INFLUENCE OF MONETARY AND FISCAL POLICY INSTRUMENTS ON THE GROWTH OF REAL GNP IN THE POST-1980 TURKEY : AN EMPIRICAL INVESTIGATION

by

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I. INTRODUCTION

The purpose of this study is to investigate the effectiveness of fiscal and monetary policy instruments as a stabilization tool in the context of the post-1980 Turkey. The topic is interesting from many aspects. First, results to be derived in this paper may seem to be a little piece of evidence in support of one or another school of thought in economics on the "appropriateness" of the monetary and fiscal policy as a stabilization tool. Stated alternatively, we will try to determine which one of these policy tools has a dominant influence on real GNP in the post-1980 Turkey. Secondly, though a number of studies exist to investigate the case for the developing countries, studies on developing countries constitute a smaller number. In this respect, our study may be a small contribution to fill the gap. Thirdly, Turkey is a country which experienced an important structural change in her economy in the post-1980 era. A. Chowdhury [1989] describes Turkey as a "...small, closed economy...which for decades has relied on import-substitution-led industrialization ...until early 1980s, when extensive trade liberalizations did occur." Therefore, comparing our results with that of Chowdhury's will at least be interesting. Our study uses vector-autoregressions (VARs) as an analytical tool. But before describing the method and its variants, we will spend some time on "causality" as it provides the conceptual grounds for our methodology and conclusions. We will also give a brief account of the developments in the Turkish economy in the post-1980 era. Our study ends with a discussion of the results obtained.

II. CAUSALITY, ECONOMICS AND VECTOR-AUTOREGRESSIONS

A. CAUSALITY AND ECONOMICS

We start by mentioning the difference between the dictionary meaning of the verb "to cause" and its particular usage in economics. To be more explicit, the Merriam-Webster dictionary [1974, p. 123] defines the verb "to cause" as "...something that brings about a result". In economics, however, though there is an ongoing debate on it, "to cause" or "causation" is generally related with "prediction". The most popular definitions are given by C.W.J Granger and C.A Sims, which we will discuss later on in detail.

Correlation and regression analyses are the tools that have been known and used for a long time in economic research to investigate the relationships between variables. It has also long been known that if a high correlation is found between two variables, this does not necessarily mean that these two variables are causally related. D.A Pierce [1977, pp. 11-12] puts the argument as follows:

> Variables may be functionally related yet uncorrelated; and perhaps more often, they may be correlated yet not causally related. The former effect arises because correlation is a measure of linear association only; the latter because of common association of both with a third factor.

However, D.A Pierce goes on to say that if a high partial correlation is found between the two variables, this implies causation, given the assumption of linearity and if all the influences or variables within that system are identified. But,

this does not answer the question of which one is causing which, and the phenomena can still be more complex. For example, problems of simultaneity and interactions among the variables may arise. This may be due to "...missing causal variables, overlapping variables, and fractional causal lags." [Granger, 1982, p. 248] In this case, Granger [1982] poses the questions that whether or not there are any instantaneous relationships that cannot be so explained and whether or not such residual instantaneity is sufficiently important to require special attention and interpretation." There is also a difference between instantaneous causality, i.e., true simultaneity, and the causality brought about by the time lags. In the latter case, the nature of the data series becomes important. For example, in a yearly data series identifying the "precedence" is more difficult than it is the case for the quarterly or monthly data. However, in the former case, the question is whether X_t can be better predicted by using Y_{t-j} $(j \geq 0)$ and X_{t-j} $(j > 0)$ rather than using Y_{t-j}, X_{t-j} $(j > 0)$. Apart from being a theoretical consideration, the issue is generally resolved by using specification tests for the significance of the $(j=0)$ term(s). If, as a result. simultaneity is detected, Granger [1982, p. 250] suggests that "...the introduction of identifiability of the model appears to have solved the question of how to decide on the direction of instantaneous causality,...but it should strictly be called conditional exogeneity or instantaneous causality because its correctness depends on the correctness of the assumptions required to identify the model.

At this point, we should make the above terminology more clear. Therefore, it will be natural to begin with what is actually meant by Granger-causality. Chow [1983, p. 212] explains Granger-causality as follows :

> ...X causes Y, given an information set A_t, which includes at least (X_t, Y_t) if Y_t can be predicted better by using past X_t than by not using it.

Of course, it is also implicitly assumed that X and Y must be distinct. Therefore, Granger's definition makes use of time series relationships and searches for causal implications between variables in terms of predictability and time lags. D.A Pierce [1977, p.12] further argues that "...Granger's definitions do not require that the system be linear; if it is, then the predictions compared are linear predictions."

Now, let us see what Granger [1969] originally proposes. Granger starts with accepting a stationary stochastic process for A_t, where $\bar{A}$ represents the set of past values $\{A_{t-j},\ j=1,2,\ldots,\infty\}$. Let $\bar{A}(k)$ represent the set $\{A_{t-j},\ j=k,k+1,\ldots,\infty\}$. Let us denote the optimum, unbiased least-squares predictor of A_t using the set of values B_t by $P_t(A/B)$. Therefore $P_t(X/\bar{X})$ will be the optimum predictor of X_t using only past X_t. The predictive error series will be denoted by $\epsilon_t(A/B) = A - P_t(A/B)$ and the variance of $\epsilon_t(A/B)$ by $\sigma^2(A/B)$. Granger further assumes that U_t represents all the information in the universe accumulated up to time t-1 and that $\overline{U_t - Y_t}$ denotes all this information apart from the specified series Y_t. Then, the following definitions are given :

Definition 1 : Causality. If $\sigma^2(X / U) < \sigma^2(X / \overline{U - Y})$, we say that Y is causing X. Y_t causes X_t if we are better able to predict X_t using all available information than if the information apart from Y_t had been used.

Definition 2 : Feedback. If

$$\sigma^2(X / U) < \sigma^2(X / \overline{U - Y}) \text{ , and} \qquad (1.1a)$$

$$\sigma^2(Y / U) < \sigma^2(Y / \overline{U - X}) \qquad (1.1b)$$

we say that feedback is occurring. That is, feedback is said to occur when X_t is causing Y_t and vice versa.

Definition 3 : Instantaneous Causality.

$$\text{If } \sigma^2(X / \overline{U} , \overline{\overline{Y}}) < \sigma^2(X / \overline{U}) \qquad (1.2)$$

where $\overline{\overline{Y}}$ indicates the current and past values of Y. Then, we say that instantaneous causality is occurring. In other words, the current value of X_t is better predicted if the present value of Y_t is included in the prediction than if it is not.

There also exist variations around the theme of Granger-causality. For example, Sims [1972] suggests that X_t fails to Granger-cause Y_t if in a regression of Y_t on lagged, current and future X's, the latter coefficients are zero. This is equivalent to saying that "...the prediction Y from current and past X's would not be improved if future values of X are included." [Maddala, 1988,p.330] In other words, Sims defines "...X to be strictly exogenous relative to Y if the linear predictor based on $\ldots, X_{t-1}, X_t, X_{t+1}, \ldots$ is identical to the linear predictor based on $\ldots, X_t, X_{t-1}, \ldots$" Sims [1972] himself shows that his definition and Granger's definition are identical, assuming a covariance stationary process with no linear deterministic component. Later on, Y. Hosoya [1977] showed

that these assumptions are not necessary. Furthermore, Chamberlain [1982] showed that Sims' and Granger's tests for causality are equivalent even under the general case, where one can use "...conditional independence instead of linear predictors." [Chamberlain, 1982. p. 569] This follows from the fact that [Ibid. p. 581] :

> ...the extended Granger definition of "y does not cause x" is stronger than the condition that y be independent of future x conditional on current and past x; so noncausality is stronger than strict exogeneity. Under a weak regularity condition, however, if y is independent of future x conditional on current and past x and past y, then y does not cause x.

Leamer prefers to use the term "precedence" instead of "causality". Maddala [1988, p. 330] interprets Leamer's argument as follows: "...all we are testing is whether a certain variable precedes another and we are not testing causality as it is understood."
In the above discussion of causality, we have seen that stationarity of the variables in question is the preliminary assumption to begin with. As Granger [1969, p. 429] puts forward it : "...the definitions have assumed that only stationary series are involved. In the nonstationary case, $\sigma^2(Y / \overline{U})$ etc. will depend on time t and in general the existence of causality may alter over time." C. Hsiao [1981, p. 94] argues that "...such a prefiltering [i.e achieving stationarity] may be viewed as an attempt to remove the effects of a third variable so that we may concentrate in the cyclical movements..." Thus, the previous assertion by D.A Pierce that a high partial correlation between two variables implies causation is, in a sense, equivalent to saying that if a high

simple correlation is found between two stationary variables, this implies causation, without establishing the direction of causation.

Granger's definition of causality also implies a question of order and justifies the use of stationary or prewhitened series. As A. Grasa [1989, p. 225] states

> ...when making inference from actual data this [Granger's] definition implies a question of order : first take account of the past of the variable; then relate the component of that variable which cannot be predicted from its own past to the other variable, or variables. This is equivalent to first filtering the series and use the filtered series to determine the type of relation with the other variable."

After making this interpretation, A. Grasa counter-argues that Granger's concept of causality may be too restrictive because of an order of deciding which explanatory variables are to appear in any given relation. He further proposes an alternative definition:

> ...A variable X causes another variable Y, if the variable X appears as one of the explanatory variables in the relation selected to explain variable Y, using all relevant information in the selection model process. [Grasa, 1989, p. 226]

The implications of this definition is as follows :

> ...the own past of the variable to be explained will be considered as one explanatory variable, but without establishing a priority against any other explanatory variables. [Grasa, 1989, p. 226]

This also means that if the past values of a variable do not explain the current values of that variable, the former do not need to appear in the regression equation as they are treated as just

another set of explanatory variables. Furthermore,

> ...if we were to adopt this alternative definition, then there would not be any clear justification for introducing first the past of the dependent variable as an explanatory variable, i.e there is no reason to prewhitening the series. [Grasa, 1989, p. 227]

Therefore, this definition seems to give us more flexibility in the actual modelling process, especially when we have more than one set of X's.

Exogeneity is a concept closely related to Granger-causality or "precedence". A number of definitions are made to deal with the concept of exogeneity. Before finishing this part of our paper, let us briefly summarize some of these definitions.[1]

1. **Predeterminedness.** A variable is defined to be predetermined in a given equation if it is independent of the contemporaneous and future errors in that equation.

2. **Strict exogeneity.** A variable is said to be strictly exogenous if it is a predetermined variable and if it is also independent of the past errors in that equation.

Influenced by the Lucas critique [Lucas, 1976], Leamer [1985] defines X as an exogenous variable if the conditional distribution of Y given X is invariant to modifications that alter the process generating X, i.e if the Lucas critique does not apply to it !

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[1] The exposition given here follows that of Maddala [1988].

Engle, Hendry, and Richard [1983] suggest three more definitions regarding exogeneity. These are the following :

1. Weak exogeneity
2. Strong exogeneity
3. Super exogeneity

A weakly exogenous variable X_t is the one that an inference on a set of parameters (lambda) conditional on X_t involves no loss of information. Weak exogeneity also appears as a condition for efficient estimation.

If X_t is weakly exogenous and the parameters in $f(Y_t/X_t)$ remain invariant to changes in the marginal distribution of X_t, then X_t is said to be superexogenous. This concept is also related to the Lucas critique and has similarity with Leamer's definition. However, Leamer argues that weak exogeneity is unnecessary as a condition for superexogeneity. Thus, he defines superexogeneity in the same way as Engle, Hendry and Richard but without the requirement of weak exogeneity. Engle, Hendry and Richard define a strongly exogenous variable X_t as the one which is weakly exogenous and which is not caused in the sense of Granger by any one of the endogenous variables in the system. That is, Granger non-causality is necessary for strong exogeneity, according to Engle, Hendry and Richard.

However, Cooley and LeRoy [1985] argue that Granger non-causality is neither necessary nor sufficient condition for exogeneity as

understood in the simultaneous equation model. They also show that Granger causality does not necessarily imply predeterminedness. In support of their argument, they give the following example :

They consider a money-income model specified as :

$$M_t = \alpha_1 Y_t + \beta_{11} M_{t-1} + \beta_{12} Y_{t-1} + \epsilon_{1t}$$
$$Y_t = \alpha_2 M_t + \beta_{21} M_{t-1} + \beta_{22} Y_{t-1} + \epsilon_{2t}$$

Then, the reduced form can be written as follows :

$$Y_t = h_{11}Y_{t-1} + h_{12}M_{t-1} + v_{1t} \qquad (1.3)$$
$$M_t = h_{21}Y_{t-1} + h_{22}M_{t-1} + v_{2t} \qquad (1.4)$$

For Granger non-causality, we have to have the reduced form coefficient $h_{21} = 0$. But, from the structural form, we know that :

$$h_{21} = \frac{\alpha_1 \beta_{22} + \beta_{12}}{1 - \alpha_1 \alpha_2} \qquad (1.5)$$

and that $h_{21} = 0$ implies that $\alpha_1 \beta_{22} + \beta_{12} = 0$. But, this does not necessarily mean that $\alpha_1 = 0$. An α_1 value equal to $-\beta_{12}/\beta_{22}$ also provides the equality.

Also, the structural form of the money-income model is not identified. This creates difficulties in the interpretation of the equations as to what they represent. Therefore, it may be unsafe to make statements about causal relationships in unidentified models. As a closing remark, we also share Maddala's [1988, p. 333] view that the linkage between Granger causality and exogeneity has some pitfalls, and that it is better to keep the concepts separate.

B. VECTOR AUTOREGRESSIONS AND RELATED CONCEPTS

In relation with the concepts of "causality" and "exogeneity" defined before, an ad hoc style to treat and model the macroeconomic relationships is to use the vector autoregressive models (VARs), where we document the "stylized facts" of macroeconomic behaviour. Stanley Fischer [1981, p. 402] makes the assertion that vector autoregressions are "...a convenient way of summarizing empirical regularities and perhaps suggesting the predominant channels through which relations work."

