

THE BLACK MARKET EXCHANGE RATE AND STABILITY OF DEMAND FOR MONEY IN PAKISTAN: A COINTEGRATION ANALYSIS

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Abstract. Little attention has been paid to analyze the impact of black market exchange rate on the demand for money in developing countries that have black market activities for their currencies. The main purpose of this study is to examine empirically the impact of black market exchange rate on the demand for money in Pakistan where official and black market exchange rates operate side by side due to exchange controls. After incorporating black market exchange rate as one of the determinants of money demand function, it is estimated using quarterly data over 1972-2000 period. Employing ARDL approach combined with CUSUM and CUSUMSQ tests, the results show that M_2 not M_1 is cointegrated with income, inflation rate and black market exchange rate and the estimation relation is also stable for M_2 .

I. INTRODUCTION

In many studies attempts have been made to include an official exchange rate in the money demand function (*see*, for example, Arrango and Nadiri, 1981; Bahmani-Oskooee and Pourheydrian, 1990; Chowdhury, 1997; and Pozo and Wheeler, 2000). However, the official exchange rates in small open economies are more of an exception than a rule. The empirical evidence on the issue is, however, inconclusive with some studies reporting a significant while others reporting an insignificant impact of foreign variables on the domestic demand for money. The differences in findings may thus be attributed to either the improper use of a proxy for the foreign exchange rate, inefficient estimation, or both. Little attention has been paid to analyze the

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impact of the black market exchange rate on the long-run demand for money in developing countries that have black market activities for their currencies (for an exception, *see* Hassan *et al.*, 1995; Bahmani-Oskooee, 1996; Arize and Shwiff, 1998 and Tabesh, 2000). The main purpose of this paper is to examine empirically the impact of the black market exchange rate on the demand for money function in Pakistan.

Historically, Pakistan's exchange rate system has been managed floating type coupled with a great deal of regulation. In Pakistan, with exchange controls, it has been observed that two types of foreign exchange rates, official and black market exist and operate side by side. Individuals tend to alter their portfolio by substituting foreign money for domestic money if the expectations of foreign exchange rate depreciation increase. Due to the exchange controls, the substitution of foreign currency for domestic money takes place through the black market and it may be regarded as the market setting for equilibrium exchange rate that reflects the operation of market forces. This adjustment happens side by side with an official exchange rate. The expectations of foreign exchange rate depreciation lead to a rise in an expected return from holding foreign assets and, in turn, tend to increase the opportunity cost of holding domestic money.

The above discussion brings out the importance of black market exchange rate in Pakistan as an important determinant of the demand for money in these countries. Given this introduction, Section II provides literature review. In Section III, we introduce the money demand function and explain the estimation and stability test procedures. Data sources are also cited in this section. Section IV reports the results and Section V concludes our discussion.

II. REVIEW OF PREVIOUS STUDIES

The effects of the official exchange rate on the money demand function have received a considerable amount of attention from researchers (*see*, for example, Arango and Nadiri, 1981; Bahmani-Oskooee and Pourheydrian, 1990; Chowdhury, 1997; and Pozo and Wheeler, 2000). However, the official exchange rates in small open economies are more of an exception than a rule. The empirical evidence on the issue is however inconclusive with some studies reporting a significant while others report an insignificant impact of foreign variables in the domestic demand for money. The differences in findings may thus be attributed to either the improper use of a proxy for the foreign exchange rate, inefficient estimation, or both. In most of the developing countries with exchange controls or restrictions, both black

market exchange rate and official exchange rate exist and operate simultaneously; with substantial discrepancies between official and black market exchange rates in these countries. Individuals tend to alter their wealth portfolios by substituting foreign currency for domestic money whenever they expect foreign exchange rate depreciation. This adjustment takes place mostly in the black market.

