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The Long-Run Relationship among Money, Income And The Price Level In Pakistan

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Abstract

This paper explores whether a significant long-run relationship exists between money, price level and GDP in the Pakistani economy. We apply time-series econometric techniques to quarterly data for the Pakistan economy for 1972: I to 2003: IV. An important feature of our analysis is the use of tests for unit roots and ARDL and ECM. ARDL has a numerous advantages over the traditional approaches of causality and Cointegration. Certain characteristics of the Pakistani experience suggest that there is a stable long run relationship. Radical changes in monetary policy have significantly affected the movement of the macroeconomy. We find that a long-run relationship exists between money supply (M1), GDP and the CPI.

Key words: Monetary Policy, GDP, Price Level, Autoregressive Distributive Lag Model (ARDL).

1. NTRODUCTION

Monetary policy plays an important role in economic growth. The relationship among money supply, income and prices has long been a subject of controversy between the Keynesian and monetarist schools of thought. According to Keynesian, in the Hicks-Hansen, IS-LM model, money affects income through changes in the rate of interest. This is a short-run model in which the price level is assumed to be constant. As long as the investment demand curve is elastic and the demand for money is not infinitely elastic, changes in money have a positive effect on income. Since changes in money stock are induced by changes in income, not vice versa. Monetarists, on the other hand, relied on the equation of exchange as a theoretical framework for explaining the relationship between money and income. In their framework, given that the income velocity of money is stable, money has a direct and proportional effect on income. In the long-run money has a neutral effect on income since prices change proportionally to change in money leaving the real value of income unchanged. Friedman and Schwartz (1963), and subsequent works by Friedman, attempts to provide theoretical as well as empirical support for the close relationship between money and income. So money plays active role in income generation, and changes in income are induced largely by changes in money stock.

The question whether money causes the income is important for monetary economist and has been subjected to a variety of modern econometrics techniques, producing conflicting results. One often applied method to investigate the empirical relationship between money and income in Granger Causality Analysis (Granger 1969), Johnson Maximum Likelihood Cointegration Test (1988) in order to determine the long run relationship. Johnson method imposes a strict restriction that the variables in system will be of equal order of integration. Furthermore it does not include the information on structural break in the time series data and also suffer from low power. Studies in case of Pakistan have only focused the Granger Causality Analysis.

Recently researchers in this area have attempted to distinguish between the short run and the long-run relationships between money and income. Tanner (1993) and Tanner and Davis (1997) have shown that there was a temporary breakdown of money-income relationship in the United States during the 1980s. However, over the period of 1874-1993, money remained the most important variable accounting for fluctuations of income. On the other hand, Rapach (1998) showed long-run neutrality of money along the lines advocated by Lucas (1970) and empirically supported by King *et al.* (1991) and Gali (1992). Similarly, Fung and Kasumovich (1998) has studied the relationship for six OECD countries and showed that money shocks influence nominal income.

The purpose of this paper is to add to the body of existing literature by examining the money, income and prices relationship in short-run as will as in long-run in Pakistan. In this paper we are not only going to use a new and recent data set but will use an alternate econometric technique, the Autoregressive Distributed Lag (ARDL) approach, which has numerous advantages. This approach can be applied irrespective of whether the variables are integrated of same order or not (Pesaran and Pesaran, 1997). It takes sufficient number of lags to capture the data generation process in a general to specific modeling framework. Moreover, a dynamic error correction model (ECM) for short run relationship, can be derived from ARDL through a simple linear transformation (Banerjee et al. 1993). The ECM integrates the short run dynamics with the long run equilibrium without loosing long run information. Furthermore ARDL approach avoids problems resulting from non-stationary time series data (Laurenceson and Chai, 2003).

