Demand for Money By Business Sector in a Developing Country: Evidence from Pakistan

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DEMAND FOR MONEY BY BUSINESS SECTOR IN A DEVELOPING COUNTRY: EVIDENCE FROM PAKISTAN

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1. Introduction

The estimation of the demand for money behaviour is one of the most important areas of applied monetary economics. Because optimal conduct of monetary policy mainly depends upon the shape and stability of the estimated money demand function. There are a number of studies spanning all sorts of economies. Over the period of time the variable specification has narrowed down to a compact and well defined list. Cointegration analysis is now dominant methodology. Despite these outward appearances of a progressive scientific research programme there is potentially a serious flaw at the heart of the great majority of studies. The problem is that these studies employ data which are an aggregate of two entirely different sectors: the household and the business. If the structure of the equations for these two sectors is not identical and their aggregation is not stable over time then the variance of forecast error in policy projection may be much greater then would be obtained by disaggregation. This weakness is worrying if the estimates are used for policy purposes.

This study is an attempt to provide estimates of money demand for the business sector in Pakistan. The demand for money by the business studies has been thoroughly studied in the developed countries [e.g., Baumol (1952), Miller and Orr (1966, 1968), Price (19720, Hacche (1974), Wilbratte (1975) and Hall et al (1989)]. To our knowledge there is no equivalent work for this country. However in developing countries a thin empirical literature is available on business sector demand for money [e.g., Ungar and Zilberfarb (1980) and Qayyum (1995)]. This paper estimates the demand for money (M2) in Pakistan by the business sector by using quarterly data for the period 1962q1 to 1992q2.

2. Model Spcification

Theories of money demand, such as the quantity theory of money (Friedman 1959) and the inventory theoretic approach (Baumol 1952), states that the demand for money by the business sector depends on a transaction variable, the rate of inflation and the rate of interest(s). Following Johansen and Juselius (1990) we specified the vector autoregressive money demand function as

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$$\mathbf{X}_t = \sum_{i=1}^{k} \Pi_i \mathbf{X}_{t-1} + \mu_t + \Phi \mathbf{D}_t + \varepsilon_t \qquad 1$$

Where X_t is the vector of the variables of real demand for money (RM_t), the real sales ($RSAL_t$), the call money rate (rc_t), the rate of interest on advances (ra_t) and the rate of inflation (π_t). The variable D_t are seasonal dummies and ε_t is a residual term obeying classical assumptions of independent and identically distributed (iid). The vector Π_i contains the estimated long-run coefficients of the determinants of money demand. *A priori* expectations about the coefficient are: RSAL and r_c have positive sign whereas r_a and π_t have negative sign. This function can be transformed into the error correction mechanism

$$\Delta \mathbf{X}_t = \Gamma_1 \Delta \mathbf{X}_{t-1} + ... + \Gamma_{k-1} \Delta \mathbf{X}_{t-k+1} + \Pi \mathbf{X}_{t-k} + \mu_t + \Phi \mathbf{D}_i + \varepsilon_t \qquad 2$$

where

$$\Gamma_i = -\mathbf{I} + \Pi_1 + ... + \Pi_i, \quad i = 1, 2, ...k \qquad 3$$

and

$$\Pi = -\mathbf{I} + \Pi_1 + ... + \Pi_k \qquad 4$$

This model includes variables both in levels and in differences. Under the assumptions all the variables including $\Pi_i X_t$ term of the model are stationary. The 'Δ' in the first difference of the series. Theoretical expectation on the estimated parameters are positive for real sales and own rate of interest and negative for rate of inflation and the call money rate. The coefficient of $\Pi_i X_t$ (ECM) is expected to be negative. Therefore, this equation can be estimated with the Ordinary Least Square (OLS) method. The error correction model captures the short-run dynamics of the demand for money. However, the term $\prod$ is a cointegrating matrix which consists of the long-run relationship among the variables of real money demand and its determinants. It contains all the relevant information (Qayyum 1995).

Before estimating the cointegrating relationship between the money demand and its determinants, we first test the order of integration of the individual time series using the Augmented Dickey Fuller (ADF) test. Unfortunately the normal t ratios are not valid in this case, so we use critical 't' values of Mackinnon (1991).

We use Johansen's (1988) maximum likelihood method to analyse the cointegrating relationship between the real money demand and the real sales, the rate of inflation, the call money rate and the rate of interest on bank advances. To determine the number of cointegrating vector the statistics of trace and maximal eigenvalue of the stochastic matrices are estimated. The significance of the estimated coefficient of individual variables is tested by applying the likelihood ratio test.

