DEMAND FOR MONEY IN PAKISTAN: SOME POLICY IMPLICATIONS

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Money plays an important role in the determination of income, employment and prices. A basic issue in the monetary economics is the theory and measurement of demand for money. In fact, the potential effectiveness of both fiscal and monetary policy for influencing aggregate economic activity depends on the form of the money demand function and the values of its coefficients. Keeping in view the fact that demand for money plays an important role in conducting an appropriate monetary policy, its various issues have been examined in both developed and developing countries.

In Pakistan, Khan(3) estimated the adjustment between actual and desired money balanced and used partial-adjustment mechanism. The implication of this mechanism is that a decline in the real value of last period's nominal money stock due to rising prices will be offset by an increase in the amount of nominal money balances currently held.

According to Khan(4) the demand for money in Pakistan with special reference to two mechanisms i.e. real and nominal adjustment mechanisms, he found that the real-adjustment mechanism fared better than the nominal-adjustment mechanism. He also stated that the money demand function estimated through a nominal-adjustment mechanism gives lower income and interest rate elasticities and also reduces the significance level of these coefficients. He also found that income and interest rate are the most important variables in the money demand function in Pakistan.

According to Khan (1982) the interest response of the demand for money is not significant and the income variable is the most important variable in the demand for money function of Asian countries.

According to the study conducted by Lia Z.A. and L.S. Fan, they estimated that interest coefficients and interest elasticities of demand for money in the Asian countries are insignificant. But they estimated that income coefficient and in-

come elasticities are highly significant.

According to[1] they estimated demand for money function for 19 countries in the Middle Eastern Department of Fund. They stated that the great majority of countries exhibit an income elasticity in the range of 1.00 to 1.50 On the whole the estimates of equation using broad definition of money are better determinant i.e. from 1.25 to 1.50. They estimated income elasticity of narrow money for Pakistan is 1.02512 and for broader money is 1.37241 (SMPL 1974-1978).

METHODOLOGY

Economic theory suggests that the demand for real balances should depend on at least three sort of variables: Income, Interest Rate and some type of Wealth. As people's income rises, they will demand more money for transaction purposes; as the interest rate rises, they reduce their money holding; and also as peoples' net worth rises, they will increase cash balances. By taking into account the data available, for example, the data on wealth was not available, so I defined demand function for money at time t is that:

$$M_d = f(y,r) \qquad (1)$$

Where:

M_d = demand for money
y = income
r = rate of interest

For a linear calculation, the equation 1 is:

$$M_t = a + by - cr \qquad (2)$$

or

$$M_t = Ay^{a1} r^{a2}$$

Where:

M_t = stock of money balances demand
y = national income
r = interest rate
a1, a2 = income and interest rate elasticities respectively.

It is generally accepted that the demand for money is an increasing function of income ($a_1 \geq 0$) and decreasing function of interest rate ($a_2 < 0$). For estimation purpose equation 2 can be written in the log form.

$$\ln M_t = \alpha_0 + \alpha_1 \ln y_t - \alpha_2 \ln r_t \quad (3)$$

The demand for money may be assumed to adjust to the change with a given period from the previous period M_{t-1}

$$M_t^* = \lambda \left[y_t^{a_1} r_t^{a_2} M_{a_3 t-1} \right] \quad (4)$$

or

$$\ln M_t = \theta + a_1 \ln y_t - a_2 \ln r_t + a_3 \ln M_{t-1} \quad (5)$$

Data:

The data used annual observations of the variables for the period 1970 to 1987. The data for this paper was taken from the IMF financial statistic (1988) and from the different issues of Pakistan Economic Survey. The interest that I used for this purpose is the call money rate.

REGRESSION RESULTS

The results of the multiple regressions are given below:

$$M_t = a + by_t - cr + U_t$$

$$M_t = 14.4 + .3575\, y_t - 1.798\, r \quad (1)$$

(3.22) (.0033) (.3617)

$R^2 = .9987$ D.W = 2.17

$\bar{R}^2 = .9985$ n = 18

d.f = 15

The above regression shows coefficients for income and interest rate possess the anticipated sign and all the coefficients like constant term, income and interest rate are statistically significant at 99% confidence level.

According to $R^2 = .9987$, it means 99.87% variation is explained by the dependent variable (m) and is very good fit data.

If you see the D.W = 2.17 and according to rule of thumb the value close to 2 has no autocorrelation but here little bit negative autocorrelation occurs.