This paper examines to determine the relationship among money supply, income and price level for the time series quarterly data of 30 years (1972-20093 for Pakistan. It is too much crucial for the economic growth, development and policy makers in order to examine this relationship. The remaining sections of the article are as follows; section II presents the literature review, section III includes modeling, data and methodological framework, section IV explains the results interpretation, and finally, section V concludes the whole study and presents some policy implications.

1.1 REVIEW AND PREVIOUS WORK

National Income, prices and Money Supply, these are three key macroeconomic variables that play an important role in setting pace of economic growth and maintaining macroeconomic stability. Various studies have analyzed the causality between money supply and income. The results of the various studies are not consistent and controversy is there.

Some studies have established unidirectional causality running from income to money, and from money to income, some have established bi-directional causality while others have found no evidence of any causality many economist work on this topic in different countries of the world and by so many other variable included with the money income causality such as prices, interest rate, and level GDP inflation etc.

Upadhyaya (1991) evaluated the effectiveness of monetary and fiscal policies for the period 1957-87. He used a St. Louis type reduced from single equation model for four developing countries: India, Pakistan and Srilanka. He modified the original St. Louis equation by adding foreign trade variables. He explained changes in nominal GNP through money supply (M1) and government expenditure. He assumed that the effect of each of the explanatory variable on the dependent variable was completed with in two years. Therefore, he specified two-year lags for each variable. In the case of Pakistan the impact of change in money stock (M1) was found to be significant in the first year, but this become insignificant for all the lagged periods. However, the overall cumulative impact was significant. The effect of government expenditure was significant for only the first year and then become insignificant. He found unidirectional causality from the monetary variable to nominal GNP. He confirmed the exogeoneity of the monetary variable (M1) with respect to nominal GNP. Therefore, he argued that monetary policy is more effective than fiscal policy in Pakistan.

Abbas (1991) examined the effectiveness of monetary policies for selected developing Asian countries for the period 1960-1988. He used Granger test for measuring causality between the monetary variables (M1 and M2) and income (GDP). Abbas found that M1 did not cause income (GDP), irrespective of whether the lag-length used was 1,2 or 3-years or even when the lag-length was selected using the Final Prediction Error (FPE) method.. For the lag-length of one year, M2 caused income (GDP). On the other hand, M2 and GDP show a bi-directional causality for lag-length of 2 and 3-years and also with the model based on the FPE method. Thus the effectiveness of the monetary variable in term of GDP variation was not confirmed.

The validity of these results is limited due to separation of East Pakistan. Moreover, these studies used nominal GNP rather than real GNP as a dependent variable.

Hussain (1992) used Granger and Sims test to judge the relative effectiveness of monetary and fiscal policies. He reported that monetary policy is effective for the period 1971-72 to 1989-90.but the validity of the results are limited due to excessive massaging of the data, the arbitrary assumption of a one year policy impact lag and the use of nominal GNP rather than real GNP as the dependent variable. These empirical studies suffer from the following methodological deficiencies:

I) They did not examine the time series properties of the variable (stationarity of the variables). Thus, OLS regression analysis leads to (I) non normal coefficient distribution (II) spurious regression problem (III) inconsistent and inefficient OLS estimated of parameters and (IV) invalid error correction representation (Johnson and Juselios 1991)

II) They run the regressions in difference form. This eliminates the long run information embodied in the level (without difference) form.

Biswas and Saunders (1988) provide further empirical evidence on the money income relationship in the United States. Their study uses Hsiao (1972, 1981) minimum final prediction error approach in the causality testing as well as an arbitrary lag select technique.

Hussain (1982) used the St.Louis equation to judge the relative effectiveness of monetary policy and fiscal policy for Pakistan the period (1949-1971). He used M1 and total government expenditure as proxies of monetary and fiscal policy respectively. He reported that monetary policy is relatively is less effectively in term of nominal GDP determination than fiscal policy.

