ECONOMETRIC MODELLING OF THE MONETARY AGGREGATES IN TURKEY

A THESIS BY SEVGİ RECBEROĞLU
TO
THE INSTITUTE OF
ECONOMICS AND SOCIAL SCIENCES
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS
FOR THE DEGREE OF MASTER OF ECONOMICS

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tarafından bağışlanmıştır

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I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

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She was not with me during this process, but my mother always supported me for what I did, and I am dedicating this thesis to her.

ABSTRACT

ECONOMETRIC MODELLING

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MONETARY AGGREGATES IN TURKEY

SEVGİ RECBEROĞLU

MASTER OF ECONOMICS

Supervisor: Assist. Prof. Kıvılcım Metin

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The aim of this thesis is modelling the demand for money in Turkey with cointegration techniques. For this purpose, monetary aggregates of M1, M2, M2y, M3a, M3, and LO are tested with differing variables for the period of 1987-1997. The largest model tries to explain the money demand by means of real income, interest rates on time deposits, interest rates on treasury bills, and inflation variable. Since cointegration requires certain properties on data, in the thesis, first the time series properties of the data set are investigated. Then cointegration and weak exogeneity are tested. Due to the invalidity of weak exogeneity for many of the variables, in the next stage, for each money definition an ECM model is formulated. The results obtained from both cointegration tests investigating the long-run money demand and ECM models examining the temporal causality between reel money stock and the long-run determinants of the money demand strongly suggest the existence of a stationary long-run money demand in Turkey. Furthermore the diagnostic test results of the ECM models show that the money demand functions in Turkey have the parameter constancy property despite the financial reforms effects in the stated period, high and volatile inflation rates, and especially 1994 financial crisis.

Key Words: Monetary Aggregates, Cointegration, Weak Exogeneity, ECM

ÖZET

TÜRKİYEDEKİ PARASAL BÜYÜKLÜKLERİN EKONOMETRİK OLARAK MODELLENMESİ

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Bu çalışma, Türkiye'deki para talebini eş-bütünleşme yöntemi ile modellemeye çalışmaktadır. Bu amaçla, M1, M2, M3a, M3 ve LO tanımlı parasal büyüklüklerin her biri 1987-1997 dönemi için farklı değişkenler ile test edilmiştir. En geniş model, para talebini reel gelir, vadeli mevduat faizleri, hazine bonolarının faizleri ve enflasyon değişkeni ile açıklamaya çalışmaktadır. Eş-bütünleşme yöntemi veri setinin belirli özelliklerde olmasını gerektirdiğinden tezde, öncelikle veri setinin zaman serisi özellikleri incelenmiş, daha sonra eş-bütünleşme ve zayıf dışsallık test edilmiştir. Pek çok değişken için zayıf dışsallık geçerli bulunamadığından, bir sonraki aşamada her para tanımı için ECM modelleri formule edilmiştir. Gerek uzun dönem para talebini inceleyen eş-bütünleşme yönteminden ve gerekse reel para stoğu ile uzun dönem para talebi değişkenlerinin geçici nedensellik ilişkisini inceleyen ECM modellerinden çıkan sonuçlar Türkiye'de durağan bir uzun dönem para talebi olduğu hipotezini kuvvetle desteklemektedir. Aynı zamanda, ECM modellerinin diagnostic testleri Türkiye'deki para talebi fonksiyonlarının 1987-1997 dönemi içindeki finansal liberalizasyon programlarının etkisine, yüksek ve değişken enflasyona ve özellikle 1994'te yaşanan finansal krize rağmen parametre sabitliğini koruduğunu göstermiştir.

Anahtar Kelimeler: Parasal Büyüklükler, Eş-bütünleşme, Zayıf Dışsallık, ECM modeli

Contents

APPENDIX I

LIST of TABLES

- **TABLE-6 Single Equation Estimation Results**

- **TABLE-7 Results for Alternative M3 Model**

APPENDIX II

LIST of FIGURES

1-INTRODUCTION

Prior to 1980, the banking and financial system of Turkey revealed all attributes of "financial repression" with negative real interest rates, high tax burden on financial earnings, and high liquidity and reserve requirement ratio. After 1980, Turkey was subjected to several different economic and political changes that were very different from other periods in its history.

Most importantly, the institutional framework went through various alterations towards liberalization which included the liberalization of foreign exchange regime, removal of legal ceilings on deposit interest rates, and simplification of the Central Bank's control over commercial banks with a revision of the liquidity and reserve requirement system. 1987-1997 period is the maturing stage of these liberalization attempts in institutional framework.

Along with changes in the monetary institutions, Turkey during the stated period faced substantial and fluctuating rates of inflation, important variations in national income, large public sector deficits, and extremely high total foreign debt outstanding as a percentage of export earnings which all together led to the financial crisis of 1994.

Empirical modelling of the demand for money in Turkey during 1987-1997 is the purpose of this study. To this end, the study specifically addresses three sets of objectives. First, to determine whether there exists a stationary long-run money demand function in Turkey during the stated period; second, to investigate the determinants of the money demand function; third, to examine the temporal causality between the real money stock and the determinants of the long-run money demand function.

Metin (1992), Kelezoğlu (1992), Özdenören (1993), and Yavan (1993) try to explain the demand for money in Turkey by means of income, own rate of return on money (proxied by interest rates on time deposits) and the opportunity cost of holding money (proxied by inflation for durable goods, inflation for gold, or expected loss defined as the difference between expected inflation and returns on money) for various periods until 1991 for M1 and/or M2 and/or M3 definitions of money. The present analysis performs similar formulations for a more recent data set (1987-1997) for M1, M2 and M3. In addition, it also considers M2y, M3a, and LO definitions of broad money in the analysis.

The study emphasizes more an empirical investigation rather than a theoretical analysis. Empirical investigation is based on the unit root theory developed by Dickey-Fuller (1976), on the multivariate cointegration theory developed by Johansen (1988), on the weak exogeneity theory developed by Johansen (1992a; 1992b) and on the econometric modelling framework suggested by Juselius (1992).

As Judd and Scadding (1992) emphasize, parameter constancy is particularly important for money demand equations. The graphs of Turkish data indicate changes in seasonal patterns for some variables, high variability of inflation rate, and marked changes in interest rates as 1994 crisis occurred, suggesting the possibility of large structural breaks. So, the constancy of the relationship between real money stock and the long-run determinants of money demand, given the changes in the financial system, and the 1994 crisis is also examined. The analysis is based on parameter constancy theory suggested by Chow (1960).

Accordingly, the rest of the study is as follows. In Chapter 2, the economic envirement that forms a basis for the money demand process of Turkey during 1987-1997 is discussed. In Chapter 3, the economic theory of money demand and the literature about the subject are developed. In Chapter 4, the econometric theory used in the study is explained. Chapter 5 presents the results of the applications of the econometric approach developed in Chapter 4. These include the results of unit root tests, cointegration tests, and weak exogeneity tests. Depending on these results, Chapter 6 estimates an error correction model that captures the short-run dynamic adjustment of the cointegrated variables. Finally, Chapter 7 derives conclusions and discusses the economic implications of the findings. The related tables are reported in Appendix I, and the related graphs are presented in Appendix II.

2- TURKISH ECONOMY (1980-1997)[1]

1987-1997, the period analyzed is the last stage of the era of Turkish attempts towards liberalization that have begun with the introduction of a comprehensive stabilization program in 1980 in order to integrate with the global financial markets. The program aimed to re-orient the overall development strategy from a highly regulated inward looking economy to an outward looking economy operating under market incentives.

For this purpose, a pegged exchange rate regime of continuous adjustments, elimination of price controls, gradual removal of trade restrictions and phasing out of subsidies were implemented.

In 1984, the banks were allowed to accept foreign currency deposits from citizens and to engage in foreign transactions. In 1989, the capital account was fully liberalized and full convertibility of Lira was recognized. The monetary authorities tried to keep the Turkish Lira strong by increasing the real interest rates to improve the capital account, against pressures towards currency substitution caused by the deregulation of restrictions. However, these liberalization actions led to a massive inflow of short-term capital. The availability of foreign exchange enabled the Turkish Lira to appreciate against the major currencies in real terms and caused a rapid expansion of import demand.

In 1986, an interbank money market for short-term borrowing was enacted. The Central Bank started open market operations in 1987, which led to the diversification of the

[1] This section is summarized from Balkan and Yeldan, 1996, Yeldan and Köse,1998, Yeldan,1998, and Kesriyeli (1997) and the values for the last few paragraphs are from State Institute of Statistics.

monetary instruments of the Central Bank. In 1989, the use of rediscount facilities as an instrument of selective credit policy was abandoned. Most importantly, in early 1990, a new monetary program was announced. The program was based on a new concept of controlling the stock of the Central Bank's balance sheet formulated as the *Central Bank Money* and the protocol signed with the Treasury limited the growth of Central Bank Money in order to control the public sector requirements and monetization of the fiscal deficit.

In order to regulate and supervise the capital market, a Capital Market Board was established, and the Istanbul Stock Exchange was set up in 1986. To encourage equity financing, significant tax incentives were granted, and since 1986, all dividends and capital gains have been exempted from personal taxation.

During 1988-1993, fiscal position of the government rapidly deteriorated. Factor revenues in 1988, which amounted 4675.6 billions TL decreased to 570.2 billions TL in 1993 in real terms. Current transfers increased from 6160.8 billions TL in 1988 to 8150.7 billions TL in 1993. Furthermore, although tax revenues improved, the public disposable income decreased from 10001 billions in 1988 to 8489.8 billions in 1993. As a consequence, budget deficits and public sector borrowing requirements as a percentage of GNP increased from 3.0 percent to 6.7 and 4.8 percent to 12.1 percent, respectively in the stated period. The stock of government debt instruments (GDI) grew rapidly to reach to 12.8 percent of the GNP by 1993. By comparison, the stock of GDI's were only 5.7 percent of GNP in 1988. Furthermore, domestic debt stock increased more than twofold as a percentage on GNP between 1988-1993.

Also, one of the direct facets of the vulnerability of the Turkish macroeconomic balances in 1987-1997 period was the continued inflation. Price inflation as measures by the annual change in the consumer price index was around 60-65 percent in the last part of the 1980s. After 1991, until 1995, the inflation rate accelerated and reached a plateau of 70 percent.

As a result of such deteriorating macroeconomic fundamentals, rooted in the public sector imbalances but to a large extend of unsustainable growth in current account deficits as a result of short term capital inflows, beginning in January 1994, the Turkish Economy suffered from a major financial crisis. The Istanbul Stock Exchange Composite Index fell by 50 percent in dollar terms, and the stock market suffered huge dollar losses during this period, all interest rates significantly increased in the second quarter of 1994 (see, Graph 6). The Central Bank, during this period intervened in the foreign exchange market, and between January and April 5 over $3 billion which accounted about half of year-end 1993 reserves of the Central Bank was used in order to support lira.

Financial crisis was then followed by a real contraction. Real gross domestic product declined by more than 5 percent that year with the inflation rate increasing to almost 150 percent. The number of unemployed that year increased by at least 600 000. The pace of capital accumulation, both public and private, severely contracted, while the trade deficit rose to unsustainable levels.

In April 1994, an austerity program aiming at restoring confidence in the Turkish Lira and reducing fiscal and external imbalances was declared. Reducing government budget deficit and slowing down the inflation by enforcing higher taxes, state controlled prices, devaluation and speeding up privatization were the tools of the program.

Central Bank, in this set up aimed to achieve stability in financial markets and tried to increase its decreasing foreign exchange reserves for the rest of the 1994 until the end of the 1995. By the end of 1995, the uncertainity in the economy icreased by the effects of the premature general elections, involvement in the customs union, and the government changes within the year. Hence following 1996, the Central Bank aimed to control stability in the financial markets and the Central Bank policy targeted reserve money and the movements in the foreign exchange.

The economy after the April 1994 program still suffered from high rates of inflation, increasing current account deficits, and increasing budget deficits. After 1995, the economy witnessed a further acceleration of inflation, and the rate of annual inflation measured by the consumer price index was 82.9% in mid-96 whereas it reached to 99.1% at the end of 1997. Current account deficits amounted to 2500 million dollars in the last month of 1997 and the government budget deficit increased to 10% of the real GNP in 1997.The following chapters try to estimate a stable relation for the money demand that is formed in the described period, above.

3-ECONOMIC THEORY and RELATED LITERATURE

Money is demanded for at least two reasons: as inventory to smooth differences between income and expenditure streams, and as an asset among several assets in the portfolio (see, Baumal,1952, Tobin,1956, Friedman,1956).The first one, the transactions motive evolves from the lack of perfect synchronization between income and expenditures and implies that nominal money demand depends on the price level and some measure of the volume of real transactions. Holdings of money as an asset are determined by the return to money as well as returns on alternative assets and by total assets (often proxied by income). These determinants lead to a long-run specification in which nominal money demand (M^d) depends on the price level (P), a scale variable (Y), and a vector R of rates of return on various assets :

$$M^d / P = m(Y, R) \qquad (1)$$

The function m(.,.) is assumed to be increasing in Y, and those components of R that are the returns of assets included in the money (e.g. interest rates on demand deposits, time deposits, and repurchesments) and decreasing in the components of R associated to the assets excluded from money (e.g. returns on holding goods, real estate, gold, etc.; inflation, and returns on holding treasury bills).

Commonly, in order to derive more economic interpretable formulations of the model, (1) is specified in log-linear form, albeit with the interest rates entering in their levels.

$$LM^d - LP = c + \alpha(Ly - LP) + \beta R \qquad (2)$$

Chapters 5-6 employs such a specification above, (except for the interest rate entering the M1 definition with logarithmic transformation), where the competing assets are narrow and broad money as measured by M1, M2, M2y, M3a, M3, LO, Lira treasury bills, and domestic durable goods.

Haffer and Jansen (1991), and Miller (1991) test such formulations for U.S. demand for money and find that while demand for M1 is *not* cointegrated with income and interest rate, demand for M2 is. On the other hand, McNown and Wallace (1992), who considered the current floating exchange rate period, show that, while M1 money demand is cointegrated with income and interest rate, M2 monetary aggregate is *not*.

Choudry (1995a) substitutes inflation to interest rates for Argentina, a high inflationary country for M1 and M2 real money demands for two different periods and concludes a Cagan type money demand function which states that changes in the real money balances result from variations in the expected rate of prices only, for Argentina.

Ericsson and Scharma (1996) test a reparametrized version of the same formulation and find economically meaningful long-run relationship among real money demand, real income, interest rates on time deposits, interest rate differential between time deposits and treasury bills and interest rate differential between repos and treasury bills for the Greek money demand.

Furthermore, some authors Mundel (1963), Arango and Nadiri (1981), McNown and Wallace (1992), Choudry (1995b), Bahmani-Oscooee, Shabsigh (1996) consider the inclusion of the exchange rate in the money demand function, arguing that a depreciation of domestic currency (or an appreciation of foreign currency) raises the domestic currency value of an individual's foreign assets. If this increase is perceived as an increase in wealth, the demand for money could increase. Many find that this inclusion improves the econometric properties of the money demand function. But such a formulation is beyond the interests of the present analysis.

For Turkey, Metin (1992) estimates the real narrow money (M1) demand to be a function of real income, interest rates and inflation in the long-run for the period of 1948-1987. In the short-run, she found the current real money demand to be a function of one lagged interest rate, current price changes relative to the previous period, one lagged real balances, current real income, one lagged price changes relative to the same period of the last year, one lagged interest rate changes relative to the same period of the last year, and the cointegrating vector.

Kelezoğlu (1992) analyzes the money demand for the period 1977(1)- 1989(4) and finds cointegration among real money demand for M2 and M3, (L(M2/P), L(M3/P)) real income, and the expected loss (EL) of holding money, where expected loss is defined as the difference between expected inflation and the real return on money. For M1, he derives the conclusion of the existence of stable long-run equilibrium among real money demand (L(M1/P)), real income, interest rates and inflation.

For the same period, Özdenören (1993) estimates the money demand function for M1 and M2, the dependent variable defined as (LM1/P, LM2/P) slightly different from Kelezoğlu (1992) and still concludes the existence of cointegration between real money demand, real income, and the expected loss of holding money.

