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AN EMPIRICAL INVESTIGATION UPON MONEY MULTIPLIERS AND THEIR STABILITY IN TURKISH ECONOMY FOR THE POST - 1990 PERIOD

H. LEVENT KORAP*

Abstract

In this paper, we investigate whether the money multiplier process has a stable or forecastable characteristics in Turkish economy. Our estimation results point out that the processes leading to the money supply definitions over the base money indicates an unstable characteristics also decreasing the effectiveness of monetary policies applied by monetary authority. Besides, the sub-components of money multipliers give no support to a stable money multiplier process, thus do not support the Monetarist explanations in conduct of the monetary policy.

***Keywords**: Money Multipliers, Turkish Economy, Instability*

I. INTRODUCTION

As the pioneer of the Monetarist perspective of economics thought, Friedman (1968: 14) declares that in implementing the monetary policy the first requirement is that the monetary authority should guide itself by magnitudes that it can control, not by ones that it cannot control and suggests the control of monetary totals as the best available guide to be choosen for policy purposes. Thus in policy regimes based on controlling the monetary stocks have been alleged that the quantity of money supplied can be controlled, or at best, changes in factors affecting the money supplies can be foreseen by monetary authority also leading to the stability of monetary regime (Paya, 1998: 167). For instance, monetary targeting would be an appropriate policy regime in an inflationary environment if there exists a long run relationship between the changes in money stock and changes in price level, provided

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that the causality runs from the money stock changes into the price changes. Otherwise, given that a bi-directional causality occurs, no controlling on the money stock can possibly be provided by the monetary authority and this case would in turn help monetary aggregates be endogeneous out of control of monetary authority. Such a case can also be considered under different adjustment mechanisms leading to the endogeneity of money caused by changes in various economic aggregates.

Once agreed upon the importance of controlling the changes in monetary aggregates in a Monetarist perspective, effective policy making requires some stable relationships between these aggregates. As a partially or fully controllable target for monetary authority, the monetary base constitutes a fundamental relationship in policy making in order to estimate the appropriateness and stability of policies applied by these authorities. In this vine, the monetary base issued by the central bank is high-powered, because part of its is multiplied up as the banking system creates additional deposits as a major component of the money supply (Begg, Fischer and Dornbusch, 1994: 402). These processes leading to money supply definitions take us to the notion 'money multiplier' which tells us how much the money supply changes for a given change in monetary base and also which reflects the effect on money supply of other factors besides monetary base (Mishkin, 1997: 436). Hence the stability of money multiplier should be dealed with for an effective monetary policy practice (Keyder, 1998: 248).

In this paper, we examine the stability of money multiplier in a similar way to Şahinbeyoğlu (1995) which empirically tests whether the money multiplier exhibits stability by using stationarity and cointegration estimation techniques, rather than Gökbudak (1995) which interests in the same subject by distinguishing the base money and money supplies into sub-components and then examines the relationships between each other.

II. A MONEY MULTIPLIER MODEL FOR TURKISH ECONOMY

In costructing the multiplier process following the notation in Şahinbeyoğlu (1995), we first specify the money supply *(M_s)* in economy as the total of cash held by non-bank private sector *(C)* and the deposits of the banking system *(D)*,

$$M_s = C + D \qquad (1)$$

Also high powered money, i.e. monetary base *(B)*, would be consisting of the net liabilities of the central bank held by either the non-bank private sector *(RP)* or banks *(RB)*,

$$B = RP + RB \qquad (2)$$

multiplying both sides of (1) by $B / (RP + RB)$ would give,

$$M_s = [(C + D) / (RP + RB)] * B \qquad (3)$$

and further multiplying both the numerator and denominator of the term in square brackets by $1/D$, we will have the following identities,

$M_s = [(1 + (C / D)) / ((RP / D) + (RB / D))] * B$

$M_s = [(1 + c) / (p + b)] * B$

$M_s = k * B$ (4)