Khan and Siddique (1990) investigate the direction the causality among money, price and economic ectivity for Pakistan for the period 1972:I to 2003:IV. to asses the effectiveness of monetary policy. They used the test procedure of Sims. They found the direction of causation runs from economic activity (nominal GNP) to money (M1 and M2) without any feedback. It was suggested that the expansion of money supply is determined by the change in economic activity. They found that unidirectional causality running from M1 to prices and bidirectional feedback relationship between M2 and prices. Thus they conclude that growth in money supply and prices are exogenous. Therefore, money supply is not are key variable in the determination of level of output.

Some more studies have tasted the relationship among income, money supply and the price level using time series data techniques, for Canada Stock and Watson (1989), for US data Friedman and Kuttner (1992, 1993) and Thoma (1994) reports that changes in money do not have a statistically significant impact on output in the United States.

Recently Hafer and Kutan (2002) used a sample of 20 industrialized and developing countries to examine the long run relationship between money and income. They have estimated a significant long run relationship.

Most recently Azher Iqbal et al. (2004) has studied money income link in developing countries and concluded that the causal relationship between money and two variables viz, income and prices appeared to be fairly heterogeneous across diverse sample of fifteen developing countries. Most of the evidence seems to favour the view that the relationship between the nominal money and real output is bi-directional. Their result was very much country specific. This highlights the dangers together in cross-section equations countries with very different economic experiences, which may reflects different institutional characteristics, different policies in their implementation. They further found that there would be no' wholesale' acceptance of the view that 'money leads income' and there would be no 'wholesale' acceptance of the view that money follows income as well.

Ramchandran and Kamaiah (1992) reexamined the relationship between money and price for India. They used seasonally adjusted quarterly data for 1961:1 to 1987:4 with four alternative measures of monetary stock (M1, M2, M3, and MB) and two price proxies (WPI and CPI with 1970 as a base year). They applied the Akaike Minimum Final Production Error (FPE) method to choose the quarterly lagged length of each variable. Granger test has been applied on the given lagged structure and the F test used for ascertaining joint significance. They found that M3 and price proxies have feed back relationship. For M2 and M3 the causal direction the causal direction across the price proxies seems inconsistent. However, no causation was observed between price proxies and M1 definition of money. They also examined causality through Engle-Granger (1987) method. They estimate error correction models (ECM)-the above question with lag term of cointegrated residuals. The significant EC terms in the price questions showed unidirectional causality from money (M1, M2 and M3) to prices. For M3 feed back was observed. Thus the results obtained from ECM showed that monetary was effective with respect to (M1, M2 and M3) as a means for controlling inflation in India.

Ibrahim (1998) examined the temporal causality between aggregates (M1 and M2) and other macroeconomic variables (CPI, real industrial production index and one year treasury bill rate) for Malaysia over the period over 1976:I to 1995:IV by using unadjusted seasonal data. He used Enger-Granger causality test (1987) in two variables (money and output), three variables (money, output and price) and four variables (money, output, price and interest rate) models. He used FPE criterion to determine the lagged length. He found that the models for 3 and 4 variables are co-integrated with M2.Results showed that bidirectional causality exists between M2 and real industrial production, and M2 and monetary policy was seen to be ineffective in Malaysia.

Biswas and Saunders (1998) examined causality between M1 and nominal national income for India over the period 1973:1 to 1995:4. They used Engle-Granger (1987) causality test. They specified two lags of each variable and lagged error term of co-integrated regression. Results showed that nominal income and money supply have a feed back relationship. Thus, monetary policy was ineffective.

Camas and Joyce (1993) used Granger causality test in multivariable framework for India and Mexico for the period 1963 - 75 and 1970-82, respectively. They used industrial production index, CPI, domestic credit, foreign exchange reserves and American money supply, which was used as a foreign money supply proxy. They found that domestic monetary policy was not effective in either country. They further supported these results through variance Decomposition (VDCs) and Impulse Response (IRFs) based analysis.

These empirical studies suffer from the invalid from error correction models. If variables are linked by more than one co-integrating vectors, then the Engle-Granger procedure (1987) is no longer applicable (Thomas 1997).