Blejer (1978) examined the effects of the black market exchange rate expectations on the domestic demand for money in three developing countries namely Brazil, Chile, and Columbia With foreign exchange. His study concluded that a depreciation in the black market exchange rate led to a decrease in domestic money demand. He contended that in nations where a substantial discrepancy between the official and the black market exchange rate was quite observable, the expected black market exchange rate could be a major determinant of the domestic demand for money.

Following Blejer (1978), Hassan (1995) investigated the money demand function in Nigeria using quarterly data from the period of 1976-88. Like Blejer, he used conventional regression analysis and his study supported the findings of Blejer (1978). He concluded that expected black market exchange rate depreciation had a significant effect on domestic money demand. He pointed out that depreciation in the black market exchange rate led to a decrease in demand for money and suggested that it should be taken into account in the execution of monetary policy. Furthermore, since the black market exchange rate is the product of exchange restrictions or controls, it should not be regulated because it might lead to the flight of capital through illegal means.

Bahmani-Oskooee (1996) investigated the Iranian demand for money over the period from 1959-90 using annual data. He applied Johansen's cointegration technique and the exclusion test and he demonstrated that long-run demand for real money, M_2 in Iran includes real income, the inflation rate, and the black market exchange rate (not the official exchange rate).

The research work done by Bahmani-Oskooee (1996) attracted a considerable amount of attention from researchers and, to the best of my knowledge, at least three of the studies were conducted for developing countries in line with Bahmani's analysis of the black market exchange rate as a determinant of money demand in Iran.

Arize and Shwiff (1998a) tried to estimate a money demand function that included the black market exchange rate as another determinant of the

demand for money in 16 developing countries using annual data from 1951 to 1988.¹

The main purpose of their study was to test empirically the proposition attributable to Bahmani-Oskooee (1996) that in a country where “there is a black market for foreign currencies, it is the black market exchange rate and not the official rate that should enter into the formulation of the demand for money.” Through the Hausman test, they found that the black market exchange rate was an appropriate regressor in the empirical specification of the money demand function which confirmed Bahmani-Oskooee’s (1996) hypothesis. The authors suggested that the policy makers and monetary authorities in these countries should use currency depreciation to unify the black market with the official market for foreign exchange while following stabilization policies. Arize and Shwiff (1998) estimated the money demand function for 25 developing countries using the same procedure as they had used for 16 developing countries. They found the black market exchange rate as an important determinant of money demand function.

Tabesh (2000) investigated the demand for money in Iran using annual data over the 1959-94 period. The main purpose of his study was to test whether a long-run demand for real M_2 money in Iran was determined by real income, the inflation and expected black market exchange rate.² The author concluded that in a stable money demand function, speculation regarding the black market exchange rate, along with real income, and the rate of inflation determined the domestic demand for real cash balances.

The studies reviewed above bring out one important aspect that before the estimation of functional form of the money demand function, it is necessary to find the cointegration among variables. As the cointegration found, it is regarded as a stable long-run relationship between money demand and its determinants. None of the studies especially in developing countries applied any test for the stability. The issue related to the stability of the long-run coefficients that are used to form the error correction term in conjunction with the short-run dynamics will be addressed in this study. To

¹The 16 countries were India, Korea, Malaysia, Pakistan, the Philippines, Taiwan, Thailand, Egypt, Ghana, Morocco, Tunisia, Brazil, Argentina, Uruguay and Venezuela.

²Tabesh used the same model specification as Bahmani-Oskooee (1996) specified in his study. The only difference was the estimation of the black market exchange rate. Even he used the same statistical tests as Bahmani-Oskooee (1996).

this end, CUSUM and CUSUMSQ tests will be employed to test the stability of the long-run money demand function.

III. THE DEMAND FOR MONEY AND ARDL APPROACH

A stable money demand function is one of the important issues for policy makers in both developed and developing countries. Various factors are considered as determinants of money demand function. The general agreement in the literature is that a money demand equation should contain a scale variable to the level of transactions in the economy and a variable representing the opportunity cost of holding money. In the context of an open economy, a variable reflecting the relative returns of foreign money vis-à-vis domestic money can be included in the money demand equation to reflect the impact of currency depreciation on domestic money demand.