In Yavan (1993), nominal M2 money demand for the period 1980-1991 is analyzed with the backward looking and forward looking approaches. Johansen multiple cointegration part of the article determines a long-run relationship among nominal money demand, price index, nominal income, gold price index, and the highest of the three monthly, six monthly, nine monthly, yearly interest rates for the stated period. For the short-run, nominal money demand depended on change in the current income, current inflation rate, current changes in interest rate, changes in the price of gold in the third lagged period, and the difference between the realized money demand and the desired money demand in the two lagged period.

4-ECONOMETRIC THEORY

In this chapter, the econometric theory used in the thesis is discussed. Definitions of the main concepts and presentations of the tests are a collection of summaries basically from Banarjee. *et. al.*(1993), Doornik and Hendry (1994), and Ericson and Irons (1994).

4-1 Stationarity and Integratedness

A stochastic process is called *strictly stationary* if, for any subset (t_1, t_2, ... , t_n) of Ŧ and any real number h such that $t_i + h \in$ Ŧ, i = 1,2, ... , n,

$$F(x(t_1), x(t_2), ..., x(t_n)) = F(x(t_1 + h), x(t_2 + h), ..., x(t_n + h)), \qquad (1)$$

where F(.) is the joint distribution function of the *n* values. Strict stationarity therefore implies that all existing moments of the process are constant through time.

In practice, it is more common to deal with stationarity in the weak sense, restricting the momments to means, variances, and covariances of the process. A process is *weakly stationary* (or *second-order stationary* or *covariance stationary*) if

$$E[x(t_i)] = E[x(t_i) + h)] = \mu < \infty, \qquad (2)$$

$$E[(x(t_i))^2] = E[(x(t_i + h))^2] = \mu_2 < \infty, \text{ and} \qquad (3)$$

$$E[x(t_i).x(t_j)] = E[x(t_i + h).x(t_j + h)] = \mu_{ij} < \infty, \qquad (4)$$

where μ, μ_2, and the μ_{ij} are constant over t. for all t ∈Ŧ and h such that $t_r + h \in$ Ŧ (r = i,j). Thus, the contemporaneous second momments do not depend on time, and the lag dependencies are functions only of lag length. That the first raw moments are constant over time also implies that the variance of the process is constant. Consider a vector process {x(t)} = {x_1(t), x_2(t), ..., x_m(t) }', then covariances of the form E[$x_k(t_i)$, $x_l(t_j)$] are finite constants and are functions of *i, j, k,l* only for admissible *i, j, k,*and *l.*

Hence an autoregressive process,

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \varepsilon_t , \qquad (5)$$

is stationary if $|\alpha_1| < 1$ with ε_t, identically, independently distributed continuous random variables.

If one or more of the above conditions are not fulfilled, then the process is said to be *non-stationary*. Modelling with non-stationary series may cause misleading results such as high R^2, large confidence intervals, homoscedasticty and no autocorrelation, even in the case where there is no sense in the regression analysis; that is in the case where the variables have no theoretically meaningful relationship.

Since almost all economic series are non-stationary, it follows that these series have to be made stationary before any sensible regression analysis can be made. A convenient way of getting rid of non-stationarity in a series is differencing the series. A discrete process is integrated of order d (I(d)) if it must be differenced d times to reach stationarity; that is, $\Delta^d x_t$ is stationary where the differencing operator Δ^d is defined by $(1-L)^d$ (using the lag operator L, itself defined by $L_n x_t = x_{t-n}$).

Two issues about integratedness worth mentioning. First, if x_t is stationary, then Δx_t or even $\Delta^d x_t > 0$, are also stationary by definition of integratedness. Thus, the stationarity of $\Delta^d x_t$ is not sufficient for x_t to be I(d). Second, consider, the autoregressive process,

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \varepsilon_t , \qquad (6)$$

where $|\alpha_1| < 1$, $x_0 = 0$, and $\varepsilon_t \sim IN(0, \sigma^2)$, t=1, 2, ..., T. Then $\{x_t\}$ is non-stationary since $E(x_t) = \alpha_0(1-\alpha^t_1)(1-\alpha_1)^{-1}$ which is not constant over t. Hence $\{x_t\}$ is a non-stationary series that is not an integrated process. Thus non-stationarity of a series does not necessarily imply the integratedness of the process.

4-2 Unit Root and Unit Root Tests

The general way of identifying integratedness and the order of integration is testing for a unit root. Consider a general autoregressive process AR(p) :

$$\alpha(L)y_t = u_t, \qquad (7)$$

with $\alpha(L) = 1 - \Sigma^{p}_{i=1}\alpha_i L^i$ and can be expressed in terms of its factors as

$$\alpha(L) = \prod_{i=1}^{p}(1-\lambda_i L) \qquad (8)$$

If AR polinomial $\alpha(L)$ contains the factor (1-L), [i.e. if there is some λ_i equal to one], then the process is said to contain a *unit root.*

Among the alternative tests for unit root are Dickey-Fuller, Augmented Dickey Fuller (ADF), Said-Dickey, and Phillips-Perron. Augmented Dickey-Fuller test is found to be the most useful of different unit root tests in practice by Dejong, *et.al.* (1992) and Schwert (1987, 1989) who study the operating characteristics of the unit root tests. In this thesis, for this efficiency, ADF test is performed.

When y_t folows an AR(p) process,

$$y_t = \sum_{i=1}^{p} \rho_i y_{t-i} + \varepsilon_t \tag{9}$$

a test can be constructed with the regression model :

$$y_t = \rho y_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + u_t \tag{10}$$

with $\rho = 1 + \delta$, and the null and the alternative hypothesis are :

$H_0 : \delta = 0$

$H_1 : \delta < 0$

The rejection of the null hypothesis evaluated with the critical values in Fuller (1976) in favor of the alternative hypothesis implies that the process is integrated of order zero. The hypothesis can not be evaluated with the standart t-statistic because the distribution is not the Student t-distribution under the null hypothesis. If the hypothesis can not be rejected, then the next step is testing whether the series is I(1) [i.e. $\Delta yt \sim I(0)$]. The process of differencing is repeated until an order of integration is established or it is realized that the series can not be made stationary by differencing. The regression can also be allowed for the possibility that the data-generation process contains a constant, or a deterministic time trend.

The technical statistical theory on unit root processes provides the basis for statistical inference about the empirical existence of cointegration.

4-3 Cointegration

Time series $x_t = (x_{1t}, x_{2t}, ..., x_{nt})$ of n variables are said to be cointegrated of order d,b where $d \geq b \geq 0$, (see, Engle and Granger, 1987) if ;

(i) each of them is I(d),

(ii) and, there exists a non-zero $n \times 1$ vector α such that $x'_t\alpha \sim I(d-b)$. The vector α is called the cointegrating vector.

For empirical econometrics, the most interesting case is where the series transformed with the use of the cointegrating vector become stationary, that is, where d=b, and the cointegrating coefficients can be interpreted as the parameters in the long run equilibrium relationships of the cointegrating variables.

The idea in the long-run equilibrium relationship is that the variables hypothesized to be linked by some theoretical economic relationship should not diverge from each other in the long-run. Such variables may drift apart in the short-run or because of seasonal effects, but if they were to diverge without bound, an eqilibrium relationship among such variables could not be said to exist. Cointegration may be viewed as the statistical expression of the nature of such equilibrium relationships. (see, Banerjee, Dolado, Galbraith, and Hendry, 1993).

In this thesis analysis, the cointegration tests are carried out using the *maximum likelihood procedure* suggested by Johansen (1988). This procedure, directly investigates cointegration in a vector autoregression (VAR) model, and provides more robust results than that of Engle-Granger two-step procedure when there are more than two variables (Gonzalo, 1994).

Johansen (1988) defines a distributed lag model of a vector of variables Z where constant, trend and seasonal dummies are excluded as:

$$Z_t = \pi_1 Z_{t-1} + \pi_2 Z_{t-2} + \ldots + \pi_k Z_{t-k} + \varepsilon_t \,, \qquad (11)$$

where Z is a vector of N *stationary* variables and ε_t is an independently and identically distributed N-dimentional vector with zero mean and Ω variance matrix. In case that the variables in Z happen to be non-stationary, rewriting the equation in a fashion similar to that of ADF test as below is suggested :

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \ldots + \Gamma_{k-1} \Delta Z_{t-k+1} + \pi Z_{t-k} + \varepsilon_t \,, \qquad (12)$$

where

$$\Gamma i = -I + \pi_1 + \pi_2 + \ldots + \pi_i \;\; (i=1,\ldots,k)$$

and

$$\pi = -(I - \pi_1 - \pi_2 - \ldots - \pi_k).$$

The long run or cointegrating matrix is given by π which is an $N \times N$ matrix and includes a number of , say, *r* cointegrating vectors between the variables in Z. In this framework, r is the rank of the long-run matrix, π. If there exists a represantation of π such that $\pi = \alpha\beta'$, for which α and β are both $N \times r$, the rows of β form the *r* cointegrating vectors. Matrix β is called the *cointegrating matrix* with the property that $\beta' Z \sim I(0)$ while $Z \sim I(1)$. The matrix α is called the adjustments or the coefficients matrix, and measures the speed of adjustment of particular variables with respect to a disturbance in the equilibrium relation.

Johansen and Juselius (1990) demonstrate that β can be estimated as the eigenvector associated with the *r* largest and significant eigenvalues found by solving

$$|\lambda S_{kk}-S_{k0}S_{00}^{-1}S_{0k}| = 0, \qquad (13)$$

where $S_{ij} = T^{-1}\sum_{t=1}^{T} R_{it}R_{jt}^{'} \qquad i, j = 0,k.$

In turn, R_{0t} is set of residuals from regressing ΔZ_t on the lagged differences of ΔZ_t and R_{kt} is set of residuals from regressing Z_{t-k} on the lagged differences. Using the eigenvalues obtained from solving (13), Johansen and Juselius prove that the hypothesis that there are at most *r* cointegrating vectors can be tested by calculating the following two likelihood test statistics known as maximum eigenvalue and trace, respectively :

$$-2LnQ = -T\ln(1-\lambda_{r+1}) \qquad (14)$$

and

$$-2LnQ = -T\Sigma^{N}_{i=r+1}Ln(1-\lambda_i) \qquad (15)$$

where $\lambda_{r+1}, \ldots, \lambda_N$ are the estimates of N-*r* smallest eigenvalues. The analysis may also include constant, and trend terms as well as seasonal dummies.

In the determination process, the maximum eigenvalue and trace statistics are calculated for each null hypothesis that $r = 0, r = 1, \ldots, r = N-1$, against the alternatives $r \geq 1, r \geq 2, \ldots, r = N$. Given the critical values tabulated in Johansen (1988) and Johansen and Juselius (1990), the first null hypothesis that could not be rejected gives the number of cointegrating vectors in the model. If all of the null hypothesis are rejected, then there are N cointegrating vectors in the system.

If a non-zero vector(s) is indicated by the test, a stationary long-run relationship is implied. Since cointegrating vectors are obtained from the reduced form of a system in which all the variables are assumed to be jointly endogeneous, cointegrating vectors can not be interpreted as representing structural equations. However, cointegrating vectors may be due to constraints that an economic structure imposes on the long-run relationship among the jointly endogenous variables (see, Dickey, *et.al.* 1991).

In empirical applications of the Johansen method, establishing the optimum lag length to be applied in the VAR model [i.e. k in (13)] is necessary. If the empirical analysis is concerned exclusively with the estimation and identification of a cointegrating vector, since long lags might approximate the possible autocorrelation structure of the error terms, the general practice is to allow for relatively long lags. However, if the aim is using the estimated cointegrating vector for further analysis, long lags may cause inconsistency with economic theory. To chose the optimum lag length, Schwarz (SC), and Hannan-Quinn (HQ) information criteria may be used. Here,

$$SC = \log \sigma^2 + k\,(\log T) / T, \qquad (16)$$

$$HQ = \log \sigma^2 + 2k\,(\log(\log T)) / T, \qquad (17)$$

with the maximum likelihood estimate of σ^2:

$$\sigma^2 = ((T-k) / T)\, \sigma^2 = 1 / T\Sigma^{T}_{t=1}\, u^2_t .$$

4-4 Weak Exogeneity

The three different exogeneity concepts introduced by Engle *et al.* are called weak, strong and super exogeneity. and correspond to three different ways in which a parameter estimate may be used : inference in a conditional model, forecasting conditional on forecasts of the exogenous variables, and policy analysis. Since the main purpose of this thesis is inference, weak exogeneity is the concept to be considered.

Let $\mathbf{x}_t = (y_t, z_t)'$ be generated by the process with conditional density function $D(\mathbf{x}_t|\mathbf{X}_{t-1},\lambda)$, where $\mathbf{X}_{t-1}$ denotes the history of the variable $\mathbf{x}$: $\mathbf{X}_{t-1} = (\mathbf{x}_{t-1}, \mathbf{x}_{t-2}, ..., \mathbf{X}_0)$. Let the parameters $\lambda \in \Lambda$ be partitioned into (λ_1, λ_2) to support the factorization

$$D(\mathbf{x}_t|\mathbf{X}_{t-1}, \lambda) = D(y_t|z_t, \mathbf{X}_{t-1}, \lambda_1).D(z_t| \mathbf{X}_{t-1}, \lambda_2). \quad (18)$$

Then $[(y_t|z_t ; \lambda_1), (z_t, \lambda_2)]$ operates a sequential cut on $D(\mathbf{x}_t|\mathbf{X}_{t-1},\lambda)$ if and only if λ_1 and λ_2 are variation free; that is, if and only if

$$(\lambda_1, \lambda_2) \in \Lambda_1 \times \Lambda_2, \quad \text{where} \quad \lambda_1 \in \Lambda_1 , \lambda_2 \in \Lambda_2,$$

so that the parameter space Λ is the direct product of Λ_1 and Λ_2. Thus, λ_1 and λ_2 are variation free if the parameter space Λ_1 is not a function of the parameter λ_2 , and the parameter space Λ_2 is not a function of the parameter λ_1 . In other words, for any values of λ_1 and λ_2 , admissible values of the parameters λ of the joint distribution can be recovered. The essential element of the weak exogeneity is that the marginal distribution contains no information relevant to λ_1.

Then, z_t is weakly exogenous for a set of parameters of interest ψ if and only if there exists a partition (λ_1, λ_2) of λ such that (i) ψ is a function of λ_1 alone, and (ii) $[(y_t|z_t ; \lambda_1), (z_t, \lambda_2)]$ operates a sequential cut. Hence weak exogeneity ensures that there is no loss of information about parameters of interest from analyzing only the conditional distribution.

4-5 Autoregressive Distributed Lag and Error Correction Models

An autoregressive distributed lag, ADL(m, n) model with a constant and *p* exogenous variables, which can also be written as ADL(m, n; p) has the form :

$$y_t = \alpha_0 + \sum_{i=}^{m} \alpha_i y_{t-i} + \sum_{j=1}^{p} \sum_{i=0}^{n} \beta_{ji} x_{jt-i} + \varepsilon_t \qquad (19)$$

where $\varepsilon_t \sim IID(0, \sigma^2)$. Using the lag operator $L^n z_t = z_{t-n}$, the equation can be rewritten as

$$\alpha(L) y_t = \alpha_0 + \sum_{j=1}^{p} \beta_j(L) x_{jt} + \varepsilon_t , \qquad (20)$$

where $\alpha(L) = 1 - \Sigma^{m}_{i=1} \alpha_i L^i$. Given *joint stationarity*, the long-run solution of (19) is

$$E(y_t) = (1 - \sum_{i=1}^{m} \alpha_i)^{-1} [\alpha_0 + \sum_{j=1}^{p} \sum_{i=0}^{n} \beta_{ji} E(x_{jt})] \qquad (21)$$

$$= (\alpha(1))^{-1} [\alpha_0 + \sum_{j=1}^{p} \beta_j(1) E(x_{jt})] \qquad (22)$$

$$= \theta_0 + \sum_{j=1}^{p} \theta_j E(x_{jt}) \qquad (23)$$

where $\alpha(1)$ and $\beta(1)$ represent the substitution of unity for the lag operator L in the lag polinomials.