Regarding the magnitude of the regression result it says that if income increase by Rs. 1 billion the demand for money increases by Rs..3575 million, and if the interest rate increases by 1% demand for money decrease by Rs.1.798 billion.

If you look into the residual plot out of the 18 year data

the data for 5 years belong to outlier, it means during these years the data away from regression line negatively or positively.

For Regression 2, I used real values for national income and money demand and the results look like this:

$$\text{Real } M_t = a + by_t - cr_t + U_t$$

$$M_t = 32.241 + .3388 - 3.264 \qquad (2)$$
$$(5.4337)\ (.0106)\ (.54377)$$

$R^2 = .986$ D.W = 1.842

$\bar{R}^2 = .984$ n = 18

d.f = 15

If we look into the regressions (1) and (2) both the models have same coefficient signs and are statistically significant at 99% confidence level.

In regression 2, 98.6% variation explains the dependent variable. If we see D.W = 1.842, it indicates positive autocorrelation.

If we see the residual plot here only 3 years data belongs to outliers, mean not on the regression line. But if we look into the magnitude in regression (2) constant term has the value of 32.241.

If real income increases by Rs.1 billion real demand for money will increase by Rs .3388 billion, and if the interest rate increases by 1% real demand for money will go down by Rs. 3.26365 billion.

By taking the log of the data and estimating equation (3) the results look like this:

$$\ln M_t = a_o + a_1 \ln y_t - a_2 \ln r_t + U_t$$

$$\ln M_t = .-1108 + .9674 \ln y_t - .3523 \ln r_t \qquad (3)$$
$$(.1608)\ (.01896)\ (.07399)$$

According to this model when we took log of the data, the coefficients of income and interest rate are significant at 99% confidence level. The coefficients of determination, R^2 are extremely high.

D.W = 1.6, it indicates positive autocorrelation problem.

If we look into the magnitude, it indicates that if 1% change in income, will change .967% of demand for money, and 1% change in interest rate will change the demand for

money by .352%

By taking the log of the real values the results are as under:

$$\ln M_t = a_0 + a_1 \ln y_t - a_2 \ln r_t + U_t$$

$$\ln \hat{M}_t = .1393 + .9324 \ln y - .3771 \ln r \qquad (4)$$
$$(.285) \quad (.0465) \quad (.0733)$$

Here the constant term is positive but not significant, but the coefficients are significant.

$R^2 = .965$, it explained 96.5% variation of the dependent variable.

D.W = 1.61, indicates positive autocorrelation.

As far as the concerned for the magnitudeis there is no much difference.

REGRESSION 5

For the adjustment equation (5)

$$\ln M_t = \theta + a_1 \ln y_t - a_2 \ln r_t + a_3 \ln M_{t-1} + U_t$$

$$\ln \hat{M}_t = -.225 + .446 \ln y - .06 \ln r + .5466 \ln M_{t-1}$$
$$(.15) \quad (.1609) \quad (.1055) \quad (.16711)$$

$R^2 = .9966$ D.W = 2.3

$\bar{R}^2 = 9958$ n = 17 df = 13

Here also R^2 is very good fit, but all the coefficients are not statistically significant, such as constant term is not significant with negative sign, and also interest rate coefficient is not significant. But income's coefficient's is significant at 95% and lagged coefficient for money is significant at 99% confidence level.

D.W = 2.31, means negative autocorrelation problem.

As the T-test is not so high it indicates multicollinearity problem among the independent variables.

POLICY IMPLICATIONS

For conducting appropriate monetary policy it is important that the supply of money should grow with the demand for it. It can be achieved by determining the economy's capacity to absorb increased money supply with the changes in the national income and interest rate. The income and interest rate elasticities which have a key role to play in the formula-

tion of monetary policy are given in the table:

INCOME & INTEREST RATE ELASTICITIES OF DEMAND FOR MONEY

	Income	Interest rate
Nominal values	1.0055	- .164
Real values	0.942	- .303
Log log	0.967	- .352
Log lag	0.446	- .0605
Log with real values	.932	- .377

With the help of elasticities given in the table policy makers can determine the level of money required in the economy.
Money supply growth rule (2)

$$g^*_m = g^*_y$$

rate of growth of real money stock and real national income.
So income elasticity of money demand is

$$g^*_m = ag^*_y$$

a = income elasticity of demand for money.
According to this real money stock should grow by a (alpha) times the growth rate of national income.
In this study I also used interest rate, so

$$g^*_m = ag^*_y - B(Beta)g^*_r$$

β = interest rate elasticities

g_r = growth rate of interest rate

Here I have the value of a (income elasticity) and B (Beta) (interest elasticity) and g^*_y an g^*_r. On this basis policy maker can set a target for the expansion of money stock in the economy.