Variable selection and framework chosen are considered to be highly important to modeling and estimating the demand for money. Proper specification of opportunity cost variable happens to be the most important factor in obtaining meaningful results. In literature, it has been accepted that interest rate is not a suitable opportunity cost variable of holding money. This is because of the fact that in developing countries money markets are relatively thin and controlled by the monetary authorities. Furthermore, the choices of asset holders are limited to or between mostly money or goods and not between money and financial assets. Due to the lack of alternative financial assets, the individuals in these countries are generally constrained to invest in bank deposits and bank bonds, at the interest rate which is set by the countries' monetary authorities. Changes in these administered rates are made very infrequently, and therefore, these rates show little or no variations over time (Wong, 1977). So the rate of inflation appropriately reflects the true opportunity cost of holding money in developing countries where inflation rate is fairly high as real assets are considered to be more attractive than financial assets. In such countries, due to the underdeveloped nature of capital market and limited range of financial assets available to the investors, real assets are likely to constitute a substantial component of the individual portfolio. In this situation, to the extent that the rate of inflation reflects the return on real assets, price level changes should be a very important determinant of the demand for money.

Following Bahmani-Oskooee (1996), the money demand is assumed to take the following form:

$$\log M_t = a_0 + a_1 \log Y_t + a_2 \pi_t + a_3 \log BEX + \varepsilon_t \quad (1)$$

where

M_t = Desired holding of real money balances (M_1 or M_2)³

π = $[\text{CPI} - \text{CPI}(-1)] / \text{CPI}(-1)$

CPI = Consumer Price Index (1995 = 100)

Y_t = A measure of real income proxied by Industrial Production (1995 = 100)

BEX = Black market exchange rate is measured by the number of domestic currencies per US dollars

ε_t = Stochastic disturbance term

Following macro theory, while an estimate of a_1 is expected to be positive, an estimate of a_2 is expected to be negative. As for an estimate of a_3 , it could be negative or positive. Given that EX (official exchange rate) is defined as number of units of the domestic currency per US dollar, an increase in EX or depreciation of domestic currency raises the value of foreign assets in terms of domestic currency. If this increase is perceived as an increase in wealth, then the demand for domestic money increases yielding a positive estimate of a_3 . However, if an increase in EX induces an expectation of further depreciation of the domestic currency, public may hold less of domestic currency and more of foreign currency. In this case an estimate of a_3 is expected to be negative. The variations in black market exchange rate are the result of the variations in official exchange rate.

Although our aim is to estimate the long-run income, inflation, and black market exchange rate elasticities of M_1 and M_2 monetary aggregates as outlined by equation (1) and examine their stability, only relying upon equation (1) will not be sufficient. Indeed, Laidler (1993, p. 175) argues that only relying on long-run money demand function is inadequate. He suggests that some of the problems of instability in the money demand function could stem from inadequate modeling of short-run dynamics characterizing departures from the long-run relationship.

³ M_1 consists of currency outside the banks and demand deposits at scheduled banks divided by CPI (Consumer Price Index). M_2 consists of M_1 plus Quasi money divided by CPI.

The error correction version of Autoregressive Distributed Lag (ARDL) model pertaining to variables in equation (1) is as follows:

$$\begin{aligned} \Delta \log M_t = & a_0 + \sum_{i=1}^n a_{1i} \Delta \log M_{t-i} + \sum_{i=0}^n a_{2i} \Delta \log Y_{t-i} + \sum_{i=0}^n a_{3i} \Delta \pi_{t-i} \\ & + \sum_{i=0}^n a_{4i} \Delta \log BEX_{t-i} + \delta_1 \log M_{t-1} + \delta_2 \log Y_{t-1} \\ & + \delta_3 \pi_{t-1} + \delta_4 \log BEX_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

The ARDL approach is very suitable to our formulation of the demand for money because we may have a stationary variable such as inflation rate along with non-stationary variables such as money or income. Pesaran *et al.* (2001) argued that the ARDL approach has the advantage of avoiding the classification of variables into I(1) or I(0) and unlike standard cointegration tests, there is no need for unit root pre-testing.