A generalized error correction model (ECM), corresponding to the above ADL(m, n; p) model is (for r ≤ m):

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{r} \eta_i (y_{t-i} - \sum_{j=1}^{p} x_{jt-i}) + \sum_{j=1}^{p} \beta_{j0} \Delta x_{jt} + \sum_{j=1}^{p} \sum_{i=1}^{r} \xi_{ji} x_{jt-i} \qquad (24)$$

$$+ \sum_{j=1}^{p} \sum_{i=r+1}^{n} \beta_{ji} x_{jt-i} + \sum_{i=r+1}^{m} \alpha_i y_{t-i} + \varepsilon_t$$

with $\eta_1 = \alpha_1 - 1$, $\eta_i = \alpha_i$, $i = 2, \dots, r$; $r = \min(m, n)$;

$\xi_{j1} = \alpha_1 - 1 + \beta_{j0} + \beta_{j1}$, $\xi_{ji} = \alpha_i + \beta_{ji}$, $i = 2, \dots, r$,

and

$$\Delta x_{jt-i} \equiv (x_{jt-i} - x_{jt-i-1}).$$

For each of the error correction terms,

$$(y_{t-i} - \sum_{j=1}^{p} x_{jt-i})$$

one lagged term in x_{jt} is present to break 'homogeneity' : that is to allow the error correction term to take the form

$$(y_t - \sum_{j=1}^{p} \theta_j x_{jt-i})$$

where θ_j is not equal to one.

When the equilibrium relationship is of the form $y^* = \theta x^*$, and the parameter in the equilibrium relationship is known [i.e. estimated], then the error correction term is one such as ($y_t - \theta x_t$) and they can be inserted to the ECM and the terms in lagged x can be eliminated.

Furthemore, error correction terms are viewed as a way of capturing adjustments in a dependent variable which depended not on the level of some explanatory variable, but on the extend to which an explanatory variable deviated from an *equilibrium realtionship* with the dependent variable.

Hence, cointegration implies and is implied by the existence of an error correction representation of relevant variables. Through this isomorfism with ECMs, cointegration brings together short- and long-run information in modelling the data. That unification resolves the "debate" on using levels or differences, with Box-Jenkins time series models and classical "structural" models both being special cases of ECMs.

5-EMPIRICAL TEST RESULTS

The first section of this chapter provides information about the data set used in this study. The following sections present the empirical results of stationarity, cointegration, and exogeneity tests.

5-1 The Data Set

Six alternative definitions of money (all in TL. billion) are considered in empirical modelling. M1 is the narrow money which is defined as currency in circulation plus demand deposits, M2 is M1 plus time deposits, M2y is M2 plus deposits on foreign money, M3a is M2 plus official deposits in private banks, M3 is M3a plus deposits on foreign money in the Central Bank, and LO, the broadest money definition in Turkey, is M3 plus deposits on foreign money. GNPr is the real income (TL. billion, gross national product at 1987 prices), P is the consumer price index (1987=100), STL, 1MON, 6MON, 1YEAR, HF, GF represent the returns on sight deposits, monthly, six monthly, yearly time deposits, treasury bills, and overnight deposits, respectively.

The data span the period 1987-1997[2]. Within this period, all the monetary and price data are available monthly, interest rate data are available monthly until 1991(1), weekly from 1991(1) onwards, and GNPr is only available quarterly. Thus, in order to keep the data frequency the same, quarterly time series is decided to be used in this thesis. The

[2] The auther realizes that cointegration is a long-run concept and that ideally, the tests should be run over a much longer sample period. However, 1987 is chosen to be the beginning of the data period because of the inconsistency of the monetary definitions of the Central Bank before 1987.

data are collected from the Central Bank of Turkey and The State Institute of Statistics. The data set is presented in Table 1 in Appendix I. Also graphical representations of all money definitons, all interest rate definitions , GNPr and P can be found in graphs 1,6,9,10 in Appendix II, respectively.

5-2 Results of Unit Root Tests

Since cointegration requires a certain stochastic structure of the time series involved, before starting the empirical analysis, the degree of integratedness of the data series are checked. The order of integration of each individual series is identified with unit root test. Table-2 in Appendix I show the results of ADF (Dickey and Fuller, 1981) test based on the unit root test critical values from MacKinnon (1991). L represent the logarithm, D represent the first difference, DD represent the second difference of the related variables, r suffix at the end of the monetary variables identify the variables in real terms. It is calculated as log of the variable minus log of P.

The different ADF test results with constant, contant and trend, constant, trend and three seasonal dummies are reported in Table-2.a[3] . Since differencing eliminates the trend (see, Graphs 4, 8), Table 2.b and 2.c reports only constant, constant and three seasonal dummies ADF values. In this manner, I(1) and I(2) tests allow for an alternative hypothesis of stationarity with a non-zero intercept on the differenced series, while the

[3] The statistical package program employed to perform all tests is PcGive Professional 8.0 by Doornik and Hendry (1994).

I(0) test allows for the alternative hypothesis of trend stationarity and a non-zero intercept on the series in levels. Trend stationarity implies that the deviation of the series from a linear function on time follows a stationarity process. Seasonal dummies enter the relationship exogenously.

However, the ADF values with constant are consired for baseline modelling. The other values are tabulated for further information to the readers. The test is performed with five lags of the dependent variable and the series are differenced until the fifth lag is significant. If the fifth lag is significant with differencing n times, the series is assumed to be integrated of order n; I(n).

Considering the information above and examining the graphs in Appendix II, it is clear that none of the variables are I(0)[4], but all the interest rate variables, real income and LM1r, LM2r, LM2yr are I(1), whereas LP, LM3ar, LM3r, LLOr are I(2) at 5% significance critical value.

5-3 Results of Cointegration Tests

This section reports the results of the cointegration tests among the series (LM1r, LGNPr, LSTL, LP), (LM2r, LGNPr, 1YEAR, HF, DLP), (LM2yr, LGNPr, 1YEAR), (DLM3ar, LGNPr, 1MON), (DLM3r, LGNPr, 6MON), (DLLOr, LGNPr, 1MON, HF,

[4] Throughout the analysis, for all test results, * indicates significance at 5%, ** indicates significance at 1% significance level.

DLP)[5] each representing a money demand for respective money definition. Considering the fact that some of the variables in the data set are I(2), first differencing is applied to LP, LM3ar, LM3r, LLOr to make them I(1). If variables in a money demand function are cointegrated, they will be constrained to an equilibrium relationship in the long-run.

The maximum likelihood procedure developed in Johansen (1988) and Johansen and Juselius (1990) is used for finding the cointegrating vectors, in a Vector Autoregressive Model, VAR. For this purpose, first the optimum lag length to be applied in the cointegration analysis must be determined. So, a VAR(5) is modelled. Here, lag length is chosen to be five due to the fact that a higher lag length would result in a significant loss of information.

The model is estimated with including unrestricted seasonal dummies, an unrestricted constant term and a restricted trend. Removing one lag of all variables at a time, and re-estimating over the same sample, until the models are reduced to a VAR(1), the minimum of the Schwarz and Hannan-Quinn information criteria for each system gives the optimum lag length for the VAR model. Schwarz and Hannan-Quinn test values are reported in Table-3 for each money demand equation model. In case of a conflict

[5] Initially, cointegration analysis are performed systematically among (real balances, income, interest rates on deposits) , (real balances, income, interest rates on deposits, inflation), (real balances, income, interest rates on deposits, inflation, interest rates on treasury bills) for each money definition for each monthly, three monthly, six monthly , yearly interest rates on deposits and interest rates on overnight deposits representing the own rate of return of money. The systems reported here, are the most efficient of all with respect to their performance of consistancy with economic theory. Also, as representatives of the own rate of return of broad money (M2y, M3, LO), interest rates on foreign currency had to be considered in the systems. The data of three monthly, six monthly, and yearly interest rates on US$ and DM -these data are available only from 1991(1) onwards- were tried to be included in the cointegration analysis for the period 1991(1)-1997(4) similar to that described above. But *singularity problem* in the system prevented the analysis of this form.

between Schwarz and Hannan-Quinn test values, the lag length Schwarz criteria determines is assumed to be optimum.

The values in Table-3 reveal that for each money demand model, the minimum value of the test values are associated to a VAR(1), so the optimum lag length should be considered to be one.

Finding the optimum lag length as one, as a second step, cointegration analysis is performed for each money demand model. Table 4.a-4.f reports the results of the Johansen cointegration test finding the cointegrating vectors. Maximum eigenvalue score and trace score together with 5% critical values are reported in the table to decide on the number of cointegrating vectors. Trace score is accepted in the decision process, so according to the trace score results in tables 4.a, 4.b, 4.c, 4.d, 4.e, 4.f, the number of cointegrating vectors are three for M1, three for M2, one for M2y, two for LM3a, two for M3, three for LO.

The first rows corresponding to the number of cointegrating vectors of the standardized β' eigenvectors reports the estimated cointegrating vectors as representative of the cointegration space. The number of cointegrating vectors being less than the number of variables in the cointegrating systems may be a clue for some variables being weakly exogenous for the parameters of interest (tests for weak exogeneity will be carried on in the next section).

The estimated cointegrating vectors are given economic meaning by means of normalizing on the real money balances. These normalized equations are obtained from reduced forms and may represent money demand, money supply, or some more complicated interaction. (Johansen and Juselius, 1990); from the standardized β' eigenvectors, the first cointegrating vectors for M1, M2y, M3a, M3, LO and the third cointegrating vector for M2 appear to be the money demand equations in levels for M1, M2, M2y, and growth rate of money demand for M3a, M3, and LO. These equations show signs on the variables that are consistent with money demand. The relations are :

LM1r = 1.0390(LGNPr) + 0.6235(LSTL) - 10.5400(DLP) - 0.0157 t

LM2r = 4.2867(LGNPr) + 0.5260(1YEAR) - 0.0709(HF) - 0.0804(DLP) – 0.0487 t

LM2yr = 5.0800(LGNPr) + 1.7120(1YEAR) – 0.0552 t

DLM3ar = 0.3147(LGNPr) + 0.4805(1MON) – 0.0084 t

DLM3r = 0.1505(LGNPr) + 0.2319(6MON) - 0.0036 t

DLLOr = 0.1253(LGNPr) + 0.3465(1MON) – 0.0236(HF) – 0.1789(DLP) – 0.0039 t

Real income enters with a positive coefficient in all the money demand equations. The interest rates (LSTL, 1YEAR, 1YEAR, 1MON, 6MON) representing the own rate of return of the money enters with positive coefficient in all the equations. HF and DLP representing the returns on treasury bills and goods as alternatives to holding money enter the equations of M1, LM2, LO with negative coefficients. Thus, all the variables are in expected sign.

5-4 Results of Weak Exogeneity Tests

For inference, a reliable single equation analysis should have regressors that are weakly exogenous (see, Engle, Hedry, and Richard, 1983). In accordance with the economic framework LGNPr, LSTL, DLP should be weakly exogenous for LM1r; LGNPr, 1YEAR, HF, DLP should be weakly exogenous for LM2r; LGNPr, 1YEAR should be weakly exogenous for LM2yr; LGNPr, 1MON should be weakly exogenous for DLM3ar; LGNPr, 6MON should be weakly exogenous for DLM3r; and finally LGNPr, 1MON, HF, DLP should be weakly exogenous for DLLOr. That is, the knowledge of LM1r, LM2r, LM2yr, DLM3ar, DLM3r are not required for inference on marginal processes of (LGNPr, LSTL, DLP), (LGNPr, 1YEAR, HF, DLP), (LGNPr, 1YEAR), (LGNPr, 1MON), (DLGNPr, 6MON, GF, HF), respectively.

In order to test for weak exogeneity for all the conditional parameters, a procedure based on the Johansen (1992a, 1992b) is used. The procedure restricts the standardized α coefficients of the parameters and tests the restriction for significance by a LR-test. For every parameter the restriction consist of imposing a matrix of α's in which the parameter in question has an α equal to one, where as the remaining parameters have α's equal to zero. An application of testing weak exogeneity in the context of cointegration is also provided in Johansen (1992b). The results obtained by the assumption that there is a unique cointegrating vector [i.e. r = 1] are reported in Table 5. The results suggest that (LM1r, LGNPr, LSTL, DLP), (LM2r, LGNPr, 1YEAR, HF, DLP), (LM2yr, LGNPr, 1YEAR), (DLM3ar, LGNPr, 1MON), (DLM3r, LGNPr, 6MON), (DLLOr, LGNPr, 1MON, HF, DLP) can not be assumed weakly exogenous for β's.

As already mentioned, for inference, conditional models should have regressors that are weakly exogenous (see, Engle, Hendry and Richard, 1983). In the context of cointegration, weak exogeneity means that inference about the cointegrating vector can be performed on the conditional model without loss of information relative to the system analysis. Even lacking weak exogeneity, single equation modelling can proceed, treating the system-based estimated cointegration coefficients as given (see, Metin, 1998). The next chapter develops such conditional models for each money definition and examines their properties.

6- EMPIRICAL MODELLING

Because weak exogeneity does not appear valid for many of the variables, and since cointegration implies that the transitory components of the series can be given a dynamic specification by means of the error-correction models, in this chapter, a single equation modelling based on Jusellius' (1992) approach is applied to investigate the temporal causality between the determinants of the long-run money demand in Turkey and the real money supply during the stated period.

The money demand models include the error correction terms obtained from the earlier cointegration analysis. The general ECMs involve variables of interest transformed to the I(0) space and the lag error correction terms. Here, single equation modelling starts with an unrestricted fourth order ADL, written as an ECM :

$$DLM1r = \sum_{i=1}^{k-2} \beta_{1i} DLM1r_{t-i} + \sum_{i=0}^{k-2} \beta_{2i} DLGN\Pr_{t-i} + \sum_{i=0}^{k-2} \beta_{3i} DLSTL_{t-i} + \sum_{i=0}^{k-2} \beta_{4i} DDLP_{t-i}$$
$$+ \beta_5 CM1.1_{t-1} + \beta_6 CM1.2_{t-1} + \beta_7 CM1.3_{t-1} + CTS_{M1} + u_t$$

$$DLM2r = \sum_{i=1}^{k-2} \delta_{1i} DLM2r_{t-i} + \sum_{i=0}^{k-2} \delta_{2i} DLGN\Pr_{t-i} + \sum_{i=0}^{k-2} \delta_{3i} D1YEAR_{t-i} + \sum_{i=0}^{k-2} \delta_{4i} DHF_{t-i}$$
$$+ \sum_{i=0}^{k-2} \delta_{5i} DDLP_{t-i} + \delta_6 CM2.1_{t-1} + \delta_7 CM2.2_{t-1} + \delta_8 CM2.3_{t-1} + CTS_{M2} + u_t$$

$$DLM2yr = \sum_{i=1}^{k-2} \eta_{1i} DLM2yr_{t-i} + \sum_{i=0}^{k-2} \eta_{2i} DLGN\Pr_{t-i} + \sum_{i=0}^{k-2} \eta_{3i} D1YEAR_{t-i}$$
$$+ \eta_4 CM2y.1_{t-1} + CTS_{M2y} + u_t$$

$$DDLM3ar = \sum_{i=1}^{k-2} \sigma_{1i} DDLM3ar_{t-i} + \sum_{i=0}^{k-2} \sigma_{2i} DLGN\Pr_{t-i} + \sum_{i=0}^{k-2} \sigma_{3i} D1MON_{t-i} + \sigma_4 CM3a.1_{t-1}$$
$$+ \sigma_5 CM3a.2_{t-1} + CTS_{M3a} + u_t$$

$$DDLM3r = \sum_{i=1}^{k-2} \tau_{1i} DDLM3r_{t-i} + \sum_{i=0}^{k-2} \tau_{2'} DLGN\Pr_{t-i} + \sum_{i=0}^{k-2} \tau_{3i} D6MON_{t-i}$$
$$+ \tau_4 CM3.1_{t-1} + \tau_5 CM3.2_{t-1} + CTS_{M3} + u_t$$

$$DDLLOr = \sum_{i=1}^{k-2} \xi_{1i} DDLLOr_{t-i} + \sum_{i=0}^{k-2} \xi_{2i} DLGN\Pr_{t-i} + \sum_{i=0}^{k-2} \xi_{3i} D1MON_{t-i} + \sum_{i=0}^{k-2} \xi_{4i} DHF_{t-i}$$
$$+ \sum_{i=0}^{k-2} \xi_{5i} DDLP_{t-i} + \xi_6 CLO.1_{t-1} + \xi_6 CLO.2_{t-1} + \xi_7 CLO.3_{t-1} + CTS_{LO} + u_t$$

where k = 4 and CTS_{M1}, CTS_{M2}, CTS_{M2y}, CTS_{M3a}, CTS_{M3}, CTS_{LO} represent the constant term , trend and three seasonal dummies for each money definition (the lag legth is chosen as 2, because a higher lag would result in a significant loss of observations for such a data set).