$k = M_s / B$ (5)

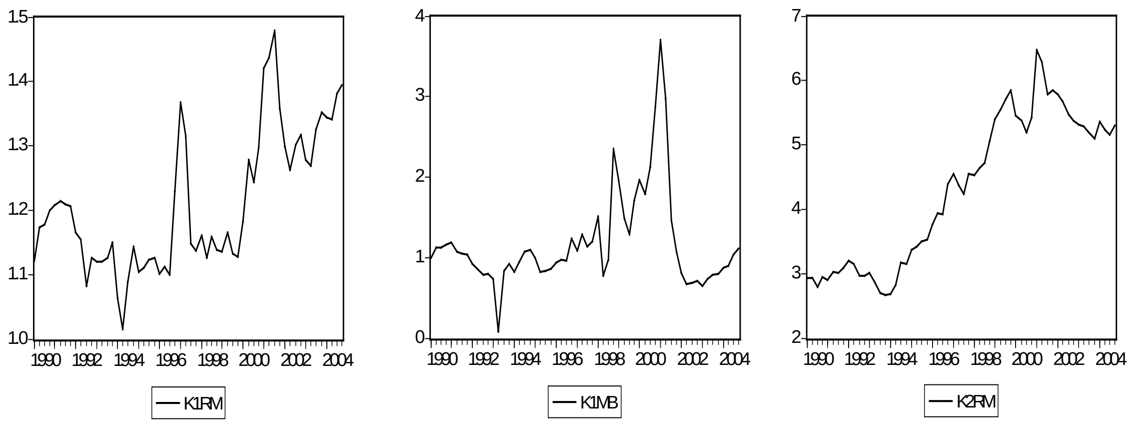
Above '*c*' is the ratio of the cash to deposits and '*p*' and '*b*' indicate the reserves to deposit ratio of the non-bank private sector and the reserve assets to deposit ratio of the commercial banks respectively. In equation (4), '*k*' equals to $[(1 + c) / (p + b)]$ and is called as the money multiplier which indicates that the changes in money supply are the products of the changes in monetary base (*B*) and changes in value of multiplier (*k*). Thus for a stable and predictable relationship between the monetary base and monetary aggregates originated from this aggregate, in equation (5) we expect that (M_s / B) is stationary. Or if we rearrange equation (5) in a logarithmic scale, we obtain equation (6) below in which all the terms are in natural logarithms,