In this set up, the null of no cointegration defined by $H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ is tested against the alternative of $H_1: \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0$ by the means of familiar F-test. However, the asymptotic distribution of this F-statistic is non-standard irrespective of whether the variables are I(0) or I(1). Pesaran *et al.* (2001) have tabulated two sets of appropriate critical values. One set assumes all variables are I(1) and another assumes that they are all I(0). This provides a band covering all possible classifications of the variables into I(1) and I(0) or even fractionally integrated. If the calculated F-statistic lies above the upper level of the band, the null is rejected, indicating cointegration.

Once cointegration is established, we shift back to equation (2) and try to estimate the entire model using an appropriate lag selection criterion such as Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). Only an appropriate lag selection criterion will be able to identify the true dynamics of the model. From this second stage, not only we obtain estimates of long-run elasticities ($\delta_2 - \delta_4$), but also we apply the CUSUM and CUSUMSQ tests to the residuals of equation (2) to test for stability of long-run elasticities by taking into account the short-run dynamics.

As Pesaran and Pesaran (1997) suggest employing CUSUM or CUSUMSQ tests proposed by Brown *et al.* (1975) to establish the stability of short-run (coefficient estimates of the first differenced variables) as well as long-run (coefficient of EC_{t-1}) parameters. The sample period is broken and the CUSUM and CUSUMSQ statistics are updated recursively and are plotted against the break points. If the plot of CUSUM or CUSUMSQ stay within 5% significance level (portrayed by two straight lines of which

equations are given in Brown *et al.* (1975), section 2.3), then the coefficient estimates are said to be stable.

THE DATA

The quarterly data over 1972Q₁-2000Q₄ is collected from the International Financial Statistics (IFS) by the IMF. The black market exchange rate data over 1972-1993 have been collected from various issues of Pick's Currency Yearbook. These references collect the black market exchange rate data in a systematic and consistent manner from private reporting resources and these data represent the best available "on the street" par values between domestic and foreign currencies. From Pick's Currency Yearbook, the black market exchange rate data are available upto 1993Q₄. The remaining data on black market exchange rate are collected from daily newspapers and are converted into quarterly.

IV. EMPIRICAL ESTIMATES

This section tries to apply the Methodology of the previous section in estimating M_1 and M_2 money demand functions for Pakistan. In the first step, the test for cointegration using F-test with new critical values is carried out. According to Bahmani-Oskooee and Brooks (1999), the F-test is sensitive to the number of lags imposed on each first differenced variable. Thus, we impose two, four, six, eight, ten and twelve lags on each first differenced variable in equation (2) and report the results in Table 1.

TABLE 1
Results of F-Test for Cointegration

	Lag Order					
	2	4	6	8	10	12
M_1 Monetary Aggregate	3.44	5.24	4.23	3.32	2.92	2.76
M_2 Monetary Aggregate	2.82	3.86	2.43	1.03	1.01	1.29

NOTE: At 10% level of significance, the critical value of the upper bound is 3.57.

It appears that there is at least one F-statistics that is greater than the critical value, supporting cointegration between monetary aggregates (M_1 and M_2), income, inflation rate and black market exchange rate. However, we consider these results preliminary at this stage and look for more evidence of cointegration in the second stage when an appropriate lag selection criterion is employed.

In the second stage, we employ Akaike's Information Criterion (AIC)⁴ in selecting the lag length on each first differenced variable and re-estimate equation (2) and report the results in Tables 2 and 3.

In each table there are two panels. We go through an explanation for each panel, considering Table 2 that reports the results for real M_1 monetary aggregate. Panel A reports the coefficient estimates of all lagged first differenced variables in the Auto Regressive Distributed Lag (ARDL) model (short-run coefficient estimates). Not much interpretation could be attached to the short-run coefficients. All they show is the dynamic adjustment of all variables.

