2	overidentified
Income	16	4	12	0	overidentified
Dom. Credit	16	2	14	2	overidentified
Money Sup.	16	5	11	2	overidentified

c) Problems with the Data

Multicollinearity Problem

Multicollinearity problem is broadly defined as the tendency of the data to bunch or move together, rather than being "spread out" (Kmenta,J. 1971). For example, in time - series data the variables tend to exhibit the same trends, cyclical and secular, over time.

The linear regression model was

$$\underset{(nxI)}{y} = \underset{(nxk)}{X} \cdot \underset{(kxI)}{B} + \underset{(nxI)}{u}$$

When a multicollinearity problem exists, $|X'X| \approx 0$(1),

(1) X' donotes the transpose matrix of X.

that is, it is not singular ($|X'X| = 0$) but close to singular. If the value of $|X'X|$ determinant is approximately zero, then the inverse $(X'.X)^{-1}$ will tend to have large diagonal elements - just as taking the reciprocal of a number close to zero will lead to a large value. $(X'.X)^{-1}$ matrix appear on the computer output under the title of "XTX", it is observed that most of the elements on the diagonal are too large with compared to the other elements of this matrix.

The estimated standard errors, however are proportional to the square roots of elements along the diagonal of the inverse matrix. The estimated standard errors therefore will typically tend to be large, implying a lack of precision in the estimators. Equivalently, the t ratios defined before, will tend to be small, so that few if any of the coefficients will appear to be significantly different from zero. At the same time, R^2 may be high and the F test may very well show that the hypothesis that all the coefficients are zero should be rejected. Low t ratios with high F statistic will indicate the presence of a multicollinearity problem. With those symptoms the set of explanatory variables does influence the dependent variable, but the separate effects of each of the individual explanatory variables cannot be distinguished.

The estimators are both imprecise and unstable in the presence of a problem of multicollinearity.

Considered that time-series data is used here, a strong multicollinearity problem is existing. As expressed before, the reduced form was used in order to test the represented model. Many explanatory variables appearing in the reduced form equations, were perfectly combined to others, such as real money stock (m_t), nominal money stock (M_t), and the price level (P_t). A perfect multicollinearity problem arises when m_t, M_t, and P_t appears in the same equation, since one of those three can be expressed as a perfect combination of the other two:

$$m_t = M_t/P_t \quad \text{or} \quad \log m_t = \log M_t - \log P_t$$

Following this diagnosis, the treatment is clear: remove the offending explanatory variable. Since the purpose adopted was just the testing of the model, the problem of multicollinearity is not taken into consideration.

Besides, most of the explanatory variables tend to move together. It is well known that time-series economic data, by their very nature, tend to move together, often reflecting common underlying factors such as trends and cycles. For example, all the national income aggregates $P_t \cdot y_t$, G_t, T_t, DC_t tend to move together so that including two or more of these variables among the explanatory variables in a regression will almost inevitebly lead to a multicollinearity problem.

Degrees of Freedom Problem

When the available data simply do not include enough observations to allow an adequate estimate of the model, the degrees of freedom problem arises.

The difference between the number of observations (n) and the number of explanatory variables (k) included into the regression plus one, is referred to as the degree of freedom of the problems of the data.

$$n - (k-1) > 0$$

Number of observations (n) is 17 for 1964-1980 period, 21 for 1980/2-1985/2 quarterly period. Degrees of freedoms of 14 equations estimated using ordinary least squares method, derived from the reduced form are given below:

Equation	1964-1980	1980/2-1985/2
Price level	17-9 = 8	21-8 = 13
Balance of payments	17-10 = 7	21-9 = 12
Government expenditures	17-11 = 6	21-10 = 11
Government revenues	17-11 = 6	21-10 = 11
Real income	17-7 = 10	21-6 = 15
Domestic credit	17-12 = 5	21-11 = 10
Money supply	17-12 = 5	21-11 = 10

One reason why high R^2 rates are obtained at 1964-1980 estimation period is that the corresponding degrees of free-doms are relatively small - another reason would be smooth cycles and similar trends of the annually data used for 1964-1980 estimation. Quarterly data exhibits relatively more dispertion which worsenes the goodness of fit of the estimations.

