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ALTERNATIVE MEASURES OF MONEY AND THE VOLATILITY OF VELOCITY

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The paper aims at comparing the relative volatility of the velocity series constructed using the "Divisia Monetary Aggregate", with those obtained in the traditional way, using the simple-sum monetary aggregate. The period under investigation is 1966-90; and the country of reference is Turkey. The empirical findings suggest that velocity of the M2 Divisia Monetary Aggregate displays much less volatility than the velocity of simple-sum M2. In the case of M1, however, in conformity with our expectations, there is not much difference between the two series.

1. INTRODUCTION

A highly volatile velocity undermines the case for monetary policy. The behaviour of the velocity is closely tied to the behaviour of the demand for money[1]. Hence velocity and/or its underlying demand for money function always attracted attention as highly important relationships in macroeconomic models. Researchers have tried to cure the temporal instability seen in these functions by testing alternative explanatory variables that would be responsible for the shift. Where this attempt failed, they tried to isolate the source of the shift: was it due to a shift in the intercept or was it attributable to the change in slope coefficient(s)?[2]. A third remedy was sought through alternative measures of money, the so-called "Divisia Monetary Aggregate" (DMA), where money stock would be estimated as a weighted average of its components.[3] The weights would be based on the degree of "moneyness" of the assets incorporated in the definition of money stock. The velocity of the DMA, thus obtained, may be well-behaved since substitution among different components of money stock are internalized

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through aggregation. This way, shifts in the related demand for money function disappear.

As pointed out by Laidler (1990: 150n), "..our ability to find a stable demand for money aggregate constructed **ex post** and to account for recent instability by referring to the changing characteristics of particular assets suggests that underlying the demand for money function is a more basic stable demand for the services that monetary assets provide".

This paper tries to compare the relative volatility of the velocity series constructed using the Divisia index, with those obtained in the traditional way. The country of reference is Turkey and the period under investigation is 1966-90.

For the simple-sum aggregation, the necessary condition is perfect substitution among the components. As pointed out by Barnett (1990: 206), "(s)imple sum aggregation would indeed be the correct method of measuring the nominal accounting stock of money, if none of the components yielded interest, as once was the case with M1". In Turkey, the numerous financial innovations and deregulation of the post-80 period blurred the distinction between balances held for transactions **versus** those held for asset purposes. Thus the assumption of perfect substitution among individiual components is no longer valid. There are quite a few savings-type assets (such as liquid money market mutual fund participations, foreign exchange deposits, 1-month and 3-month term deposits, the recently introduced short-term securities issued by banks against their assets[4]), that are held for transactions purposes. Recent argument is that the individual components of M1, M2 and the broader definition of money stock bear different degrees of "moneyness", therefore they should be assigned different weights when added together. Hence, the DMA[5] is constructed, where the weights are based on the difference between the rate of return on a pure "store of value" (R) and the component's own yield (r). The larger the difference, the higher the opportunity cost of holding that particular asset and therefore the greater is its degree of moneyness. Transactions balances provide the largest share of monetary services and hence are weighed more in the Divisia aggregate. Therefore components such as commercial sight deposits and currency, which are generally non-interest bearing, are assigned relatively highest weights.

For computing the "maximum available expected holding period yield", alternative measures are proposed. As discussed in Barnett et al. (1981:50n) "(t)erm structure theory, national expectations theory, and perfect arbitrage, dictate use of the maximum available short rate (plus a probably small maturity premium)". However, Shiller (1979) prefers maximization over available rates of all maturities.

Belongia and Chalfant (1990: 26n), on the other hand argue that "although the return on something completely illiquid, such as the return on human capital, would be the preferred choice to represent R, practical measurement issues have led to the use of long bond rates in empirical studies". R is also referred to as the "benchmark yield".