From the results of the extensive literature that has estimated money demand, the signs of the coefficients are expected to be :

$\beta_{1i}, \delta_{1i}, \eta_{1i}, \sigma_{1i}, \tau_{1i}, \xi_{1i}$	i = 1,2	< 0
$\beta_{2i}, \delta_{2i}, \eta_{2i}, \sigma_{2i}, \tau_{2i}, \xi_{2i}$	i = 1,2,3	> 0
$\beta_{3i}, \delta_{3i}, \eta_{3i}, \sigma_{3i}, \tau_{3i}, \xi_{3i}$	i = 1,2,3	>0
$\beta_{4i}, \delta_{4i}, \delta_{5i}, \xi_{4i}, \xi_{5i}$	i = 1,2,3	<0

The models are fitted to the quarterly data over the period 1987(1)-1997(4). Then the reduction based on Hendry's (1989) general to specific simplification methodology is made by eliminating step by step the statistically as well as economically most insignificant regressors. The decision on which insignificant regressors are eliminated is based on two criteria :

1- The t-statistic is the criteria that is used in reducing the ADL model. The regressors that have a t- statistic lower than the critical one are considered to be insignificant.

2-Eliminating the insignificant regresors with a higer lag length is preferable even if their t- statistics are higher than the insignificant regressors with a lower lag length. The reason is that the regressors which are nearer in time to the dependent variable are assumed to have a stronger impact that can be hidden by the presence of the other variables.

The general and the final models and diagnostic statistics are reported in Tables 6.a-6.f in Appendix I. The last remaining equations with all variables being significant[6] are :

$$DLM1r = -37.171+0.694(DLGNPr)-0.334(DDLP)+0.922(CM1.2_{t-1}) - 0.064(CM1.3_{t-1}) - 0.233(Seasonal\text{-}2)$$

[6] In order to keep some variables in the system, their significance at 10% significance level are assumed to be valid at the last stage of the estimation process.

$DLM2r = -0.478 - 0.448(DLM2r_{t-1}) - 0.339(DLM2r_{t-2}) - 0.337(DDLP_{t-2}) + 0.390(CM2.2_{t-1})$

$- 0.057(CM2.3_{t-1})$

$DLM2yr = 12.138 + 0.129(DLGNPr_{t-1}) + 0.175(D1YEAR_{t-1}) + 0.027(CM2y.1_{t-1})$

$DDLM3ar = 16.725 + 0.143(DLGNPr_{t-1}) + 0.151(D1MON_{t-1}) - 0.830(CM3a.1_{t-1})$

$- 0.435(CM3a.2_{t-1})$

$DDLM3r = 2.060 + 0.151(DLGNPr_{t-1}) + 0.349(D6MON_{t-1}) - 1.087(CM3.1_{t-1})$

$- 0.373(CM3.2_{t-1})$

$DDLLOr = -0.270 + 0.078(DLGNPr_{t-1}) + 0.296(D1MON) - 1.108(DDLP) - 0.276(DDLP_{t-1})$

$- 1.132(CLO.1_{t-1}) - 0.118(CLO.2_{t-1})$

The diagnostic statistics reported in Table 6a-6f, test against several alternative hypotesis – residual autocorrelation (DW and AR), skewness and excess kurtosis (NORMALITY), autoregressive conditional heteroscedasticity (ARCH), nonlinearity of type X^2 ,X being the regressors, and parameter non-constancy (CHOW). Chow test is performed by the seperation of the analyzed period to two sub-periods before and after 1993(1) and is an F-type statistic as :

$$CHOW = ((RSS_t - RSS_1 - RSS_2)/(RSS_1 + RSS_2)) \times ((T-2k)/k)$$

where RSS_t, RSS_1, RSS_2 , k refers to the residual sum of squares for the whole sample, for the sub-period 1 ($t=1,...,T_1$) ,for the sub-period 2 ($t=T_{t+1}, ..., T$) and the number of variables in the model, respectively.The test statistic is distributed as CHOW~F(k,T-2k) under the null hypothesis. Calculation of the Chow statistic for each model is reported under the respective tables.

In spite of its importance for forecasting and policy, constancy has proved elusive for estimated money demand functions of many countries (see, Judd and Scadding, 1982 for the United States). While nonconstant empirical equations do not preclude a stable underlying relation, they leave unresolved the question of whether the observed predictive failure arises from shifts in the underlying relation or whether it is simply a consequance of model misspecification.

For Turkish money demand, this question is moot for the estimated money demand equations for each money definition are remarkably constant in spite of large fluctuations in inflation rate, the introduction of new financial instruments, liberalization of the financial system, and most importantly 1994 financial crisis.

For each money model, normality of errors, autoregressive conditional homoscedasticity, and the lack of residual autocorrelation and nonlinearity together with the property of constancy reveal that the models are econometrically well specified. That is, the models are data-admissible, data coherent, marginalized and conditional representations of the data generation process. Furthermore, the models yield economically sensible interpretations.

In the short-run, changes in the real M1 balances depend :

(a) positively on current changes in the real income,

(b) negatively on current changes in the inflation rate,

(c) two ECT's,

(d) and negatively on the second seasonal dummy, Hence, all the independent variables in the real money demand equation for M1 are in expected sign. LSTL does not have any impact on the short-run adjustment process of M1 although it has a relationship with M1 in the long-run. The M1 money demand depends positively on the second cointegrating vector, and negatively on the third cointegrating vector. The size of these coefficients suggest that the adjustment of M1 to equilibria via the second ECT is fast whereas it is slow via the third ECT. The model has 65% explanatory power with σ= 7.6%.

Changes in the M2 real balances is related [7]:

(a) negatively to the changes in the one lagged and two lagged M2 real balances.

(b) negatively to the changes in the two lagged inflation rate,

(c) and, to two ECT's,

In the short-run representation. M2 depends positively on the second cointegrating vector, negatively on the third cointegrating vector. M2 adjusts to equilibria with the second cointegrating vector faster that that of the third cointegrating vector. M2 being negatively dependent on its lagged values indicates that an increase in this year's and last year's growth rate of money supply leads to a decay of 45% and 34% of next year's growth rate of real balances,respectively. Furthermore, an increase in the one lagged inflation changes causes next year's money balances decrease by 34% due to an increase in the oppotunity cost of holding money. Although real money has a long run relationship with the real income, interest rate and interest rate on treasury bills, this

[7]An alternative general to specific VAR(3) formulation for M2 yield an R^2 = 40% with σ = 6.7% . The result suggests that DLM2r = f (DLM2r$_{-1}$, DLM2r$_{-2}$, DDLP, DHF, DHF$_{-1}$, DHF$_{-2}$, CM2.2$_{-1}$, CM2.3$_{-1}$), but the coefficient of the DHF term is positive contrary to the expectations, and can not be explained with the economic theory. Hence, the resulting parsimonius model was not prefered to the reported parsimonius model . Similarly an alternative model for M3 summarized in Table 7 yield a higher R^2 then the reported model here, but some of the coefficient's being in opposite sign than expected makes the model unpreferable.

relation does not appear in the ECM. The model explains 27% of the variability of the changes in the M2 balances with 7% standard error.

Changes in the M2y real balances is associated with :

(a) positive one lagged changes in real income,

(b) positive one lagged changes in the own rate of return (yearly interest rates),

(c) and a positive ECT.

Although significant, the coefficient on the ECT is very small implying that the adjustment process of M2y is really slow to disturbances from equilibrium. An increase in the changes in the real income and interest rate of this year causes next year's growth of real balances to increase by 13% and 18%, respectively. The model explains 22% of the variability in the changes in real M2y with σ =5%

For M3a, the short-run dynamics depend :

(a) on positively to one lagged changes in real income,

(b) on positively to one lagged changes in the own rate of return (monthly interest rates),

(d) and two ECT's.

In the short-run representation. M3a depends negatively on both of the cointegrating vectors. Growth rate of M3a adjusts to equilibria via the first cointegrating vector faster than via the second cointegrating vector. Furthermore, an increase in the one lagged real income changes causes next year's money balances growth rate increase by 14.3% and an increase in the one lagged changes in interest rates causes it to increase by 15%. The model explains 73% of the variability of the changes in the growth rate of the real balances with 5.6% standard error.

In the short-run, changes in the growth rate of M3 is related :

(a) positively on one lagged changes in real income,

(b) positively on one lagged changes in the own rate of return (6 monthly interst rates),

(c) and two ECT's with negative coefficients.

Growth rate of M3 adjusts to equilibria via the first cointegrating vector faster than via the second cointegrating vector. Furthermore, an increase in the one lagged real income changes causes next year's money balances growth rate increase by 15.1% and an increase in the one lagged changes in interest rates causes it to increase by 34.9 %. R^2 of the regression is 72.8% and the standard error is 5.4%.

Changes in the growth rate of the broadest money definition in Turkey depends :

(a) positively on one lagged changes in real income,

(b) positively on one lagged changes in the own rate of return (monthly interest rates),

(c) negatively on current and one lagged percentage changes in the inflation rate.

(d) two ECT's with negative coefficient.

The first cointegrating vector has greater impact on the growth rate adjustment process of real money balances than the second cointegrating vector. An increase in the current real income changes are associated with 7.8% increase in next year's money balances changes in the growth rate , and an increase in the current changes in interest rates are associated with 29.6 % increase in the percentage change in the growth rate of real balances. Furthermore, changes in the current and one lagged inflation rate cause next year's real balance growth rate decrease by 110.8% and 27.6%,respectively. Although the interest rates on treasury bills cointegrate with real balances, it does not appear in the short-run adjustment process of growth rate of LO. R^2 of the regression is 72.8% and the standard error is 5.4%.

Note that despite the weak exogeneity of DLM3ar, DLM3r, DLLOr with the Johansen method, significance of the ECT's in the parsimonius models imply the adjustment of real money to equilibria, hence, the endogeneity of the money definitions in the system.

7- CONCLUSIONS

The present analysis attempted to determine whether there exists a stationary long-run money demand function in Turkey. The time period involved is from1987 to 1997. During the stated period, Turkey experienced high and volatile inflation, huge government budget deficits, and unsustainable current account deficit associated with a financial crisis in 1994.

Cointegration tests (Johansen Procedure) are applied to test the hypothesis of a stationary long-run money demand function. The most general function tested includes real balances, real income, own rate of return of money, and returns on alternative assets. Specifically, M1 real balances are tested with real income, interest rates on sight deposits and inflation. M2 real balances are tested with real income, yearly interest rates on time deposits, interest rates on treasury bills, and inflation. M2y is considered with real income and yearly interest rates on time deposits. Test for the M3a includes real balances of M3a, real income, and monthly interest rates on time deposits. M3 real balances are tested with real income, and six monthly interest rates on time deposits. Finally, LO real balances are considered to be a function of real income, monthly interest rates on time deposits, interest rates on treasury bills and inflation.

The results provide a strong support for the presence of a long-run equilibrium relation for each money definition. This indicates that all monetary measures are equally preferable measures with which to consider the long-run economic impacts of changes in monetary policy. However, from the ECMs, holdings of all money balances appear to be endogenously determined by the private sector. With the money stocks being endogenous, they can not be controlled by the government, although the government can target them through its policies for financial structure. Interest rates' being endogeneous for all monetary definitions (see,Johansen test results for weak exogeneity) prevent the central authorities to control and/or regulate interest rates as a means of targetting money. Indeed, no policies for controlling income, interest rates on deposits, interest rates on treasury bills, and inflation are means of targetting money when M1, M3a, M3, and LO are the considered measures. On the other hand, antinflationary policies might help targeting the real balances for M2, and policies for controlling income might help targeting the real balances for M2y.

Moreover, the estimated conditional money demand functions in Turkey are remarkably stable and otherwise well-specified over the period 1987-1997. The empirical stability of the equations suggest that the process determining the money demand in Turkey has remained unchanged during 1990s, even while inflation and interest rates have varied, financial liberalization has occurred, and the economy witnessed a remarkable economic crisis.

The analysis did not include the exchange rate variable as an opportunity cost of holding money, but Abel, et. al.(1979) show that since both goods and foreign assets can be substituted for domestic currency, both the rate of inflation and the rate of change of exchange rate need to be included in the money demand function. (Choudry, 1995b). Choudry (1995b) also concludes the existence of a stationary long-run money demand function in three high inflation countries (Argentina, Israel, Mexico) are only ensured if the annualized rate of change of the exchange rate is included in the relationship. According to Ramirez-Rojas, in order to estimate a money demand function in high inflation countries, it may be necessary to include a measure of currency substitution in the money demand function. Although the inflation rate in Turkey is not as high as Argentina, Israel, or Mexico, Selçuk (1994) concludes the existence of a high currency substitution in Turkey. Hence, although the present analysis ensures the existence of a stationary long-run money demand function without the exchange rate variable, the inclusion of exchange rate in the system might help to improve the results.

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TABLE 1- THE DATA SET

	M1	M2	M2Y	M3A	M3	LO
1987-1	4521.7	11498	13535.5	12759.7	13000.8	15038.3
1987-2	5077.2	12293.1	14741.6	13713.3	14039.9	16488.4
1987-3	5993.9	13897.2	16890.7	15485	15751.6	18745.1
1987-4	8268.2	16559	20680.5	18551	18879	23000.5
1988-1	6809.2	15988.1	20610.1	18256.8	18609	23231
1988-2	7302.3	16957.3	21878.8	19686.7	20459.7	25381.2
1988-3	8754	19665.5	25864	22722.5	23610	29808.5
1988-4	11243.7	27195.8	34689.8	28998.8	29800	37294
1989-1	10580	30340.2	38462.9	31840.2	32789.8	40912.5
1989-2	12760.8	34065.1	42418.7	36637.6	37544.2	45897.8
1989-3	16310.8	39776.4	49260.2	41648.6	42608.7	52092.5
1989-4	20358.1	49153.3	60516.3	50929.6	51833.8	63196.8
1990-1	19520.4	51620.6	64062.8	53860.8	55118.7	67560.9
1990-2	24653.6	59314.2	72700.7	61838.9	63094.5	76481
1990-3	26843	64172.4	79250.6	67338.4	68817.6	83895.8
1990-4	29326.4	70707.3	89464.5	74114.9	75129	93886.2
1991-1	28570.9	75123.5	97019.5	77716	78880.8	100776.8
1991-2	33419.4	86117.5	113321.6	89483.2	91058.3	118262.4
1991-3	39429.8	99878	135784.1	104367.4	106114.6	142020.7
1991-4	42115.9	113563.4	160429	118788.2	120810.4	167676
1992-1	43716.9	127955.8	188092.1	135029.4	138487	198623.3
1992-2	50956.5	143454.7	223325.9	150669.4	154136.8	234008
1992-3	60087	162075.2	263288.4	169978.5	174367.6	275580.8
1992-4	70520.6	182988.9	289512.9	191535.4	195496.7	302020.7
1993-1	86118.9	217615.4	352852.8	225650.2	230013.1	365250.5
1993-2	90423.6	224475	383492	239846.1	246058.8	405075.8
1993-3	105198.5	245411.4	447862.2	258213	264591.7	467042.5
1993-4	132307.8	291974.7	544931.9	304006.1	308923.9	561881.1
1994-1	110583.7	284905.7	623097.2	301791.6	307098.1	645289.6
1994-2	153093.6	469334.2	872333.2	483628.3	489757.7	892756.7
1994-3	205486.9	563014.7	1076014	589727.9	602875.8	1115875
1994-4	238981	642490	1271201	662050	681208	1309919
1995-1	234180	765592	1499007	801890	824331	1557746
1995-2	314250	979810	1755311	1014524	1048166	1823667
1995-3	372786	1126714	2065735	1172739	1214959	2153980
1995-4	396047	1270423	2625517	1309347	1353195	2708289
1996-1	421300	1435626	2941222	1514858	1566047	3071643
1996-2	511326	1825307	3596559	1917899	1966716	3737968
1996-3	620375	2253409	4412845	2379236	2434092	4593528
1996-4	831415	2801675	5504597	2960636	3017282	5720204
1997-1	997629	3232451	6381505	3420739	3482316	6631370
1997-2	1087974	3768239	7538027	4019527	4107067	7876855
1997-3	1158960	4484355	8983852	4844740	5177293	9676790
1997-4	1378604	5264529	10827297	5791192	6104543	11667311