Cooley and LeRoy [1985] state that "...the [recent] ascendance of neoclassical macroeconomics, with its emphasis on rational expectations and general equilibrium modelling, has engendered much scepticism about the validity of the a priori restrictions used to identify Keynesian econometric models...one response to this enhancement with the received macroeconometrics..." came mainly from Cristopher Sims as a "...style of inquiry that is less dependent on theoretical restrictions but uses modern time series methods." This approach is called as "a-theoretical macroeconomics" by Cooley and LeRoy. Vector autoregressive model constitutes the basic underlying tool of all applications of a-theoretical macroeconometrics. Following the treatment given in Cooley and LeRoy, we define a scalar autoregression just as a regression of a variable on its own past values :

$$y_t = \sum_{i=1}^{n} h_i \, y_{t-i} + u_t \qquad (1.6)$$

where u_t is a mean-zero, homoscedastic and serially uncorrelated unobservable scalar random variable, y_t is an observable scalar variable and h's are scalar parameters. Then, a VAR model differs from the above in that y_t and u_t are vectors and the coefficients are square matrices, i.e.,

$$Y_{i,t} = \sum_{j=1}^{n} H_j \, Y_{i,t-j} + u_{i,t} \ , \ i = 1,\ldots,k \qquad (1.7)$$

$$\text{with} \quad E \left(u_t \, u_t' \right) = \Sigma \qquad (1.8)$$

where Y_t is a (k x 1) column vector, k is the number of equations in the model and n is the maximum lag length in the model. H and Σ are of (n x n) and (k x k) dimensions, respectively.

Or equivalently, following M. Aoki [1987], we can write the system as follows :

$$A(L) y_t = u_t \qquad (1.9)$$

where A(L) is a matrix polynomial in the lag operator L, and $A(L) = I - A_1 L - \ldots - A_p L^p$ and u_t is a vector valued mean-zero white noise process with a constant covariance matrix:

$$E \left(u_t \, u_s' \right) = U \, \delta_{t,s} \qquad (1.10)$$

where the matrix U need not be diagonal because of contemporaneous correlations among the components of the vector u_t.

As the approach is ad hoc in nature, "...the econometrician makes no attempt to use theory to distribute zeros in the coefficient matrices, so that prior information guides only the selection of

the variables to enter...and the lag length n" [Cooley and LeRoy, 1985, p. 285]. VAR models found many application areas. Though not exhaustive, Cooley and LeRoy give us the following list :

a) Forecasting
b) Causality tests
c) Tests of theories

   1) Martingale models
   2) Optimal control
   3) Rational expectations monetarism
   4) Measurement errors
   5) Permanent- income consumption models

d) Hypothesis seeking
e) Data characterization
f) Innovation accounting and impulse response analysis
g) Policy analysis

As suggested by Cooley and LeRoy, VAR modelling can be used for testing the Granger-causality. For simplicity, let us consider the following bivariate model :

$$\begin{bmatrix} a(L) & b(L) \\ c(L) & d(L) \end{bmatrix} \begin{bmatrix} y_i \\ x_i \end{bmatrix} = \begin{bmatrix} u_{1i} \\ u_{2i} \end{bmatrix} \qquad (1.11)$$

where

$$a(L) = a_0 - a_1L - a_2L^2 - \ldots \qquad c(L) = c_0 - c_1L - c_2L^2 - \ldots$$
$$b(L) = b_0 - b_1L - b_2L^2 - \ldots \qquad d(L) = d_0 - d_1L - d_2L^2 - \ldots$$

and

$$E\,(u_i\, u_j') = \begin{cases} \Sigma & \text{if} \quad i = j \\ 0 & \text{if} \quad i \neq j, \text{ [(2 x 2) zero matrix]} \end{cases} \qquad (1.12)$$

$$\text{with} \quad \Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{bmatrix} \qquad (1.13)$$

In model (1.11), y does not Granger-cause x if $c_i(L) = 0$, $i > 0$. If $b_0 \neq 0$ and $c_0 \neq 0$, this implies instantaneous Granger-causality.

A concept deriving from a VAR model is the moving average representation (MAR). This can be shown in model (1.11) as follows: if the matrix A(L) is invertible, the model may be represented in the MA(∞) form as

$$y_t = A(L)^{-1} u_t \qquad (1.14)$$

Using the MARs of the variables in the system "...VAR models can be used to provide summary characterizations of the cyclical behaviour of a system of macroeconomic variables." [Cooley and LeRoy, 1985, p. 288] Then, each variable in the system can be expressed as a function of "innovations", i.e the u_t term in equation (1.14). Referring again to (1.14), it is also true that the response of the i-th element of y_{t+k} to the innovation in the j-th variable at date t is the i,j element of the matrix $A(L)^{-1}$. A tabulation of these responses from k = 0 ... K is called an impulse response function (IRF).

Yet another useful tool in VAR modelling is called variance decompositions (VDCs). This idea follows from the fact that "... the covariances among the innovations are zero by definition, the variance of each variable will be a weighted sum of the variances of each variable, with the weights being determined by the elements of the $A(L)^{-1}{}_k$." [Cooley and LeRoy, 1985, p. 289] Therefore, VDCs determine which innovations contribute to the forecast error of each variable. Here, ordering of the equations becomes very important.

Mathematically speaking[2], we can transform the u_t term in model (1.14) to white noise v_t by

$$v_t = W\ u_t \tag{1.15}$$

where W is a lower triangular matrix with the unit diagonal elements such that $W\ U\ W' = \Sigma$ is diagonal. Then, we rewrite model (1.14) as :

$$y_t = A(L)^{-1}\ W^{-1}\ v_t = G(L)\ v_t \tag{1.16}$$

Given a vector autoregression model driven by innovation disturbances, the predicted value of y_{t+k} for $k > 1$, given y_t, y_{t-1}, ..., which is denoted by $y_{t+k/t}$ can be calculated by

$$y_{t+k/t} = [\ G(L)\ /\ L^k\ ]_+\ v_t \tag{1.17}$$

where the symbol $[\ ]_+$ denotes that part of the expression with non-negative power in L. The prediction error can be written as

$$y_{t+k} - y_{t+k/t} = G_0 v_{t+k} + G_1 v_{t+k-1} + \ldots + G_{k-1}\ v_{t+1} \tag{1.18}$$

Then, the error covariance matrix is given as a sum such that

$$y_{t+k} - y_{t+k/t} = \sum_{i=0}^{k-1} (G_i\ \Sigma\ G_i') \tag{1.19}$$

Equation (1.19), i.e the variance decomposition, expresses the prediction error as the sum of components contributed by the elements of v_t.

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[2] This analysis is taken from M. Aoki [1987]

Let us now finish our discussion by quoting from M. Aoki [1987, p. 257] :

> ...the variance decomposition and the sequence of impulse response matrices may be used to infer dynamic properties of the model and how innovations originating in a certain sector or variable affect the rest of the model or the time series components if clear interpretation of the components of the innovation is available.

C. PRACTICAL PROBLEMS IN BUILDING THE VAR MODELS

In our analysis of causality and the VAR models so far, we have not dealt with the problem of determining the lag lengths of the variables entering the models. A problem faced in applied work is to choose the lag length of the variables to appear in the model as explanatory variables. Another problem is that, in the VAR model proposed by Sims, all the variables in the system enter the model with the same lag order. This is an unrealistic assumption which is very difficult to justify on economic grounds. Furthermore, if one increased the common lag by one, the number of parameters to be estimated increases by the square of the variables in the system, which quickly exhausts the degrees of freedom.

Thus, to avoid this problem, a variant of the VAR model called "constrained-VAR model" was proposed by C. Hsiao [1981]. The model was extended by P.E Caines, C.W Keng and S.D Sethi [1981]. The suggested approach "...allows each variable to be a function of the subset of other variables under consideration. Moreover, each

variable...is allowed to have different lag lengths." [Chowdhury, 1989, p.36] Therefore, in the constrained VAR approach, equations of the model need not contain <u>all</u> the variables in the model. Furthermore, variables are allowed to enter the equations with different lag lengths. However, we still face the problem of determining whether a variable appears in an equation and, if it does, selecting the appropriate lag length.

Granger-causality is a useful tool that helps in solving this problem. An approach proposed by Hsiao [1981] makes use of the Granger-causality definition in conjunction with Akaike's final prediction error (FPE) criterion. The FPE method "...is appealing because it balances the risk due to the bias when a lower order is selected and the risk due to the increase of variance when a higher order is selected." [Hsiao, 1981, p. 88] This approach means that "...not only is there a reduction in the number of parameters to be estimated, but at the same time the influence of each variable may be felt at different time lags." [Hsiao, 1981, p.88]

Judge, et al., [1982, p. 713] defines FPE criterion as follows :

$$FPE_{(a,b)} = \frac{T + (\text{number of parameters})}{T - (\text{number of parameters})} \frac{SSE_{(a,b)}}{T} \qquad (1.20)$$

where T is the sample size effectively used in the estimation and $SSE_{(a,b)}$ is the sum of squared errors if y_{t-1}, ... , y_{t-a} and x_{t-1} and x_{t-b} are used as regressors. Hence,

> ...increasing the number of parameters increases the first [factor]...but decreases $SSE_{(a,b)}$. It is assumed that these two forces are balanced optimally where their product reaches its minimum. [Judge, et al. p.713]

Hsiao's approach combines the concept of Granger-causality and the FPE criterion. The method can be outlined as follows :

1) Determine the order of the lag length of the dependent variable to form an autoregressive process using the FPE criterion, i.e by choosing the lag order at which the lowest FPE is obtained.

2) Enter the next variable (say, X_1) to the equation fitted in step 1. Determine the lag length of X_1 using the FPE criterion.

3) Compare the smallest FPE's of steps 1 and 2. If FPE obtained in step 2 is smaller than that of step 1, this means that X_1 is Granger-causing Y. If so, keep X_1 in the equation with the lag of order corresponding to the one where the minimum FPE is obtained.

4) Repeat steps 1-3 for other X's and find the final specification of the particular equation in question.

5) Repeat steps 1-4 for the other equations of the model.

6) Combine all single equation specifications in order to identify the system, forming the maintained hypothesis.

However, it is also necessary to check the specified model by deliberately over- and underfitting and by comparing the alternative models against the maintained hypothesis using a likelihood ratio (LR) test. The LR test can, for practical purposes, be defined as follows : [Maddala, 1988, p. 137]

$$LR = n \, \text{Log}_e \left(\frac{RRSS}{URSS} \right) \qquad (1.21)$$

where RRSS : Restricted Residual Sum of Squares
URSS : Unrestricted Residual Sum of Squares

The LR test is, of course, not the only test available for specification analysis. But it is the one most widely used in applied work. Other similar and asymptotically equivalent tests are the Wald (W) and Lagrangian Multiplier (LM) tests. Again, the LR test is generally preferred to W and LM tests as it was found that $W \geqslant LR \geqslant LM$ and that W may be biased against rejecting the null hypothesis and LM may be biased against accepting it.

After specifying the model properly, we are ready to estimate it. For the model proposed by Sims, ordinary least squares (OLS) is an appropriate technique as we have the same regressors in all equations. But for the constrained VAR model we defined above, seemingly unrelated regression (SUR) technique of A. Zellner [1962] is suggested for more efficient parameter estimates.[3] Before finishing this chapter, we will summarize the SUR method as it will be the technique we will use in the estimation of our model.[4]
Let us suppose that we have a set of m regression models, and let n observations on model j be represented by :

$$y_j = X_j \beta_j + \epsilon_j \qquad (1.22)$$

with $$E(\epsilon_j \epsilon_j') = \sigma^2_j I \qquad (1.23)$$

where y_j is n x 1, X_j is n x k_j and β_j is k_j x 1.

A combined regression model can be formed from these equations in the following way :

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[3] RATS (version 2.11) User's guide. section 11.5

[4] Our summary closely follows the exposition given by Chow [1983. p. 81]

$$\begin{bmatrix} y_1 \\ y_2 \\ .. \\ .. \\ y_m \end{bmatrix} = \begin{bmatrix} X_1 & 0 & .. & .. & 0 \\ 0 & X_2 & .. & .. & 0 \\ .. & .. & & & .. \\ .. & .. & & & .. \\ 0 & .. & .. & .. & X_m \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ .. \\ .. \\ \beta_m \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ .. \\ .. \\ \epsilon_m \end{bmatrix} \qquad (1.24)$$

The residuals in different regression submodels are correlated with $E\ \epsilon_i\ \epsilon_j' = \sigma_{ij}\ I$ and $\sigma_{ii} = \sigma^2$. This means that the set of m dependent variables is affected by some common factors not explicitly included in the explanatory variables. The variance-covariance matrix of the residual vector of (1.24) is given by :

$$V = \begin{bmatrix} \sigma_{11} I & \sigma_{12} I & .. & .. & \sigma_{1m} I \\ \sigma_{12} I & \sigma_{22} I & .. & .. & \sigma_{2m} I \\ ... & ... & & & ... \\ ... & ... & & & ... \\ \sigma_{1m} I & \sigma_{2m} I & .. & .. & \sigma_{mm} I \end{bmatrix} = \Sigma \otimes I \qquad (1.25)$$

where $\Sigma = (\sigma_{ij})$ and $\otimes$ denotes the Kronecker product. In most applied work Σ is unknown, and the residuals from the OLS regressions can be used to form consistent estimates of σ_{ij}. Once the covariance matrix (1.26) is consistently estimated, β's of the combined regression model can be efficiently estimated in the probability limit by using the generalized least squares technique.

III. TURKISH ECONOMY IN THE 1980's

A. BACKGROUND

The Turkish economy was generally considered as a closed economy with economic policies primarily aiming at industrialization and growth led by import substitution. Except for a short period between 1923 and 1929, import substitution was chosen as "the way" to industrialization throughout the course of the Turkish economy until 1980. Since then, a programme of major structural change has been re-shaping the socio-economic structure.

What led to the structural transformation in the Turkish economy? Or, using a more popular term, what conditions necessitated the structural adjustment in the Turkish economy ? A popular but short answer to this question is a severe foreign exchange and external debt crisis, as it is in many other cases.

A brief look at the Turkish economic history shows three major foreign exchange and external debt crises. The first one occurred in 1958. The remedy was a major devaluation and a stabilization programme. This was followed by a military intervention in 1960. The second one was experienced in 1970. Again, a major devaluation was made in August 1970. A partial military intervention followed these developments in 1972. The cause of these two crises is generally attributed to the problems caused by the import-substitution strategy.

