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# *The Long-run and Short-run Endogeneity of Money Supply in Pakistan: An Empirical Investigation*

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*Using Standard Granger Causality test, this study demonstrates that Pakistan's money supply for the period 1980–2003 is not exogenously determined in the short run. Empirical results support the Structuralists' view as well as the Liquidity Preference view on money endogeneity. However, it also provides partial support to the Accommodationists' view of money endogeneity. Nevertheless, in the long run—a time span exceeding twenty-four months—it is the base money that determines the total bank advances. Hence, the central bank has considerable influence on money supply in the long run.*

## 1. Introduction

Traditionally money supply has been regarded as exogenous. The Post-Keynesian economists have seriously questioned the validity of this general perception.[1] On the basis of historical events and empirical evidences, researchers have strongly maintained that money supply is determined endogenously. This has been regarded as Post-Keynesian invention.

Economists have long debated whether the money supply curve is vertical or horizontal. Verticalists contend that money supply depends on total reserves, and reserves are the liabilities of central bank and are exogenously determined by central bank, therefore money supply should be depicted as a vertical line. While Horizontalists argue that during the 'market period' the central bank sets the interest rate and accommodates, to establish the liquidity of bank deposits, whatever the reserves are demanded. Hence Horizontalists consider interest rate to be exogenously determined while money supply to be endogenously determined.

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[1] Goodhart (1973) viewed standard multiplier analysis with skepticism and questioned the validity of the assumption that stock of high-powered money is exogenous. See also Basil Moore (1997), Thomas Palley (1994), Sidney Weintraub (1978)

Although Post-Keynesians have developed consensus on the endogeneity of money supply, they have different viewpoints about the efficacy of the horizontal money supply curve.[2] Howells (1995) contends that the horizontal supply curve does not represent stock of money supply. It simply shows the "flow" of reserve money during the market period. However, Lavoie (1996) demonstrated that the horizontal money supply curve could be compatible with different views of the Post-Keynesians, such as non-accommodating behavior of the central bank, financial innovations, portfolio adjustments, liquidity preference theory, and the principle of increasing risk.

More specifically, in Post-Keynesian framework the growth in money supply is often viewed as endogenous. The Post-Keynesian notion of the endogeneity of money supply reverses the simple neoclassical notion that the supply of money is determined through the central bank initiatives that depend on factors outside the financial markets. Post-Keynesians, on the other hand, contend that the supply of money both in terms of its fluctuations and credit availability is determined by factors within the financial markets. According to this argument the monetary authority is unable to control the volume of money stock in the economy simply because the creation of money is demand determined. There are basically three distinct theories of money supply endogeneity: Accommodationists' view, Structuralists' view and Liquidity Preference view. All these three approaches, however, share a common view that money supply is determined from the demand side within financial markets.

The theoretical literature proposed arguments to support money endogeneity. To test this theoretical argument, the empirical literature on the endogeneity of money for various economies has shown that money supply is endogenously determined. For example, Nell (2001), Shanmugam et al. (1996), and Vera (2001) have presented a time series analysis for the case of South Africa, Malaysia, and Spain respectively. To the best of our knowledge, no one has attempted to test this hypothesis for less developed countries including Pakistan. Ironically, low-income countries are blessed with high unemployment and corruption. One prescription that is often suggested by Keynesians is to pursue active monetary and fiscal policies to circumvent the problem of high unemployment. The effectiveness of these policies especially in the short run is seriously undermined due to the presumption that money supply is exogenous. In this paper an attempt has been made to test this presumption that money supply is exogenous both in the short run and in the long run using monthly data from 1980 to 2003.

[2] For a discussion on the points of agreement between various Post-Keynesian authors, see Howells (1997).

The study is organized as follows: section 2 reviews the theoretical and empirical literature, section 3 describes the data and methodology, and section 4 presents the empirical results. Conclusions and policy implications follow in the final section.