Errors-in-Measurement Problem

Data are measured subject to various inaccuracies and biases. Beside the failure of providing satisfactory data of economic institutions in Turkey, potential inaccuracies result from a lack of precise correctness in conceptualization. For example, the GNP accounts are revised from time to time on the basis of such changes in conceptualization, e.g. defining what is included in its accounts.

APPENDIX 2

ELEMENTS OF THE π MATRIX

$\pi_{1,1} = -\alpha_4+1$ $\pi_{2,1} = 0$ $\pi_{3,1} = 0$

$\pi_{4,1} = 0$ $\pi_{5,1} = 0$ $\pi_{6,1} = 0$

$\pi_{7,1} = -\alpha_3$ $\pi_{8,1} = 0$ $\pi_{9,1} = \alpha_5$

$\pi_{10,1} = \alpha_6$ $\pi_{11,1} = \alpha_4-\alpha_6$ $\pi_{12,1} = \alpha_6$

$\pi_{13,1} = \alpha_4-\alpha_6$ $\pi_{14,1} = 0$ $\pi_{15,1} = \alpha_2$

$\pi_{1,2} = \alpha_7(1-\alpha_4)-\alpha_{10}-\alpha_{18}(\alpha_8-\alpha_1\alpha_7)$ $\pi_{2,2} = 1$

$\pi_{3,2} = 0$ $\pi_{4,2} = 0$

$\pi_{5,2} = (1-\alpha_{20})(\alpha_8-\alpha_1\alpha_7)$ $\pi_{6,2} = \alpha_{20}(\alpha_8-\alpha_1\alpha_7)$

$\pi_{7,2} = -\alpha_3\alpha_7+\alpha_{19}(\alpha_8-\alpha_1\alpha_7)$ $\pi_{8,2} = 0$

$\pi_{9,2} = \alpha_5\alpha_7+\alpha_{18}(\alpha_8-\alpha_1\alpha_7)-\alpha_7$

$\pi_{10,2} = \alpha_6\alpha_7+1$ $\pi_{11,2} = \alpha_7(\alpha_4-\alpha_6) + \alpha_{10}-1$

$\pi_{12,2} = \alpha_6\alpha_7$ $\pi_{13,2} = (\alpha_4-\alpha_6)\alpha_7$

$\pi_{14,2} = 0$ $\pi_{15,2} = \alpha_2\alpha_7+\alpha_9+\alpha_{17}(\alpha_8-\alpha_1\alpha_7)$

$\pi_{1,3} = \alpha_{11}(1-\alpha_4)$ $\pi_{2,3} = 0$ $\pi_{3,3} = \alpha_{13}$

$\pi_{4,3} = 0$ $\pi_{5,3} = 0$ $\pi_{6,3} = 0$

$\pi_{7,3} = -\alpha_{11}\alpha_3$ $\pi_{8,3} = 0$ $\pi_{9,3} = \alpha_5\alpha_{11}$

$\pi_{10,3} = \alpha_6\alpha_{11}$ $\pi_{11,3} = \alpha_{11}(\alpha_4-\alpha_6)$ $\pi_{12,3} = \alpha_6\alpha_{11}$

$\pi_{13,2} = (\alpha_4-\alpha_6)\alpha_7$ $\pi_{14,3} = 0$ $\pi_{15,3} = \alpha_2\alpha_{11}+\alpha_{12}$

$\pi_{1,4} = \alpha_{14}(1-\alpha_4) - \alpha_{18}\alpha_{14}(1-\alpha_4)$ $\pi_{2,4} = 0$

$\pi_{3,4} = 0$ $\pi_{4,4} = \alpha_{14}$ $\pi_{5,4} = \alpha_{14}(1-\alpha_1)(1-\alpha_{20})$