The 1970's were full of surprises for the Turkish economy. First of all, due to the successful devaluation in 1970[5], export earnings showed considerable increases. Secondly, remittances from a wave of Turkish workers who started to find employment abroad in the late 1960's and early 1970's brought about a surplus in the current account in 1972 and 1973. Workers' remittances continued to be an important source of foreign exchange afterwards, too. Thirdly, the oil price hikes of 1973 and onwards and the increases in the prices of basic and intermediate industrial goods were not reflected to the functioning of the domestic economy by the then governments thorough a scheme of subsidization until 1977. Furthermore, the economy continued to expand steadily, while many industrial countries were taking measures to slow down their economic growth. Given the external conditions, the import-substitution strategy, policies aiming at further growth of the economy and the insufficiency of domestic savings to finance all these, the economy went into trouble again. First of all, an increased import bill caused a deficit in the current account again. Secondly, the country started to run out of her foreign exchange reserves. Then, we see policies like short term foreign borrowing to support the subsidization schemes and to finance the continuing and new investments by the public sector (most of which, by the way, were not economically feasible) plus the so-called "DCMs - Turkish Lira deposits convertible to foreign exchange with a foreign exchange

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[5] Marshall-Lerner conditions were proved later on to be satisfied.

rate guarantee" which encouraged private sector's foreign (mostly short-term) borrowing to finance their investments. As a result, an economic crisis was inevitable. There were two economic stabilization programme attempts based on stand-by agreements with IMF in 1978 and 1979, which did not work. In sum, the country was in total bankruptcy at the end of 1970's. An external debt crisis was on the scene again and further foreign borrowing was no longer available. Meanwhile, real GNP growth became negative, industrial production stopped almost completely, inflation reached to unprecedented levels and because of the chaos also in the political and social arena, the country was heading towards a civil war.

B. 1980's

Under these circumstances, an economic stabilization programme was put into effect in January 1980 in accordance with an agreement with IMF. And, a rescheduling of external debt was undertaken. Thus, an era of "structural adjustment" had to be opened in the Turkish economy. It is also important to remember that full membership to the European Community (EC) is an ultimate goal for Turkey, who has already been an associate member of the Community since 1973. Therefore, Turkey already had to change the structure of her economy for full integration with the EC. Hence, the measures taken, which in fact exceeded IMF's expectations, aimed at "...correcting the structural weaknesses of the Turkish economy over the medium term...as well as stabilizing the economy in the short-run." [OECD, 1980, p. 32]

This meant liberal, outward-oriented economic policies aiming at export-led growth and industrialization. Some of the principal objectives of this programme were to reduce government control and introduce new instruments to allow for indirect demand management policies, which would be more market-oriented in the future and which would also encourage competition and greater development of private initiative. Measures included the reorganization of the [SEEs - State Economic Enterprises], which in the 1970s contributed to the breakdown of the economy because of their inefficient functioning, subsidized pricing policies and overstaffed management due mainly to political polarization. Reorganization of the SEEs included huge increases in the sale prices of their products, abolition of government subsidies in most cases, and revision of staffing policies, while privatization was deemed to be the ultimate goal for these enterprises.

Integration of the Turkish economy with the world economy is "the basic philosophy" underlying all the transformations in the 1980s. This would be realized by placing a greater importance on the development of export sectors, or in reality making resources available to these sectors at the expense of domestic shortages and price increases.

In line with the "basic philosophy", the Turkish currency (the Lira) was devaluated by 33 percent in 1980. But a fixed exchange rate system remained in effect. In May 1981, a system of daily

adjustment of the nominal exchange rate, which can be called as "managed floating" was started by the Turkish authorities. In August 1988, a system of partial market setting of the official exchange rate was introduced. It is important to note here that there was almost no difference between the official rate and the black market rate in contrast to the huge differentials of 1970's. These developments were aiming at achieving the complete convertibility of the Turkish Lira. Therefore, in January 1989, commercial banks were authorized to engage in overseas trading of Lira in selected countries. A complete removal of the restrictions on capital movements is considered as the final step in achieving the convertibility of the Turkish Lira.

Trade liberalization constituted a major step for Turkey's integration with the world economy. Therefore, many quotas on imports were replaced by tariffs and substantial tax rebates were granted to exporters. In 1970's a "positive list" that explicitly identified the items allowed to be imported was in effect. In the 1980's, this list was replaced by a "negative list" and everything that is not in this list is allowed to be imported. A system of export subsidies was one of the major foreign trade policy instruments until 1984. Afterwards, export-subsidies were largely reduced and exchange rate policy became the major policy tool for export promotion. As a result, Turkish exports grew at about 30 % a year between 1980 and 1985, while world trade was growing at a modest level of 3 % and despite unfavourable conditions in the

world economy. However, due to a setback in exports in 1986, the system of tax rebates on exports was reintroduced. Afterwards, trade policies mainly aimed at further refinement of the export incentives and import duties. Especially, export tax rebates have been progressively phased out[6] and completely abolished at the beginning of 1989. Instead, subsidization at the stage of production and preferential credits to exporters were introduced. Credits are given by the newly established Eximbank (August 1987).

Meanwhile, the political and social unrest at the end of 1970's was suppressed by a military takeover in 1980. The presence of a military government between September 1980 and November 1983 made the implementation of the economic reforms easier. Afterwards, though faced with some opposition, the civil government (elected in November 1983) continued to further the economic reforms. The same party, after winning the elections in 1987, is still in power as of August 1990.

During 1980's real growth rate of GNP became the highest among the OECD countries. However, share of gross investment in GNP declined in the early 1980's and attained the level of mid-1970's after 1985, again. However, the share of domestic savings also increased. This contributed to the improvement of the external balance.

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[6] This is also due to Turkey's obligations to GATT and to the European Community.

Increased export earnings and a tourism boom brought about a current account surplus in 1988 again, after 15 years.

The debt crisis was settled down as a result of the agreement with IMF, which meant a "green light" for the international financial community. Then, the debt crisis of the third world broke out in 1982, followed by a recession in the industrial countries. Turkey, in fact, did not seem to be so much affected by these developments. However, the U.S dollar value of the external debt of Turkey started to accumulate again. This time the cause is attributed to the public sector's borrowing to finance infrastructure investments, the private sector's preference to use foreign funds because of the high cost of domestic credits and the decline of the U.S dollar in the world financial markets. The State Planning Organization identifies the reasons for the increase in the ratio of external debt to GNP as follows : [1989, p. 70 - translation from Turkish]

> ...the ratio of external debt to GNP showed an increase between 1984 and 1987 and decreased again in 1988. One of the most important reasons which increased this ratio is the pursuit of a flexible exchange rate policy in order to promote exports and other foreign exchange earnings, and the adjustment of the exchange rate above the increases in the domestic price level. This policy, causing a contraction in GNP in dollar terms, increased the ratio of external debt to GNP. Furthermore, developments in the exchange rate parity of the U.S dollar against the other currencies in the world financial markets increased the amount of the outstanding debt, as measured in U.S dollars.

All these caused a two-fold increase in Turkey's external debt between 1983 and 1988. In this period, external debt increased from 20.3 billion U.S $ to 39.6 billion U.S $. The latter figure is

about 2.5 times larger than the amount which meant a bankruptcy for the Turkish economy at the end of 1970's. However, Turkey, today, is able to honour her payments, though this is exerting pressure on the domestic socio-economy.

The structural change in the Turkish economy meant a policy change in the manipulation of all macro-variables. Interest rates were no exception. Before 1980, ceilings were in effect on the nominal interest rates. Given the increases in the general price level, real interest rates turned out to be negative especially during the second half of 1970's. One of the main objectives of the 1980 stabilization programme was the pursuit of a positive real interest rate policy. Therefore, interest rate ceilings were abolished and "...higher interest rates were expected to increase savings and deposits in the banking sector, and facilitate channelling of loanable funds towards productive investments." [OECD, 1990, p. 91] However, due to the lack of supervision and relevant legal framework, this policy resulted in the so-called broker-crisis in 1982, as "...when several larger firms were unable to honour interest payments on their bonds or to their creditor banks, the system experienced a liquidity crisis." [OECD, 1990, p.91] After this experience, interest rates were regulated again by the monetary authorities. However, the main policy was again to assure positive real interest rates, which can be considered as an intermediate target of the monetary policy. At the same time, measures were taken to reduce the social cost of the possible future liquidity crises by introducing a scheme of "deposit

insurance". Banking law was also revised in 1985 and banks were audited externally. Furthermore, an interbank money market was created in 1986. Interest rates in this market, varying considerably within short periods, gave a valuable indication to the Central Bank (CB) about the tightness of bank liquidity. Attempts were also made to establish an efficiently functioning secondary market for government securities. Interest rates at the interbank market and in the secondary market are being freely determined.

Keeping the "basic philosophy" in mind, foreign banks were authorised to open branches in Turkey in 1985. Foreign transactions were simplified and transferred from the CB to commercial banks. Residents of Turkey were also allowed to open foreign currency accounts with banks and make payments, cash withdrawals and transfers abroad. Then, a rapid increase in the foreign currency deposits was experienced. This meant a currency substitution by the public due mainly to increasing inflation especially after 1984. Another feature of financial reforms in this period is the opening of a new stock exchange in Istanbul, which is aimed at consolidating the credit structure of the private sector by means of financing instruments in the capital market.

Returning back to the interest rate policy again, interest rates on sight deposits were liberalized in October 1986. But this time "...banks were allowed to pay interest on minimum balances of sight

deposits up to 90 % of the prevailing time deposit rate." [OECD, 1987, p. 35] This policy aimed at making the Turkish Lira sight deposits more attractive versus foreign currency sight deposits, which bear market interest rates. By the way, lending rates were set freely by commercial banks and were generally 10 % above the rates on time deposits of one year maturity.

This was followed by the lifting of interest rate ceilings on bank deposits of one year and on private bonds in July 1987. Then, a new package of economic stabilization measures came in February 1988. And, interest rates on time and sight deposits were determined officially.[7] In June 1988, the interest rate on sight deposits was lowered to 30 per cent. In October 1988, banks were authorised to determine freely all interest rates on deposits and credits with the exception of official deposits. However, the rates were allowed to be changed once a month. Afterwards, in May 1989, banks were permitted to offer floating interest rates for two- to five-year deposits.

In general, it can be said that greater reliance on monetary policy was a characteristic of the economic liberalisation programme of 1980. As we mentioned before, the positive interest rate policy was an intermediate target of the monetary policy. However, as is the case in developing countries, The central bank (CB) is not

[7] Interest rates were determined as 65 per cent per annum for time deposits of one year and longer maturity, 36 per cent for sight deposits and 10 per cent for official deposits.

independent and shares the responsibility for monetary policy with other government institutions. In the Turkish context, the CB is also obliged to fund selective credit programmes and the public sector in general.[8] Therefore, monetary aggregates become very difficult to control.

Reserve and liquidity ratio requirements are the obligatory deposits that the commercial banks have to keep with the Central Bank in the former case and within themselves in the latter case. These requirements acted as policy tools to control money supply, namely M1, M2, M2X, and M3.[9] No important change was made in the legal reserve ratios right after the January 1980 programme. Old ratios (1.4.1979) for sight deposits and time deposits over 1 year were kept at the same level, i.e 35 per cent and 30 per cent respectively. In May 1981, banks were allowed to include foreign currency in their legal reserves and in July, the reserve ratio for 3-month deposits was also increased from 30 per cent to 35 per cent. In January 1982, banks were permitted to include Treasury bonds in their legal reserve requirements, up to 25 per cent of these reserves. Reserve ratio requirements were regulated again in June 1982. The rate for time deposits varied between 30 and 40 percent depending on the annual rate the bank was offering. Then,

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[8] This is an important statement for our study, which gives hints about the relationships between monetary and fiscal policy tools.

[9] M2X is the broad definition of money supply (M2) plus the foreign currency deposits.

the rates were changed again in January 1983. According to the new decisions, the reserve ratio was unified at 25 per cent for both sight and demand deposits. Liquidity ratio is set at 10 per cent for all banks. The ratio of government bonds that could be included in the legal reserve requirements was also increased to 50 per cent. Then, we see a period of silence until June 1984, when the commercial banks' liquidity requirement was raised from 10 to 15 per cent of their liabilities. Afterwards in 1985 and 1986 the reserve and liquidity requirement was overhauled and a unified reserve ratio of 21 percent was introduced in March 1985 and then reduced to 15 per cent in March 1986 after taking several steps. The monetary policy was further eased in July 1987 by decreasing the legal reserve ratio for Turkish Lira deposits from 15 to 10 per cent. The liquidity ratio was increased by 1 percentage point. However, the reserve ratio was increased by 2 percentage points in September 1987 and in December 1987. The February 1988 measures meant a tighter monetary policy and the legal reserve ratio and the liquidity ratio was increased to 16 per cent and to 27 percent, respectively. The reserve ratio was further increased to 16.5 per cent in June and to 17 percent in August 1988. However, the legal reserve ratio was lowered again to 14 per cent while the liquidity ratio was increased to 30 per cent in September 1988. The unified reserve ratio was split into two for sight and time deposits in October 1988 and determined to be 25 percent for sight deposits and 14 per cent for time deposits. These ratios were still in effect as of the end of our sample period.

As we have seen in the above survey of the changes in the legal reserve and liquidity ratios, frequent changes have been made in these ratios. This policy is closely related to the Central Bank's desire to manipulate the money supply effectively, especially in the absence of open market operations. The central bank was not authorized to engage in open market operations until February 1987. At this date the CB were allowed to engage in open market operations for the following securities : Treasury bonds, registered bonds and commercial paper issued by joint-stock companies, certificates of deposit issued by banks, revenue-sharing certificates, and other bonds issued by government agencies.

Let us now quote another striking fact from an OECD report [Economic Surveys : Turkey, 1987/1988, p. 88]

> ...starting in March 1988, the Central Bank also began to intervene in the interbank money market. However, there were practically no market-makers -other than the Central Bank- who quote two-way interest rates and stand ready to borrow or lend for their own account.

In 1986, CB started for the first time the policy approach of targeting a monetary aggregate. M2 was chosen to be kept on a growth path during the year. The growth rate target was determined from the projections for real income growth, inflation and interest rates. OECD [1987, p. 33] tells the rest of the story as follows:

> ...On the basis of an expected real growth of GNP of 5 per cent and inflation as measured by the wholesale price index of 25 per cent, an increase of M2 by 35 per cent was planned for 1986. Since it is not feasible to control M2 directly, the Bank derived from the target path of M2 a required path of reserve money and its components on the basis of projections for reserve money multiplier over

> time...the outcome for M2 in 1986 was a growth of 38.6 per cent at the end of the year, which was close to the target set...A further slow down of the growth of M2 to 30 per cent [was] planned for 1987...

The realization for 1987 was about 44 per cent. For 1988, the target for the growth of M2 was 40 percent. The assumptions for setting this target was a 5 per cent real GNP growth, an inflation rate of 43 percent and a real interest rate of 4 percent. Targets were also established for currency in circulation, and the sum of sight and time deposits as 36 and 41 per cent, respectively. The realizations were as follows : growth of M2 (53.6 %), growth of currency in circulation (50.6 %) and growth of the sum of sight and time deposits (54.1 %).