PREDICTION

$$M^d_f = 14.40028 + .3575476(255.63944) - 1.798204(8.285)$$

$$14.40028 + 91.403268 - 14.298121$$

$$M^d_f = 90.90543$$

$$M^d_f \pm t_{a,n-k} \sqrt{S^2 + RS^2 (X'X)^{-1}R'}$$

$$R=\begin{bmatrix}1 & 255.639 & 8.285\end{bmatrix}\begin{vmatrix}10.3854 & -.00338 & -1.10398\\ -.00338 & .000010706 & .0000772\\ -1.104 & .0000772 & .13087\end{vmatrix}\begin{vmatrix}1\\ 255.639\\ 0.285\end{vmatrix}$$

$$\begin{bmatrix}3743 & -.0000054 & .000008\end{bmatrix}\begin{vmatrix}1\\ 255.639\\ 0.285\end{vmatrix}\sqrt{.3729858+6.76337}=\underline{2.6714}$$

t.95%

$$90.90543 - 2.131\ (2.6714) \leq M_f^d \leq 90.90543 + 2.131\ (2.6714)$$

$$85.21268 \leq M_f^d \leq 96.59818$$

MEAN FUTURE

$$y_f^m \pm t_{a,n-k}\sqrt{RS^2 (X'X)^{-1} R'} = \sqrt{.37298} = .6107$$

CONFIDENCE INTERVAL

$$90.90543 - 2.13(.6107) \leq M_f^d, < 90.90543 + 2.13\ (.6107)$$

$$89.604 \leq M_f^d \leq 92.206$$

CONCLUSION

The purpose of this study has been to analyze the demand for money in Pakistan by using nominal and real values of income and money. The money demand function estimated through nominal values gives lower interest rate elasticities and high income elasticities. The coefficient for both the models are highly significant but the magnitude of interest rate for nominal values was lower than using real

values. Since these income and interest rate elasticities play an important role in formulating monetary policy, a money demand function estimated through nominal values will give you wrong estimate of the demand for money in the economy. For appropriate and meaningful monetary policy the supply of money should be increased in such a way that it should not lead to inflation or deflation in the economy.

In this study I also found that income and interest rates are the most important variables for the demand of money in Pakistan. They together explain 98.5% of variations in the demand for money. It is also found that money market in Pakistan is sensitive to interest rate.

REFERENCES

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2. Boanson, William H. Macro Economics, Theory and Policy, New York, Harper & Row, 1972.

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4. Khan, Ashfaque H., Adjustment Mechanism and the Money Demand Function in Pakistan, Pakistan Economic and Social Review, Vol.XX, No.1, Summer, 1982.

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Regression # 1
(Nominal Values)

SMPL 1970 - 1987
18 Observations
LS / / Dependent Variable is M

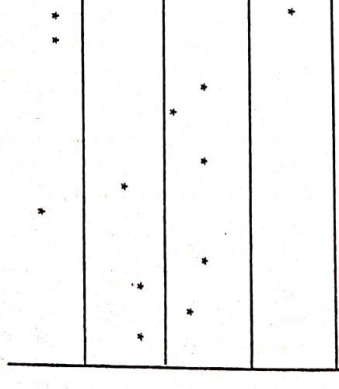
VARIABLE	COEFFICIENT	STD. EROR	T-STAT.	2-TAIL SIG
C	14.400280	3.2226403	4.4684728	0.000
GNP	0.3575476	0.0032721	109.27295	0.000
MR	- 1.7982041	0.3617586	- 4.9707293	0.000

Re-squared	0.998761	Mean of dependent var	90.90544
Adjusted R-squared	0.998595	S.D. of dependent var	69.38972
S.E. of regression	2.600648	Sum of squared resid	101.4506
Durbin-Watson stat	2.174627	F-statistioc	6043.762
Log likelihood	- 41.10369		