$\pi_{6,4} = \alpha_{14}(1-\alpha_1)\alpha_{20}$ $\pi_{7,4} = -\alpha_3\alpha_{14} + \alpha_{14}\alpha_{19}(1-\alpha_1)$

$\pi_{8,4} = 0$ $\pi_{9,4} = \alpha_5\alpha_{14} + \alpha_{18}\alpha_{14}(1-\alpha_1)$

$\pi_{10,4} = \alpha_6\alpha_{14}$ $\pi_{11,4} = \alpha_{14}(\alpha_4-\alpha_6)$ $\pi_{12,4} = \alpha_6\alpha_{14}$

$\pi_{13,4} = (\alpha_4-\alpha_6)\alpha_{14}$ $\pi_{14,4} = 0$ $\pi_{15,4} = \alpha_2\alpha_{12} + \alpha_{15}+\alpha_{17}\alpha_{14}(1-\alpha_1)$

$\pi_{1,5} = -\alpha_{18}$ $\pi_{2,5} = 0$ $\pi_{3,5} = 0$

$\pi_{4,5} = 0$ $\pi_{5,5} = 1-\alpha_{20}$ $\pi_{6,5} = \alpha_{20}$

$\pi_{7,5} = \alpha_{19}$ $\pi_{8,5} = 0$ $\pi_{9,5} = \alpha_{18}$

$\pi_{10,5} = 0$ $\pi_{11,5} = 0$ $\pi_{12,5} = 0$

$\pi_{13,5} = 0$ $\pi_{14,5} = 0$ $\pi_{15,5} = \alpha_{17}$

$\pi_{1,6} = (1-\alpha_4)(0{,}169\alpha_{11}-0{,}155\alpha_{14})-\alpha_{18}(1-\alpha_1)(0{,}169\alpha_{11}-0{,}155\alpha_{14})$

$\pi_{2,6} = 0$ $\pi_{3,6} = 0{,}169\alpha_{13}$ $\pi_{4,6} = -0{,}155\alpha_{14}$

$\pi_{6,6} = \alpha_{20}(1-\alpha_1)(0{,}169\alpha_{11} - 0{,}155\alpha_{14})$

$\pi_{7,6} = \alpha_3(0{,}155\alpha_{14} - 0{,}169\alpha_{11}) + \alpha_{19}(1-\alpha_1)(0{,}169\alpha_{11} - 0{,}155\alpha_{14})$

$\pi_{8,6} = 0{,}887$ $\pi_{9,6} = \alpha_5(0{,}169\alpha_{11}-0{,}155\alpha_{14}) + \alpha_{18}(1-\alpha_1)(0{,}169\alpha_{11}-0{,}155\alpha_{14})$

$\pi_{10,6} = \alpha_6(0{,}169\alpha_{11} - 0{,}155\alpha_{14})$

$\pi_{11,6} = (\alpha_4-\alpha_6)(0{,}169\alpha_{11}-0{,}155\alpha_{14})$

$\pi_{12,6} = \alpha_6(0{,}169\alpha_{11}-0{,}155\alpha_{14})$ $\pi_{13,6} = (\alpha_4-\alpha_6)(0{,}169\alpha_{11}-0{,}155\alpha_{14})$

$\pi_{14,6} = 0{,}102$

$\pi_{15,6} = \alpha_2(0{,}169\alpha_{11}-0{,}155\alpha_{14})+0{,}169\alpha_{12}-0{,}155\alpha_{15}+\alpha_{17}(1-\alpha_1)(0{,}169\alpha_{11}-0{,}155\alpha_{14})-\alpha_{21}$

$$\pi_{1,7} = (1-\alpha_4)(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14})-0{,}098\alpha_{10}-0{,}098\alpha_{18}(\alpha_8-\alpha_7)$$

$$\pi_{2,7} = 0{,}005 \qquad \pi_{3,7} = 0{,}243\alpha_{13} \qquad \pi_{4,7} = -0{,}223\alpha_{14}$$