After the experience of three years of monetary targeting, the Central Bank did not announce a monetary programme for 1989, mainly on the grounds of "...the adverse consequences for credibility of policy in the case of repeated failure to achieve established targets..." [OECD, 1990, p. 57]

OECD suggests that it would perhaps be more successful if M1 instead of M2 were chosen as the target variable. It is argued that [OECD, 1987, p. 33]

> ...to relate monetary developments reliably to changes in real economic variables and to apply systematic targeting of a monetary aggregate, however, requires the existence of an identifiable and stable money demand function. Otherwise, i.e, if there is evidence of instability in the demand for money, a steady growing money supply, instead of stabilizing economic activity, could well induce fluctuations and

destabilize expectations. Estimates for Turkey made by the OECD Secretariat of various forms of money demand equations of the standard Goldfeld-specification cast some doubt on the validity of the assumption of M2 stability. It was easier to find an equation for M1 with satisfactory test statistics.

Now, let us have a brief look at developments in the fiscal policies after the 1980 transformation. During the first three years of the transformation, the government budget deficit was considerably reduced though a series of measures such as the widening of the income tax base, raising some indirect taxes, improving tax collection procedures and imposing limits on some expenditure items, especially public investment and subsidies. Incomes policies also supplemented the monetary and fiscal policies. In the following years, a greater importance was given to the achievement of greater decentralisation of public finance and investments, reorganisation of the State Economic Enterprises, and to efforts for their privatization, the principal aim of which "...is to make the economy more responsive to market forces, increase industrial efficiency and promote real growth." [OECD, 1987, p. 46] Decentralisation of public finance and investments meant a greater fiscal autonomy for local governments (municipalities). "Public Sector Borrowing Requirement" was also aimed to be decreased.

Introduction of the "Value Added Tax - VAT" was one of the most important features of the stabilization programme. VAT was put into effect at the beginning of 1985 and caused considerable increases in the tax revenues in the following years.

In Turkey, government expenditure can generally be divided into the following categories : central government, special funds, local governments and SEEs. The target for the central government was a balanced budget. But, when a deficit equivalent to the 2.8 per cent of GNP was achieved (like 1985), this was interpreted as a favourable result. Apart from the SEEs, the breakdown of general government expenditures in terms of percentages of the total shows that central government's share is 68.4 % and 65.1 %, local administrations' share is 11.4 % and 11.2 %, social security institutions' share is 13.9 % and 13.5 % and the share of special funds is 6.3 % and 10.2 %, respectively for 1986 and 1987. Special funds were formed in 1985 and aimed to be a tool for fiscal decentralisation. The most important source of these funds is their participation in tax revenues and factor incomes, of which they receive a predetermined share. When we examine the breakdown of the general government expenditures according to its usages, it is seen that current expenditures were the primary area of government expenditure until 1983. From 1983 onwards, transfer expenditures start to dominate. This reflects the growing importance of interest payments, compensation to wage earners and export-subsidies. Transfer payments are also made to the SEEs. The third category of government expenditures is the government investments. Government investments especially showed an increase between 1985 and 1987, amounting to 25.4 and 23.4 per cent of all government expenditures in 1986 and 1987, respectively. However, budgetary cuts decreased this ratio in more recent years. As a final memorandum item, we can

state that total expenditures as per cent of GNP was 28.5 per cent in 1980. This ratio decreased to 25.0 per cent in 1985 and increased again to 30.7 per cent in 1987.

STATISTICAL APPENDIX TO CHAPTER III.

I. GROWTH OF REAL GNP (Percentage change over the previous year)

YEARS	GNP GROWTH	YEARS	GNP GROWTH	YEARS	GNP GROWTH
1960	3.4	1970	5.8	1980	-1.1
1961	2.0	1971	10.2	1981	4.1
1962	6.2	1972	7.4	1982	4.5
1963	9.7	1973	5.4	1983	3.3
1964	4.1	1974	7.4	1984	5.9
1965	3.1	1975	8.0	1985	5.1
1966	12.0	1976	7.9	1986	8.1
1967	4.2	1977	3.9	1987	7.4
1968	6.7	1978	2.9	1988	3.4
1969	5.4	1979	-0.4	1989	n.a

Source : OECD, Economic Surveys : Turkey, various issues

II. GROWTH OF FIXED CAPITAL INVESTMENTS AND CONSUMPTION
(PUBLIC + PRIVATE)
(Percentage changes over the previous year)

YEARS	F. CAPITAL INVESTMENTS			CONSUMPTION		
	TOTAL	PUBLIC	PRIVATE	TOTAL	PUBLIC	PRIVATE
1970	13.5	12.5	14.7	2.4	3.3	2.3
1971	-5.1	-8.7	-0.9	12.5	6.5	13.6
1972	11.8	13.9	15.7	6.6	7.3	6.4
1973	11.3	8.4	14.4	2.1	8.5	1.1
1974	2.1	0.7	3.5	7.2	4.7	7.7
1975	16.8	29.4	4.7	8.1	11.4	7.5
1976	15.6	17.3	13.5	9.1	16.1	7.8
1977	7.4	13.4	0.0	4.7	15.8	2.5
1978	-10.9	-13.8	-6.8	1.2	-3.3	2.2
1979	-3.6	4.6	-11.6	-2.5	1.7	-3.1
1980	-1.0	-3.7	-17.3	-3.4	8.8	-5.2
1981	1.7	9.4	-8.7	0.6	0.9	0.6
1982	3.5	2.2	5.5	3.9	2.0	4.2
1983	3.0	1.9	4.7	4.7	1.7	5.0
1984	0.4	-4.7	8.4	6.2	2.1	6.8
1985	16.9	23.1	8.2	1.5	3.1	1.3
1986	11.0	7.5	16.4	10.9	6.6	11.5
1987	5.5	-3.4	18.6	6.3	4.9	6.5
1988	-1.6	-14.1	13.3	2.6	2.1	2.7

Source : OECD, Economic Surveys : Turkey, various issues
Note : 1988 figures are provisional.

III. CONSUMER PRICES -- ALL ITEMS -- (1985 = 100)

YEARS	CPI	YEARS	CPI	YEARS	CPI
1970	1.2	1977	4.2	1984	71.1
1971	1.3	1978	6.1	1985	100.0
1972	1.5	1979	9.5	1986	130.4
1973	1.9	1980	19.7	1987	182.3
1974	2.2	1981	26.8	1988	312.0
1975	2.7	1982	35.9	1989	530.0
1976	3.3	1983	45.3		

Source : OECD, Main Economic Aggregates, 1969-1988, p. 672; and
State Institute of Statistics, Ankara

IV. GROWTH OF REAL GNP (Average Annual Percentage Change)

COUNTRY GROUPS	1965-75	1975-80	1980-85	1986	1987	1988
Developing Countries	6.5	5.4	3.2	4.7	3.9	4.3
Low Income	5.5	4.6	7.4	6.4	5.3	...
Middle Income	7.0	5.7	1.6	3.9	3.2	...
Oil Exporters	7.0	5.9	0.9	0.6	0.8	2.2
Highly Indebted C.	6.9	5.4	0.1	3.5	1.7	...
High Inc. Oil Export.	8.7	8.0	-2.5	-8.1	-2.9	...
Industrial Countries	4.5	2.8	2.4	2.6	2.9	4.1
Socialist Countries(1)	...	5.4(2)	3.3	4.1	2.5	3.8
Turkey	6.6	4.9	4.4	8.1	7.4	3.4

Source : State Planning Organisation, "Developments Before the
Sixth Five Year Development Plan", 1989, Turkey, p. 7
(1) : Net Physical Product
(2) : 1970-1979

V. CHANGES IN OIL AND OTHER BASIC INDUSTRIAL GOODS PRICES
(Average Annual Percentage Changes) (*)

GOODS	1973-78	1979-81	1982-85	1979-85	1986	1987	1988
Oil	257	162	-21	106	-50	29	-21
Other	23	-5	-6	-20	-4	8	24

Source : the same as Table IV.
(*) : First four columns show the cumulative increase during
the period.

VI. CHANGES IN CONSUMER PRICES (Average Annual Percentage Changes)

COUNTRY GROUPS	1970-79	1980-85	1986	1987	1988
Developing Countries	18.1	32.2	31.1	40.5	67.1
Industrialized Countries	7.9	6.2	2.4	2.9	3.2
World	10.4	13.4	8.5	10.9	...

Source : The same as Table IV.

VII. TURKEY'S EXTERNAL DEBT AND RELATED STATISTICS
(1980 - 1988)

(1) : GNP, million U.S $
(2) : Total External Debt, million U.S $
(3) : Long Term Debt, million U.S $
(4) : Principal Repayments, million U.S $
(5) : Interest Payments, million U.S $
(6) : External Debt / GNP, percentage
(7) : Debt Service / Exports, percentage
(8) : Current Account Balance, million U.S $
(9) : International Reserves, million U.S $

YEARS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1980	55,801	19,086	15,542	593	506	34.2	19.2	-3,409	3,298
1981	56,240	19,196	15,681	804	988	34.1	21.1	-1,916	2,426
1982	51,543	19,679	16,460	1,192	1,170	38.2	23.5	-935	2,802
1983	49,683	20,289	16,441	1,164	1,234	40.8	25.4	-1,898	2,729
1984	48,228	21,573	16,966	1,180	1,183	44.7	20.4	-1,407	2,442
1985	51,445	25,983	19,898	2,363	1,318	50.5	28.1	-1.030	2,318
1986	56,503	32,789	24,793	1,995	1,495	58.0	28.0	-1,528	2,913
1987	66,017	40,932	31,470	3,017	1,885	62.0	29.8	-979	3,631
1988	68,408	39,592	31,589	3,844	2,424	57.9	32.1	+1,519	3,912

Source : World Bank, World Debt Tables, 1988-1989, Washington D.C

VIII. TURKEY'S FOREIGN TRADE (million U.S $)

YEARS	EXPORTS	IMPORTS	YEARS	EXPORTS	IMPORTS
1970	589	948	1980	2,910	7,909
1971	677	1,171	1981	4,703	8,933
1972	885	1,563	1982	5,746	8,843
1973	1,317	2,086	1983	5,728	9,235
1974	1,532	3,777	1984	7,133	10,757
1975	1,401	4,738	1985	7,958	11,613
1976	1,960	5,129	1986	7,457	11,199
1977	1,753	5,797	1987	10,190	14,283
1978	2,288	4,599	1988	11,662	14,372
1979	2,261	5,069	1989	11,627	15,763

Source : OECD, "Economic Surveys : Turkey", various issues; and Foreign Economic Relations Board of Turkey (DEIK), "Bulletin", January/February 1990

IX. TURKISH EXPORTS BY COMMODITIES (million U.S $)

COMMODITIES	1970	1974	1979	1984	1988
AGRICULTURAL PRODUCTS	440	852	1,344	1,719	2,341
Cereals	10	27	169	267	441
Fruit and Vegetables	138	294	648	646	867
Industrial Crops	259	460	448	492	696
Live Animals & Sea Products	34	71	84	343	337
MINING & QUARRYING PRODUCTS	39	80	133	240	377
PROCESSED & MANUFACTURED PROD.	109	600	785	5,144	8,944
Processed Agricultural Prod.	42	130	151	808	885
Manufactured Products	68	470	634	4,336	8,059
Textiles and Clothing	26	147	378	1,875	3,201
Hides and Leather Industry	5	75	44	401	514
Forestry Industry	3	24	1	24	22
Chemicals	7	37	24	173	734
Rubber and Plastics	2	1	3	97	352
Glass and Ceramics	1	12	37	146	233
Cement	3	8	45	56	7
Iron and Steel	0	1	31	576	1,458
Non-ferrous Metals	15	40	15	86	226
Metal Products and Machinery	2	16	18	134	383
Electrical Equipment, etc.	0	1	5	100	294
Other	5	108	34	668	636
TOTAL	589	1,532	2,261	7,133	11,662

Source : OECD, "Economic Surveys : Turkey", various issues

X. MONEY AND BANKING (end of period, million Turkish Lira)
(1979 - 1983)

MONETARY AGGREGATES	1979	1980	1981	1982	1983
M1	467.7	738.5	1,019.3	1,407.0	2,083.9
- Notes and Coins	143.7	217.5	280.6	411.9	547.5
- Sight Deposits	321.4	517.9	734.2	991.8	1,516.9
- Deposits with CB	2.6	3.1	4.5	3.3	19.5
M2	555.7	924.4	1,709.7	2,679.0	3,477.0
- Time Deposits	88.0	185.9	690.4	1,272.0	1,393.1
M3	609.8	1,073.9	2,142.1	3,176.4	3,981.7
- Other Quasi Money	54.1	149.5	432.4	497.4	504.7
CENTRAL BANK CREDITS	382.1	655.2	925.5	910.5	1,234.1
- Treasury	91.7	188.7	261.9	266.2	333.8
- SEEs	122.7	178.2	233.3	256.4	250.5
- Deposit Money Banks	75.8	149.8	264.7	301.3	541.5
- Agri. Cooperatives	46.7	92.8	120.0	42.6	61.7
- Other	45.2	45.7	45.6	44.0	41.8

Source : the same as Table IX.

XI. MONEY AND BANKING (end of period, million Turkish Lira)
(1984 - 1988)

MONETARY AGGREGATES	1984	1985	1986	1987	1988
M1	2,447.6	3,420.0	5,357.4	8,682.3	11,311.5
- Notes and Coins	735.5	1,011.4	1,415.2	2,274.7	3,425.6
- Sight Deposits	1,680.3	2,388.7	3,926.5	6,400.8	7.873.8
- Deposits with CB	31.8	19.9	15.8	6.8	12.1
M2	5,492.7	8,539.7	12,276.3	17,702.0	27,195.2
- Time Deposits	3,045.1	5,119.7	6,918.9	9,019.7	15,883.7
M3	5,938.6	9,198.6	13,140.9	19,132.0	29,736.4
- Other Quasi Money	445.9	658.9	864.6	1,430.0	2,541.2
CENTRAL BANK CREDITS	880.0	1,299.6	1,828.0	3,438.6	5,142.3
- Treasury	528.4	794.5	1,051.5	1,406.6	2,081.9
- SEEs	36.9	122.4	213.3	763.3	1,082.1
- Deposit Money Banks	242.5	290.9	424.2	989.0	1,351.3
- Agri. Cooperatives	35.7	42.1	55.0	134.7	148.8
- Other	36.5	49.7	84.0	145.0	478.2

Source : the same as Table IX.