Covariance Matric

C,C	10.3854104	C,GNP	- 0.00337647
C.MR	- 1.10398420	GNP,GNP	1.0706D-05
GNP, MR	7.7187D-05	MR,MR	0.13086929

Residual Plot



Obs	RRSIDUAL	ACTUAL	FITTED
1970	-0.34866	21.2344	21.5831
1971	2.41939	22.9755	20.5561
1972	-2.10365	22.0590	24.1627
1973	0.29677	27.0680	26.7712
1974	3.57948	30.6790	27.0995
1975	-3.74133	33.0740	36.8153
1976	-3.58266	41.6510	45.2337
1977	1.41708	51.7730	50.3559
1978	0.56284	63.6630	63.1002
1979	3.04758	76.5260	73.7484
1980	1.41461	90.6880	89.2734
1981	-1.70362	103.524	105.228
1982	-4.92632	116.510	121.436
1983	2.70325	146.025	143.322
1984	1.31130	163.267	161.956
1985	-0.47415	183.905	184.379
1986	0.86144	211.111	210.250
1987	-0.73335	230.565	231.298

Regression # 2
(Real Values)

SMPL 1970 - 1987
18 Observations
LS / / Dependent Variable is RLM

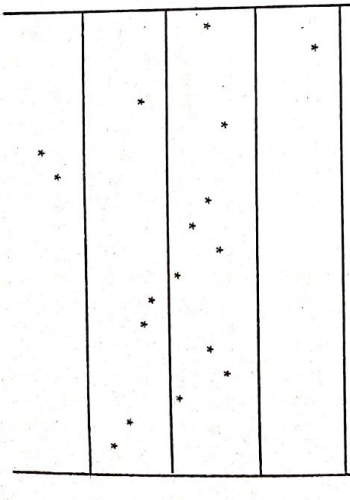
VARIABLE	COEFFICIENT	STD. EROR	T-STAT.	2-TAIL SIG.
C	32.241226	5.4337232	5.9335423	0.000
GNP	0.3388853	0.0106197	31.910989	0.000
MR	- 3.2636557	0.5437730	- 6.0018715	0.000

Re-squared	0.986329	Mean of dependent var	90.90544
Adjusted R-squared	0.984506	S.D. of dependent var	69.38972
S.E. of regression	3.909966	Sum of squared resid	101.4506
Durbin-Watson stat	1.841680	F-statistioc	6043.762
Log likelihood	- 48.44351		

Covariance Matric

C,C	29.5253475	C,GNP	- 0.03088354
C.MR	- 2.53824272	GNP,GNP	0.00011278
GNP, MR	0.00005727	MR,MR	0.13086929

Residual Plot



Obs	RRSIDUAL	ACTUAL	FITTED
1970	2.11351	68.9429	66.8294
1971	7.04680	69.2033	62.1565
1972	-4.22768	63.0257	67.2534
1973	-1.11698	62.9488	64.0658
1974	3.37454	56.2917	52.9172
1975	-7.60555	50.1882	57.7937
1976	-6.67883	58.9958	65.6746
1977	2.16372	66.6319	64.4682
1978	1.44589	77.1673	75.7214
1979	2.71581	85.6954	82.9796
1980	0.93854	90.6880	89.7495
1981	-0.52321	92.5147	93.0380
1982	-2.17227	98.3207	100.493
1983	2.24827	115.893	113.645
1984	3.11100	122.114	119.003
1985	0.62504	130.244	129.619
1986	-0.98507	144.399	145.384
1987	-2.47353	150.696	153.170

Regression # 3
(Log Model)

SMPL 1970 - 1987
18 Observations
LS / / Dependent Variable is LNM

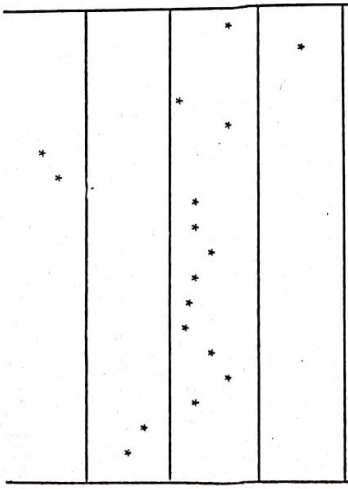
VARIABLE	COEFFICIENT	STD. EROR	T-STAT.	2-TAIL SIG.
C	- 0.11[illegible]8587	0.1607913	-0.6894576	0.000
GNP	0.967[illegible]4247	0.0189571	51.032353	0.000
MR	- 0.35[illegible]2695	0.0739893	- 4.7610850	0.000

Re-squared	0.994449	Mean of dependent var	4.203533
Adjusted R-squared	0.993709	S.D. of dependent var	0.832932
S.E. of regression	0.066062	Sum of squared resid	0.065464
Durbin-Watson stat	1.600350	F-statistioc	1343.727
Log likelihood	-48.44351		