Monetary base (or Central Bank Money) growth rate targets can produce the predicted effect on economic activity, on condition that there is a predictable money multiplier and a predictable velocity. If the saving portion of money stock is related to income differently than its transactions portion, the change in the degree of "moneyness" of the components of the money stock may lead to alteration in the relationship between monetary base growth and the growth of economic activity. Thus, the outcome may be a highly volatile velocity. In such a case, the change in velocity may reflect the changing nature of the money stock. Hence, while velocity measured in the traditional way may show sizable volatility, velocity based on underlying "monetary services measures" may prove to be relatively stable. Therefore, in recent literature, in evaluating the relationship between the money stock and spending (or prices), index of monetary services provided by the stock of all relevant financial assets is being preferred over the use of simple-sum money stock measures. Whenever substantial shifts among monetary assets are encountered, changes in "simple-sum" monetary aggregates may deviate considerably from changes in their underlying monetary services. In periods of high interest rate and inflationary expectations, transfers from monetary aggregate into unregulated money market instruments gain pace; hence velocity measured in the traditional way may display a fall. Therefore, inclusion of these "other assets" in the DMA may further reduce the volatility of velocity.

2. STEPS FOLLOWED IN THE CONSTRUCTION OF THE DMA

The DMA is constructed for narrow and broad definition of money in the following manner:

(1) The user cost[6] of each asset (p_{it}) is calculated using the formula:

$$p_{it} = P_t^* [(R_t - r_{it}) / (1 + R_t)] \quad (1)$$

where P_t^* is the price index[7], R_t is the maximum available one period holding yield on any asset, r_{it} is the nominal "own yield" on the asset i; taken as "net of taxes". In the present study, since there was no data on "long term-bond yield", R was proxied by growth rate of nominal GNP (GNP) and the yield on foreign exchange (RTFX), whichever the highest.

GNP = [(1 + inflation rate) x (1+ growth rate of real GNP)]-1

RTFX = [(1 + revaluation rate) x (1 + interest rate on FX)]-1

(revaluation rate is that of foreign exchange against TL)

Growth rate of nominal GNP was used as a proxy for nominal return on real assets (except for the years 1970-71, 1978, 1980-84, 1986, 1988, when the RTFX was higher), following Friedman and Schwartz (Judd and Scadding, 1982: 1007). The benchmark yield needs to be higher than the yield on any monetary service yielding asset.

(2) The expenditure share of the services of component i in period t (s_{it}), is:

$$s_{it} = [p_{it}q_{it} / \Sigma p_{it}q_{it}] \quad (2)$$

where, q_{it} stands for the quantity of each item in the monetary aggregate.

(3) The growth rate (G) of the DMA can now be obtained using the formula

$$G(DMA) = \sum_{i=1}^{n} s_{it}^{*}\, G(q_{it})_t \quad (3)$$

where, $s_{it}^* = 1/2(s_{it} + s_{i,t-1})$; and n is the number of assets in the aggregate. In short, summation of the growth rates of constituent assets weighted by their relative shares gives the growth rate of the DMA. The growth rate of the DMA, therefore, becomes a "share weighted average of the growth rates of the components" (Barnett and Spindt, 1979: 52).

(4) Denoting a chosen year as the base year (: 100), the growth rates obtained above can be used to construct the index series for the DMA.

(5) Converting the nominal GNP into index numbers with the same base year as the DMA and taking the ratio of this series to DMA Index, gives the velocity index, with base year : 100 (See Charts 1 and 2).

3. VOLATILITY COMPARISON OF THE DIVISIA VELOCITY WITH THE TRADITIONAL VELOCITY[8]

The ARCH Test results obtained for all equations cannot reject the null hypothesis that there is no autoregressive conditional heteroscedasticity (ARCH) at the 5% level of significance. Hence, we sufficed by comparing the standard errors of the autoregressive equations. Standard errors of the regression are used to measure the volatility of the velocity of circulation. Up to four lags were tried for each equation and the optimum lag orders were determined by the Schwartz criterion. Results are posted in Table 1.