XII. THE STRUCTURE OF GENERAL GOVERNMENT EXPENDITURES
(per cent of total)

EXPENDITURES	1980	1981	1982	1983	1984	1985	1986	1987
General Services	35.0	34.5	31.8	35.1	33.8	26.9	22.2	25.4
Defence	16.6	14.0	14.0	12.7	12.6	12.2	11.8	12.0
Other Public Services	18.9	21.6	21.8	18.4	18.2	25.9	28.3	23.2
Health	3.9	2.8	2.9	2.7	2.7	2.5	2.3	2.2
Education	12.6	11.5	12.4	11.1	10.7	9.9	9.8	10.0
Interest Payments	2.2	3.9	4.0	5.7	8.2	8.7	12.3	14.2
Social Security Outlays	10.8	11.7	13.1	14.3	13.8	13.9	13.3	13.0
Current Expenditures	41.4	37.4	39.0	36.8	36.0	34.4	31.3	30.6
Investment Expenditures	20.4	23.1	23.1	18.4	18.0	21.5	25.4	23.4
Transfer Expenditures	38.2	39.6	37.9	44.8	46.0	44.1	43.3	46.0
Central Government	81.3	81.5	80.2	78.0	78.7	73.5	68.4	65.1
Local Administrations	7.2	6.2	6.1	7.3	6.9	9.0	11.4	11.2
Social Security Inst.	11.5	12.3	13.7	14.7	14.4	14.3	13.9	13.5
Special Funds	....	....	....	....	....	3.2	6.3	10.2
Total Exp. as per cent of GNP	28.5	27.3	26.4	27.7	25.0	26.7	29.5	30.7

Source : OECD, "Economic Surveys : Turkey", 1989/1990, Paris

IV. A VECTOR AUTOREGRESSIVE MODEL FOR THE RELATIVE EFFECTIVENESS OF MONETARY AND FISCAL POLICIES IN TURKEY : POST-1980 PERIOD

In this chapter, we will develop a 4-equation vector autoregressive model to study the relationships and the interactions among the real GNP growth, money supply, fiscal policy variables and exports in the context of the post-1980 Turkey.

A. PRELIMINARY ANALYSIS OF THE DATA

Quarterly data from 1980.1 to 1988.4 will be used in our analyses. Description of the variables to be used in our models are as follows:

- Y : Real GNP Growth, calculated from the GNP series measured at 1968 prices
- GC : Changes in Government Consumption (Current Expenditures), calculated from the series measured at 1968 prices
- GI : Changes in Government Investment, calculated from the series measured at 1968 prices
- M1 : Nominal changes in Money Supply (M1)
- M2 : Nominal changes in Money Supply (M2)
- E : Changes in Exports, calculated from the series measured in current U.S dollars

In this list, GC and GI are intended to serve as proxies for the expenditure side of the fiscal policy (thus, we exclude the tax system) and the two money stock variables are considered to reflect the monetary policy regime. Exports are included in our models as a measure of the external conditions. In this list, nominal and

real values are mixed. This is because, the policy makers in Turkey aim at targetting the nominal magnitudes of the policy variables in stabilizing the real GNP growth.

All variables have first been seasonally adjusted using the Micro_TSP program (version 4.1). The procedure uses the ratio to moving average (i.e, multiplicative decomposition) to obtain the seasonal coefficients. In the next step, we have calculated the percentage change in each variable over the previous quarter. Series thus obtained and their graphs are enclosed in the appendix to this chapter.

Seasonal adjustment coefficients obtained from this procedure are presented in Table 4.1.

TABLE 4.1 SEASONAL ADJUSTMENT COEFFICIENTS FOR THE VARIABLES TO BE USED IN THE MODELS

Quarter	Y	GC	GI	M1	M2	E
1	.9553	.9999	.8461	.9594	.9889	.9890
2	1.0000	.9855	1.0565	.9592	.9863	.9096
3	1.0990	1.1068	.9914	.9967	.9947	.9081
4	.9457	.9097	1.1095	1.0664	1.0236	1.1835

Source : Calculated by using the Micro_TSP version 4.1

Table 4.1 shows that real GNP growth is higher in the third quarter than it is during the rest of the year. Both of the monetary variables are less than their yearly averages in the first three quarters and the fourth quarter is characterized by a monetary growth. Fiscal variables exhibit different properties. Government

consumption is 11 % higher in the third quarter than its yearly averages. Government investment has been found to be more active in the second and in the fourth quarters. Exports show about 18 % increase in the fourth quarter with respect to its yearly averages.[10]

It is important to note at this point that Turkey experienced five electoral activities (three referenda and 2 general elections), all in the fourth quarter, between 1982 and 1988. This is, in fact, a considerable fact in explaining the high monetary growth and government investment experienced in the fourth quarters. An important hike in the government consumption in 1987 is also attributable to the general elections in that year. Contemporaneous correlations among the variables are shown in Table 4.2.

TABLE 4.2 CONTEMPORANEOUS SIMPLE CORRELATION COEFFICIENTS AMONG THE VARIABLES

	Y	GC	GI	M1	M2	E
Y	-					
GC	.1711	-				
GI	.2568	-.0102	-			
M1	.1195	.3499	.1527	-		
M2	-.1110	.1081	-.2421	.1123	-	
E	.1807	.0779	-.0087	-.1303	.2688	-

[10] For an analysis of Turkish Exports using multiplicative classical decomposition, see : Atukeren, E; "A Time Series Analysis of Turkish Exports: 1980-1989 (in Turkish)", DEIK Bulletin, Foreign Economic Relations Board of Turkey, Istanbul, May 1989

Among these contemporaneous simple correlations, only the one between GC and M1 has been found to be statistically significant at 5 % confidence level. Given the quarterly nature of our data, these results suggest that interactions among these macro variables take more time and that we might exclude the simultaneous interactions. Though, following the argument by A. Grasa discussed in the first chapter, we do not require that the variables to be used in the model have to be stationary series, the Box-Pierce Q statistics (1970) show that all series, except GI, are at least covariance stationary. Q statistics obtained at 30 lags are as follows: Y(24.671), M1(16.966), GC(6.661), M2(28.763), GI(55.862), and E(10.096), where the corresponding critical value of the chi-square statistic at 5 % level is 43.8. Correlogram analysis of GI indicated a first-order autoregressive process. No further attempts were made to induce a white-noise series for GI, because of the reasons discussed in Chapter One (pp. 5-6).

B. MODEL BUILDING USING THE FPE CRITERION AND THE CAUSALITY IMPLICATIONS

Four models, each with four equations, will be formed based on the variables we have defined earlier. Each model will involve one fiscal and one monetary policy variable and all models will include the real GNP growth and the Exports. In building these models, we will make use of the Akaike's "Final Prediction Error" criterion, which was discussed in the first chapter of our paper. Then, the specification of the models thus formed will be tested

against the alternatives using the likelihood ratio tests. Formally, our study involves the construction of the following models (see Table 4.3).

TABLE 4.3 MODELS TO BE USED IN OUR STUDY

MODEL #	V A R I A B L E S			
1	Y,	GC,	M1,	E
2	Y,	GI,	M1,	E
3	Y,	GC,	M2,	E
4	Y,	GI,	M2,	E

Final Prediction errors obtained by regressing by OLS each variable on its own lags and on the lagged values of the other variables in their respective equations gave the following specifications shown in Table 4.4. Considering the degrees of freedom problems, we have initially allowed for eight lags in forming the models. Specifications obtained by using the minimum FPE criterion are shown in Table 4.4.

TABLE 4.4 SPECIFICATIONS OBTAINED BY USING THE MINIMUM FPE CRITERION

A. MODEL # 1

EQ. #	DEP. VAR.	Y	GC	M1	E	R^2	$\bar{R}^2$	FPE
1	Y	4	3	-	8	.854	.655	4.580
2	GC	-	4	-	5	.639	.447	519.067
3	M1	7	-	7	-	.814	.598	9.770
4	E	6	2	-	-	.642	.483	69.409

TABLE 4.4 (...continued...)

B. MODEL # 2

EQ. #	DEP. VAR.	Y	GI	M1	E	R^2	$\bar{R}^2$	FPE
1	Y	4	8	8	-	.966	.825	2.908
2	GI	-	1	-	-	.528	.509	98.326
3	M1	7	-	7	-	.814	.598	9.770
4	E	6	5	-	-	.772	.605	57.371

C. MODEL # 3

EQ. #	DEP. VAR.	Y	GC	M2	E	R^2	$\bar{R}^2$	FPE
1	Y	4	3	3	8	.896	.661	4.860
2	GC	-	4	-	5	.639	.447	519.067
3	M2	-	4	1	-	.433	.298	9.086
4	E	6	2	-	-	.642	.483	69.409

D. MODEL # 4

EQ. #	DEP. VAR.	Y	GI	M2	E	R^2	$\bar{R}^2$	FPE
1	Y	4	8	8	8	.990	.870	5.146
2	GI	-	1	-	-	.528	.509	98.326
3	M2	-	8	1	8	.862	.602	7.034
4	E	6	5	8	-	.912	.673	57.349

The numbers below the variable names show the optimum lag length with which they enter their respective equations. Accepting the above specifications as the maintained hypotheses, we have further tested their adequacy against the alternatives using the likelihood ratio tests. In forming the alternatives, we took a simple strategy of adding the four- and eight-period lagged values of the variables which did not appear in the specifications we reached above to their respective equations, thus forming nested hypotheses. Then, these alternatives and the maintained hypotheses were estimated by the SURE method. Likelihood ratio tests for testing the relevance of these alternatives gave us the following

re-specification of the model (see Table 4.5, also see the appendix to this chapter for the test statistics and their significance levels).

TABLE 4.5 SPECIFICATIONS OBTAINED BY USING THE MINIMUM FPE CRITERION

A. MODEL # 1

EQ. #	DEP. VAR.	Y	GC	M1	E	R^2	$\bar{R}^2$	D.W
1	Y	4	3	4*	8	.967	.876	2.69
2	GC	-	4	8*	5	.875	.638	1.78
3	M1	7	4	7	-	.847	.501	1.93
4	E	6	2	-	-	.642	.483	2.14

B. MODEL # 2

EQ. #	DEP. VAR.	Y	GI	M1	E	R^2	$\bar{R}^2$	D.W
1	Y	4	8	8	4*	.991	.879	1.20
2	GI	-	1	-	-	.528	.509	1.61
3	M1	7	-	7	-	.803	.574	1.44
4	E	6	5	8*	-	.893	.601	1.41

C. MODEL # 3

EQ. #	DEP. VAR.	Y	GC	M2	E	R^2	$\bar{R}^2$	D.W
1	Y	4	3	3	8	.891	.644	2.91
2	GC	-	4	-	5	.636	.444	1.78
3	M2	-	4	1	-	.432	.297	1.78
4	E	6	2	8*	-	.791	.456	2.37

D. MODEL # 4

EQ. #	DEP. VAR.	Y	GI	M2	E	R^2	$\bar{R}^2$	D.W
1	Y	4	8	8	8	.988	.850	2.02
2	GI	-	1	-	-	.528	.509	1.62
3	M2	4*	8	1	8	.909	.529	1.98
4	E	6	5	8	4*	.978	.811	1.67

Note : The (*) indicates the variables for which the LR tests produced significant test statistics.

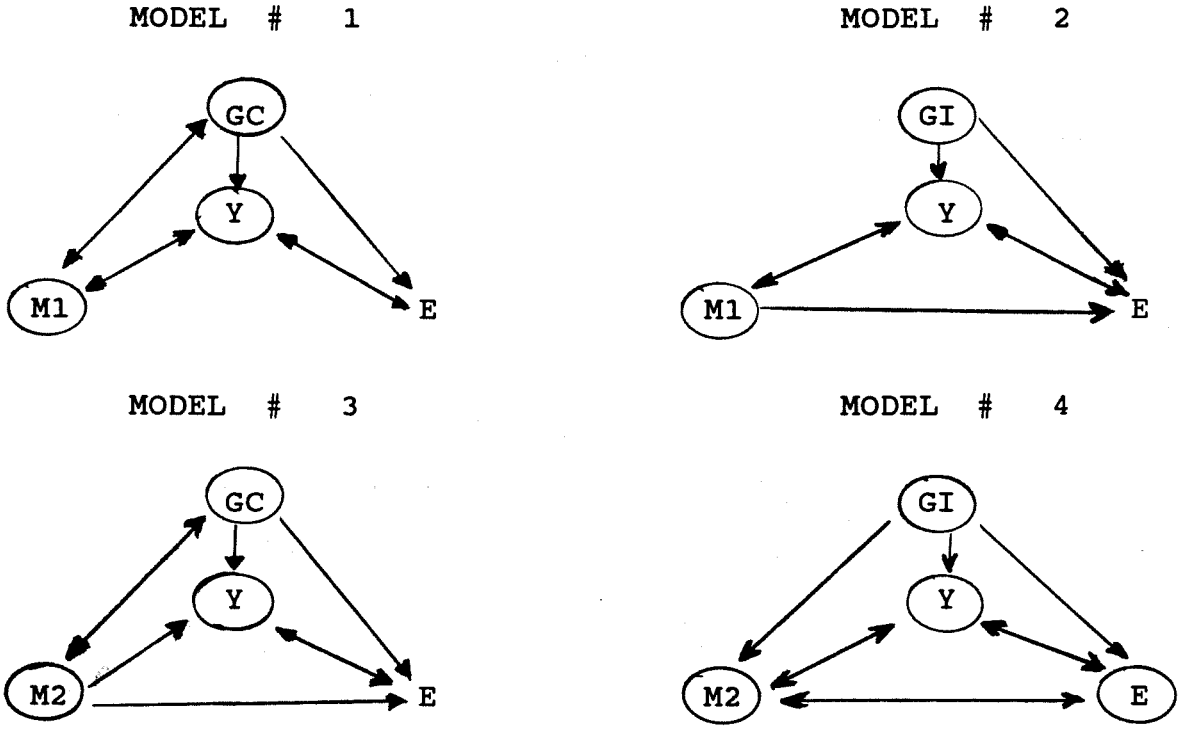
As a result of the likelihood ratio tests, several changes were made to the maintained hypotheses. This may be attributed to the fact that while OLS were used in building the maintained hypotheses, the SURE method were used in the estimation of the alternatives. We consider that the efficiency gain brought about by the SURE method may be responsible for the inclusion of the new variables which were otherwise found to be statistically insignificant. It is also interesting to see that some of the R^2 and R^2 statistics show differences in Tables 4.4 and 4.5 even though the equations have the same specification. This is due to the simultaneous estimation of the models in contrast to the OLS estimation, where the cross-correlations among the equations are not taken into account. In the rest of this chapter, we will discuss the causality implications, impulse response functions and the variance decomposition analysis of our models and then compare them with the results of the similar studies on the subject.