Masih and Masih (1997) tested money-price causality in bi-variate and multivariate framework for Pakistan for the period 1971:1 to 1994:4. They used CPI, spot exchange rate, industrial production index, market interest rate and two alternative proxies of money supply (M1 and M2). They used the Johansen (1991) technique for multivariate framework. They found, through ECMs, that price was leading variable. Thus, monetary policy was seen to be ineffective in Pakistan. They further supported these results through VDs and IRF base analysis.

Qiao Yu (1997) used the Johanson (1991) technique for estimating VECM for China for the period 1979. 1 to 1994.12. He used three alternative measures of money supply (M0, M1 and M2), two alternative measures of credit, five alternative measures of output, three alternative measures of sales, fixed-assets investment, merchandise imports, retail price index and exogenous dummy for tight monetary policy. He estimated several three variable systems. These systems contain a price variable, a non-price variable and a financial variable. He reported that the performance of bank credit is less impressive than that of the monetary aggregates.

1.1.1 METHODOLOGY AND DATA DISCRIPTION

The traditional practice in determining long run and short run relationship among variables in literature has been used the standard Johnson Cointegration and VECM framework, but this approach suffers from serious flaws as discussed earlier. The results related to long term as will as short term relationship often depends upon the observation period and the economic techniques employed. In this regard, when time series data are used for analysis in econometrics, several statistical techniques and steps must be undertaken. First of all unit root test has been applied to each series individually in order to provide information about the stationarity of the data. Non-stationary data contains unit roots. The existence of unit roots and to determine the degree of differences in order to obtain statistically stationary series of variables that are money supply M1, GDP and Prices P, Augmented Dickey-Fuller Test (1979, 1981) and Philips-Parron (1988) have been applied. The tests are based upon estimating the following equations.

$$\Delta GDP_t = \alpha_0 + \alpha_1 t + \alpha_2 GDP_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta GDP_{t-i} + \varepsilon_{t1} \quad (1)$$

$$\Delta M1_t = \beta_0 + \beta_1 t + \beta_2 M1_{t-1} + \sum_{i=1}^{n} \delta_i \Delta M1_{t-i} + \varepsilon_{t2} \quad (2)$$

and

$$\Delta P_t = \lambda_0 + \lambda_1 t + \lambda_2 P_{t-1} + \sum_{i=1}^{n} \psi_i \Delta P_{t-i} + \varepsilon_{t3} \quad (3)$$

If the time series data of variable is found to be non-stationary, then there may exist a long run relationship among these variables, M1, GDP, and P.

Since, in order to obtain robust results for the long run relationship, we utilized the ARDL approach to known the existence of long run relationship and short run. ARDL is a powerful concept because it allows us to describe the existence of an equilibrium/relationship in long run and short run dynamics without loosing long run information. ARDL approach consists of estimating the following equation.

$$\Delta GDP_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{n} \beta_i \Delta GDP_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta M1_{t-i} + \sum_{i=1}^{n} \delta_i \Delta P_{t-i} + \lambda_1 GDP_{t-1} + \lambda_2 M1_{t-1} + \lambda_3 P_{t-1} + \varepsilon_t \quad (4)$$

The first part of the equation with β_i , γ_i and δ_i , represents the short run dynamics of the model whereas the parameters λ_1, λ_2 and λ_3, represents the long run relationship, the null hypothesis of the model is,

H_0: $\lambda_1 = \lambda_2 = \lambda_3 = 0$ (There exist no long run relationship.)

H_1: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$

The ARDL model testing procedure starts with conducting the bound test for the null hypothesis of no Cointegration. The calculated F-statistic is compared with the critical value tabulated by Pesaran (1997) or Pesaran et. al. (2001). If the test statistics exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected regardless of whether the underplaying order of integration of the variables is zero or one. Similarly, if the test statistic falls below a lower critical value, the null hypothesis is not rejected .however, if the test statistic falls between these two bounds, the result is inclusive. When the order of integration of the variables is known and all the variables are I (1), the decision is made on the upper bound. Similarly, if all the variables are I (0), then the decision is made based on the lower bound.