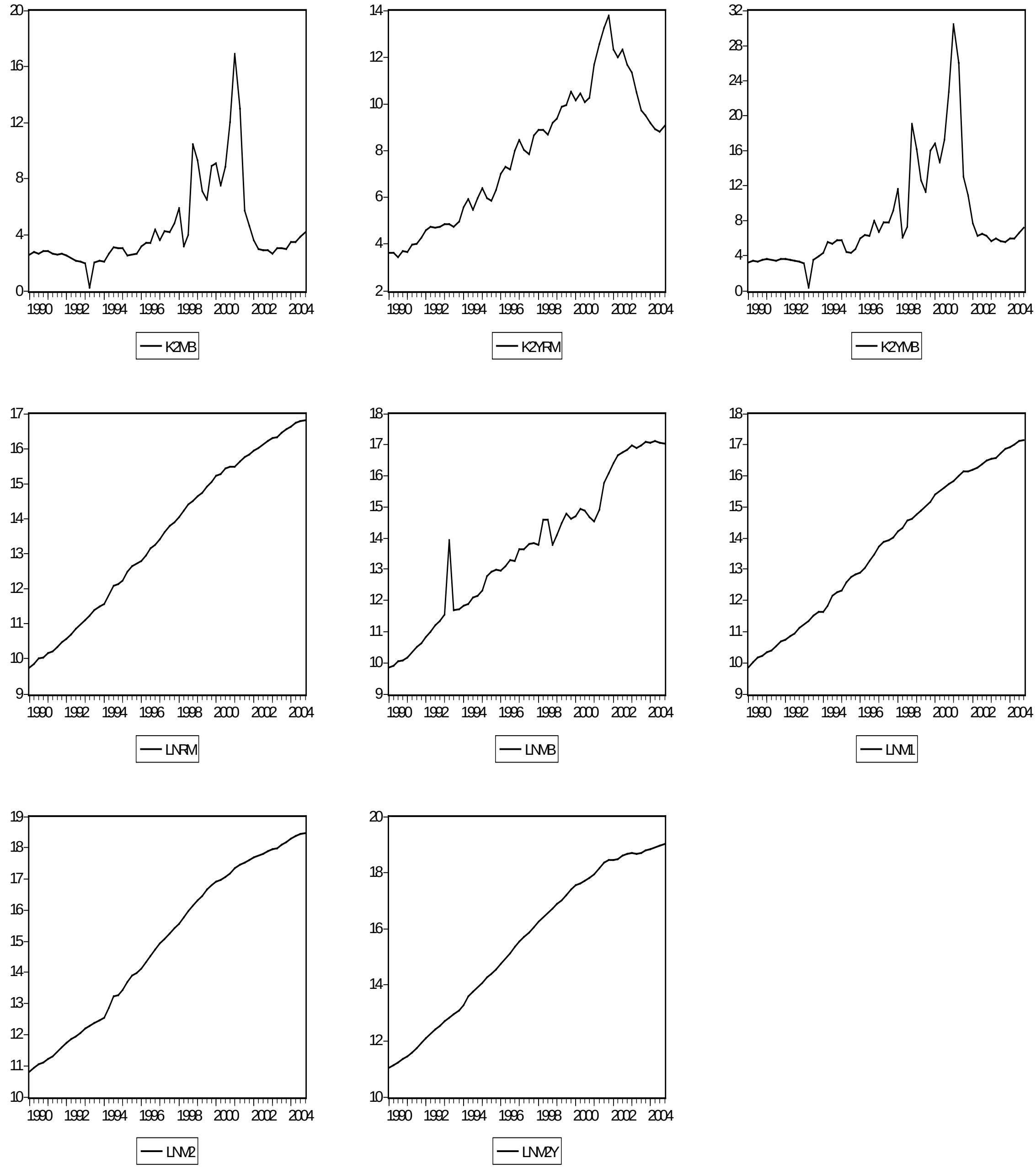
$lnk = lnM_s - lnB$ (6)

Thus a long run cointegration relationship between the money supply and monetary base each of them in log levels would also be a sufficient condition with a cointegrating parameter equal to one if they are non-stationary but have the same order of integration.

As a next step for our econometric analysis, we investigate the time series properties of the variables used. The time series representations of the various money multipliers and of the log-scaled variables used in this paper are seen in Table 1.

TABLE 1: TIME SERIES USED IN THE PAPER





We now make use of Eviews 5 User's Guide by QMS (2004: 505-507) for the explanations in unit root theory. Let us consider a simple *AR(1)* process,

$$y_t = \rho y_{t-1} + x_t{'}\delta + \varepsilon_t \tag{7}$$

where x_t are the optional exogenous regressors which may consist of constant or a constant and trend and ρ and δ are the parameters to be estimated. Also ε_t are assumed to be white noise. If $|\rho| \geq 1$, y is a nonstationary series and the variance of y increases with time and approaches infinity. If $|\rho| < 1$, y is a (trend-)stationary series. Thus, the hypothesis of (trend-)stationarity can be evaluated by testing whether the absolute value of ρ is strictly less than one.