C. CAUSALITY IMPLICATIONS, IMPULSE RESPONSE FUNCTIONS AND THE VARIANCE DECOMPOSITION ANALYSIS OF THE MODELS

An examination of the structure of Model # 1 shows that feedback effects exist between Y and M1, GC and M1, and Y and E. No Granger-causality was found between M1 and E, whereas unidirectional causations from GC to E and to Y were established. In Model # 2, as in Model # 1, we have the same monetary policy variable, but the fiscal policy variable is now GI. Under this system, the interaction between the fiscal and the monetary variables

disappears and a Granger-causality from M1 to E is established. Other relationships among the variables remain the same as in the first model. The third model can be compared with the first model, too. This time, the fiscal policy variable, GC, remains in the model, but M2 enters the system instead of M1. In this system, there is a unidirectional causation from GC to M2, from M2 to Y and from M2 to E. Comparison of Model # 4 with Model # 2 is relatively easier. GI is the fiscal policy variable in both models, and introducing M2 in Model # 4 instead of M1 in Model # 2 reveals a unidirectional causation from the fiscal variable to the monetary policy variable, namely, from government investment to M2. Schematic representation of our findings is presented in Figure 4.1.

FIGURE 4.1 SCHEMATIC REPRESENTATION OF THE STRUCTURES OF THE MODELS



where, the circles around the variables show that the variable in question causes itself via its own lagged values.
By comparing the models simultaneously, we can reach the following conclusions:

- There is a feedback effect between the real GNP growth and the growth of the exports. This can be considered as an evidence of the open economy character of the Turkish economy in after 1980, thus it reflects the structural transformation.

- There is also a feedback effect between M1 and Y. M2 was also found to Granger-cause the real GNP growth. Furthermore, in the presence of GI, a feedback relation between M2 and Y was also detected. In three models, except Model # 2, there exists a unidirectional causation from the fiscal policy variable to the monetary aggregates. This reduces the effectiveness of targeting at a monetary aggregate, making its control extremely difficult. In fact, the monetary targeting experience of 1986-1987 in Turkey supports our conclusions. Though high growth rates were achieved in this period (% 8.3 and % 7.4 for 1986 and 1987,respectively), the monetary aggregate (M2) grew more than its targeted value. The rates were % 38 versus % 35 in 1986 and % 44 versus % 30 in 1987. Considering that we have used a 9-year horizon in our models, these results also produce the conclusion that monetary aggregates matter in the Turkish economy.

We will discuss the policy implications of these finding after examining the impulse response functions (IRFs) and the variance decompositions (VDCs) produced by these models. In doing these analyses, as we mentioned in the first chapter, ordering of the variables, i.e, the order they enter into the analysis becomes important. Chowdhury, Fackler and McMillin (1986, p. 799) put the argument as follows : "...because of the cross equation correlation, when a variable higher in the order changes, variables lower in the order are assumed to change. The extent of the change depends upon the covariance of the variables higher in the order with those lower in the order." Following this argument, we came to the conclusion that an ordering like "Fiscal Variable - Monetary Variable - Exports - GNP Growth" is more likely to produce better results for our models as this ordering captures the essence of the structure better than the alternatives. Using the above ordering, IRFs calculated for our models are shown in Table 4.6.

TABLE 4.6 IMPULSE RESPONSE FUNCTION ANALYSIS OF THE MODELS

	MODEL # 1		MODEL # 2		MODEL # 3		MODEL # 4	
Period	GC	M1	GI	M1	GC	M2	GI	M2
1 - 4	.010	.618	1.578	3.844	1.379	-3.393	-1.141	-1.955
5 - 8	-.006	3.270	1.611	4.902	1.762	3.771	.851	-.542
9 - 12	.323	2.252	-.601	-2.857	-1.800	-.183	-.805	20.032
13 - 16	.444	1.675	2.674	7.310	.871	-2.182	.502	10.823
17 - 20	.501	6.987	.924	2.325	.120	2.479	.908	9.924
Sum :	1.272	14.803	6.186	15.524	2.332	.678	.314	38.283

The above table shows the effect of a one standard deviation shock to the policy variable in period one on the growth of real GNP, in terms of percentages. According to this analysis, monetary

variables seemed to exert more influence on real GNP growth. But, these results should be interpreted with care. First of all, structure of the model that produces the results should be taken into consideration. In any case, existence of the negative numbers in the above table indicates that any stabilization attempt towards real GNP growth would induce fluctuations because of the system dynamics. However, in all cases, the net effect is positive. Secondly, the use of IRFs is justified in the case of stationary series. As our modelling approach did not require stationarity for the variables entering the system, and in fact GI is not stationary, further caution should be paid to the above results. The ambiguous results obtained from Model # 4, where GI is involved, justify this view. Now, let us review the results obtained from the variance decompositions of the models using the same ordering of the variables. However, the problem of non-stationarity still holds in this case, too. Keeping this objection in mind, the results thus obtained are presented in Table 4.7.

TABLE 4.7 VARIANCE DECOMPOSITION ANALYSIS OF THE MODELS

	MODEL # 1				MODEL # 2			
Period	GC	M1	E	Y	GI	M1	E	Y
1	2.58	.20	13.48	83.75	.41	20.06	40.63	38.89
4	1.72	26.66	8.82	62.80	6.82	27.38	33.67	32.13
8	1.18	35.53	8.60	54.69	5.42	36.39	29.83	28.36
12	1.08	37.42	9.19	52.29	5.55	38.99	28.37	27.08
16	1.16	34.20	10.29	54.34	6.14	45.04	24.92	23.90
20	1.20	33.26	10.72	54.82	7.00	49.62	22.12	21.26

TABLE 4.7 (...continued...)

	MODEL # 3				MODEL # 4			
Period	GC	M2	E	Y	GI	M2	E	Y
1	39.76	14.88	.72	44.64	25.51	8.53	53.96	12.00
4	13.30	72.32	.36	14.01	6.36	84.30	7.28	2.05
8	11.44	75.80	.25	12.52	.50	98.34	.93	.22
12	10.58	77.66	.28	11.48	.76	95.67	3.00	.56
16	8.64	81.39	.30	9.67	.44	96.39	2.70	.46
20	7.58	83.39	.29	8.74	.48	93.68	5.09	.75

Table 4.7 shows the breakdown of the k-period ahead forecast error, in terms of the contributing variables, given a shock to the system and with a particular ordering of the variables. In our case, we shocked GC and GI in period one by the standard error of their respective equations. To avoid cross-equational correlations, an orthogonal matrix of error terms was formed by using the Choleski decomposition.

The above results are also in accordance with those obtained from the IRFs. However, it should be noted that both IRFs and VDCs are sensitive to the changes in the ordering of the variables, and to the problem of non-stationarity as discussed before. Nevertheless, we can state that the monetary aggregates started to play an important role on the real GNP growth in Turkey after 1980. This is also apparent from the specification of our models, i.e monetary variables appear in all equations where the dependent variable is Y. Yet the problem with monetary policy tools is their feedback relation with the target variable, Y, which makes the implementation of a stabilization programme based on targeting the

monetary aggregates quite difficult. The structure of our models built on the Granger-causality concepts showed that fiscal policy might be more favourable from this stand point. However, later on, the IRF and VDC analyses revealed that monetary tools have a greater impact on the real GNP growth. The experience with M1 showed a feedback effect with Y in both cases, i.e in the presence of both GC and GI. M2 showed a feedback in the presence of GI and a unidirectional causation towards Y in the presence of GC. Therefore, we can suggest that the stabilization attempts should aim at targeting the M2 while keeping an eye on the fiscal policy variables. As a result, neither a pure monetary policy nor a pure fiscal policy can produce a successful stabilization programme. A mixture of the two would produce more favourable results. In doing that, targeting at M2 together with a control over the government expenditures may produce a favourable stabilization regime. In that case, the causation from GC to M2 should be taken into account in determining the target value of the M2 growth, i.e, a target should first be set for GC as it "precedes" M2. But, even this approach stresses the importance of setting up a fiscal policy in the first place. In the Turkish context, this means that the public sector borrowing requirement should be reduced as it exerts a considerable pressure on the monetary aggregates. Therefore, we arrive at the conclusion that an appropriate fiscal policy provides a necessary condition for a successful monetary policy.

D. COMPARISON OF THE RESULTS WITH OTHER SIMILAR STUDIES

S. Atesoglu (1975) used a Friedman-Meiselman (1963) type reduced form model to analyze the relative effectiveness of monetary and fiscal variables in Turkey for the period 1950-1968. He concluded from his findings that "...in contrast to [Friedman-Meiselman], ...results...lead to the conclusion that autonomous expenditures and money perform equally well as an explanatory variable for induced expenditures." (Atesoglu, 1975, p. 371) The sample period corresponds to a period where agricultural sector had been the dominant sector in the economy. Therefore, he stated that "...an approach which does not neglect autonomous expenditures, money or agricultural income, is likely to be more useful for interpreting short-term economic changes in Turkey." (Atesoglu, 1975, p. 373) Given the period, i.e., a closed economy with a dominant agricultural sector and under a fixed exchange rate regime, his results are consistent with our conclusions. Another study was undertaken by M. Fry (1980). His main conclusions are as follows : "...monetary policy which makes the active use of the deposit rate of interest is clearly superior to a policy solely relying on control over the nominal money supply." (Fry, 1980, p. 544) He further suggests that (p. 544)

> ...concentration on these monetary policy instruments does not, of course, imply that fiscal, price, exchange rate and foreign trade policies are unimportant in Turkey. Indeed, fiscal policy has strong influence on the rate of growth in the money supply. And appropriate price and exchange rate policies are too crucial for the success of Turkey's [1980] stabilization programme.

As we have not used the other monetary policy instruments such as interest rates or reserve ratio requirements in our models, we are unable to comment on their effectiveness as a policy tool. However, in Model # 3, we found a unidirectional causality from M2 to Y in the presence of GC whereas a feedback effect existed in Model # 1, where the monetary aggregate was M1. A similar relationship was also detected by A. Chowdhury (1989). A. Chowdhury also used the VAR modelling approach to study the relative effectiveness of monetary and fiscal policies in Turkey. His findings also suggest that "...the M1 system in Turkey shows that unidirectional causality exists between M1 and Y while there is unidirectional causality from G [Government expenditure] to Y. Unidirectional causality also exists from G to both M1 and E." (Chowdhury, 1989, p. 39) Our study also produced the same relationships except the feedback between M1 and G. This may result from the differences in the definitions of the fiscal policy variables. That is, in our models, government consumption was chosen as one of the fiscal policy variables, whereas A. Chowdhury used the government expenditures scaled by potential GNP. Our Model # 3 is also in conformity with his findings that "...a feedback exists between M1 and Y while there is a unidirectional causality from M2 to Y." (Chowdhury, p. 40) The explanation for this case goes as follows:

> ...increases in income raises the interest rates by increasing the transactions demand for money. Fear of instability in the financial market may discourage potential investors from investing in various financial assets and taking advantage of the higher interest rates. As a substitute, economic agents may be induced to transfer funds from non-interest earning demand deposits to interest earning savings accounts. These transfers may affect M1, which include demand deposits, but

not the total volume of M2, which includes both demand and savings deposits." (Chowdhury, 1989,p. 40)

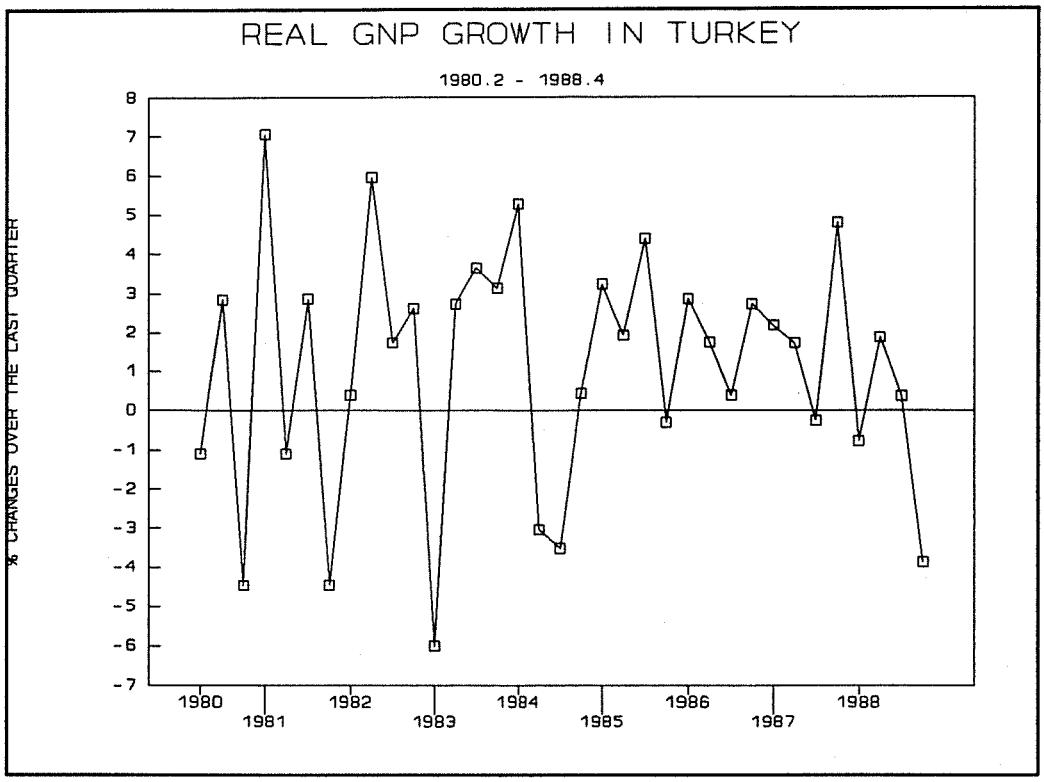
This argument also stresses the importance of an interest rate policy. However, A. Chowdhury's conclusions are such that fiscal rather than monetary actions exert the dominant influence on the economic activity in Turkey. This result is also generalized to the case of developing countries in a paper by A. Darrat (1984). It should also be recognized that A. Chowdhury's conclusions are based on the period between 1966.1 to 1983.4. That is, it does not fully reflect the effects of the 1980 transformation that re-shaped the Turkish economy. In our study, we examined only the post-1980 period, sometimes sacrificing the degrees of freedom available. We can also state that despite the various changes in the manipulation of the monetary and fiscal variables, the main policy, i.e, the "basic philosophy", remained the same in essence during the sample period. As suggested by A. Chowdhury, J.S Fackler and W.D McMillin (1986, p. 796), "...the Lucas critique is also potentially applicable to the VAR technique." As the VAR model is basically a reduced form technique, analyses, especially the IRFs which are also called as the dynamic policy multipliers (Aoki, 1981, p. 41) and VDCs, based on it may be more sensitive to the critique. But, in our case, as the sample period does not contain major policy changes, we shall assume that there are not potential dangers imposed by the critique.