$$\pi_{5,7} = 0{,}098(1-\alpha_{20})(\alpha_8-\alpha_7) \qquad \pi_{6,7} = 0{,}098\alpha_{20}(\alpha_8-\alpha_7)$$

$$\pi_{7,7} = -\alpha_3(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14}) + 0{,}098\alpha_{19}(\alpha_8-\alpha_7)$$

$$\pi_{8,7} = 0{,}119$$

$$\pi_{9,7} = \alpha_5(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14})-0{,}098\alpha_7+0{,}098\alpha_{18}(\alpha_8-\alpha_7)+0{,}949$$

$$\pi_{10,7} = \alpha_6(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14})+0{,}196$$

$$\pi_{11,7} = (\alpha_4-\alpha_6)(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14})+0{,}098\alpha_{10}-0{,}191$$

$$\pi_{12,7} = \alpha_6(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14}) \qquad \pi_{13,7} = (\alpha_4-\alpha_6)(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14})$$

$$\pi_{15,7} = \alpha_2(0{,}098\alpha_7+0{,}243\alpha_{11}+0{,}223\alpha_{14})+0{,}098\alpha_9+0{,}243\alpha_{12}-0{,}223\alpha_{15}+$$
$$0{,}098(\alpha_8-\alpha_7)\alpha_{17}-1{,}442\alpha_{21}+\alpha_{22} \qquad \pi_{14,7} = -0{,}147$$

APPENDIX 3

CALCULATION OF TREND VALUES OF REAL INCOME

Trend value of real income y* was defined as:

$$y_t^* = y_0^* . e^{g.t} \qquad (1)$$

Here y_0^* represents the base year's real income and also the trend value of income corresponding to the year where t=0, "t" referres to time where 1963 value corresponds to t=0, "g" is the trend growth rate. The definition of y_t^* in terms of neperian logarithmes is,

$$\ln y_t^* = \ln y_0^* + g.t \qquad (2)$$

The mean value of $\ln y_y^*$ (denoted as $\overline{\ln y_t^*}$) and the mean value of $\ln y_t$ (denoted as $\overline{\ln y_t}$) are identical.

Calculated mean values of $\ln y_t$ for 1964-1980 and 1980/2-1985/2 periods are respectively,

$\overline{\ln y_t} = 25{,}447$ and $\overline{\ln y_t} = 28{,}790$

"g" can be derived from equation(2) as

$$g = \frac{\overline{\ln y_t^*} - \overline{\ln y_0^*}}{\bar{t}} \qquad (3)$$

The mean value of "t" ($\bar{t}$), is 8,5 for 1964-1980 period, and 9 for 1980/2-1985/2 period.

The trend growth rate for each period are,

$$g = \frac{25,447 - 24,925}{8,5} = 0,0614 \qquad \text{for 1964-1980 period,}$$

$$g = \frac{28,79 - 28,72}{9} = 0,0077 \qquad \text{for 1980/2-1985/2 period.}$$

"y_t^*" values are obtained by the replacement of the "g" values into the equation (1), and are represented in the APPENDIX 7.

APPENDIX 4

CALCULATIONS OF THE COEFFICIENTS OF APPROXIMATED EQUATIONS

Domestic Credit Equation

(1964-1980)