In Panel B, the long-run coefficients are reported. These are the coefficients of $\delta_1 - \delta_4$ from ARDL model. Following the literature, these long-run elasticities on LM are normalized by dividing them by $-\delta_1$. This yields an income elasticity of 0.52. The inflation rate elasticity is negative (-21.85) and is not significant. The black market exchange rate coefficient is positive and insignificant.

Kremer *et al.* (1992) have shown that the significant lagged error correlation term is a more efficient way of establishing cointegration. The estimates of $\delta_1 - \delta_4$ are used to form a lagged error correction term,

$$EC_{t-1} = \delta_1 \log M_{t-1} + \delta_2 \log Y_{t-1} + \delta_3 \pi_{t-1} + \delta_4 \log BEX$$

After replacing the linear combination of the lagged level of variable in the ARDL model equation (2) by EC_{t-1} , the model is re-estimated by imposing the same lag structure selected by the Akaike's Information Criterion, and look for the significance of EC_{t-1} . A negative and significant coefficient of EC_{t-1} will be an indication of cointegration. As can be seen from Panel B, the EC_{t-1} carries an expected negative sign but is insignificant, indicating that real M_1 , income, inflation rate, and black market exchange rate are not cointegrated.

The Lagrange Multiplier (LM) statistic which is distributed as χ^2 with 4 degrees of freedom is also reported. Since calculated LM statistic of 2.63 is less than the critical value of 9.48, it is concluded that the residuals of the estimated ARDL are free from serial correlation. In Panel B, Ramsey's RESET test for functional specification is also reported, which is distributed as χ^2 with only one degree of freedom. Again, since calculated RESET

⁴The Schwartz Bayesian Criterion (SBC) is also employed which gives the consistent results.

statistic is less than its critical value of 3.84, it is concluded that the ARDL model is correctly specified.

TABLE 2

Full Information Estimate of Equation (2)
(M₁ Monetary Aggregate) 1972Q₁-2000Q₄

Panel A Short-Run Coefficient Estimates (Black Market Exchange Rate)

Lag Order	$\Delta \ln M$	$\Delta \ln Y$	$\Delta \pi$	$\Delta \ln BEX$
0		0.10 (2.59)	-1.09 (4.78)	-0.03 (0.39)
1	-0.11 (1.03) ^a			-0.17 (2.14)
2	0.14 (1.41)			
3	0.02 (0.21)			
4	0.36 (4.37)			
5	-0.13 (1.48)			

Panel B Long-Run Coefficient Estimates and Diagnostics

Constant	$\ln Y$	π	$\ln BEX$	\bar{R}^2	EC_{t-1}	LM^b	$RESET^c$
9.85 (10.49)	0.52 (1.72)	-21.85 (1.27)	0.43 (0.98)	0.73	-0.07 (1.43)	2.63	0.01

Notes: a Number inside the parenthesis is the absolute value of the t-ratio.

b LM is the lagrange multiplier test for serial correlation. It has a χ_2 distribution with four degrees of freedom. The critical value at the 5% level of significance is 9.48.

c RESET is Ramsey's specification test. It has a χ_2 distribution with only one degree of freedom. The critical value at the 5% level of significance is 3.84.

A graphical presentation of CUSUM and CUSUMSQ tests is provided in Figures 1 and 2 for real M₁ monetary aggregate. As can be seen, the plot

TABLE 3

 Full-information Estimate of Equation (2)
 (M₂ Monetary Aggregate) 1972Q₁-2000Q₄

Panel A Short-Run Coefficient Estimates (Black Market Exchange Rate)

Lag Order	$\Delta \ln M$	$\Delta \ln Y$	$\Delta \pi$	$\Delta \ln BEX$
0		0.10 (2.56)	-1.16 (6.03)	0.01 (0.02)
1	-0.02 (0.19)		-0.21 (0.54)	-0.06 (0.94)
2	0.26 (2.10)		0.01 (0.01)	0.04 (0.64)
3	0.23 (1.86)		-0.28 (1.23)	-0.14 (2.15)
4	0.39 (3.40)			
5	0.04 (0.39)			
6	-1.14 (1.49)			
7	0.03 (0.38)			
8	-0.01 (0.04)			
9	0.10 (1.15)			
10	0.28 (2.95)			