	STL	1MON	3MON	6MON	1YEAR
1987-1	0.1	0.28	0.35	0.38	0.43
1987-2	0.1	0.28	0.35	0.38	0.43
1987-3	0.1	0.28	0.35	0.38	0.43
1987-4	0.1	0.28	0.35	0.38	0.43
1988-1	0.36	0.4	0.45	0.52	0.65
1988-2	0.36	0.4	0.45	0.52	0.65
1988-3	0.1	0.35	0.47	0.51	0.64
1988-4	0.12	0.601	0.64	0.708	0.839
1989-1	0.1425	0.5066	0.5737	0.6	0.7049
1989-2	0.1178	0.4165	0.5051	0.5329	0.6342
1989-3	0.1187	0.4221	0.5161	0.5416	0.6388
1989-4	0.12	0.3923	0.4908	0.5182	0.5883
1990-1	0.1213	0.3596	0.4667	0.4918	0.5666
1990-2	0.1203	0.3621	0.4689	0.4925	0.5683
1990-3	0.1212	0.3637	0.4711	0.4926	0.5694
1990-4	0.1208	0.3869	0.5065	0.5193	0.5935
1991-1	0.1295	0.4542	0.58348	0.58652	0.63714
1991-2	0.12115	0.517375	0.609375	0.601175	0.6191
1991-3	0.12185	0.550675	0.553525	0.61985	0.66595
1991-4	0.121725	0.580575	0.69655	0.6473	0.727175
1992-1	0.119025	0.568875	0.67975	0.689825	0.716775
1992-2	0.1189	0.584175	0.6963	0.696625	0.746775
1992-3	0.1093	0.571075	0.68345	0.685425	0.74045
1992-4	0.10752	0.57534	0.68916	0.69392	0.74226
1993-1	0.108425	0.5286	0.6383	0.692375	0.740425
1993-2	0.10785	0.528175	0.63975	0.695575	0.745875
1993-3	0.107825	0.528575	0.6399	0.69305	0.745225
1993-4	0.10942	0.52888	0.63792	0.6907	0.74732
1994-1	0.15494	0.70168	0.66304	0.87194	0.96118
1994-2	0.1616	1.1811	1.292925	1.12135	1.22395
1994-3	0.7406	0.54412	0.67498	0.74624	0.97512
1994-4	0.5034	0.60766	0.75768	0.80098	0.95306
1995-1	0.11348	0.70558	0.85692	0.89874	0.99908
1995-2	0.11704	0.62698	0.7311	0.78378	0.91006
1995-3	0.11474	0.59242	0.68978	0.73736	0.8645
1995-4	0.13176	0.77358	0.8055	0.83434	0.91544
1996-1	0.159075	0.79794	0.83184	0.8438	0.92848
1996-2	0.159075	0.756375	0.79205	0.840975	0.915675
1996-3	0.137175	0.75535	0.7962	0.8463	0.929975
1996-4	0.189575	0.75955	0.7965	0.845925	0.93745
1997-1	0.194425	0.710425	0.76595	0.82675	0.902275
1997-2	0.19545	0.703625	0.769775	0.826275	0.902125
1997-3	0.2129	0.758975	0.82165	0.90265	0.96235
1997-4	0.284425	0.7836	0.83155	0.913625	0.965725

	HF	GF	GNPr	P
1987-1	0.464687	0.3018	13407.1	100
1987-2	0.498278	0.3435	16308.8	100
1987-3	0.495789	0.4421	25229.1	100
1987-4	0.52092	0.4236	20074.2	100
1988-1	0.664654	0.6245	14522.1	152.4
1988-2	0.689018	0.631	16831.5	169
1988-3	0.565883	0.6414	25614.4	186.2
1988-4	0.686668	0.4677	19139.9	212.2
1989-1	0.556857	0.3997	14393.9	244.2
1989-2	0.61685	0.4553	16605.8	272.9
1989-3	0.632527	0.3469	26448.6	307.5
1989-4	0.504059	0.2687	19897.8	348.6
1990-1	0.496794	0.4258	16114.1	397.6
1990-2	0.504563	0.6164	19073.1	443.6
1990-3	0.548229	0.5499	27931.4	489.9
1990-4	0.625973	0.6272	21472.8	559.2
1991-1	0.756	1.0427	15899.8	645.2
1991-2	0.795071	0.7205	18738.9	731.4
1991-3	0.819964	0.6276	28891.1	817.4
1991-4	0.825834	0.5987	21357.3	957
1992-1	0.743667	0.6376	17290.8	1152.9
1992-2	0.922439	0.6849	19917.4	1212.6
1992-3	0.870604	0.6331	30444	1370.5
1992-4	0.929872	0.6777	22670.3	1588.3
1993-1	0.831403	0.6694	18267.7	1821.7
1993-2	0.869269	0.5947	22127.9	2027.9
1993-3	0.875275	0.5748	32820.2	2305.8
1993-4	0.891182	0.6963	24460.8	2717.2
1994-1	1.30003	3.5053	19017.2	3163.3
1994-2	3.1401	0.5394	19982	4377
1994-3	1.27357	0.6914	29960.4	4868.3
1994-4	1.37614	0.9204	22773.4	6127
1995-1	1.19962	0.66	18970.4	7201.8
1995-2	0.99992	0.5777	22502.7	8069.9
1995-3	1.16218	0.7315	32967.9	9311.4
1995-4	1.81736	1.0631	24587.2	10962.3
1996-1	1.26705	0.8994	20777.9	12879.7
1996-2	1.2586	0.653	24342.8	14721.8
1996-3	1.252	0.7387	34660.6	16643.2
1996-4	1.138	0.7399	26298.5	19344.8
1997-1	0.959	0.6512	22191.4	22818.4
1997-2	1.0099	0.7053	26505.7	26192.9
1997-3	1.159	0.7523	37571.1	31381.8
1997-4	1.225	0.7804	28326.5	38535.8

Table 2.a : Augmented Dickey-Fuller Test Results for I(0)

	With Constant	With Constant&Trend	With Constant,Trend& 3 Seasonal Dummies
LM1	1.53860	-0.62150	-0.58599
LM2	1.25280	-0.39759	-0.50572
LM2Y	1.78930	-0.49734	-0.55104
LM3a	1.72580	-0.07484	-0.15288
LM3	1.78290	-0.03777	-0.08710
LLO	2.12850	-0.45755	-0.50087
LGNPr	-0.48664	-3.93620*	-2.87590
LM1r	-1.09310	-3.23010	-2.87700
LM2r	-1.42100	-1.31220	-1.42570
LM2Yr	0.50727	-1.31270	-1.21670
LM3ar	-1.00140	-0.58510	-0.62689
LM3r	-1.38890	-0.44214	-0.42693
LLOr	0.85364	-1.07440	-0.91073
LP	2.15860	-1.48790	-1.42500
LSTL	-1.05880	-0.60275	-0.11174
L1MON	-1.27050	-3.85560*	-3.81420*
L3MON	-1.65700	-3.39390	-3.42790
L6MON	-1.18570	-3.48620	-3.23890
L1YEAR	-1.13960	-3.23010	-2.81680
LGF	-1.86120	-3.32530	-3.22910
LHF	-0.89395	-1.42270	-1.36040
Critical Values	5% -2.940 1% -3.612	5% -3.531 1% -4.216	5% -3.531 1% -4.216

Table 2.b : Augmented Dickey-Fuller Test Results for I(1)

	With Constant	With Constant & 3 Seasonal Dummies
DLM1	-2.89750	-3.21290*
DLM2	-2.48790	-2.48500
DLM2y	-2.35790	-2.26420
DLM3a	-1.72580	-2.04570
DLM3	-1.92470	-1.91800
DLLO	-1.82410	-1.75510
DLGNPr	-4.52660**	-3.98550**
DLM1r	-3.42700*	-3.31120*
DLM2r	-3.18390*	-2.96750*
DLM2yr	-3.64380**	-3.14780*
DLM3ar	-2.78690	-2.51070
DLM3r	-2.64030	-2.31110
DLLOr	-2.52790	-2.48500
DLP	-1.85610	-1.56010
DLSTL	-3.11050*	-2.50170
DL1MON	-3.82760**	-4.03280**
DL3MON	-3.84310**	-4.12860**
DL6MON	-3.87410**	-4.10930**
DL1YEAR	-4.56900**	-4.52380**
DLGF	-4.48320**	-4.65680**
DLHF	-3.32570*	-3.28020*
Critical Values	5% -2.942 1% -3.617	5% -2.942 1% -3.617

Table 2.c : Augmented Dickey-Fuller Test Results for I(2)

	With Constant	With Constant & 3 Seasonal Dummies
DDLM1	-3.54550**	-4.36940**
DDLM2	-3.67410**	-3.65160**
DDLM2y	-3.55760*	-3.44550**
DDLM3a	-3.66900**	-3.70970**
DDLM3	-3.62280**	-3.64790**
DDLLO	-3.47080*	-3.36190*
DDLM3ar	-3.12410*	-2.90490
DDLM3r	-3.12090*	-2.90320
DDLLOr	-3.00660*	-2.67400
DDLP	-3.34620*	-3.11210*
Critical Values	5% -2.945 1% -3.623	5% -2.945 1% -3.623

TABLE-3 SCHWARZ and HANNAN-QUINN INFORMATION CRITERIA

Number of Lags	LM1r	LM2r	LM2yr	DLM3ar	DLM3r	DLLOr
1	-19. 08 [-20. 08]	-25. 56 [26. 94]	-16. 92 [-17. 58]	-15. 88 [-16. 54]	-16.66 [-17.32]	-26.13 [-27.52]
2	-18. 40 [-19. 85]	-24. 58 [-26. 67]	-16. 23 [-17. 14]	-15. 35 [-16. 26]	-16.24 [-17.15]	-24.13 [-26.48]
3	-17. 81 [-19. 70]	-24. 18 [-26. 96]	-15. 97 [-17.12]	-15. 19 [-16. 35]	-16.51 [-17.68]	-23.70 [-26.48]
4	-17. 09 [-19. 72]	-23. 30 [-26. 77]	-15. 15 [-16. 95]	-14. 85 [-16. 26]	-16.05 [-17.46]	-22.39 [-25.86]
5	-17. 09 [-19. 87]	-23. 79 [-27. 95]	-15. 09 [-16. 73]	-14. 21 [-15. 87]	-15.38 [-17.05]	-23.95 [-28.12]

Table 4.a : Johansen Test Results for M1 for Finding the Cointegrating Vectors

Eigenvalues:

0.805592	0.503916	0.32124	0.244021	-2.31342e-02

Null	Alternative	Max.Eigen. Score(0.95)	Trace Score(0.95)
r = 0	r ≥ 1	62.24 (31.5)**	104.2 (63.0)**
r ≤ 1	r ≥ 2	26.64 (25.5)*	51.99 (42.4)**
r ≤ 2	r ≥ 3	14.72 (19.0)	25.35 (25.3)*
r ≤ 3	r = 4	10.63 (12.3)	10.63 (12.3)

Standardized β' Eigenvectors

Variable	LM1r	LGNPr	LSTL	DLP	Trend
Row 1	1.0000	-1.0390	-0.6235	10.5400	0.0157
Row 2	-0.3088	1.0000	0.0480	0.4251	-0.0156
Row 3	4.5970	4.6680	1.0000	7.1160	-0.0239
Row 4	0.2234	-9.6820	0.2983	1.0000	0.0930

Standardized α Coefficients

Column	1	2	3	4
LM1r	0.037150	0.3379	-0.072060	0.04707
LGNPr	-0.001029	-0.3667	-0.016070	0.03268
LSTL	0.686700	-2.7680	-0.128700	-0. 20120
DLP	-0.095580	0.2426	-0.008331	-0.03382

Table 4.b : Johansen Test Results for M2 for Finding the Cointegrating Vectors

Eigenvalues:
0.7087 0.652106 0.475131 0.320609 0.136762 6.96464e-17

Null	Alternative	Max.Eigen. Score(0.95)	Trace Score(0.95)
r = 0	r ≥ 1	46.87 (37.5)**	131.80 (87.3)**
r ≤ 1	r ≥ 2	40.12 (31.5)**	84.90 (63.0)**
r ≤ 2	r ≥ 3	24.50 (25.5)	44.77 (42.4)*
r ≤ 3	r ≥ 4	14.69 (19.0)	20.28 (25.3)
r ≤ 4	r = 5	5.59 (12.3)	5.59 (12.3)

Standardized β' Eigenvectors

Variable	LM2r	LGNPr	1YEAR	HF	DLP	Trend
Row 1	1.0000	10 . 6300	-1. 3440	0. 4044	29. 8800	-0. 1555
Row 2	0. 3439	1. 0000	0. 6005	0. 1810	-1. 5670	-0. 0199
Row 3	-1. 9010	8. 1490	1. 0000	-0.1347	-0. 1529	-0. 0925
Row 4	-0. 0070	0. 6504	-2. 5860	1. 0000	-3. 8980	0. 0050
Row 5	3. 0500	5. 9490	-0. 4549	0. 1208	1. 0000	-0. 0632

Standardized α Coefficients

Column	1	2	3	4	5
LM2r	0. 007979	0. 2085	0. 0327	-0. 03706	-0. 05290
LGNPr	-0. 003401	-0. 1261	-0. 0628	0. 03540	-0. 00910
1YEAR	-0. 021560	-0. 5363	0. 1338	0. 05672	-0. 01102
HF	-0. 214600	-1. 9490	0. 6096	-0. 39130	0. 02969
DLP	-0.041110	0.0865	0.0522	-0.00256	0.00416

Table 4.c : Johansen Test Results for M2y for Finding the Cointegrating Vectors

Eigenvalues:			
0.50181	0.285215	0.161678	-2.5411e-020

Null	Alternative	Max.Eigen. Score(0.95)	Trace Score(0.95)
r = 0	r ≥ 1	27.17 (25.5)*	47.15 (42.4)*
r ≤ 1	r ≥ 2	13.10 (12.1)	19.97 (25.3)
r ≤ 2	r = 3	6.88 (6.35)	6.88 (12.3)

Standardized β' Eigenvectors

Variable	LM2Yr	LGNPr	1YEAR	Trend
Row 1	1. 0000	-5. 0800	-1. 7120	0. 05520
Row 2	-0. 8753	1. 0000	-0. 8180	0. 01423
Row 3	-10. 5200	-7, 9840	1. 0000	0. 26930

Standardized α Coefficients

Column	1	2	3
LM2Yr	-0. 05981	0. 02165	0.023850
LGNPr	0. 13800	-0. 02536	0. 006468
1YEAR	-0. 05450	0.37550	-0. 002165

Table 4.d : Johansen Test Results for M3a for Finding the Cointegrating Vectors

Eigenvalues:			
0.652383	0.602449	0.256397	-6.31978e-017
Null	**Alternative**	**Max.Eigen. Score(0.95)**	**Trace Score(0.95)**
r = 0	r ≥ 1	40.15 (25.5)**	86.46 (42.4)**
r ≤ 1	r ≥ 2	35.05 (19.0)**	46.31 (25.3)**
r ≤ 2	r = 3	11.26 (12.3)	11.26 (12.3)

Standardized β' Eigenvectors

Variable	DLM3ar	LGNPr	1MON	Trend
Row 1	1. 0000	-0. 3147	-0. 4805	0. 008433
Row 2	0. 9846	1. 0000	0. 7935	-0. 020180
Row 3	1. 8550	44. 7100	1. 0000	-0. 494500

Standardized α Coefficients

Column	1	2	3
DLM3Ar	-0. 98300	-0. 24630	-0. 001536
LGNPr	0. 10620	-0. 05232	-0. 010430
1MON	0. 02038	-0. 84200	0. 023590

Table 4.e : Johansen Test Results for M3 for Finding the Cointegrating Vectors

Eigenvalues:
0.651003 0.541871 0.274129 -2.60446e-017

Null	Alternative	Max.Eigen. Score(0.95)	Trace Score(0.95)
r = 0	r ≥ 1	40.00 (25.5)**	81.84 (42.4)**
r ≤ 1	r ≥ 2	29.66 (19.0)**	41.84 (25.3)**
r ≤ 2	r = 3	12.17 (12.3)	12.17 (12.3)