The ARDL methods estimates $(p+1)^k$ number of regression in order to obtain optimal lag length for each variable, where p is the maximum number of lag to be used and k is the number of variables in equation.

In the second step, when the long run relationship is estimated using the selected ARDL model and long run relationship among variables is found, there exists an error correction relationship. Therefore, in the third step, the error correction model is estimated. The error correction model result indicates the speed of adjustment back to the long run equilibrium after a short run disturbance. The standard error correction model (ECM) involves estimation of the following equation.

$$\Delta GDP_t = \gamma_1 + \delta_1 CE_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta GDP_{t-i} + \sum_{i=1}^{n} \beta_i \Delta M1_{t-i} + \sum_{i=1}^{n} \mu_i \Delta P_{t-i} + \varepsilon_t \quad (5)$$

To ascertain the goodness of fit the ARDL model, the diagnostic test and the stability test are conducted. The diagnostic test examines the serial correlation, functional form, normality and heteroscedasticity associated with the model. The structural stability test is conducted by employing the cumulative residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). Examining the prediction error of the model is another way of ascertaining the reliability of the ARDL model. If the error or the difference between the real observation and the forecast is insignificant, then the model can be regarded as best fitting.

We use quarterly data from 1972–2003 to investigate the existence of short-run dynamics as will as long-run equilibrium relationship among money supply, income and prices in Pakistan. Gross Domestic Product (GDP), money (M1), and Consumer Price Index (P), are used as Income, Money and Prices, respectively. Table 1 presents summery statistic of the data.

The principal data sources are International Financial Statistics (IFS) and “QUARTERISATION OF ANNUAL GDP OF PAKISTAN” by A. R. Kemal and Muhammad Farooq Arby.

Table No . 1 here

1.1.2 EMPIRICAL RESULTS

Prior to determining whether all the series are integrated, this study examines the integration order of all the variables by applying unit-root test (ADF), i.e. Dickey and Fuller (1981) and Philips-Parron (1988). Unit-root test are classified in to series with and without unit roots, according to their null hypothesis, in order to conclude whether each variable is stationarity or not. All the variables are first tested for stationarity with intercept and trend using the Augmented Dickey-Fuller (ADF) and Philips-Parron. The results in Table 2 and 3 show that GDP is I(0) and the remaining variables M1 and P are I(1).

Table No . 2 here

Table No . 3 here

Both the test results (ADF and Philips Perron) in the above tables indicate that the Gross Domestic Product (GDP) is stationary at level and is integrated of order zero I(0), while the remaining two Money supply (M1) and Prices (P) are not stationary at level but at first difference. They are integrated of order one I (1). It is possible to deploy the ARDL to determine whether there exists a stable long run relationship among these variables GDP, M1 and P in Pakistan.

Now we turned to ARDL for long run relationships as mentioned in Table 4. The main assumption of ARDL is that included variables in model are having co integrated order *I(0)* or *I(1)* or mutually . This lends to support for the implementation of bounds testing, which is three steps procedure, in the first step we selected lag order on the basis of SBC because computation of F-statistics for Co-integration is very much sensitive with lag length, so lag order 5 is selected on lowest value of SBC[1]. The total number of regressions estimated following the ARDL method in the equation 4 is $(5+1)^3 = 216$. Given the existence of a long run relationship, in the next we used the ARDL co-integration method to estimate the parameters of equation (4) with a maximum order of lag set to 5 minimize the loss of degrees of freedom. The results of bounds testing approach for co-integration long run relationship represent that the calculated *F-statistic* is 18.85, which are higher than the upper level of bounds critical value of 7.52 and lower bounds value of 6.34 for k=2, implying that the null hypothesis of no co-integration cannot be accepted and, indicating that there is indeed a co-integration relationship among the variables. Having found a long run relationship, we applied the ARDL method to investigate the long run and short run parameters.