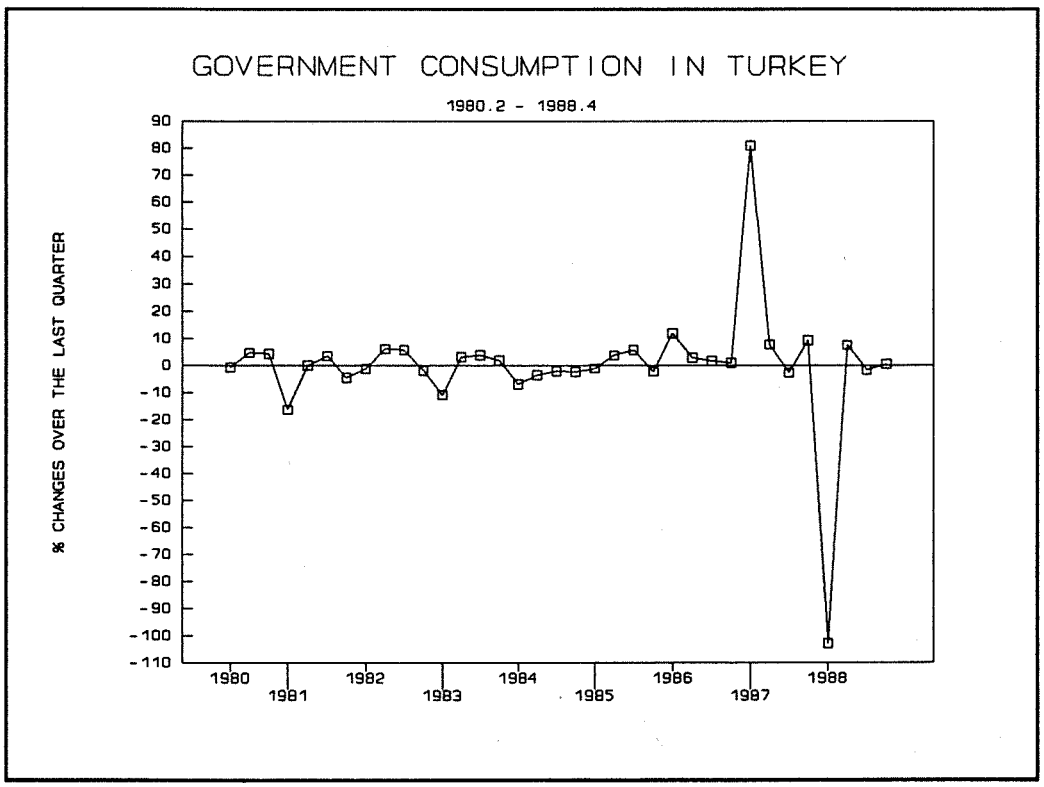
APPENDIX TO CHAPTER IV.

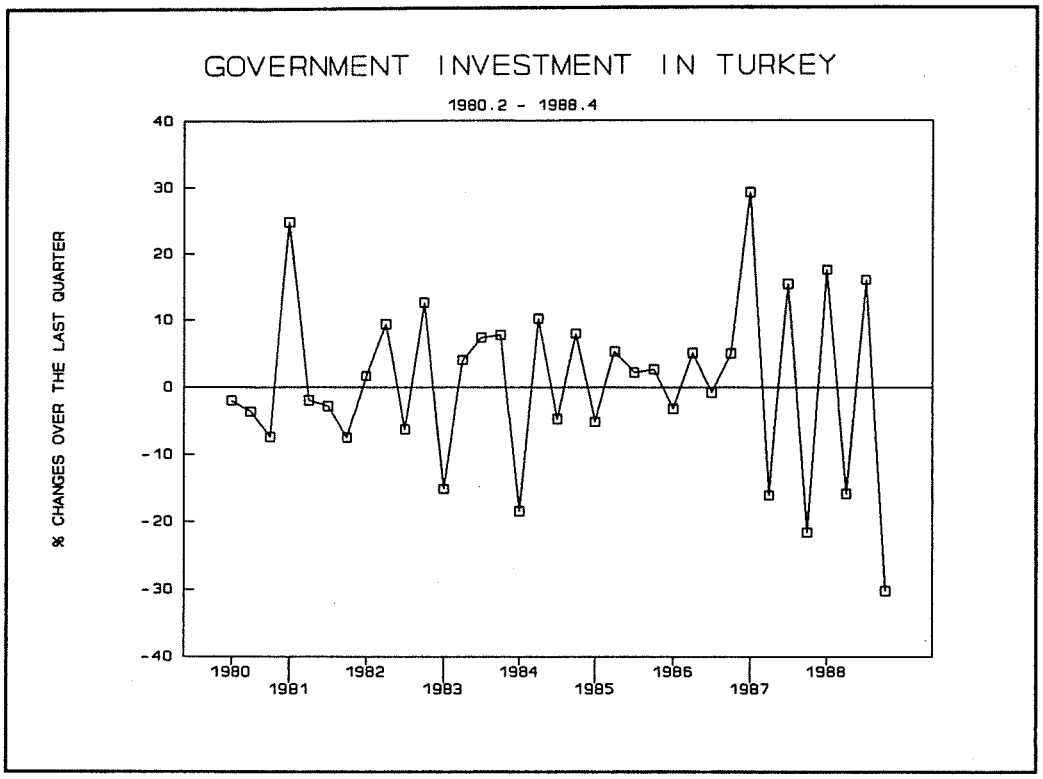
A. DATA SERIES USED IN THE MODELS (Percentages Changes over the Last Quarter)

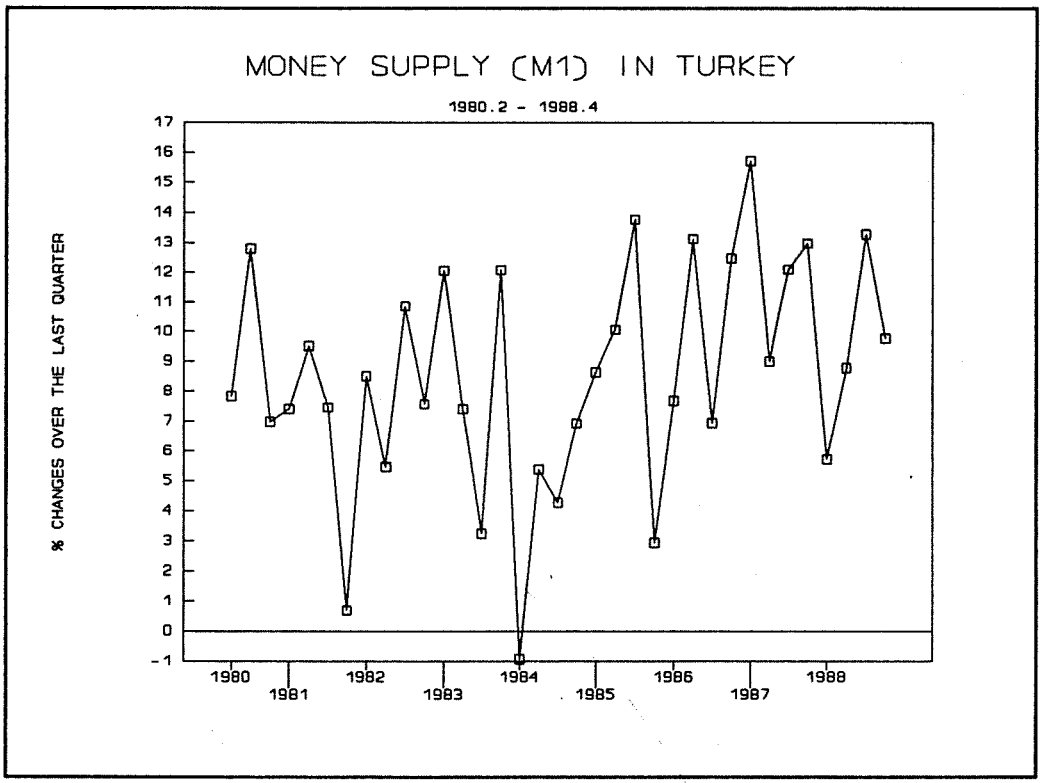
YEARS	Y	GC	GI	M1	M2	E
1980.2	-1.095250	-0.601997	-1.912710	7.83467	7.468317	-11.58864
1980.3	2.863348	4.810215	-3.500179	12.79225	16.86689	-2.934685
1980.4	-4.469840	4.432101	-7.277031	6.984544	13.70248	33.63898
1981.1	7.054568	-16.23891	24.91170	7.406284	9.746328	16.68889
1981.2	-1.100608	0.126921	-1.858583	9.506591	15.57476	-0.388263
1981.3	2.870833	3.616906	-2.704902	7.459089	17.65676	11.83708
1981.4	-4.461775	-4.434119	-7.374571	0.694519	12.97678	21.21263
1982.1	0.390361	-1.079664	1.696540	8.498861	14.72420	-8.271399
1982.2	5.948168	6.245382	9.460161	5.459094	10.07915	3.094721
1982.3	1.739355	5.912904	-6.182246	10.85249	12.28358	3.419417
1982.4	2.628791	-1.812716	12.74946	7.565811	11.07515	14.71929
1983.1	-6.002611	-10.79300	-15.05174	12.05528	6.932175	-17.13647
1983.2	2.742878	3.229246	4.104267	7.402352	5.509638	5.211968
1983.3	3.657299	3.870472	7.471095	3.249884	4.664513	-6.248190
1983.4	3.148896	1.907505	7.838425	12.07946	8.863582	6.709659
1984.1	5.281484	-6.789841	-18.44762	-0.919036	12.77174	25.51449
1984.2	-3.030767	-3.493390	10.33543	5.386131	12.01086	-1.888312
1984.3	-3.520368	-1.950875	-4.642175	4.270413	9.976473	-8.027093
1984.4	0.438688	-2.284103	8.073314	6.921526	10.97330	2.436286
1985.1	3.249803	-0.972767	-5.025342	8.623167	13.61132	3.369719
1985.2	1.943931	3.815638	5.342515	10.06033	13.15318	12.71435
1985.3	4.408478	5.921238	2.261789	13.77414	12.89496	11.80693
1985.4	-0.299013	-2.212656	2.709981	2.938445	7.016826	-19.98780
1986.1	2.878928	11.97577	-3.092461	7.688827	7.954273	0.822984
1986.2	1.765301	3.013974	5.220450	13.12549	11.28268	-2.295312
1986.3	0.386433	1.794098	-0.741836	6.945167	5.037069	-1.547777
1986.4	2.742462	1.040981	5.067731	12.48142	9.758421	3.073971
1987.1	2.199909	80.94038	29.34721	15.71829	8.839903	8.339387
1987.2	1.748558	7.853617	-16.01373	8.987180	6.363604	18.57076
1987.3	-0.249392	-2.571008	15.57988	12.10278	9.816391	16.28639
1987.4	4.813697	9.485018	-21.52287	12.98379	8.989689	-3.366615
1988.1	-0.768469	-102.7452	17.70076	5.723423	5.996175	0.964415
1988.2	1.895691	7.631012	-15.75299	8.782253	8.020330	5.548355
1988.3	0.370724	-1.634810	16.18495	13.29464	12.33149	-4.831024
1988.4	-3.872044	0.631979	-30.17525	9.759830	19.27310	4.745324

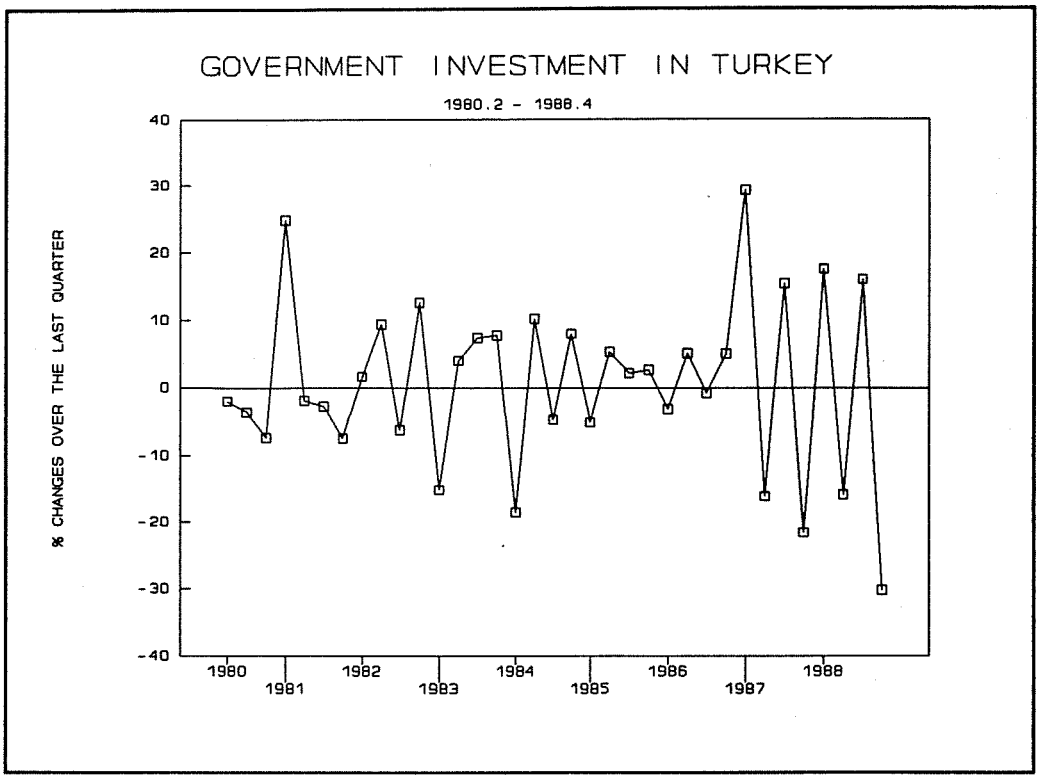
B. GRAPHICAL PRESENTATION OF THE DATA SERIES






GOVERNMENT INVESTMENT IN TURKEY
1980.2 - 1988.4
% CHANGES OVER THE LAST QUARTER
40
30
20
10
0
-10
-20
-30
-40
1980
1981
1982
1983
1984
1985
1986
1987
1988


MONEY SUPPLY (M1) IN TURKEY
1980.2 - 1988.4
% CHANGES OVER THE LAST QUARTER
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
1980
1981
1982
1983
1984
1985
1986
1987
1988