$\bar{T} = 146{,}089 \cdot 10^9$ TL

$\bar{G} = 164{,}798 \cdot 10^9$ TL

$\overline{\Delta CP} = 71{,}222 \cdot 10^9$ TL

$\overline{DC}_t = 256{,}37 \cdot 10^9$ TL

$\overline{DC}_{t-I} = 165{,}88 \cdot 10^9$ TL

$\gamma_{15} = \bar{G}/\overline{DC}_t = 0{,}642$

$\gamma_{16} = \bar{T}/\overline{DC}_t = 0{,}569$

$\gamma_{17} = \overline{\Delta CP}/\overline{DC}_t = 0{,}277$

$\gamma_{18} = \overline{DC}_{t-I}/\overline{DC}_t = 0{,}647$

(1980/2-1985/2) quarterly

$\bar{T} = 529 \cdot 10^9$ TL

$\bar{G} = 578 \cdot 10^9$ TL

$\overline{\Delta CP}_t = 349{,}2 \cdot 10^9$ TL

$\overline{DC}_t = 3539{,}8 \cdot 10^9$ TL

$\overline{DC}_{t-I} = 3141{,}3 \cdot 10^9$ TL

$\gamma_{15} = 0{,}169$

$\gamma_{16} = 0{,}155$

$\gamma_{17} = 0{,}102$

$\gamma_{18} = 0{,}887$

Money Supply Identity

(1964-1980)

$\overline{\Delta \log R} = 0{,}1415$

$\overline{\Delta \log \varepsilon} = 0{,}0588$

$\overline{\Delta \log DC} = 0{,}110$

$\gamma_{19} = 1{,}192$ $\quad \gamma_{20} = 0{,}181$ $\quad \gamma_{21} = 0{,}099$

$\gamma_{22} = 1{,}681$ $\quad \gamma_{23} = 1{,}527$

(1980/2-1985/2) quarterly

$\bar{R} = 227,47 \cdot 10^9$ TL $\qquad \bar{M} = 2321,II \cdot 10^9$ TL

$\overline{\Delta \log R} = 0,048 \qquad \overline{\Delta \log DC} = 0,047$

$\overline{\Delta \log \varepsilon} = 0,042$

$\gamma_{19} = 1,053 \qquad \gamma_{20} = 0,103 \qquad \gamma_{21} = 0,098$

$\gamma_{22} = 1,519 \qquad \gamma_{23} = 1,472$

The bars appearing on the variables are representing the average value of these variables.

APPENDIX 5

QUARTERLY GNP CALCULATIONS

Gross National Product (GNP) is calculated by adding up the value added for all sectors in the economy, based on quarterly data, which are found by the following method:

Production quantity percentage changes from one quarter to the following quarter are found out, and multiplied by a weight. This gives the growth of each sector. Weihgts used in this process are obtained as yearly figures, not quarterly; therefore all the quarterly production percentage changes of one year are multiplied by the same weight. Annual (production weight) is found by adding the quarterly (production weight) figures. Each quarters weight in this total annual (production change weight) is found.

Sector's annual value added growth rate for each year is calculated from DIE figures. Then this annual growth rate is divided into quarters by using the weihgts found for each quarter of the year. Each quarter's growth rate is used to calculate that sector's value added for that specific quarter. Previous year's GNP value is augmented by the first quarter's growth rate for the sector in question. Second quarter's value added is found by augmenting the first quarter's value added by the second quarter's growth rate. This procedure goes quite different for the agriculture sector where different crops are produced in every quarter, and each quarter's growth rate cannot be obtained (Meltem Tanrıkulu, 1986).

APPENDIX 6

DATA DEFINITIONS AND SOURCES

For 1964-1980 estimations, all data used are taken from international Monetary Fund, International Financial Statistics (IFS), and are annual. Lagged values of variables, therefore cover the 1963-1979 period. The precice definitions of the variables and the IFS line numbers are as follows:

P: Consumer Price index, 1964 = 100 line 64.

R: Net international reserves valued in Turkish lira (line 1d multiplied by line ae).

G: Government expenditure, line 82

T: Government revenues, line 81

Y: real income. This variable was generated by deflating nominal gross domestic product (GDP) -line 99b- by the consumer price index.

DC: net domestic credit of the consolidated banking system, line 32.

M: Money plus quasi-money, line 34 plus line 35

m: real money balances, that is, M/P.

y*: trend level of real income. This series was calculated from the equation $y_t^* = y_0^* e^{gt}$ where y_0^* is the 1964 value of real income-1980/2 value for the quarterly estimations of 1980-1985 and g its trend growth rate over this period.