The unit root tests that we consider test the null hypothesis of H_0: $\rho = 1$ against the one-sided alternative H_1: $\rho < 1$. Estimating equation (7) after subtracting y_{t-1} from both sides of equation would give,

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \varepsilon_t \tag{8}$$

where $\alpha = \rho - 1$. The null and alternative hypothesis may be written as,

$$H_0: \alpha = 0 \tag{9}$$

$$H_1: \alpha < 0$$

and evaluated using the conventional t-ratio for α,

$$t_\alpha = E(\alpha) / [se(E(\alpha))] \tag{10}$$

where $E(\alpha)$ is the estimate of α and $se(E(\alpha))$ is the coefficient standard error.

Dickey and Fuller (1979: 427-431) show that under the null hypothesis of a unit root, this statistic does not follow the conventional Student's t-distribution. They derive asymptotic results and simulate critical values for various test and sample sizes. More recently, MacKinnon (1996: 601-618) implements a much larger set of simulations than those tabulated by Dickey and Fuller. The more recent MacKinnon critical value calculations in this paper are also available in Eviews 5.0.

The simple Dickey-Fuller unit root test described above is valid only if the series is an $AR(1)$ process. If the series is correlated at higher order lags, the assumption of white noise disturbances ε_t is violated. The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the y series follows an $AR(p)$ process and adding p lagged difference terms of the dependent variable y to the right-hand side of the test regression,

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots.. + \beta_p \Delta y_{t-p} + v_t \tag{11}$$

This augmented specification is then used to test (9) using the t-ratio (10). A critical point here is the number of lagged differenced terms to be added to test regression and in our analysis we add a number of lags sufficient to remove serial correlation in the residuals. We additionally use the Phillips-Perron (PP) test for this purpose. Phillips and Perron (1988: 335-346) propose an alternative (non-parametric) method of controlling for serial correlation when testing for a unit root. The PP method estimates the non-augmented DF test equation (8) and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The asymptotic distribution of the PP modified t-ratio is the same as that of the ADF statistic.

We use the augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979: 427-431) and Phillips-Perron (PP) (Phillips and Perron, 1988: 335-346) unit root tests in order to check for the stationarity condition of our variables by comparing the ADF statistics and adjusted t-statistics obtained with the

MacKinnon (1996: 601-618) critical values. For the case of stationarity, we expect that these statistics are larger than the MacKinnon critical values in absolute value and that they have a minus sign. Although differencing eliminates the trend, we also report the results of the unit root tests for the first differences of the variables with a linear time trend in the test regression. The results for the estimation period 1990: 1 – 2004: 4 using quarterly data are shown in Table 2 and Table 3 below.[1] The prefix *'LN'* indicates the natural logarithm operator,

TABLE 2: ADF UNIT ROOT TESTS

	ADF test (in levels)		*ADF test (in first differences)*	
	Constant	*Constant&Trend*	*Constant*	*Constant&Trend*
Variable				
K1RM	*-1.743789(0)*	*-3.444001(1)*	*-6.707528(1)**	*-6.632154(1)**
K1MB	*-3.190790(1)***	*-3.247615(1)*	*-7.135625(1)**	*-7.080344(1)**
K2RM	*-1.082400(0)*	*-1.379562(0)*	*-6.736592(0)**	*-6.694043(0)**
K2MB	*-1.841135(2)*	*-1.878191(2)*	*-7.873974(1)**	*-7.824324(1)**
K2YRM	*-1.492278(0)*	*-0.230163(0)*	*-5.865470(0)**	*-5.981916(0)**
K2YMB	*-1.773689(2)*	*-1.761816(2)*	*-7.361307(1)**	*-7.335931(1)**
LNRM	*-1.277912(4)*	*-0.596146(4)*	*-1.560926(3)*	*-1.834635(3)*
LNMB	*-0.745827(1)*	*-5.151247(0)**	*-10.88631(0)**	*-10.79693(0)**
LNM1	*-1.288378(0)*	*-0.077653(0)*	*-6.357915(0)**	*-6.529371(1)**
LNM2	*-1.324579(1)*	*0.018138(1)*	*-4.671562(0)**	*-4.886229(0)**
LNM2Y	*-1.753907(1)*	*0.609820(1)*	*-3.123774(0)*	*-3.668400(0)***