Panel B Long-Run Coefficient Estimates and Diagnostics

Constant	$\ln Y$	π	$\ln BEX$	\bar{R}^2	EC_{t-1}	LM^b	$RESET^c$
9.57 (49.05)	0.61 (4.56)	-7.38 (2.06)	-0.39 (2.94)	0.77	-0.16 (3.64)	2.89	0.02

- Notes: a Number inside the parenthesis is the absolute value of the t-ratio.
- b LM is the lagrange multiplier test for serial correlation. It has a χ^2 distribution with four degrees of freedom. The critical value at the 5% level of significance is 9.48.
- c RESET is Ramsey's specification test. It has a χ^2 distribution with only one degree of freedom. The critical value at the 5% level of significance is 3.84.

FIGURE 1

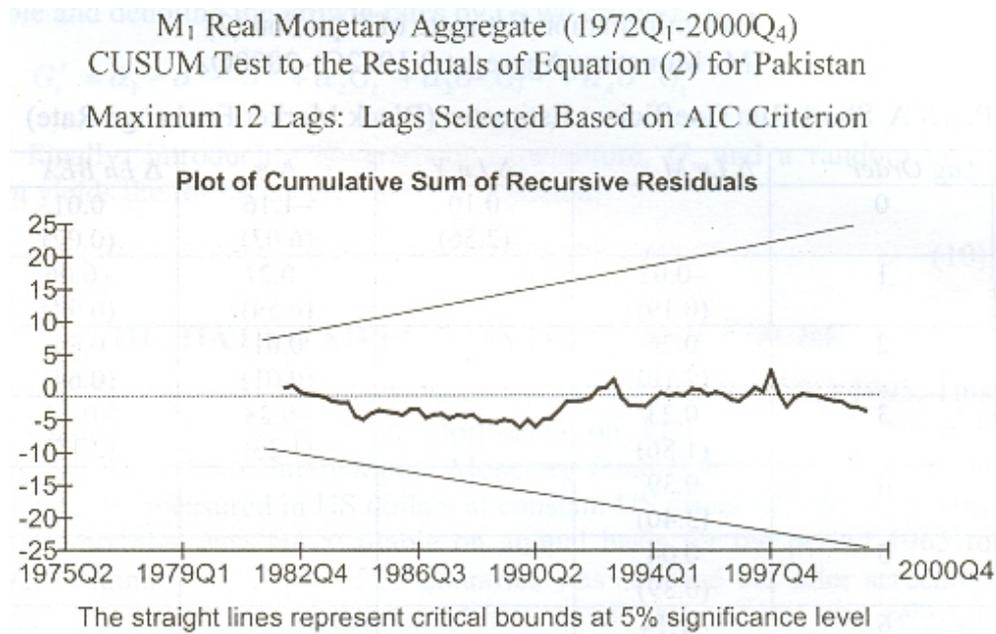


FIGURE 2

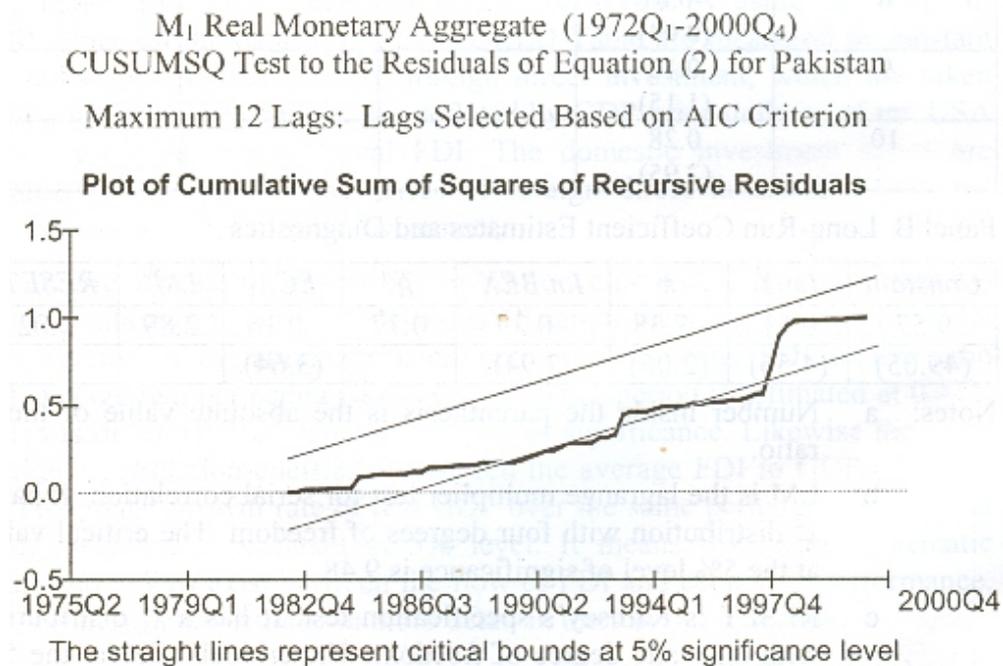


FIGURE 3

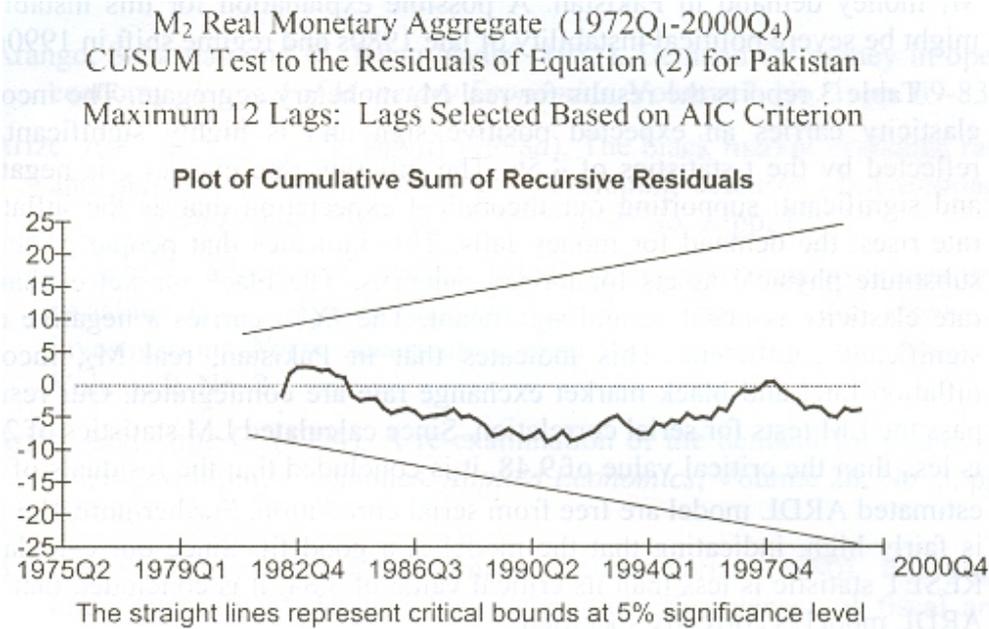
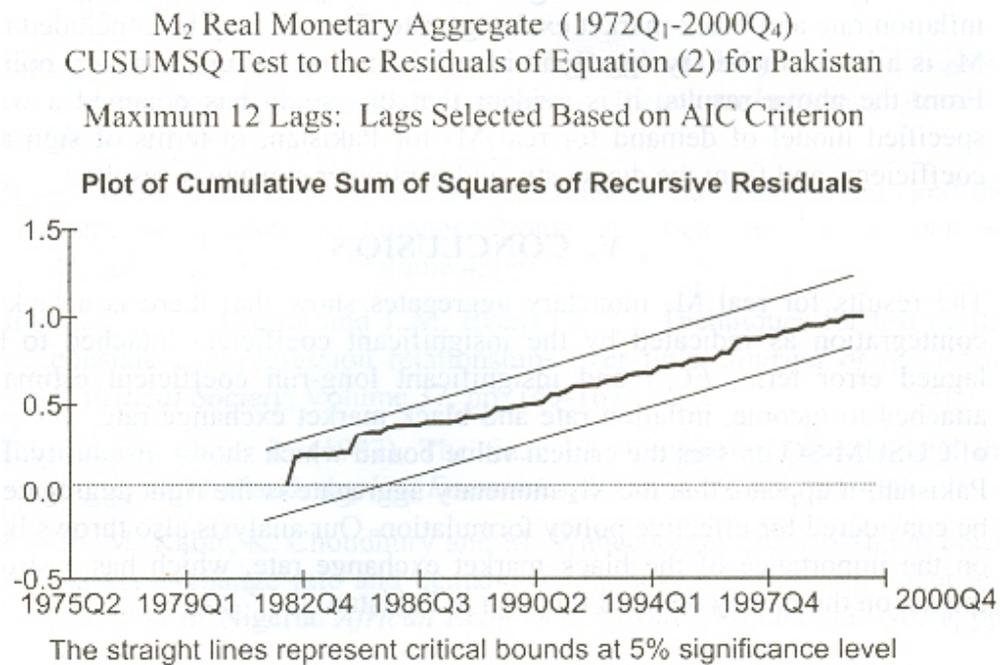