GOVERNMENT INVESTMENT IN TURKEY
1980.2 - 1988.4
% CHANGES OVER THE LAST QUARTER
40
30
20
10
0
-10
-20
-30
-40
1980
1981
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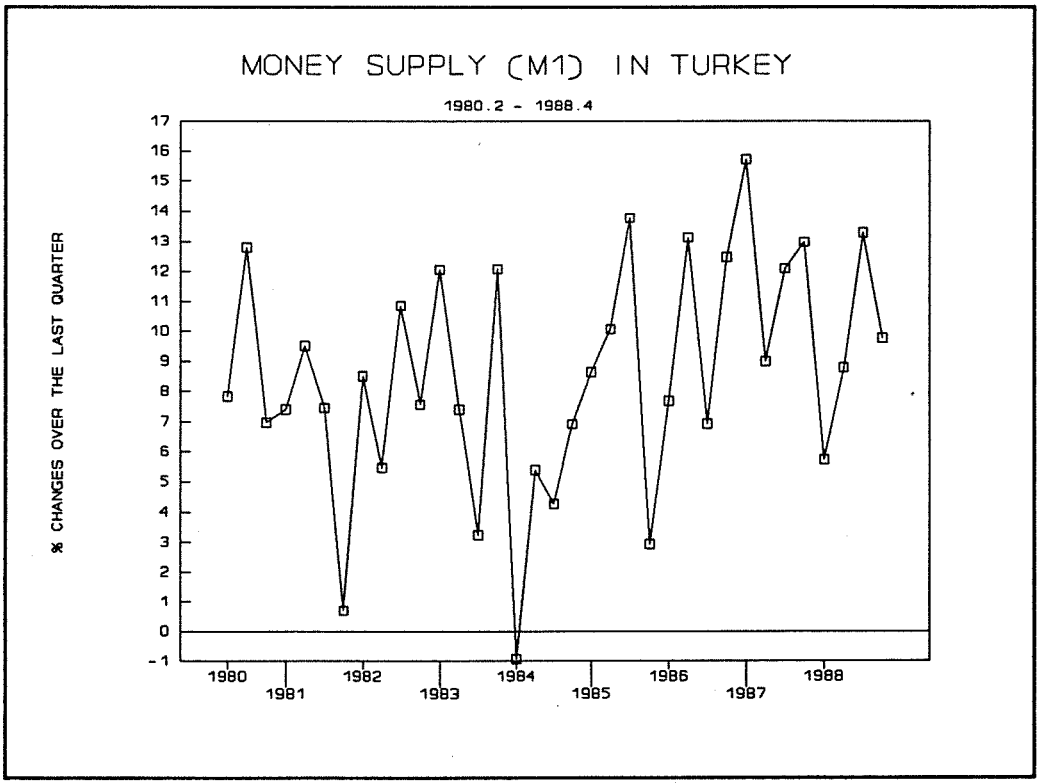
1983
1984
1985
1986
1987
1988


MONEY SUPPLY (M1) IN TURKEY
1980.2 - 1988.4
% CHANGES OVER THE LAST QUARTER
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
1980
1981
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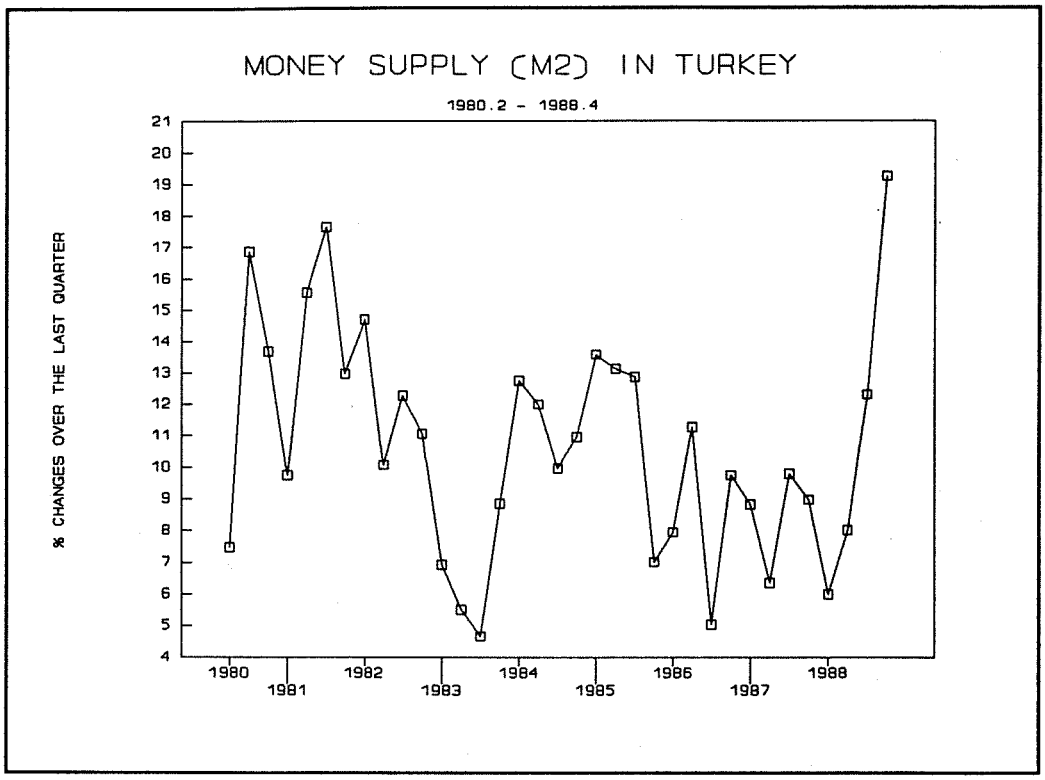
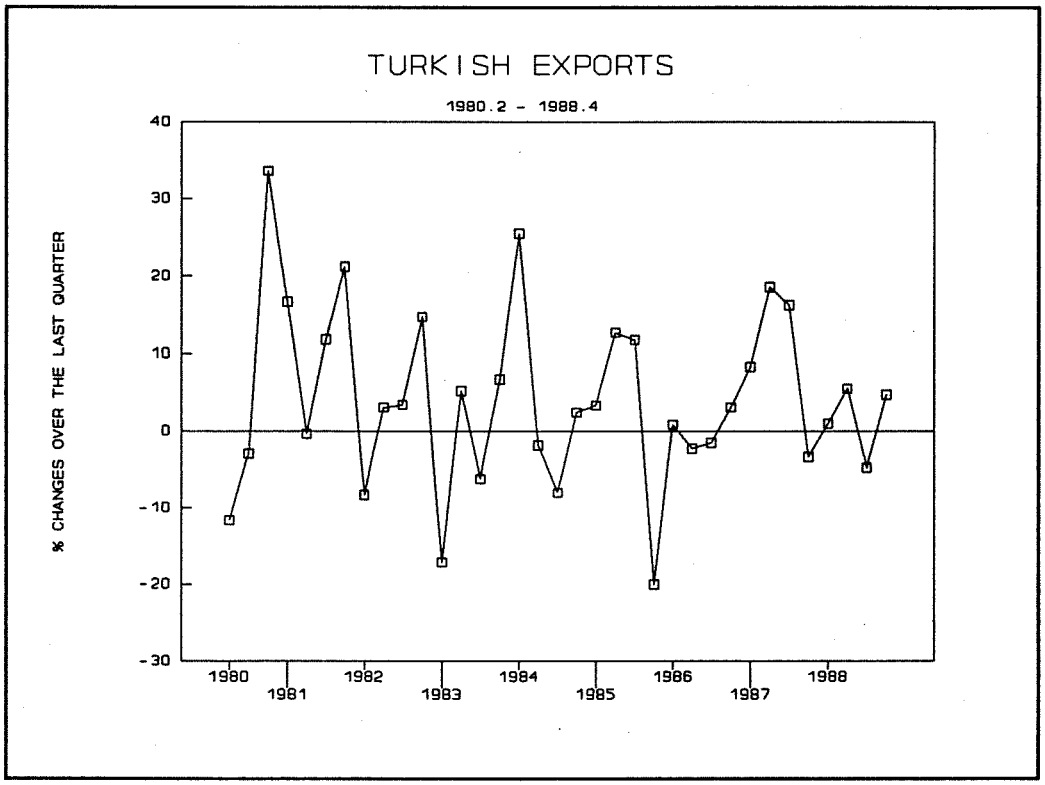
1985
1986
1987
1988


MONEY SUPPLY (M2) IN TURKEY
1980.2 - 1988.4
% CHANGES OVER THE LAST QUARTER
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
1980
1981
1982
1983
1984
1985
1986
1987
1988


TURKISH EXPORTS
1980.2 - 1988.4
% CHANGES OVER THE LAST QUARTER
40
30
20
10
0
-10
-20
-30
1980
1981
1982
1983
1984
1985
1986
1987
1988

C. LIKELIHOOD RATIO TESTS FOR TESTING THE MAINTAINED HYPOTHESES AGAINST THE ALTERNATIVE SPECIFICATIONS

MODEL #	Eq. #	VARIABLE	LAG	LR	Sig.
1	1	M1	4	19.022	0.000
1	1	M1	8	22.229	0.005
1	2	Y	4	0.558	0.968
1	2	Y	8	3.393	0.907
1	2	M1	4	2.366	0.669
1	2	M1	8	16.113	0.041
1	3	GC	4	89.131	0.000
1	3	GC	8	14.670	0.659
1	3	E	4	0.822	0.936
1	3	E	8	10.388	0.239
1	4	M1	4	0.041	0.999
1	4	M1	8	3.518	0.898
1	4	E	4	0.529	0.971
1	4	E	8	12.854	0.117
2	1	E	2	23.422	0.000
2	1	E	4	41.083	0.000
2	2	Y	4	1.309	0.860
2	2	Y	8	1.654	0.990
2	2	M1	4	1.101	0.894
2	2	M1	8	2.260	0.972
2	2	E	4	3.375	0.667
2	2	E	8	3.534	0.897
2	3	GI	4	0.593	0.964
2	3	GI	8	6.386	0.604
2	3	E	4	5.756	0.218
2	3	E	8	9.587	0.295
2	4	M1	4	11.762	0.019
2	4	M1	8	19.619	0.012
2	4	E	4	2.409	0.661
2	4	E	8	5.126	0.744
3	2	Y	4	0.888	0.926
3	2	Y	8	4.364	0.823
3	2	M2	4	4.437	0.350
3	2	M2	8	9.317	0.316
3	3	Y	4	0.806	0.938
3	3	Y	8	3.317	0.913
3	3	E	4	1.168	0.883
3	3	E	8	4.529	0.807
3	4	M2	4	2.622	0.623
3	4	M2	8	15.754	0.046
3	4	E	4	0.866	0.929
3	4	E	8	5.557	0.697

B. LIKELIHOOD RATIO TESTS FOR TESTING THE MAINTAINED HYPOTHESES AGAINST THE ALTERNATIVE SPECIFICATIONS
(...continued...)

MODEL #	Eq. #	VARIABLE	LAG	LR	Sig.
4	2	Y	4	1.331	0.856
4	2	Y	8	2.095	0.978
4	2	M2	4	2.367	0.669
4	2	M2	8	3.790	0.876
4	2	E	4	0.466	0.977
4	2	E	8	0.965	0.998
4	3	Y	4	13.592	0.009
4	3	Y	8	20.689	0.008
4	4	E	2	10.270	0.006
4	4	E	4	17.486	0.002

IV. CONCLUSIONS

In this paper, we tried to analyze the relative effectiveness of monetary and fiscal policy instruments in the Turkish economy in the post-1980 era. In doing this, we employed a modified vector autoregressive model. As opposed to the unconstrained VAR model proposed by C. Sims (1972), we preferred to use the approach developed by Hsiao (1981) and extended by Caines, Keng and Sethi (1981). In this methodology, the lag length of all variables need not be the same and all the variables need not appear in all equations. Furthermore, we refined this approach by employing the methodology proposed by A. Grasa (1989). This approach gives further flexibility to model the relationships in that it does not require the variables entering the models to be stationary series. Arguments for the justification of this proposition was given in the first chapter of our study. However, the use of non-stationary series reduces the usefulness of the analytical tools deriving from VAR models, such as impulse response functions and variance decompositions. Therefore, we rather preferred to base our arguments on the general structure of the models and their Granger-causal implications.

The models thus built aimed at identifying the relative influences of the monetary policy instruments (M1 and M2) and the fiscal policy instruments (government consumption and government investment) on the real GNP growth. As a proxy for the external

effects on the GNP, exports were included in the models, too. The sample period corresponds to the era where the Turkish economy went under an important structural transformation. During this period, the economic policies mainly aimed at an outward-oriented, export-led growth while trying to stabilize the domestic economy through monetary policy tools. However, reorganization of the public sector and the "State Economic Enterprises" was also given special importance.

The results obtained from our models successfully capture these properties, In all models, we found that fiscal instruments "cause" real GNP growth, unidirectionally. It was also found that a feedback effect exists between the money supply (M1) and Y. M2 exhibited unidirectional causation towards Y, in the presence of GC in the system, and a feedback effect with Y, in the presence of GI. It was also found, in general, that fiscal variables exert pressure on the monetary aggregates. Because of these reasons, conduct of a monetary policy seemed us to be at least not easy. However, impulse response functions and the variance decompositions showed that monetary variables have more influence on the real GNP growth than is the case for the fiscal variables. Considering our Model # 3, where there is no feedback between M2 and Y and between M2 and GC, we can suggest that targeting at the M2 growth while also controlling the level of government expenditures may produce more successful stabilization policies. Nevertheless, because of the linkage from GC to M2, a fiscal policy should be considered in the

first place and the targeting of M2 should then be planned accordingly. This result is partly in contrast with a previous study done by A. Chowdhury (1989). In his study, A. Chowdhury stressed that fiscal policy is more effective in Turkey and monetary policy has almost no relevance. However, the sample in A. Chowdhury's analysis covered the period between 1966 and 1983, while we concentrated only on the post-1980 period. Our results suggest that monetary policy matters more than the fiscal policy does, but because of the causation from fiscal policy tools to the monetary aggregates, success of the monetary policy might also depend on the design of a successful fiscal policy. In the Turkish context, this suggests that especially the public sector borrowing requirement should be reduced.

Finally, all of our models confirmed that exports have an impact on the real GNP growth. This indicates the open-economy nature of the Turkish economy in the post-1980 period. Furthermore, in three of the four models, we failed to establish a causal linkage from exports to money supply variables. This may be considered as an evidence of the extent of currency substitution in the Turkish economy, caused mainly by the inflationary environment and the low, or sometimes negative, real interest rates.

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