P_f: Consumer price index of a representative group of Turkey's major trading countries, which are USA, United

Kingdom, Syria, Switserland, Saudia Arabia, Japan, Italy, Iran, Germany and France. P_f is the avarage of those countries' price levels.

ε_t: Index of USA dollar exchange rate: line ae

ΔCP:Residual item obtained from the identity for the change in net domestic credit $\Delta CP_t = DC_t - G_t + T_t$

For the period of 1980/2-1985/2 estimations, all data except those including T, G and y are taken from IMF international Financial Statistics, and are quarterly.

Total revenues T, and expenditures G data are from State Planning Organization, Prime ministry of Turkey, January 1986. The data figures were monthly, therefore quarterly data was obtained by adding up each three month of a quarter.

For calculation of quarterly GNP, see APPENDIX 5.

APPENDIX 7

DATA FOR 1964 - 1980 ESTIMATIONS

Year	$y_t.10^6$ TL	$y_t^*.10^6$TL	P_t	P_{f_t}	ε_t TL per $	π_t
1963	66801,4	66801,4	100,0	100,0	9,02	101,09
1964	69914,5	70577,9	102,0	103,5	9,04	102,04
1965	71042,8	74942,2	108,0	106,9	9,04	104,04
1966	79772,2	80376,1	114,6	110,1	9,04	114,35
1967	77643,9	85346,3	130,7	113,5	9,04	121,60
1968	81222,6	90623,8	138,5	117,0	9,04	149,06
1969	85896,1	96227,7	145,4	121,8	9,04	146,76
1970	94971,7	102178,1	155,6	128,0	14,93	152,64
1971	103996,9	108496,4	185,2	135,8	14,15	166,51
1972	112632,9	115205,4	213,8	143,5	14,15	220,43
1973.	125691,3	122329,3	246,5	155,3	14,15	246,81
1974	149543,9	131199,2	285,6	175,4	13,99	284,20
1975	157394,5	139312,1	340,4	198,2	15,15	330,90
1976	169042,2	147926,7	399,3	217,7	16,67	405,71
1977	171863,3	157073,9	507,9	239,6	19,44	468,39
1978	175131,1	166786,8	737,7	257,6	25,25	646,03
1979	187928,9	177100,4	1170,4	285,0	35,35	1071,47
1980	180290,7	189941,6	2460,0	325,9	90,15	1856,90

Year	$R_t.10^6$TL	$M_t.10^9$TL	$m_t.10^9$TL	$T_t.10^9$TL	$G_t.10^9$TL	$DC_t.10^9$TL	$\Delta CP_t.10^9$TL
1963	568,2	13,64	13,64	11,73	11,72	21,6	3,10
1964	361,6	16,08	15,76	12,92	13,53	23,8	1,59
1965	226,0	19,10	17,68	13,58	14,48	28,1	3,41
1966	262,1	23,52	20,52	16,55	17,25	33,9	5,10
1967	198,9	27,18	20,79	20,38	20,29	38,2	4,42
1968	235,0	31,34	22,62	20,63	21,32	44,4	5,50
1969	1157,1	36,47	25,08	23,56	25,38	52,7	6,51
1970	4538,7	46,49	29,87	33,12	32,86	57,7	5,29
1971	8857,9	56,81	30,67	46,63	46,27	62,5	4,44
1972	16880,9	71,88	33,62	50,95	50,92	76,0	13,50
1973	26729,3	91,96	37,30	61,43	64,28	92,2	13,31
1974	22649,8	115,45	40,42	73,57	77,77	127,4	31,00
1975	13422,9	149,46	43,90	112,82	114,23	205,8	77,11
1976	15953,2	183,50	45,95	150,71	155,03	291,5	81,41
1977	12052,8	245,80	48,39	196,17	240, 20	411,6	76,10
1978	21033,2	325,21	44,08	323,60	347,70	551,2	115,53
1979	27113,4	541,07	46,22	545,19	611,41	879,9	262,50
1980	114851,1	902,92	36,70	942,64	1101,69	1616,6	577,64