Standardized β' Eigenvectors

Variable	DLM3r	LGNPr	6MON	Trend
Row 1	1. 0000	-0.1505	-0. 2319	0.0036
Row 2	0. 0643	1. 0000	0. 9210	-0.0212
Row 3	-2. 5400	-20.5500	1. 0000	0.2102

Standardized α Coefficients

Column	1	2	3
DLM3r	-1.1850	0.07585	0.01130
LGNPr	0.1207	-0.20560	0.01884
6MON	-0.7079	-0.61070	-0.03689

Table 4.f : Johansen Test Results for LO for Finding the Cointegrating Vectors

Eigenvalues:

0.772867	0.669327	0.451261	0.259554	0.196508	3.17614e-017

Null	**Alternative**	**Max.Eigen. Score(0.95)**	**Trace Score(0.95)**
r = 0	r ≥ 1	56.32 (37.5)**	140.90 (87.3)**
r ≤ 1	r ≥ 2	42.05 (31.5)**	84.59 (63.0)**
r ≤ 2	r ≥ 3	22.81 (25.5)	42.54 (42.4)*
r ≤ 3	r ≥ 4	11.42 (19.0)	19.73 (25.3)
r ≤ 4	r ≥ 5	8.31 (12.3)	8.31 (12.3)

Standardized β' Eigenvectors

Variable	DLLOr	LGNPr	1MON	HF	DLP	Trend
Row 1	1.0000	-0.1253	-0.3465	0.0236	0.1789	0.0039
Row 2	2.9230	1.0000	-0.5273	-0.1425	6.1380	-0.0121
Row 3	0.2679	1.9870	1.0000	0.3036	-3.4030	-0.0346
Row 4	-0.4390	14.7900	-3.0110	1.0000	0.3003	-0.1528
Row 5	0.0346	-0.5149	1.9400	-0.7971	1.0000	0.0015

Standardized α Coefficients

Column	1	2	3	4	5
DLLOr	-1.1870	-0.0092	-0.1336	0.0057	-0.0516
LGNPr	0.0792	-0.0269	-0.0681	-0.0300	-0.0380
1MON	1.2320	-0.3962	-0.2682	0.0989	-0.0035
HF	3.1510	-1.2250	-0.6499	0.3003	0.5515
DLP	0.6183	-0.2601	0.0465	0.0217	0.0418

Table5.a : Weak Exogeneity Test Results for M1

Variable	LM1r	LGNPr	LSTL	DLP
$\chi^2(3)$	44.983	38.255	24.621	20.937
p-value	[0.000]**	[0.000]**	[0.000]**	[0.000]**

Table 5.b : Weak Exogeneity Test Results for M2

Variable	LM2r	LGNPr	1 Year	HF	DLP
$\chi^2(4)$	36.673	14.747	27.584	23.238	9.063
p-value	[0.000]**	[0.005]**	[0.000]**	[0.000]**	[0.060]

Table 5.c : Weak Exogeneity Test Results for M2y

Variable	LM2yr	LGNPr	1Year
$\chi^2(2)$	16.795	1.4380	13.496
p-value	[0.000]**	[0.487]	[0.001]**

Table 5.d : Weak Exogeneity Test Results for M3a

Variable	DLM3ar	LGNPr	1MON
$\chi^2(2)$	0.9471	18.373	5.7670
p-value	[0.623]	[0.000]**	[0.056]**

Table 5.e : Weak Exogeneity Test Results for M3

Variable	DLM3r	LGNPr	6MON
$\chi^2(2)$	4.6509	17.206	13.693
p-value	[0.098]	[0.000]**	[0.001]**

Table 5.f : Weak Exogeneity Test Results for LO

Variable	DLLOr	LGNPr	1MON	HF	DLP
$\chi^2(4)$	5.2557	33.781	38.478	44.233	18.837
p-value	[0.262]	[0.000]**	[0.000]**	[0.000]**	[0.001]**

Table 6-a : Single Equation Estimation Results for M1

Variable	Coefficient	t-value	Coefficient	t-value
Constant	-4.66380	-0.455	-3.71710	-2.610
DLM1r-1	0.24133	0.730		
DLM1r-2	-0.02790	-0.104		
DLGNPr	11.28400	1.506	0.69436	4.244
DLGNPr-1	-0.26580	-0.388		
DLGNPr-2	-0.31094	-0.524		
DLSTL	-0.00046	-0.004		
DLSTL-1	-0.00636	-0.882		
DLSTL-2	-0.02982	-0.524		
DDLP	-0.09706	-0.163	-0.33381	-1.545
DDLP-1	20.7790	1.551		
DDLP-2	11.2440	1.452		
CM1.1-1	-0.19902	-1.230		
CM1.2-1	0.94501	0.816	0.92182	5.694
CM1.3-1	-0.06038	-1.639	-0.06418	-3.053
Trend	0.00020	0.127		
Seasonal	-0.07686	-0.200		
Seasonal-1	-0.34763	-0.748		
Seasonal-2	-0.59548	-1.594	-0.23308	-3.158
R^2	0.732		0.648	
σ	0.088		0.076	
DW	1.820		1.750	
AR 1-3 F(5,25)			1.33814 [0.2809]	
ARCH 3 F(3,27)			0.40860 [0.7481]	
X_i^2 F(9,20)			0.77930 [0.6375]	
Xi*Xj F(19,10)			0.49624 [0.9094]	
RESET F(1,29)			0.23559 [0.6311]	
CHOW F(6,24)			0.14458	
Normality χ^2			4.18920 [0.1213]	
Mean			0.00000	
Std. Devn.			0.69019	
Skewness			0.72000	
Excess Kurtosis			0.93000	
Minimum			-0.15169	
Maximum			0.19690	

CHOW = ((0.172-0.056-0.110)/(0.056+0.110))×((36-12)/6) = 0.14458

Note : The number of observations, the number of variables in the general model and the number of variables in the parsimonious model are 36, 19, 6, respectively.

Table 6-b : Single Equation Estimation Results for M2

Variable	Coefficient	t-value	Coefficient	t-value
Constant	-2.11290	-0.253	-0.47837	-0.568
DLM2r-1	-0.87881	-2.009	-0.44749	-1.877
DLM2r-2	-0.86882	-2.077	-0.33896	-2.094
DLGNPr	0.14853	0.207		
DLGNPr-1	0.31828	0.546		
DLGNPr-2	0.05403	0.096		
D1YEAR	0.15731	0.383		
D1YEAR-1	0.18987	0.466		
D1YEAR-2	0.42981	1.117		
DHF	0.11726	1.157		
DHF-1	-0.12232	-1.170		
DHF-2	-0.10557	-1.315		
DDLP	-1.08750	-1.391		
DDLP-1	0.45591	0.465		
DDLP-2	-0.19557	-0.509	-0.33360	-2.096
CM2.1-1	-0.03263	-0.862		
CM2.2-1	1.40970	2.080	0.38971	1.858
CM2.3-1	-0.14989	-1.702	-0.05686	-2.115
Trend	-0.00023	0.174		
Seasonal	0.09856	0.269		
Seasonal-1	0.07513	0.201		
Seasonal-2	-0.12616	-0.338		
R^2	0.6520		0.273	
σ	0.069		0.070	
DW	2.14		2.230	
AR 1-3 F(3,28)			1.87580 [0.1566]	
ARCH 3 F(3,25)			1.16600 [0.3424]	
X_i^2 F(10,20)			0.96952 [0.4976]	
Xi*Xj F(20,10)			1.59870 [0.2248]	
RESET F(1,30)			0.00185 [0.9660]	
CHOW F(6,25)			-1.91103	
Normality χ^2			1.93060 [0.3809]	
Mean			0.00000	
Std. Devn.			0.06365	
Skewness			0.36981	
Excess Kurtosis			-0.64288	
Minimum			-0.12126	
Maximum			0.13042	

CHOW = ((0.072-0.047-0.086)/(0.047+0.086))×((37-12)/6) = -1.91103

Note : The number of observations, the number of variables in the general model and the number of variables in the parsimonious model are 37, 22, 6, respectively.

Table 6-c : Single Equation Estimation Results for M2y

Variable	Coefficient	t-value	Coefficient	t-value
Constant	-7.92680	-1.532	1.21380	2.159
DLM2yr -1	-0.14774	-0.715		
DLM2yr- 2	-0.13860	-0.760		
DLGNPr	0.59116	1.489		
DLGNPr-1	-0.22734	-0.581	0.12911	2.932
DLGNPr-2	-0.06534	-0.199		
D1YEAR	0.05957	0.434		
D1YEAR-1	-0.03516	-0.172	0.17468	1.733
D1YEAR-2	-0.09524	-0.527		
CM2y.1-1	-0.18237	-1.546	0.02741	2.130
Trend	-2,29E-02	-0.003		
Seasonal	0.03168	0.150		
Seasonal-1	0.02942	0.129		
Seasonal-2	-0.14237	-0.671		
R^2	0.400		0.220	
σ	0.030		0.050	
DW	1.730		2.190	
AR1-3 F(3,30)			0.08755 [0.4996]	
ARCH 3 F(3,27)			0.25133 [0.8597]	
X_i^2 F(6,26)			0.79993 [0.5788]	
X_i*X_j F(9,23)			0.60159 [0.7827]	
RESET F(1,32)			0.19401 [0.6626]	
CHOW F(4,29)			0.17901	
Normality χ^2			5.12160 [0.0772]	
Mean			0.00000	
Std. Devn.			0.04744	
Skewness			0.86092	
Excess Kurtosis			0.71650	
Minimum			0.08074	
Maximum			0.14067	

CHOW = ((0.083-0.058-0.023)/(0.058+0.023))×((37-8)/4) = 0.17901

Note : The number of observations, the number of variables in the general model and the number of variables in the parsimonious model are 37, 14, 4, respectively.

Table 6-d : Single Equation Estimation Results for M3a

Variable	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Constant	-2.37760	-0.960	1.6725	2.506
DDLM3ar-1	0.26437	1.128		
DDLM3ar-2	0.12180	0.815		
DLGNPr	0.26613	0.701		
DLGNPr-1	0.23258	0.796	0.14312	2.964
DLGNPr-2	0.12592	0.385		
D1MON	0.09653	0.769		
D1MON-1	-0.06041	-0.369	0.15095	2.067
D1MON-2	-0.17030	-1.547		
CM3a.1-1	-11.80300	-4.000	-0.82989	-5.847
CM3a.2-1	-0.15326	-0.687	-0.43521	-7.391
Trend	0.00032	0.358		
Seasonal	0.11701	0.554		
Seasonal-1	0.24669	1.023		
Seasonal-2	0.00950	0.043		
R^2	0.830		0.730	
σ	0.005		0.056	
DW	2.050		1.630	
AR 1-3 F(3,29)			0.49015 [0.6918]	
ARCH 3 F(3,26)			0.83397 [0.4874]	
X_i^2 F(8,23)			0.42788 [0.8922]	
Xi*Xj F(14,17)			0.43672 [0.9381]	
RESET F(1,31)			1.38020 [0.2490]	
CHOW F(5,27)			0.53407	
Normality χ^2			1.57110 [0.4559]	
Mean			0.00000	
Std. Devn.			0.05188	
Skewness			0.42794	
Excess Kurtosis			0.08957	
Minimum			-0.10985	
Maximum			0.13537	

CHOW = ((0.100-0.058-0.033)/(0.058+0.033))×((37-10)/5) = 0.53407

Note : The number of observations, the number of variables in the general model and the number of variables in the parsimonious model are 37, 15, 5, respectively.

Table 6-e : Single Equation Estimation Results for M3

Variable	Coefficient	t-value	Coefficient	t-value
Constant	-0.37415	-0.118	2.06030	3.006
DDLM3r-1	0.27069	0.860		
DDLM3r-2	0.23870	1.242		
DLGNPr	0.08476	0.190		
DLGNPr-1	0.21116	0.668	0.15107	3.098
DLGNPr-2	0.00148	0.004		
D6MON	-0.13058	-0.554		
D6MON-1	0.16765	0.686	0.34857	3.300
D6MON-2	-0.18022	-0.862		
CM3.1-1	-1.39040	-3.041	-1.08720	-6.998
CM3.2-1	-0.18827	-0.568	-0.37257	-5.476
Trend	0.00039	0.397		
Seasonal	0.10852	0.484		
Seasonal-1	0.16726	0.672		
Seasonal-2	0.03450	0.145		
R^2	0.797		0.728	
σ	0.057		0.054	
DW	1.980		1.720	
AR 1-3 F(3,29)			0.45742 [0.7141]	
ARCH 3 F(3,26)			1.37770 [0.2716]	
X_i^2 F(8,23)			0.43576 [0.8872]	
Xi*Xj F(14,17)			0.37713 [0.9642]	
RESET F(1,31)			1.20950 [0.2799]	
CHOW F(5,27)			0.78072	
Normality χ^2			0.53376 [0.7658]	
Mean			-0.00000	
Std. Devn.			0.05063	
Skewness			0.13532	
Excess Kurtosis			-0.10474	
Minimum			-0,11146	
Maximum			0.12622	

CHOW = ((0.095-0.033-0.050)/(0.033+0.050))×((37-10)/5) = 0.78072

Note : The number of observations, the number of variables in the general model and the number of variables in the parsimonious model are 37, 15, 5, respectively.

Table 6-f : Single Equation Estimation Results for LO

Variable	Coefficient	t-value	Coefficient	t-value
Cunstant	-1.19350	-0.541	-0.26974	-0.636
DDLLOr-1	0.72467	2.181		
DDLLOr-2	0.30654	1.651		
DLGNPr	0.25587	0.990		
DLGNPr-1	0.12738	0.649	0.07821	3.487
DLGNPr-2	0.20899	1.042		
D1MON	0.12014	0.799	0.29563	6.559
D1MON-1	-0.28228	-2.021		
D1MON-2	-0.12104	-0.964		
DHF	0.05606	1.205		
DHF-1	0.04568	1.148		
DHF-2	0.00078	-0.020		
DDLP	-1.02210	-4.098	-1.10760	-8.337
DDLP-1	-0.19150	-0.392	-0.27628	-6.880
DDLP-2	0.14565	0.561		
CLO.1-1	-2.11100	-5.653	-1.13200	-4.343
CLO.2-1	-0.12767	-1.355	-0.11753	-1.758
CLO.3-1	-0.01367	-0.164		
Trend	0.00072	1.286		
Seasonal	0.21615	0.152		
Seasonal-1	0.05421	0.345		
Seasonal-2	-0.06354	-0.432		
R^2	0.940		0.890	
σ	0.029		0.027	
DW	2.080		2.280	
AR 1-3 F(3,27)			2.10600 [0.1470]	
ARCH 3 F(3,24)			0.67722 [0.5745]	
X_i^2 F(12,17)			1.10080 [0.4175]	
Xi*Xj F(27,2)			1.09230 [0.5876]	
RESET F(1,29)			0.07658 [0.7839]	
CHOW F(7,23)			1.87756	
Normality χ^2			2.64960 [0.2659]	
Mean			-0.00000	
Std. Devn.			0.02457	
Skewness			-0.60027	
Excess Kurtosis			0.19674	
Minimum			-0.07335	
Maximum			0.04046	

CHOW = ((0.022-0.010-0.004)/(0.010+0.004))×((37-14)/7) = 1.87756

Note : The number of observations, the number of variables in the general model and the number of variables in the parsimonious model are 37, 22, 7, respectively.