MacKinnon (1996: 601-618) critical values

	Constant	*Constant&Trend*
%1 level	*-3.54*	*-4.12*
%5 level	*-2.91*	*-3.49*

where *RM* is the reserve money which is the sum of currency issued, deposits of banking sector as the required reserves and free deposits, extrabudgetary funds and deposits of non-bank sector, while *MB* is the central bank money which is the sum of reserve money, open market operations and YTL deposits

[1] For the MacKinnon critical values, we consider %1 and %5 level critical values for the null hypothesis of a unit root. The numbers in parantheses are the lags used for the ADF stationary test and augmented up to a maximum of 12 lags, and we add a number of lags sufficient to remove serial correlation in the residuals, while the Newey-West bandwidths are used for the PP test. The choice of the optimum lag for the ADF test was decided on the basis of minimizing the Schwarz Information Criterion (SC). The test statistics and the critical values are from the ADF or UNITROOT procedures in Eviews 5.0. ADF is the augmented Dickey-Fuller test with critical values based on MacKinnon (1996: 601-618). A significant test statistic rejects the null hypothesis in favor of stationarity. '*' and '**' indicate the rejection of the null hypothesis of a unit root for the %1 and %5 levels respectively. We should specify that all the computer outputs in this paper are available upon request.

of public sector all taken from the CBRT's analytical balance sheet. *M1* consists of the sum of the currency in circulation and demand deposits in the banking system, while *M2* is *M1* plus time deposits all in domestic currency. Also *M2Y* is *M2* plus deposits denominated in foreign currencies all taken from the electronic data delivery system of the CBRT. *K1RM* and *K1MB* are the money multipliers as to the *M1* money supply and are calculated by dividing *M1* money supply to outside money, i.e. to reserve money *(RM)* and central bank money *(MB)* respectively. A similar calculation is used in order to obtain money multipliers *K2RM* and *K2MB* as to the money supply *M2* and *K2YRM* and *K2YMB* as to the money supply *M2Y*.

TABLE 3: PP UNIT ROOT TESTS

	PP test (in levels)		*PP test (in first differences)*	
	Constant	*Constant&Trend*	*Constant*	*Constant&Trend*
Variable				
K1RM	*-1.769448(5)*	*-2.722145(4)*	*-8.240509(18)**	*-8.645143(19)**
K1MB	*-2.680003(3)*	*-2.708901(3)*	*-7.082438(12)**	*-7.011441(12)**
K2RM	*-1.086891(2)*	*-1.379562(0)*	*-6.681821(4)**	*-6.627602(4)**
K2MB	*-2.298348(6)*	*-2.445277(6)*	*-8.842684(36)**	*-9.370223(37)**
K2YRM	*-1.467506(3)*	*-0.660291(3)*	*-5.825042(2)**	*-6.002343(1)**
K2YMB	*-2.139433(5)*	*-2.239733(4)*	*-6.939137(16)**	*-7.108743(17)**
LNRM	*-1.600426(2)*	*0.539265(1)*	*-6.312571(1)**	*-6.534226(0)**
LNMB	*-0.704379(11)*	*-5.139120(1)**	*-16.60489(12)**	*-16.43237(12)**
LNM1	*-1.287527(3)*	*-0.076553(3)*	*-6.287840(4)**	*-6.397743(5)**
LNM2	*-1.390681(4)*	*0.145068(4)*	*-4.713148(1)**	*-4.933123(1)**
LNM2Y	*-2.221160(4)*	*1.822212(3)*	*-3.105590(6)***	*-3.588546(6)***
Test Critical Values				
%1 level	*-3.54*	*-4.12*		
%5 level	*-2.91*	*-3.49*		