Table No .4 here

These results convey very important information. They indicate the existence of a stable long run relationship among income, money supply and price level in Pakistan. Therefore, change in money supply positively affects the income growth, while the price level has a significant negative impact. An important feature of cointegrated variables is that their time paths are influenced by the extent of deviation from the long run equilibrium. If the model is out of equilibrium at any point in time and if it returns to the long run equilibrium, the movements of at least one of the variables must respond to the magnitude of the disequilibrium. If the gap between the money supply and the GDP is large relative to the long run relationship, then the GDP must ultimately rise relative to money supply. This gap can be close in one of the three following ways.

1. This may occur if the income rises. The nominal income can increase as the result of an increase in the price level, or an increase in real out put, or some combination of increases in both of these variables.
2. The adjustment can take place through an increase in the money supply and a related large increase in income.
3. This gap can be close by a fall in money supply accompanied by a smaller fall in the nominal income.

It is not possible to determine which of these possibilities will occur without a full dynamic specification of a model. However, it is possible to investigate the short run dynamics of the present model with the Error Correction Model (ECM).

After establishing the long run relationship, table 5 reports the short-run coefficient estimates obtained from the ECM version of ARDL model. The ECM coefficient shows how quickly/ slowly variables return to equilibrium and it should

[1] At lower value of SBC, value of AIC is also low.

have a statistically significant coefficient with negative sign. The error correction term CE_{t-1}, which measures the speed of adjustment to restore equilibrium in the dynamics model, appear with negative sign and is statistically significant at 5 percent level, ensuring that long run equilibrium can be attained. Bannerjee et al., (1998) holds that a highly significant error correction term is further proof of the existence of stable long run relationship. Indeed, he has argued that testing the significance of CE_{t-1}, which is supposed to carry a negative coefficient, is relatively more efficient way of establishing Co-integration. The coefficient of CE_{t-1} is equal to (-0.433772) for short run model, which imply that deviation from the long-term equilibrium is corrected by 43.4 percent over the each quarter of year at 5 percent level of significance. The lag length of short run model is selected on basis of Schwartz Bayesian Criteria (SBC). In short run dynamics, income is influenced positively by its lagged period at 1 percent level of significance by 0.84 percent. Money supply is having positive impact on income and negative affect of the price level.

Table No . 5 here

The ECM model passes all short run diagnostic tests for no serial correlation, no conditional autoregressive serial correlation, no heteroskedasticity and no specification in functional form and the error term is normally distributed. The regression for the underlying ARDL equation fits very well at $R^2 = 0.9751$ and also passes the diagnostic tests. The cumulative sum (CUSUM) and cumulative sum of squares (CUSUMsq) plots from recursive estimation of the model also indicate stability of long run coefficients over the sample period because graphs of cumulative sum of squares (CUSUM) and (CUSUMsq) do not exceeds the critical boundaries of both the figures at 5% level of significance.

2 CONCLUSION

The main purpose is to examine the long run and short run causal relationship among income, money supply and price level in Pakistan. This subject has been widely investigated in the past in both developed and developing countries, including Pakistan.