Table 7.a Schwarz and Hannan-Quinn Information Criteria for M3

Number of Lags	1	2	3	4	5
Schwarz	-21.46	-20. 28	-20. 63	-19. 59	-21. 45
Hannan-Quinn	-22. 85	-22. 36	-23. 40	-23. 06	-25. 61

Table 7.b Johansen Test Results for M3 for the Number of Cointegrating Vectors

Eigenvalues: 0.9386	0.630201	0.617293	0.362085	0.222273	-7.42933e-018
Null	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4
Alternative	r ≥ 1	r ≥ 2	r ≥ 3	r ≥ 4	r = 5
Trace Score(0.95)	207.0(87.3)**	100.9(63.0)**	63.13(42.4)**	26.64 (25.3)*	9.55 (12.3)

Table 7.c Standardized β' Eigenvector

Variable	DLM3r	DLGNPr	6MON	GF	HF	Trend
Row 1	1. 0000	-4. 1850	-0. 3712	-2. 7230	2. 1270	-0. 0188

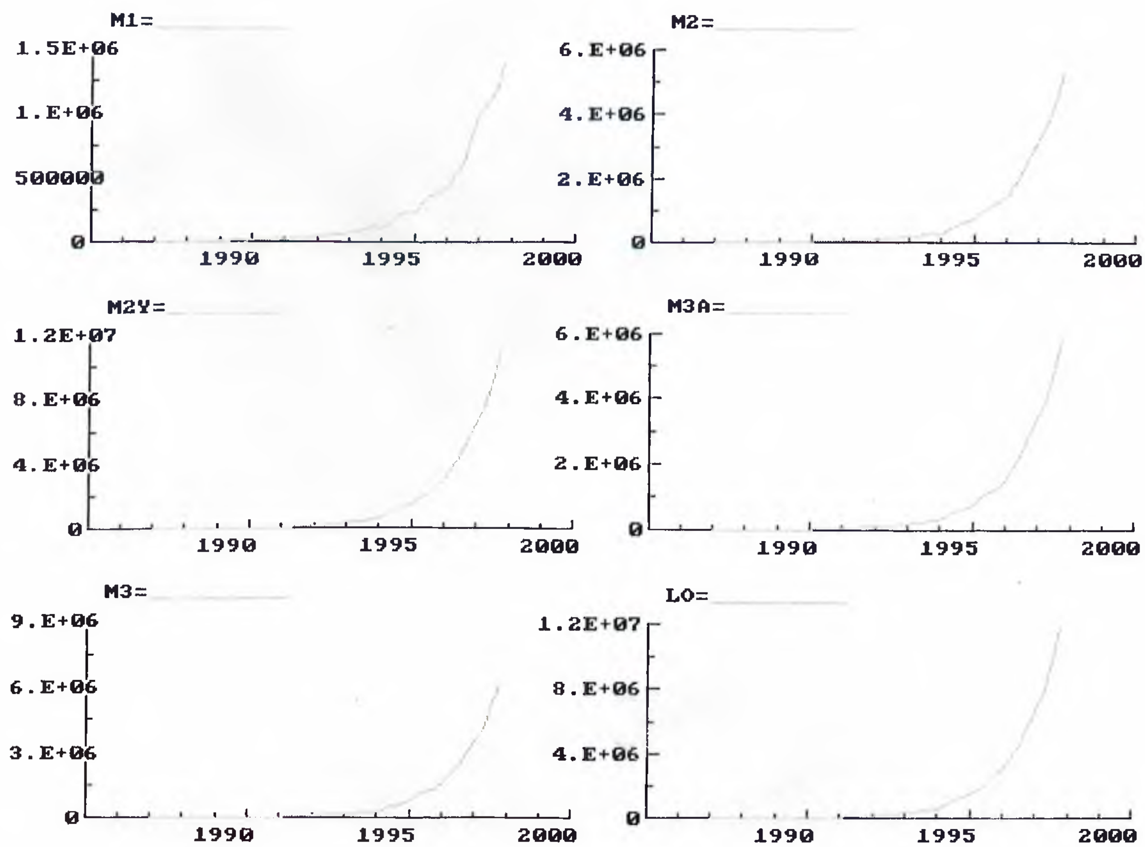
Table 7.d Results of Weak Exogeneity Test

Variable	DLM3r	DLGNPr	6MON	GF	HF
$\chi^2(4)$	73.402	68.132	80.608	75.867	68.967
p-value	[0.000]**	[0.000]**	[0.000]**	[0.000]**	[0.000]**

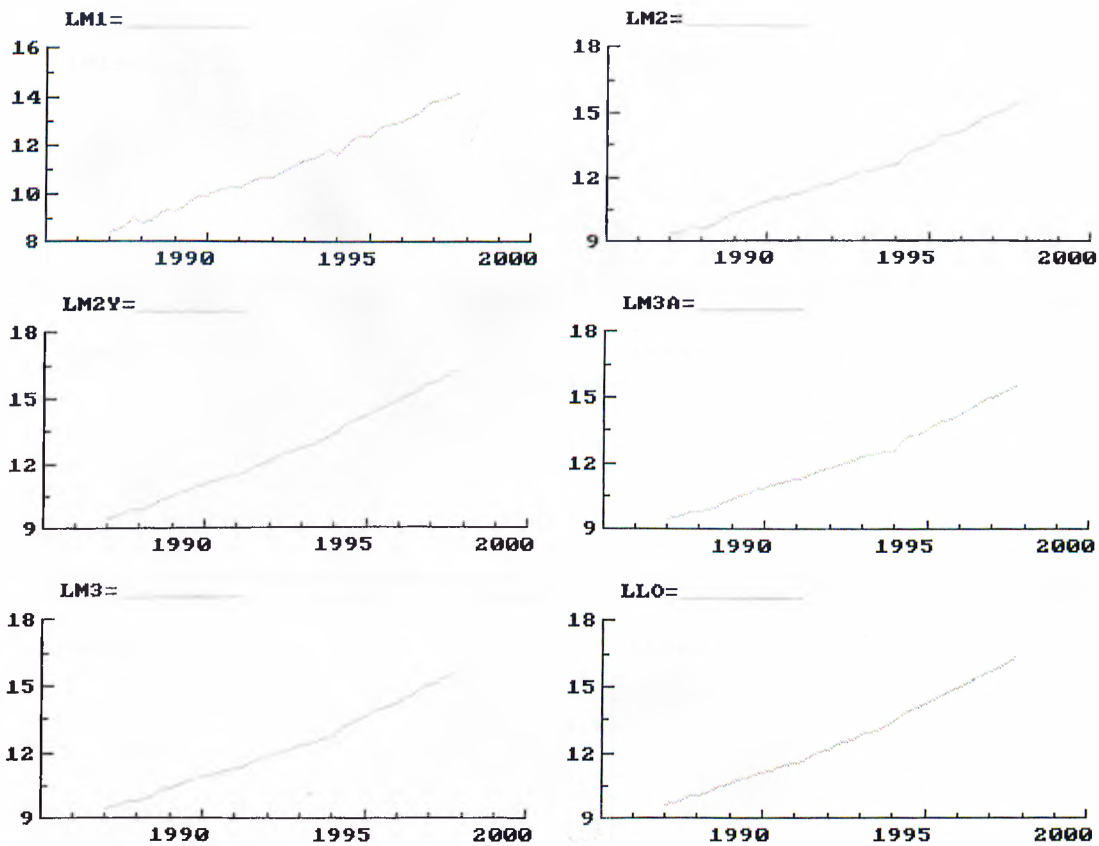
Table 7.e Single Equation Estimation Results for M3

Variable	Coefficient	t-value	Coefficient	t-value
Constant	-0.22171	-0.966	-0.12730	-5.716
DDLM3r-1	0.23875	0.607		
DDLM3r-2	-0.06080	-0.264		
DDLGNPr	-0.44421	-0.993		
DDLGNPr-1	0.10325	0.130	0.09457	3.268
DDLGNPr-2	-0.04910	-0.113		
D6MON	0.47798	1.176	0.21464	2.652
D6MON-1	-0.13399	-0.374		
D6MON-2	0.30421	0.925		
DGF	-0.06847	-2.478	-0.05306	-4.449
DGF-1	0.12880	1.284		
DGF-2	0.09033	1.586		
DHF	-0.09116	-0.907		
DHF-1	-0.07458	-1.048		
DHF-2	-0.08264	-1.655		
CM3.1-1	0.03906	0.691		
CM3.2-1	-0.64255	-0.512	-0.54090	-8.260
CM3.3-1	0.34808	2.251	0.36422	6.622
CM3.4-1	-0.00389	-0.191		
Trend	0.8467e-006	0.006		
Seasonal	0.10771	0.453		
Seasonal-1	0.23042	0.773		
Seasonal-2	0.26391	0.899		
R^2	0.912		0.812	
σ	0.047		0.046	
DW	2.360		1.760	
AR 1-3 F(3,28)			0.80698 [0.5007]	
ARCH 3 F(3,25)			0.82149 [0.4943]	
X_i^2 F(10,20)			0.70791 [0.7073]	
Xi*Xj F(20,10)			0.32305 [0.9849]	
RESET F(1,30)			0.70547 [0.4076]	
CHOW F(6,25)			0.70547	
Normality χ^2			1.23570 [0.5391]	
Mean			-0.00000	
Std. Devn.			0.04206	
Skewness			-0.07407	
Excess Kurtosis			0.14561	
Minimum			-0.10690	
Maximum			0.07645	

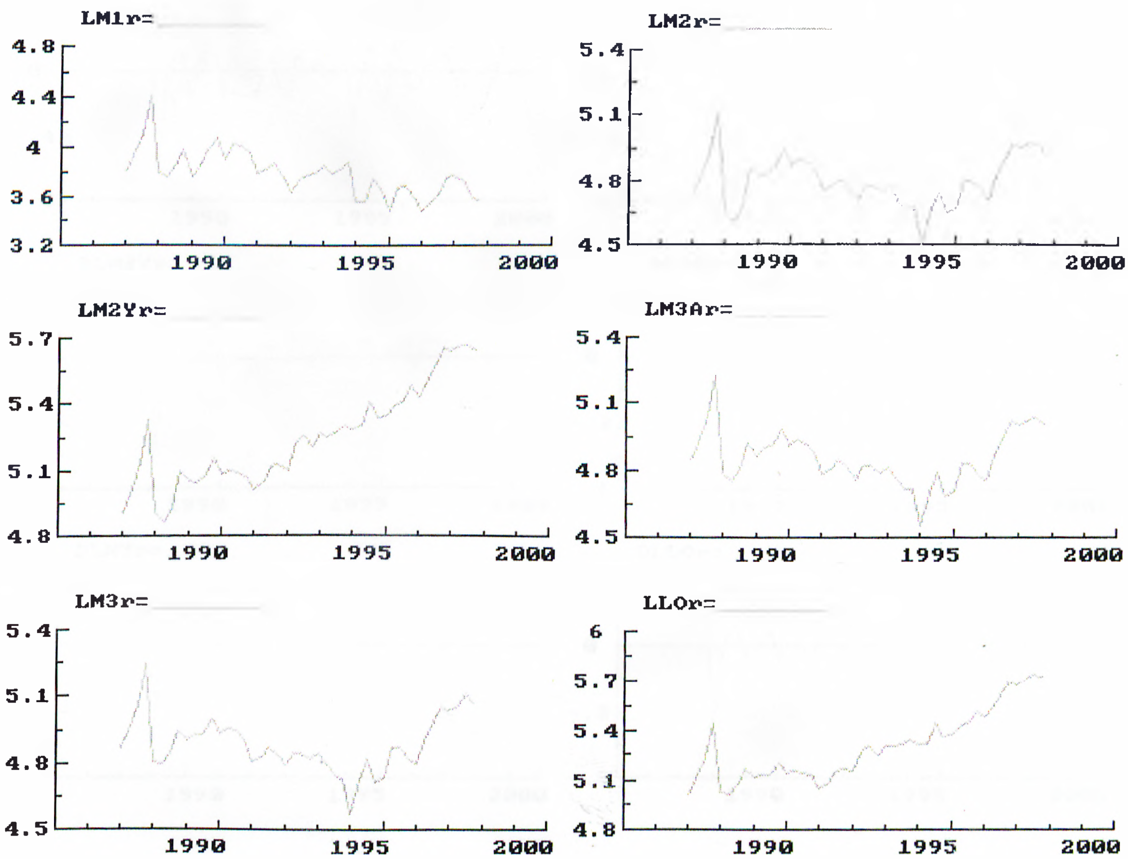
Graph 1- All Money Definitions at Levels



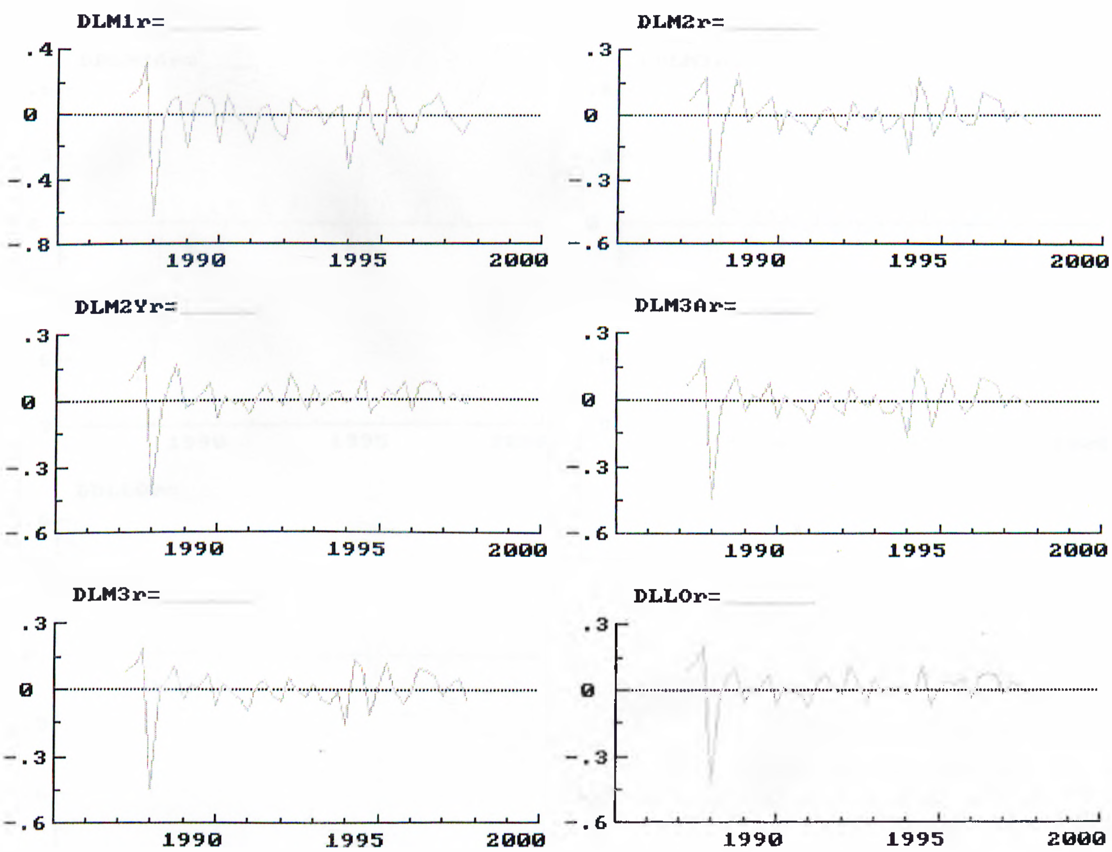
Graph 2- All Money Definitions at Log Levels



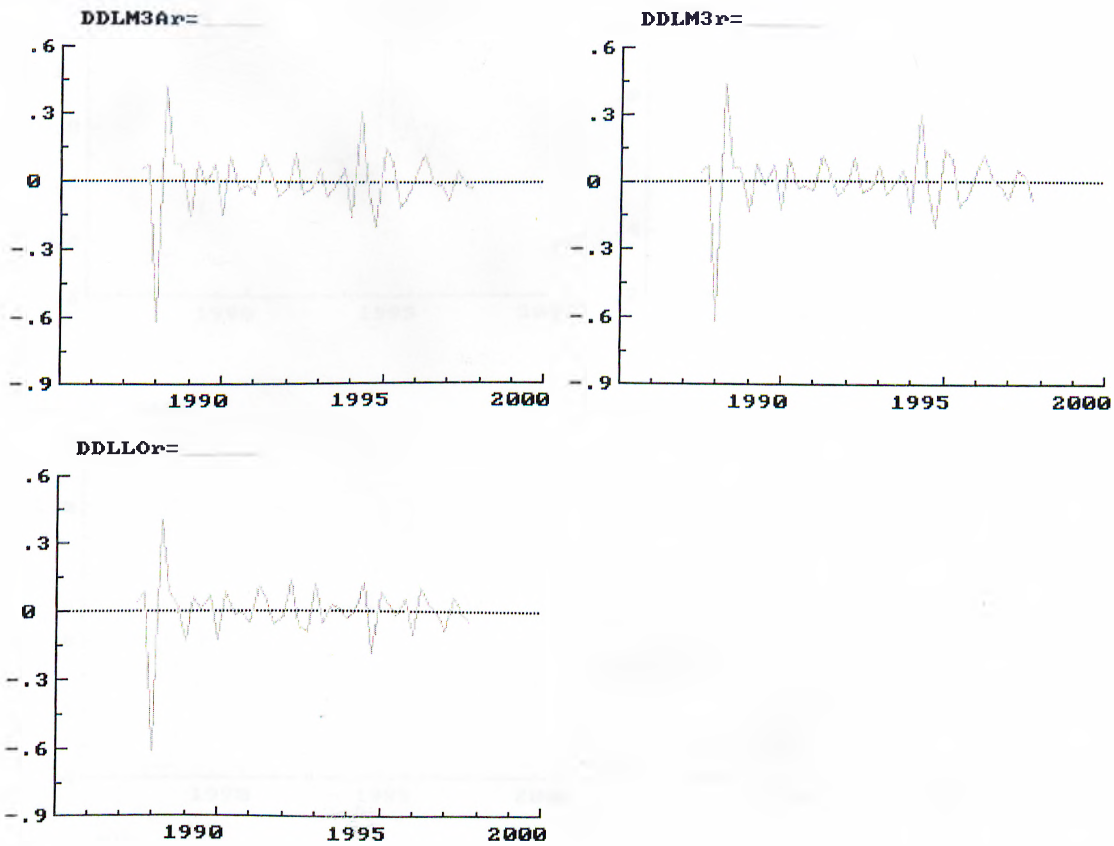
Graph 3- All Money Definitions in Real Terms