When we examine the results of the unit root tests, we see that the null hypothesis that there is a unit root cannot be rejected for all the variables except the variables *K1MB* and *LNMB* using both constant and constant&trend terms in the test equation in the level form for ADF test. But inversely, for the first differences of all the variables except the variable *LNRM* the null hypothesis of a unit root is rejected at 1% level except the variable *LNM2Y* for which the null hypothesis is rejected at 5% level by considering a trend effect. Also the PP test statistics give similar results to those of ADF test. All the variables except the variable *LNMB* seem to be non-stationary in levels but stationary in first differences. Besides the variable *LNRM* is now estimated stationary in the first differenced form. We can thus conclude that all the money multipliers except the money multiplier *K1MB*, i.e. *K1RM*, *K2RM*, *K2MB*, *K2YRM* and *K2YMB* are estimated as non-stationary. For the money multiplier *K1MB*, the ADF and PP test statistics contrast with each other for the case of stationarity.

The unit root tests do not give definite results for the stationarity of the variables in logarithms. The ADF test statistics indicate that the variable *LNRM* is not stationary in both level and first differenced form, while the PP test statistics estimate the same variable as stationary in the first differenced form. Besides, the variable *LNMB* gives contradictory results which depend on whether the trend effect in the test equation is included in the level form. For the sake of easy of estimation, we accept that all the variables in logarithms contain a unit root, that is, non-stationary in their level forms but stationary in their first differenced forms, thus enable us testing for cointegration. This assumption would not make serious problem for the variables other than the variable *LNMB* in a cointegrating analysis, but we assume that general conclusions resulting from our analysis would not change seriously in this case.

We now examine whether the variables used are cointegrated with each other in line of the explanations given above. Engle and Granger (1987: 251-276) indicate that even though economic time series may be non-stationary in their level forms, there may exist some linear combinations of these variables that converge to a long run relationship over time. If the series are individually stationary after differencing but a linear combination of their levels is stationary, then the series are said to be cointegrated. That is, they cannot move too far away from each other in a theoretical sense (Dickey, Jansen and Thornton, 1991: 58). For this purpose, we estimate a VAR-based cointegration relationship using the methodology developed in Johansen (1991: 1551-1580) and Johansen (1995) in order to specify the long run relationship between the variables. We here make use of Eviews 5 User's Guide by QMS (2004: 735-748) for the explanations. Let us assume a VAR of order p,

$$y_t=A_1y_{t-1}+\ldots+A_py_{t-p}+Bx_t+\varepsilon_t \quad (12)$$

where y_t is a k-vector of non-stationarity $I(1)$ variables, x_t is a d-vector of deterministic variables as constant term, linear trend and seasonal dummies and ε_t is a vector of innovations. We can rewrite this VAR as,

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + \varepsilon_t \quad (13)$$

where,

$$\Pi = \sum_{i=1}^{p} A_i - I \qquad \Gamma_i = -\sum_{j=i+1}^{p} A_j \quad (14)$$

Granger representation theorem asserts that if the coefficient matrix Π has reduced rank $r<k$, then there exist kxr matrices α and β each with rank r such that $\Pi=\alpha\beta'$ and $\beta' y_t$ is $I(0)$. r is the number of cointegrating relations (the rank) and each column of β is the cointegrating vector. The elements of α

are known as the adjustment parameters in the vector error correction (VEC) model and measure the speed of adjustment of particular variables with respect to a disturbance in the equilibrium relationship. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π. Also we can express that this method performs better than other estimation methods even when the errors are non-normal distributed or when the dynamics are unknown and the model is over-parametrized by including additional lags (Gonzalo, 1994: 225).