The results are as follows:

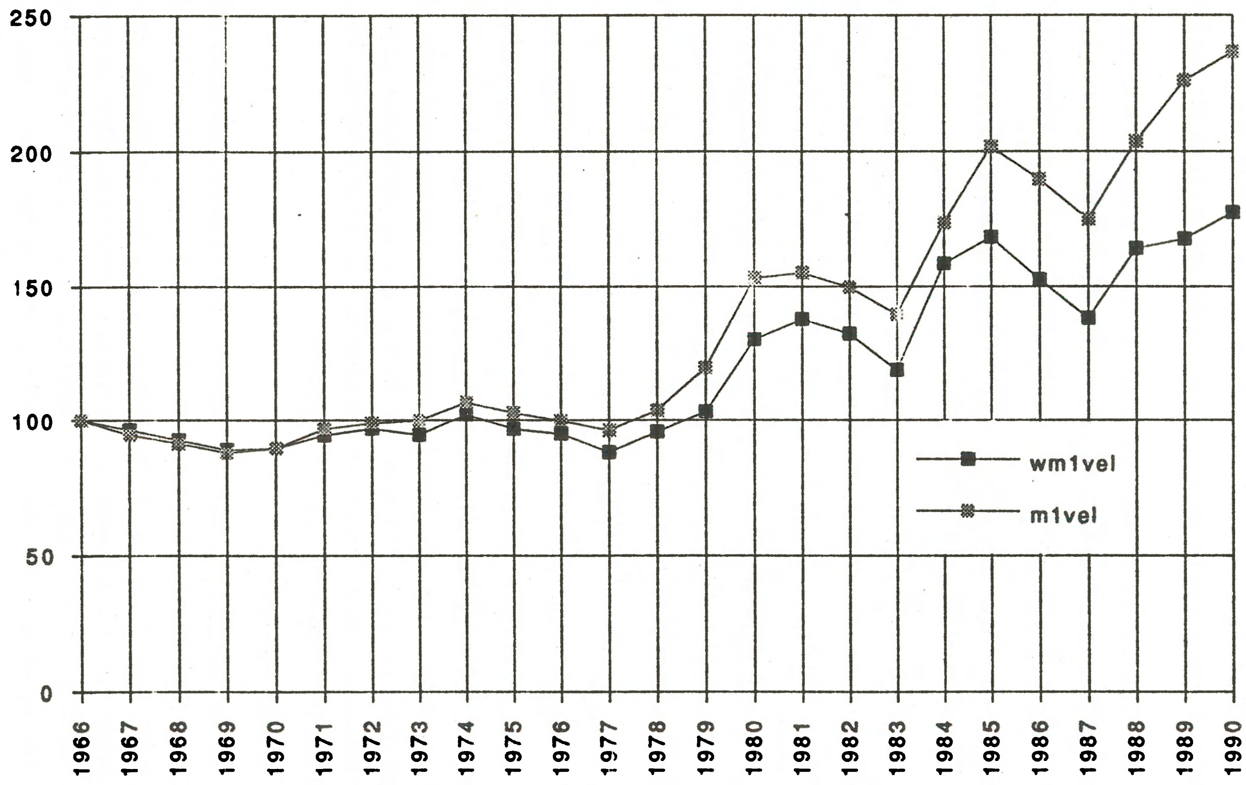
(1) M1 Velocity

In the case of M1 Divisia Velocity, the Schwartz criterion selects 1-lag as the optimum lag structure; whereas, in the case of traditional M1 velocity, 3-lag structure is the optimum. The standard error of the regression varies by the order of the lag; but for each order of the lag, the difference between the standard errors of the M1 Divisia Velocity and the traditional velocity is negligible.