DATA FOR 1980 - 1985 ESTIMATIONS

Time	$R_t.10^9$TL	$M_t.10^9$TL	$T_t.10^9$TL	$G_t.10^9$TL	$DC_t.10^9$TL	$\Delta CP_t.10^9$TL
1980/1	68,5	547,9	135,2	132,2	1078,0	-
1980/2	63,0	605,6	185,8	225,6	1251,6	133,8
1980/3	96,1	746,1	200,1	198,9	1371,3	120,9
1980/4	114,8	902,9	273,2	318,9	1616,6	199,6
1981/1	106,5	907,2	335,6	370,0	1706,0	55,0
1981/2	95,4	1097,6	339,5	325,0	1887,7	196,2
1981/3	180,4	1307,0	342,6	313,2	2194,4	336,1
1981/4	171,7	1706,2	445,2	438,3	2409,9	221,5
1982/1	190,9	1645,9	372,5	473,3	2566,3	56,1
1982/2	179,5	1826,8	427,1	442,8	2803,8	221,3
1982/3	217,4	2109,8	450,6	433,8	3028,3	241,3
1982/4	172,4	2563,0	565,9	704,2	3523,1	356,5
1983/1	218,1	3547,2	502,3	407,6	3608,5	180,1
1983/2	255,2	3933,1	656,8	574,4	3854,4	328,3
1983/3	276,1	2692,2	572,9	597,2	4185,2	306,5
1983/4	359,1	3297,9	796,0	1134,5	4882,8	359,1
1984/1	389,2	3547,2	599,0	559,8	5437,1	593,5
1984/2	429,9	3933,1	796,8	703,7	5927,9	583,9
1984/3	400,0	4285,0	837,4	904,0	6351,0	356,0
1984/4	565,3	5220,5	1347,2	1857,5	8650,9	1789,7
1985/1	506,3	5572,3	867,3	1079,6	9376,3	158,9
1985/2	633,7	6348,2	1353,7	1373,7	10564,4	1168,1

Time	$y_t \cdot 10^9 TL$	$y_t^* \cdot 10^9 TL$	P_t	Pf_t	ε_t	π_t
1980/1	3006,1	-	79,73	96,6	70,70	-
1980/2	2991,8	2991,8	100,00	100,0	78,78	101,22
1980/3	2990,5	3015,1	106,04	101,4	80,80	126,12
1980/4	2973,0	3038,7	113,92	104,0	90,15	112,13
1981/1	3060,2	3062,4	125,80	107,2	96,61	122,38
1981/2	3063,5	3086,3	130,94	111,1	110,70	138,91
1981/3	3052,4	3110,4	141,58	112,8	112,21	136,29
1981/4	3095,8	3134,7	147,98	115,8	133,62	153,08
1982/1	3157,6	3159,2	165,05	119,0	148,02	154,23
1982/2	3170,5	3183,8	175,94	121,2	165,64	184,08
1982/3	3169,8	3208,7	180,66	122,6	176,75	187,54
1982/4	3219,3	3233,7	193,12	125,6	186,75	185,50
1983/1	3339,9	3259,0	210,79	128,6	205,79	206,44
1983/2	3274,5	3284,4	220,50	130,5	221,55	230,07
1983/3	3255,4	3310,1	231,27	131,0	245,89	230,65
1983/4	3302,7	3335,9	260,43	133,6	282,80	242,56
1984/1	3422,6	3362,0	285,97	136,7	322,69	293,26
1984/2	3489,0	3388,2	328,67	139,2	369,94	314,53
1984/3	3530,5	3414,7	359,34	139,2	408,59	377,74
1984/4	3582,2	3441,4	395,54	141,6	444,74	435,38
1985/1	3671,0	3468,2	444,60	144,5	491,08	499,74
1985/2	3703,4	3495,3	473,42	147,3	535,72	504,11

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