We use quarterly data from 1962q1 to 1992q2. The data for M2 (i.e., currency plus total deposits by the business sector), call money rate, the rate of interest on bank advances, the consumer price index (1985=100) and the whole sale price index (1985-=100) were taken from various issues of International Financial Statistics of IMF and the Statistical Bulletin of State Bank of Pakistan. The quarterly data for sales are not available. We obtained the annual sales data from various issues of Economic Survey of Government of Pakistan and interpolated for quarterly series

by the method of Qayyum (1995). To obtain real values we used the wholesale price index (1985=100).

3 Test of Integration

To investigate the properties of the time series data Augmented form of Dickey-Fuller (ADF) test is used. The results of calculated τ_t-statistic corresponding to the parameter ρ for the individual series are presented in Tables I. To test the hypothesis that the $\rho = 0$, τ_t-values of Mackinnon (1991) are used. The test show that all variables have unit root in their levels at the 5 per cent level of significance. The ADF test is also performed on the first difference of the data. The results, Table I, lead to conclude that the consumer price index is integrated of order two, I(2). However, all other series are I(1) in their levels and I(0) in the first difference

The univariate analysis supports the hypothesis that macroeconomic time series being used in this study are not stationary in their level. Most of the series require first differencing to become stationary. It implies that the implicit assumption about the stationarity of data maintained in the estimation of the demand for money functions in Pakistan was not true. The rejection of stationarity assumption cost doubt of their results.

Table I: THE ADF TEST FOR UNIT ROOTS: QUARTERLY TIMES SERIES

Name of variables	Lag Length	τ_t - ratio	$\Phi 2$ (a1=a2=a3=0)	$\Phi 3$ (a2=a3=0)
LM2B	(0)	-1.80	49.66	3.20
ΔLM2B	(0)	-13.03	134.10	84.86
RM2B	(0)	-1.29	37.22	1.54
ΔRM2B	(0)	-12.01	148.28	72.15
LSAL	(4)	-2.58	7.02	3.42
ΔLSAL	(7)	-4.22	10.76	8.93
RSAL	(3)	-2.72	10.15	3.91
ΔRSAL	(4)	-5.96	18.67	17.80
LCPI	(2)	-2.38	2.45	3.62
π	(3)	-3.19	4.28	5.12
$\Delta\pi$	(2)	-10.20	48.31	58.39
LWPI	(4)	-1.95	1.28	1.91
ΔLWPI	(3)	-4.04	7.19	8.19
r_c	(2)	-2.10	1.95	2.74
Δr_c	(1)	-11.70	47.96	69.12
r_a	(0)	-1.44	2.32	2.75
Δr_a	(0)	-9.54	31.01	45.66

Note: The 5 per cent rejection region for the tests are as

ADF $\tau_t < -3.44$ (Mackinnon, 1991)

$\Phi 2$ (a1=a2=a3=0) = 4.88 and $\Phi 3$ (a2=a3=0) = 6.49 (Dickey-Fuller, 1981)

4. The Long-Run Demand for Real M2: A Cointegration Analysis

The demand for money (M2) by the business sector is analysed under the hypothesis of cointegration. As a first step, the hypothesis of no cointegration is tested against the alternative of one or more cointegrating relationships between the real money (M2) demand, real sales, rate of inflation, rate of interest on deposits (r_c) and the rate of interest on bank advances (r_a). Test statistics presented in Table II, lead us to accept the hypothesis that there are two cointegrating vectors between the money demand and its determinants. In this process, chosen lag length of VAR is five quarters. The three quarterly dummies are also used.

The first cointegrating vector is used to deduce the long-run real money demand function. The estimated coefficients of all the variables are significant at the 5 per cent level and of the signs according to theoretical expectations. The estimated coefficient of real sales is 1.23. We test the hypothesis of unit income elasticity of money using the likelihood ratio test. The result shows that calculated $\chi^2(1)$ value is 12.86, which is well above the critical value at the 5 per cent level of significance. So this hypothesis is easily rejected in the case of the business sector's demand for money (M2). This result, when compared with the outcome of the aggregate M2 demand, clearly indicates diversity of behaviour between the aggregate and the business sector. Aggregate money demand studies generally accepted the money income proportionality hypothesis, whereas we clearly reject this proposition here. In the long-run, the rate of inflation is also important in determining money demand behaviour. The rate of interest on time deposits emerged an important determinant of the long-run money demand. It represents the own rate of interest, and its sign is according to the theoretical expectations. It implies that the business sector do consider bank deposits as money in the long-run.

The most important determinants of the money demand that emerged is the rate of interest on bank advances. It is important because we first time include this variable as a determinant of the demand for real money (M2) function by the business sector in any developing country. The analysis accept Friedman's (1987) conjecture that rate of interest on bank advances may play important role in determining the demand for money by the business sector. The analysis reveals that indeed this kind of interest acts as opportunity cost variable in the holding monetary balances by the business sector. It implies that business agent gives importance to the cost of money they can obtain from the financial sector. They are more concerned about the bank advances rate than any other type of interest rate while deciding to hold money in developing countries, Pakistan.