We will now consider unrestricted VAR models with quarterly data for which the maximum lag number selected is 8 in order to estimate the bivariate cointegrating equations. Of special emphasize for the appropriate lag order to be choosen in the VAR equations is given for the mostly applied minimized Akaike's information criterion. As a next step we try to estimate the potential long run cointegrating relationship between the variables considered by using two likelihood test statistics offered by Johansen and Juselius (1990: 169-210) known as maximum eigenvalue for the null hypothesis of r versus the alternative of $r+1$ cointegrating relationships and trace for the null hypothesis of r cointegrating relations against the alternative of k cointegrating relations, for $r = 0,1,...,k-1$ where k is the number of endogeneous variables. For this purpose, we use the estimation results of max-eigen and trace tests with a linear deterministic trend restricted in cointegrating analysis, that is, intercept and trend in cointegration equation – no trend in VAR. We should specify that the critical values and their probabilities considering *0.05* significance level in choosing the rank level are taken from MacKinnon, Haug and Michelis (1999: 563-577), also available from the VAR and COINT procedures in Eviews 5.0. The estimation results are presented at Table 4 below,

TABLE 4: COINTEGRATION ANALYSIS BETWEEN THE SUB-DETERMINANTS OF MONEY MULTIPLIERS

Series: LNM1 LNRM

Lag interval (in first differences): 1 to 5

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.314376	25.05787	25.87211	0.0629
At most 1	0.039408	2.412333	12.51798	0.9378

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None*	0.314376	22.64553	19.38704	0.0162
At most 1	0.039408	2.412333	12.51798	0.9378

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

Normalized cointegrating coefficients (standard error in parantheses)

LNM1	LNRM	@TREND
-1.000000	1.064636	-0.005682
	(0.05552)	(0.00735)

Adjustment coefficients (standard error in parantheses)

D(LNM1)	-0.606697
	(0.20586)
D(LNRM)	0.017440
	(0.18561)

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Series: LNM1 LNMB

Lag interval (in first differences): 1 to 1

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.253228	18.96541	25.87211	0.2828
At most 1	0.023806	1.445666	12.51798	0.9924

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.253228	17.51974	19.38704	0.0915
At most 1	0.023806	1.445666	12.51798	0.9924

Both Trace and Max-eigenvalue tests indicate no cointegration at the 0.05 level

Normalized cointegrating coefficients (standard error in parantheses)

LNM1	LNMB	@TREND
-1.000000	-1.642365	0.340126
	(0.35143)	(0.04541)

Adjustment coefficients (standard error in parantheses)

D(LNM1)	-0.013601
	(0.01562)
D(LNMB)	-0.424182
	(0.09870)

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Series: LNM2 LNRM

Lag interval (in first differences): 1 to 5

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.243054	18.90642	25.87211	0.2863
At most 1	0.035981	2.198648	12.51798	0.9552

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.243054	16.70778	19.38704	0.1175
At most 1	0.035981	2.198648	12.51798	0.9552

Both Trace and Max-eigenvalue tests indicate no cointegration at the 0.05 level

Normalized cointegrating coefficients (standard error in parantheses)

LNM2	LNRM	@TREND
-1.000000	1.650862	-0.070158
	(0.08765)	(0.01162)

Adjustment coefficients (standard error in parantheses)

D(LNM2)	-0.229508
	(0.16027)
D(LNRM)	0.243301
	(0.13839)

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Series: LNM2 LNMB

Lag interval (in first differences): 1 to 6

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.254990	20.52731	25.87211	0.2004
At most 1	0.046641	2.865830	12.51798	0.8921

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.254990	17.66148	19.38704	0.0875
At most 1	0.046641	2.865830	12.51798	0.8921

Both Trace and Max-eigenvalue tests indicate no cointegration at the 0.05 level

Normalized cointegrating coefficients (standard error in parantheses)

LNM2	LNMB	@TREND
-1.000000	-2.539728	0.471850
	(0.52322)	(0.06671)

Adjustment coefficients (standard error in parantheses)

D(LNM2)	0.018475
	(0.01460)
D(LNMB)	-0.537121
	(0.13795)

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Series: LNM2Y LNRM

Lag interval (in first differences): 1 to 3

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.143467	11.47761	25.87211	0.8466
At most 1	0.035775	2.185837	12.51798	0.9561