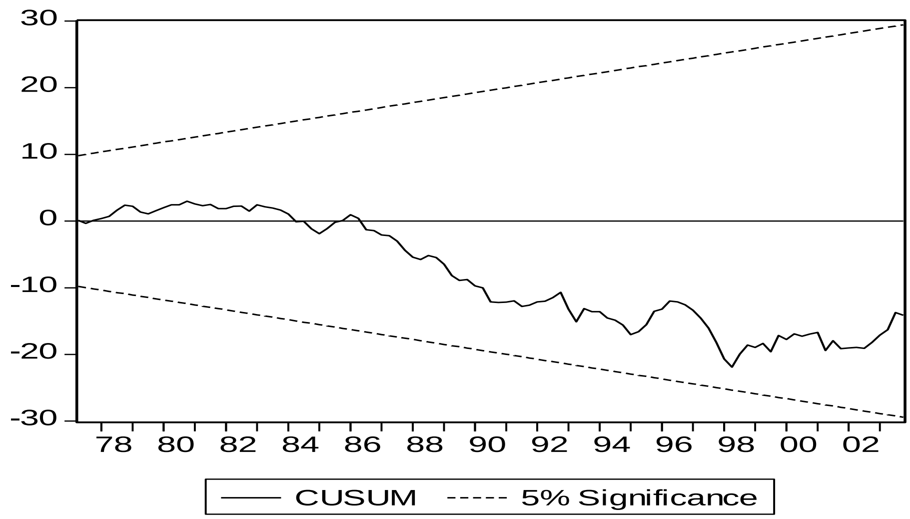
The findings drawn from the results are that there is stable long run relationship among these three variables. This means that the monetary authority should try to provide long run price stability or a low average rate of inflation. According to Eichenbaum (1997), this type of monitory policy can provide a stable economic environment. This environment will aid economic agents in their decision making. Therefore, it is fair to conclude that monetary policy, as approximated by changes in the M1 money supply, will have important implications for changes in Pakistan's nominal income in the long run. In short run the monetary policy is relatively effective. The short run results indicate that the money supply is exogenous and causes a significant movement in the price level and hence GDP.

The policy implications stemming from the analysis suggest that monetary policy plays an active role in influencing the level of economic activity in Pakistan. An increase in money supply increases economic activity, which in turn increases money demand to finance a higher level of economic activity.