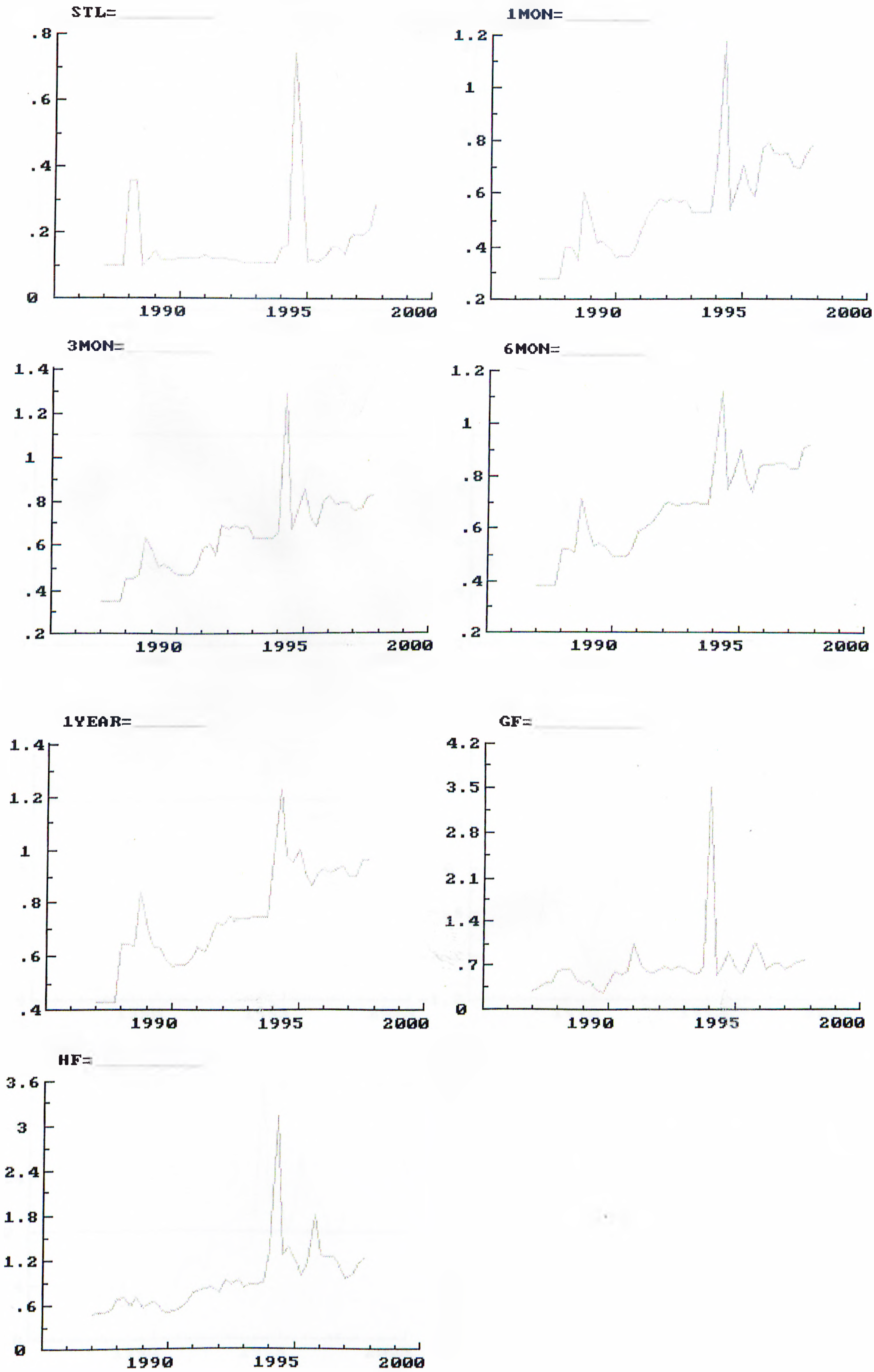
Graph 4- First Differences of all Real Money Definitions



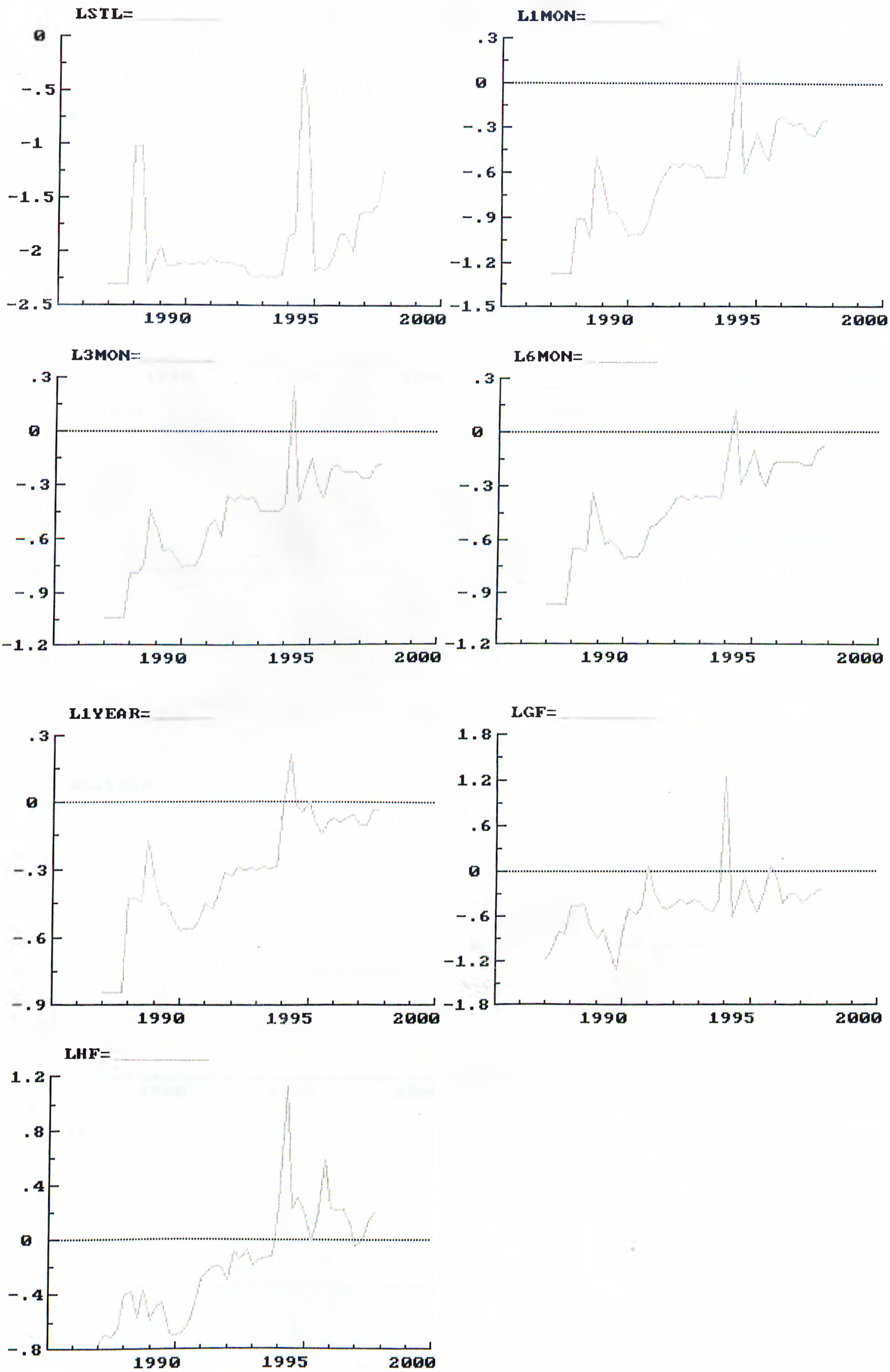
Graph 5- Second Differences of all I(2) Money Definitions



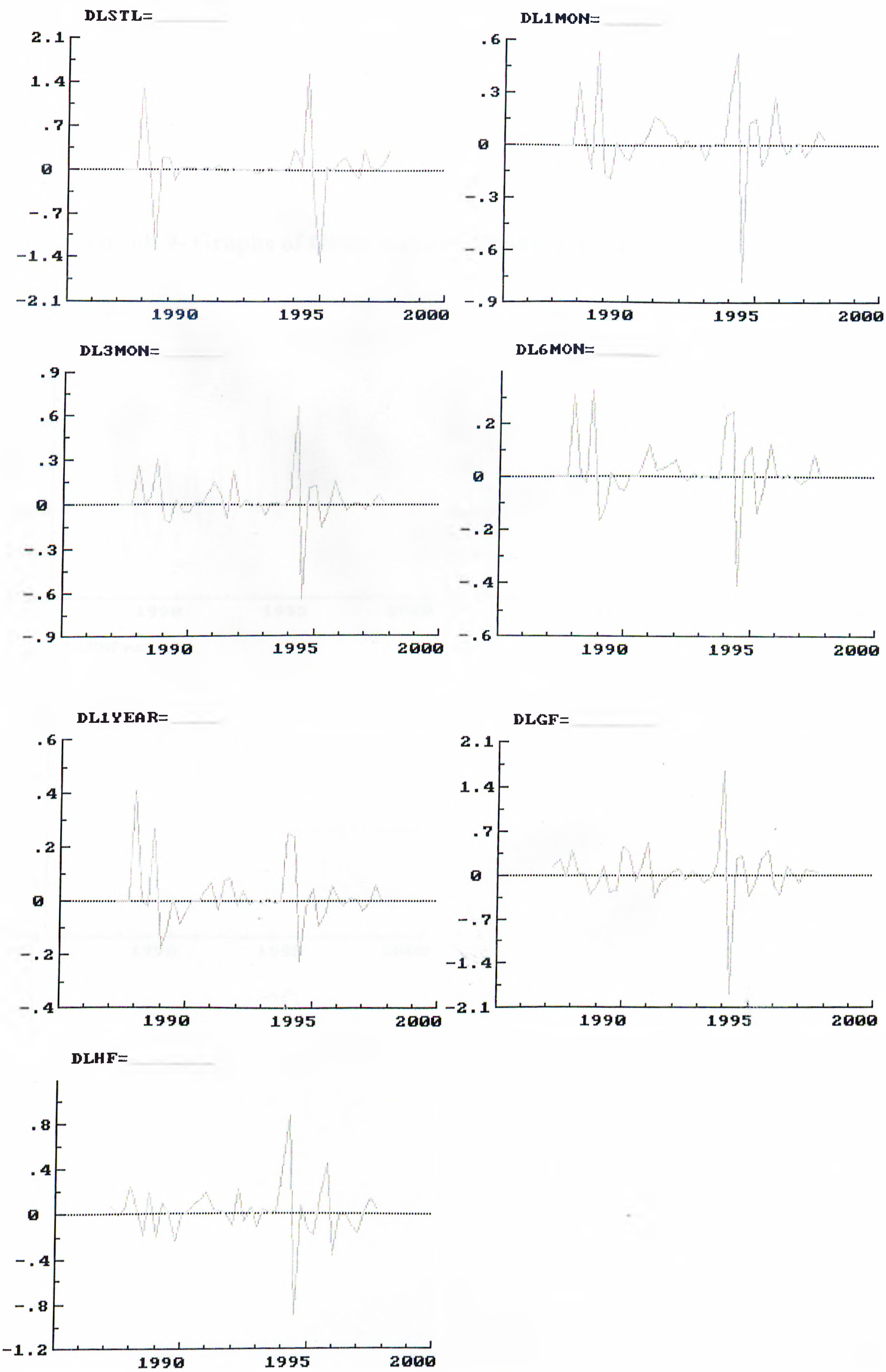
Graph 6- All Interest Rate Definitions at Levels



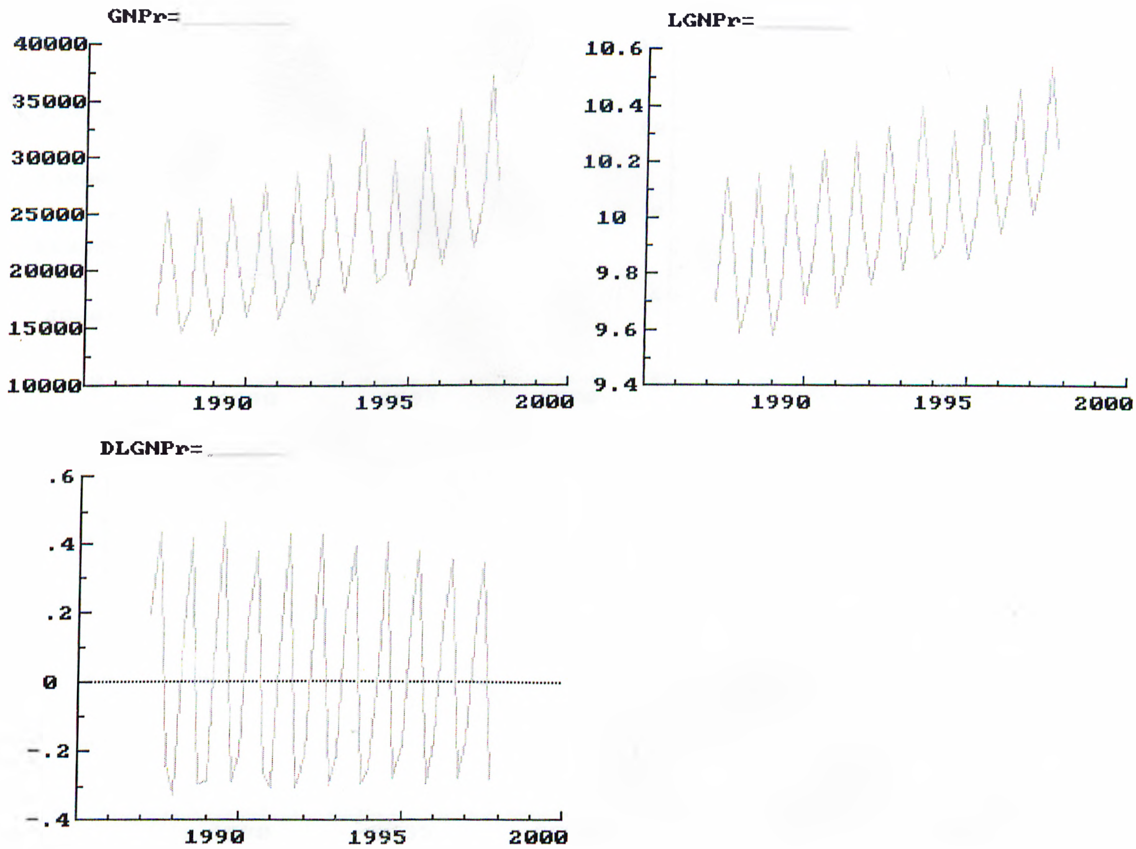
Graph 7- All Interest Rate Definitions at Log Levels



Graph 8- First Differences of all Interest Rate Definitions



Graph 9- Graphs of Gross National Product (GNPr)



Graph 10- Graphs of the Price Index (P)