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.143467	9.291778	19.38704	0.6741
At most 1	0.035775	2.185837	12.51798	0.9561

Both Trace and Max-eigenvalue tests indicate no cointegration at the 0.05 level

Normalized cointegrating coefficients (standard error in parantheses)

LNM2Y	LNRM	@TREND
-1.000000	1.822975	-0.087758
	(0.26218)	(0.03498)

Adjustment coefficients (standard error in parantheses)

D(LNM2Y)	-0.038944
	(0.05102)
D(LNRM)	0.119168
	(0.05026)

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Series: LNM2Y LNMB

Lag interval (in first differences): 1 to 2

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.171826	16.26400	25.87211	0.4716
At most 1	0.079220	4.952081	12.51798	0.6033

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.171826	11.31191	19.38704	0.4817
At most 1	0.079220	4.952081	12.51798	0.6033

Both Trace and Max-eigenvalue tests indicate no cointegration at the 0.05 level

Normalized cointegrating coefficients (standard error in parantheses)

LNM2Y	LNMB	@TREND
-1.000000	-155.3802	19.27348
	(46.5626)	(5.86990)

Adjustment coefficients (standard error in parantheses)

D(LNM2Y)	-0.000108
	(0.00013)
D(LNMB)	-0.003778
	(0.00122)

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Having estimated the potential cointegrating vector(s) in the long run variable space, we find a significant long run cointegrating vector between *LNM1* and *LNRM* with a coefficient not different from unity. If we take account of the relationship between *LNM1* and *LNMB*, estimating the cointegration analysis now gives no significant relationship between these variables. Similarly, considering the relationship between *LNM2* and *LNRM* does not yield any significant cointegrating vector, whilst we take account of the relationship between *LNM2* and *LNMB*, no significant long run vector is found by both trace and max-eigen statistics as well. As a last relationship between narrowly defined outside money and broad money balances, we examine whether there exists any long run cointegrating vector dealing with the *M2Y* aggregate including deposits denominated in foreign currencies. When we use *LNRM* with *LNM2Y*, no significant long run relationship is found between these variables. When we consider the variable *LNMB* in place of *LNRM* with *LNM2Y*, we find just the same results suggested by above findings.

All in all, the cointegrating analysis estimated in this paper points out that we could not find any cointegrating relationships between outside money under the liability of monetary authority and various money supply definitions created though the behavior of the economic agents in the economy, except the relationship between *M1* aggregate and reserve money. This results are in line with the money multipliers' stationarity test results estimated above. We have found as a whole in our empirical research that the instability characteristics of various money multipliers dominate the money markets under the investigation period, in the sense that does not give support to a Monetarist explanation of the developments in the money markets. This case would in turn lead to a conclusion that there had been no sufficient conditions for implementing an effective monetary policy for the case of Turkish economy under the investigation period.

III. CONCLUDING REMARKS

In a Monetarist perspective of economics thought, that monetary authority can control monetary aggregates and foresee their growth paths is of great importance for policy purposes. Implementing the monetary policy would result in accordance with *ex-an*te expectations, provided that the behaviour of the money multipliers indicate a stable relationship or that there exists a long run relationship foreseen by the monetary authority between the sub-determinants of these multipliers leading to the consistent estimates with respect to the future monetary policies.

We investigated in our paper whether this stability condition could have been provided for the period of 1990 – 2004 in Turkish economy. For this purpose, the stability of various money multipliers was examined and also potential long run cointegrating relationships of the sub-components of these multipliers was tried to be brought out. As the main argument resulted from our analysis, we found that the process leading to the money supply definitions over the base money indicates an unstable characteristics also decreasing the effectiveness of monetary policies applied by monetary authority. Besides, the cointegrating analysis estimated between the sub-components of money multipliers give no support to a stable money multiplier process, thus do not support the Monetarist explanations in conduct of the monetary policy.

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