(2) M2 Velocity

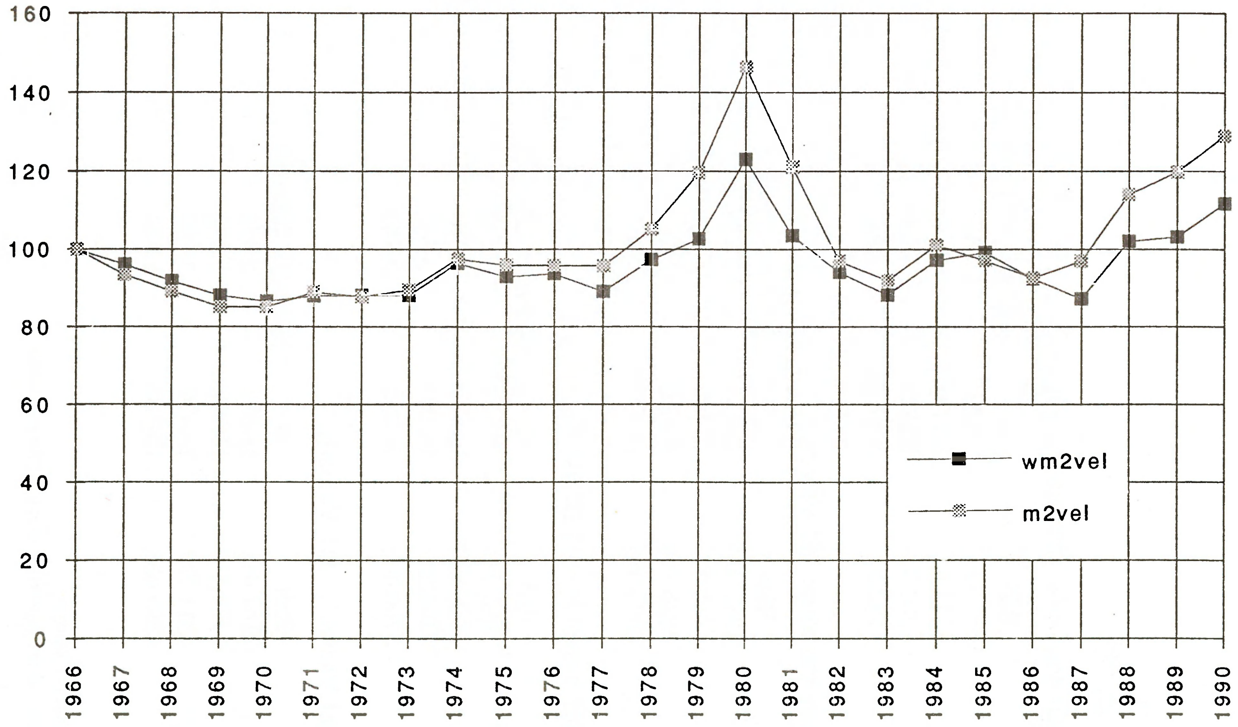
In the case of M2 Divisia Velocity, the Schwartz criterion selects 4-lag as the optimum lag structure. In the traditional M2 velocity case, however, 2-lag structure is the optimum. In the case of velocity obtained for broad definition of money, the standard error of the Divisia velocity is consistently lower than that of the traditional velocity measure, for all lag orders. Hence, the volatility of velocity in the case where money stock is a simple-sum aggregate, is consistently higher than in the case

Chart 1 : M1 Velocity (1966 : 100)



Note : M1VEL is the index of M1 velocity obtained as (GNP/period average simple sum M1). WM1VEL is the index of weighted M1 velocity obtained as (GNP/WM1); both expressed as index numbers, 1966 : 100.

Chart 2 : M2 Velocity (1966 : 100)



Note : M2VEL is the index of M2 velocity obtained as (GNP/period average simple sum M2). WM2VEL is the index of weighted M2 velocity obtained as (GNP/WM2); both expressed as index numbers, 1966 : 100.

Table 1 : Volatility Test Results - Sample Period 1970 to 1980

Model:

$$X = c + \sum_{i=1}^{n} X_{t-i}$$

(1) Dependent Variable: M2 Divisia Velocity

Lag Order	RSS	σ	Schwartz Criterion
4	995.11	7.8863	4.19
3	1151.6	8.2307	4.28
2	1203.0	8.1753	4.27
1	1242.8	8.0877	4.24

(2) Dependent Variable: M2 Velocity

Lag Order	RSS	σ	Schwartz Criterion
4	1985.413	11.139	5.274
3	1985.437	10.807	5.129
2	2026.144	10.610	5.004
1	2502.668	11.477	5.071

(3) Dependent Variable: M1 Divisia Velocity

Lag Order	RSS	σ	Schwartz Criterion
4	2595.741	12.737	5.542
3	3128.910	13.567	5.584
2	3794.321	14.519	5.632
1	3796.408	14.135	5.487

(4) Dependent Variable: M1 Velocity

Lag Order	RSS	σ	Schwartz Criterion
4	2187.411	11.692	5.371
3	2428.517	11.952	5.330
2	4311.777	15.477	5.760
1	4395.638	15.210	5.634

Notes:
RSS = regression sum of squares
σ = standard error of the regression was used for estimation

where velocity is obtained using the divisia monetary aggregate. Thus, the M2 Divisia velocity displays considerably less volatility, measured by the standard error of the regression. In the case of M1 velocity, however, a similar conclusion cannot be reached.