Table 2: **Results from the Johansen Maximum Likelihood Procedure**

a: LR Tests of Cointegration between RM_t, $RSAL_t$, π_t, rc_t and ra_t

Null	Alternative Hypothesis	Maximal Eigenvalue	Trace
$r = 0$	$r \geqq 1$	60.41*	110.29*
$r \leqq 1$	$r \geqq 2$	28.38*	49.88*
$r \leqq 2$	$r \geqq 3$	13.08	21.49
$r \leqq 3$	$r \geqq 4$	7.24	8.41
$r \leqq 4$	$r = 5$	1.17	1.17

Note: 1. (*) indicates significant at the 5 per cent level

b: Long run Money Demand

$$RM_t = 1.23\ RSAL_t - 15.07\ \pi_t + 0.18\ rc_t - 0.77\ ra_t$$

c: Restrictions on Long run Estimates: [$\chi^2(1)$ values]

$\beta_1 = 1$	12.86
$\beta_1 = 0$	9.32
$\beta_2 = 0$	41.80
$\beta_3 = 0$	12.19
$\beta_4 = 0$	13.16

5. The Dynamic Demand for Real Money (M2): An Error Correction Mechanism

In the preceding subsection the cointegrating relationship is established between the real money demand, real sales, the rate of inflation, interest rate on time deposit and the interest rate on bank advances. Taking the residual from the long-run estimated money demand function (i.e., equation 1) as an error correction term, the dynamic error correction model of the real money demand for the business sector is estimated. Estimation process starts with the unrestricted lag length of four quarters.

An unrestricted model is first estimated and then tested down towards the preferred money demand function. The estimated parsimonious error correction money demand function is (t-ratios are in the parentheses)

$$\widehat{\Delta RM_t} = \underset{(7.51)}{0.63\Delta RSAL_t} \underset{(-2.87)}{-0.50\Delta ra_t} \underset{(-2.94)}{-0.19\Delta RM_{t-1}} \underset{(2.43)}{-0.21\Delta RM_{t-3}}$$

$$\underset{(-4.08)}{-0.03ECM_{t-4}} \underset{(5.11)}{+0.29S3}$$

$R^2 = 0.65$, $F(5, 103) = 38.86$, Aut $\chi^2(4) = 2.00$,
J-B $\chi^2(2) = 3.98$ RESET $\chi^2(1) = 0.003$, Het $\chi^2(1) = 0.13$, ARCH $\chi^2(1) = 3.16$.

The residual term passed a number of test statistics at the 5 per cent level of significance. It is concluded that the residual term is free from the problem of serial correlation, normally distributed, homoscedastic.

The parameters of the estimated model have signs according to *a priori* expectations. The estimated function shows that in the short-run the change in the real sales is the most important variable in determining the real money demand (M2) by business sector in Pakistan. The short-run transaction elasticity of money is 0.65. Among the opportunity cost variables the movement in interest rate on bank advances emerged as significant determinant of the short-run real money balances. Moreover, the past quarters money demand behaviour is also important in the short-run. The estimated coefficient of the error correction term indicates that economic agents correct approximately 3 per cent of their errors in each quarter. This shows slow speed of adjustment towards the equilibrium state.

The preferred equation has been tested for stability employing the Chow (1960) test. The calculated F- statistics are: 0.69, 0.15, 1.10 and 2.16 for the periods 1971:4, 1973:2, 1980:4 and 1985:2, respectively. These results do not provide any evidence of structural break in the estimated function. The forecasting performance of the preferred function has also been examined. The results are encouraging. Test statistic for the period 1985:3 to 1991:2 is $F(24, 79) = 0.72$, showing good forecasting power of the preferred model. There is no significant over or under prediction reported by the preferred money demand function. Furthermore, the actual and the estimated, and the actual and the predicted series of the real money demand, not presented here, are fairly close to each other. Predictive accuracy is also tested by RMSE, which is 0.031.

6. Conclusions

The objective of this paper has been to estimate both the long-run and the dynamic money demand function by the business sector in Pakistan. For this purpose we considered the theory of cointegration. By using the ADF test it is found that individual series are not stationary at their level. To estimate long-run money demand function we used maximum likelihood method proposed by Johansen. The cointegrating relationship between the money demand and its determinant is found. Further we estimated the dynamic parsimonious error correction model which encompassed other model of money demand in Pakistan. The direct comparison our findings for business sector demand for money is difficult. It is concluded that business sector money demand behaviour is different from the aggregate money demand. It implies that without considering the sectoral money demand behaviour the conduct of monetary policy may not give optimal results.

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