APPENDIX

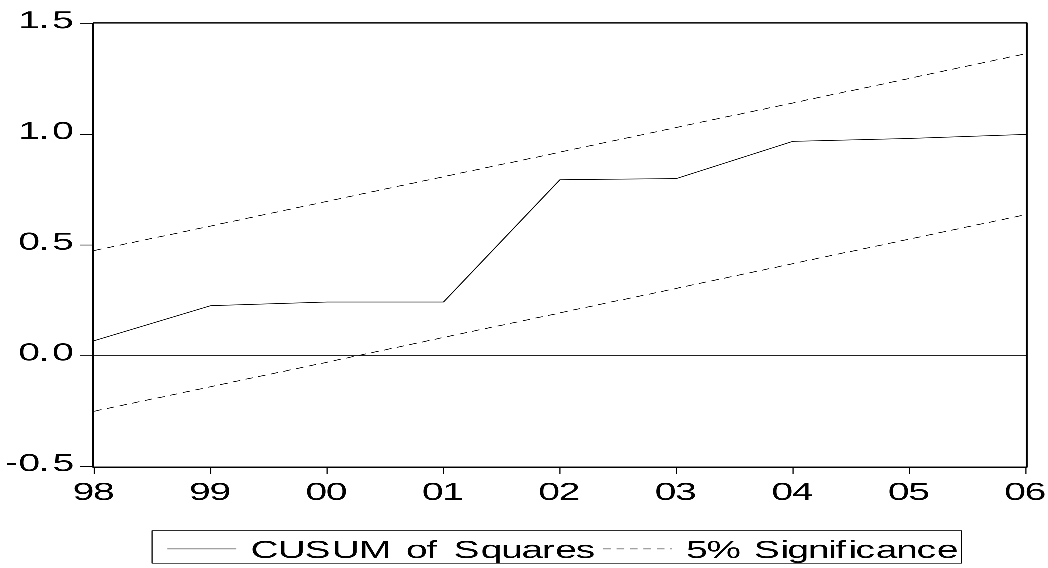
Figure 1

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

Figure 2
Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

Table No. 1

Descriptive Statistics and Correlation Matrix

Variables		GDP	M1	CPI
Mean		108087.7	314330.8	46.87789
Median		101643.4	175145.0	33.33000
Maximum		207343.1	1387600.	112.5500
Minimum		36103.08	16850.30	7.230000
Std. Dev.		48521.14	331454.0	32.59856
Skewness		0.259063	1.227473	0.673105
Kurtosis		1.825437	3.609517	2.026557
Jeraq-Bera		8.789623	34.12413	14.71932
Probability		0.012341	0.000000	0.000636
Observations		128	128	128
Correlation Matrix	**GDP**		**M1**	**P**
GDP		1.000000	0.913883	0.954548
M1		0.913883	1.000000	0.451009
P		0.954548	0.451009	1.000000

Table No. 2

Unit-Root Estimation (ADF Test)

Variables	Lag 1	Lag 2	Lag 3
GDP	-6.536704*	-6.659126*	-2.659437
ΔGDP	-11.93739*	-63.02790*	-7.873564*
M1	5.243678	5.243678	6.658352
Δ M1	-6.991286*	-6.619001*	0.293160
P	-0.631780	-0.631780	-0.707881
ΔP	-6.472669*	-4.162480*	-2.843155

Notes: * Represents significant only at 1%.

** Represents significant at 5%.

Table No. 3

Unit-Root Estimation (Philips Perron Test)

Variables	Lag 1	Lag 2	Lag 3
GDP	-13.68607*	-13.54653*	-13.51185*
Δ GDP	-29.04527*	-42.04353*	-114.3729*
M1	4.674447	4.619607	6.173147
ΔM1	-16.65859*	-16.56516*	-16.42385*
P	-0.748626	-0.762399	-0.777329
ΔP	-6.565526*	-6.358623*	-6.261957*

Notes: * Represents significant at 1%.

Table No.4

Estimated long run coefficients using the ARDL approach

Dependent Variable: GDP

Variables	**Coefficient**	**t-values**	**Prob-values**
Constant	5513256	1.474152	0.0416
GDPt-1	0.074134	4.390413	0.0017
M1t-1	0.026431	3.639197	0.0021
Pt-1	-108.60183	-2.390413	0.0059
R^2 = 0.976525		**F-Statistics** =317.93 (0.000)	
Adjusted-R^2= 0.973454		**Durbin-Watson stat** =2.006008	

Table No.5

Error correction representation for the selected ARDL-model (4, 5, 2)

Dependent variable: ΔGDP

Variables	**Coefficients**	**t-values**	***Prob*-values**
Constant	1602.060	1.830744	0.0699
ΔGDP(-1)	0.352453	1.982325	0.0459
ΔGDP(-2)	0.321290	2.642436	0.0134
ΔGDP(-3)	0.319200	2.674739	0.0069
ΔGDP(-4)	0.687078	3.510742	0.0007
ΔM1(-1)	0.013571	2.742298	0.0455
ΔM1(-2)	0.006764	2.500290	0.0397
ΔM1(-3)	0.024143	1.423669	0.0474
ΔM1(-4)	0.006214	0.337878	0.5361
ΔM1(-5)	0.008994	0.455322	0.6498
ΔP(-1)	-729.2840	-2.378164	0.0071
ΔP(-2)	-1325.322	-2.519330	0.0082
CR(-1)	-0.433772	-1.998652	0.0316

R-squared = 0.97510 Akaike info criterion = 18.79370
Adjusted R^2 = 0.96981 Schwarz criterion = 19.09408
Durbin-Watson stat = 1.98344 F-statistic = 361.5 (0.00)

Short run Diagnostic Tests

Serial Correlation LM Test 6.161794 (0.85826)
ARCH Test = 0.19562 (0.822596)
W-Heteroskedasticity Test =2.223744 (0.274)
Ramsey RESET Test = 2.108847(0.1264)
Jarque-Bera Test = 0.140 (0.9366)

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