Covariance Matric

C;C	0.02585385	C,GNP	- 0.00109727
C.MR	- 0.00950560	GNP,GNP	0.00035937
GNP, MR	- 0.00037249	MR,MR	0.00547442

Residual,Plot



Obs	RRSIDUAL	ACTUAL	FITTED
1970	0.02697	3.05562	3.02865
1971	0.11756	3.13443	3.01687
1972	-0.06719	3.09372	3.16091
1973	-0.00349	3.29835	3.30184
1974	0.03136	3.42358	3.39222
1975	-0.15151	3.49875	3.65026
1976	-0.10527	3.72933	3.83459
1977	0.01768	3.94687	3.92919
1978	0.02101	4.15360	4.13260
1979	0.04452	4.33763	4.29311
1980	0.02510	4.50742	4.48232
1981	0.01502	4.63980	4.62479
1982	0.00296	4.75798	4.75502
1983	0.03365	4.98378	4.95013
1984	0.05222	5.09539	5.04316
1985	0.02030	5.21442	5.19412
1986	-0.02979	5.35238	5.38217
1987	-0.05109	5.44053	5.49163

Regression # 4

SMPL 1970 - 1987

18 Observations

LS / / Dependent Variable is RLLNM

VARIABLE	COEFFICIENT	STD. EROR	T-STAT.	2-TAIL SIG.
C	0.1392686	0.2855767	-0.4876748	0.633
RLLNGN	0.9324534	0.0465092	20.048797	0.000
LNMR	- 0.3771103	0.0733278	- 5. 1428023	0.000

R-squared	0.965037	Mean of dependent var	4.434103
Adjusted R-squared	0.960376	S.D. of dependent var	0.339957
S.E. of regression	0.067671	Sum of squared resid	0.068691
Durbin-Watson stat	1.607282	F-statistioc	207.0149
Log likelihood	- 48.44351		

Regression # 5

SMPL 1970 - 1987
18 Observations
LS / / Dependent Variable is LMN

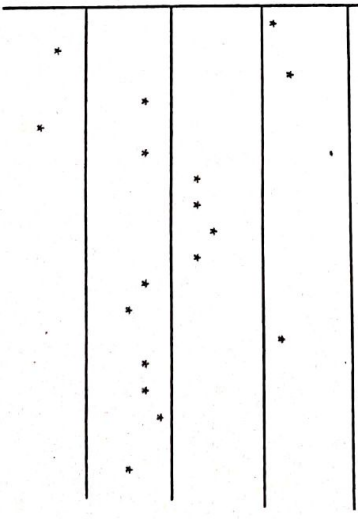
VARIABLE	COEFFICIENT	STD. EROR	T-STAT.	2-TAIL SIG.
C	- 0.2254419	0.1500733	-1.5022118	0.157
GNP	0.4464662	0.1609916	2.7732271	0.016
MR	- 0.0605333	0.1055362	- 0.5735783	0.576
LNM (-1)	0.5465724	0.1671187	3.2705634	0.006

Re-squared	0.996602	Mean of dependent var	4.271057
Adjusted R-squared	0.995817	S.D. of dependent var	0.806186
S.E. of regression	0.052138	Sum of squared resid	0.035339
Durbin-Watson stat	2.311330	F-statistioc	1270.794
Log likelihood	28.37379		

Covariance Matric

C,C	0.02252200	C,LNGNP	0.00219349
C.LNMR	- 0.00943681	C,LNM (-1)	- 0.00339810
LNGNP,LNGNP	0.02591829	LNGNP,LNMR	- 0.01370738
LNGNP,LNM (-1)	- 0.02677568	LNMR,LNMR	0.01113789
LNMR, LNM (-1)	0.01417414	LNM (-1), LNM (-1)	0.02792867

Residual Plot



Obs	RRSIDUAL	ACTUAL	FITTED
1971	0.05375	3.13443	3.08068
1972	-0.07489	3.09372	3.16861
1973	0.06674	3.29835	3.23161
1974	-0.00870	3.42358	3.43228
1975	-0.11642	3.49875	3.61516
1976	-0.00669	3.72933	3.73602
1977	0.02602	3.94687	3.92085
1978	0.02439	4.15360	4.12921
1979	0.03814	4.33763	4.29949
1980	0.02237	4.50742	4.48506
1981	-0.01111	4.63980	4.65091
1982	-0.02800	4.75798	4.78597
1983	0.05892	4.98378	4.92486
1984	-0.00561	5.09539	5.10100
1985	-0.00721	5.21442	5.22163
1986	0.00034	5.35238	5.35205
1987	-0.03203	5.44053	5.47256