4. CONCLUSION

In sum, on the basis of the empirical findings, one can say that, velocity of the M2 DMA displays much less volatility than the velocity derived using the simple-sum money stock definition. However, in the case of M1 velocity, there is not much difference between the two series. The result is in conformity with our expectations, since M1 is mostly held for transactions purposes and its components, namely, currency, commercial sight and sight saving deposits, do not have highly differential yields. In Turkey, checking accounts held by business in most years have been non-interest bearing and at times when interest was offered on these commercial sight deposits, the rates were very low (except in 1988). These deposits along with the currency component of money stock, are generally more closely tied to real income than to interest rate movements. Within the broad definition of money, however, there is higher degree of substitution possibility among the components. A significant portion of M2 is held for asset purposes; therefore, the responsiveness of these deposits to interest rate (or yield) differentials can be expected to be high, especially in high inflation periods and following deregulation and financial innovations of the post-80s.

NOTES

[1] See Keyder (1992a:268-73) for derivation of the velocity equation from money demand equation.

[2] For an application to Turkish case see Keyder (1989; 1992b).

[3] It is worth-noting the following points: (i) Divisia aggregation suffers heavily from measurement error since explicit rates of return do not exist, especially in developing countries, where markets are not well-defined and are inefficient due to continuing financial innovations and deregulations. Hence there can be fundamental econometric problems in parametric testing because of the nature of the error terms; (ii) In the literature, there is no clear preference for the use of Divisia aggregates over the simple-sum measures. Therefore, such index studies should not undermine acceptability of simple-sum aggregates in explaining underpinnings of the theory.

[4] By issuing these securities against their assets (such as consumer credit or housing credit), banks have found a way to collect "money" at a low cost since this money is not subject to reserve or bank liquidity requirements. Hence, the yield offered on such deposits is relatively higher. Wide scale use of this, we are afraid, would contribute to inflationary pressures in the short-run.

[5] The methodology used in the formulation of DMA is based on the "aggregation theory" and the "index number theory". For a survey of the development in the field of Monetary Aggregation Theory see Barnett (1990) and for the application of Index Number and Aggregation Theory to Economic Monetary Aggregates, see Barnett (1980).

[6] For an elaborate discussion of the "user cost" concept, see Barnett (1978). Donovan (1977) arrived at a user cost imputation using general economic reasoning, without the use of a model. His underlying assumption was that the "services" of financial assets were proportional to the stocks with a unitary proportionality constant. Barnett (1978), however, derived the user cost of monetary assets from a Fisherine intertemporal consumption expenditure allocation model. In this study he proves that Donovan's formula provides the correct and unique user cost monetary asset price imputation within the model developed (Barnett, 1978: 145).

[7] Since P^* does not depend upon the selection of the good "i", in the next step it cancels out. Thus, in our estimations the simplified formula, without the P^* is used.

[8] Here, we wish to acknowledge the special help and guidance provided by Dr. Erol Taymaz in conducting the stability tests.

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ÖZET

FARKLI PARA ARZI ÖLÇÜTLERİ VE PARANIN DOLANIM HIZI DEĞİŞKENLİĞİ

Çalışmada 1966-90 dönemi için Türkiye'de M1 ve M2 dolanım hızı, ağırlıklandırılmış para arzı ve geleneksel biçimde elde edilen para arzı serileri kullanılarak hesaplanmıştır. Ağırlıklandırılmış para arzı kullanıldığında, M2 dolanım hızının değişkenliği büyük ölçüde azalma göstermiştir. M1 durumunda ise, beklentiler doğrultusunda, kısa iki seri arasında önemli bir fark gözlenmemiştir.