FIGURE 4



of CUSUMSQ statistic crosses the critical value line, indicating instability in M_1 money demand in Pakistan. A possible explanation for this instability might be severe political instability of late 1980s and regime shift in 1990s.

Table 3 reports the results for real M_2 monetary aggregate. The income elasticity carries an expected positive sign and is highly significant as reflected by the t-statistics of 4.56. The inflation rate elasticity is negative and significant, supporting our theoretical expectation that as the inflation rate rises, the demand for money falls. This indicates that people prefer to substitute physical assets for money balances. The black market exchange rate elasticity is negative and significant. The EC_{t-1} carries a negative and significant coefficient. This indicates that in Pakistan, real M_2 , income, inflation rate, and black market exchange rate are cointegrated. Our results pass the LM tests for serial correlation. Since calculated LM statistics of 2.89 is less than the critical value of 9.48, it is concluded that the residuals of the estimated ARDL model are free from serial correlation. Furthermore, the \bar{R}^2 is fairly high, indicating that the model is a good fit. Since our calculated RESET statistic is less than its critical value of 3.84, it is concluded that the ARDL model is correctly specified.

The plots of CUSUM and CUSUMSQ tests are presented in Figures 3 and 4. It can be seen that the plots of these two tests do not cross the critical value line, indicating a stable long-run relationship between real M_2 , income, inflation rate and black market exchange rate. Thus, it may be concluded that M_2 is a better monetary aggregate in terms of formulating monetary policy. From the above results, it is evident that this study has obtained a well-specified model of demand for real M_2 for Pakistan, in terms of sign and coefficients and from the diagnostic and parameter constancy results.

V. CONCLUSION

The results for real M_1 monetary aggregates show that there is a lack of cointegration as indicated by the insignificant coefficient attached to the lagged error term, EC_{t-1} and insignificant long-run coefficient estimates attached to income, inflation rate and black market exchange rate. The plot of CUSUM-SQ crosses the critical value bound which shows instability. For Pakistan, it appears that the M_2 monetary aggregate is the right aggregate to be considered for effective policy formulation. Our analysis also throws light on the importance of the black market exchange rate, which has a strong impact on the money demand function in Pakistan.

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