## 2. Review of Literature

### Accommodationists' view on money endogeneity[3]

Basil Moore, an ardent proponent of the Accommodationists' view, considers credit money to be endogenously determined by credit worthy borrowers.[4] However, the central bank, as the monopoly issuer of fiat money, can effectively determine the supply price of finance at its discretion. He considers interest rate to be exogenously determined by the central bank. Perceived increase in expenditure requires a greater amount of working capital by firms or an increased demand for money by households, which creates an increased demand for loans from the banking system. If loans are granted, it will create deposits. As long as deposits are considered as means of payments, these deposits are reflected in increased money supply. Nevertheless, this increase in deposits ex post requires a greater amount of reserve money. The central bank cannot simply decline a request for the reserve money because it is responsible for establishing liquidity of deposits.

### Structuralists' view on money endogeneity

This approach focuses on the interaction between the monetary authority's policy reaction function and the asset and liability management activities of banks [Palley (1996)].[5] Although Structuralists consider money supply to be upward sloping, they emphasize that banking system can effectively circumvent reserve constrained placed by central bank in the long run through innovation of banking services and financial instruments by providing more liquid financial assets. Thus, the money supply curve eventually becomes horizontal.

### Liquidity preference view on money endogeneity

According to liquidity preference view on money endogeneity, it is the relative interest rates that reconcile the decision to borrow with the decisions to hold

[3] Cottrel (1994) labeled this view as 'Radical endogeneity theory'.
[4] Leading proponents of this view include Kaldor (1982, 1985), Lavoie (1984, 1985), Goodhart (1979), Weintraub (1978a, 1978b), and Moore (1979, 1983, 1985, 1988a, 1988b, 1989, 1991).
[5] Leading proponents of this view include Minsky (1982, 1986); Rousseas (1985, 1989) Earley (1983), Earley and Evans (1982).

**Table 1.[6] Testable Hypothesis for Empirical Investigation**

| **Accommodationists View** *(Moore1989)* | **Structuralists View** *(Palley 1996, 1998; Pollin1991)* | **Liquidity Preference View** *(Howells1995)* |
|---|---|---|
| ADVANCES⇒BROAD | ADVANCES ⇔BASE | ADVANCES ⇔BROAD |
| ADVANCES ⇒BASE | ADVANCES ⇔ MUL | |
| INCOME⇔BROAD | INCOME⇔BROAD | |

Notes: ADVANCES = log-level of total bank advances; BROAD = log-level of broad measure of monetary aggregate; BASE = log-level of monetary base; MUL = log-level of the Broad money multiplier; INCOME = log-level of nominal GNP (money income). "⇒" Denotes unidirectional causality from left to right; "⇔" denotes bi-directional causality.

increased deposits. Arestis and Howells (1996) criticize the accommodative view that increase in deposits due to approval of loans by banking system would always be held by the public because of 'convenience lending'. Moreover Arestis and Howells (1996) conclude that it is the changes in relative interest rate that reconcile the demand for additional loans with the demand for additional deposits. All these views are summarized in Table 1.

The theoretical literature has convincingly put forward arguments in favor of money endogeneity.[7] To support this theoretical argument, the empirical literature on the endogeneity of money has vehemently demonstrated that money supply is endogenously determined for various economies. However, all these studies exclusively encompass developed and middle-income economies. Nell (2001), Shanmugam et al. (1996), Vera (2001), and Pollin (1991) have presented a time series analysis to test the money endogeneity hypothesis for the case of South Africa, Malaysia, Spain, and US respectively. Table 2 provides a quick glance at the empirical literature on the Post-Keynesian money endogeneity hypothesis.

**Table 2. Empirical Studies**

| **Authors** | **Time period** | **Methodology** | **Country** | **Views Supported** |
|---|---|---|---|---|
| Pollin (1991) | 1953-1988 | Granger Causality | US | Structuralists View |
| Vera (2001) | 1987-98 | Granger Causality test | Spain | Accommodative and Structuralists View |
| Nell (2000-2001) | 1966-1997 | Error Correction Model | South Africa | All three views |
| Shanmugam et al. (2003) | 1985-2000 | Cointegration and Standard Granger Causality | Malaysia | Accommodative and Liquidity Preference View |
| Lavoie(2005) | | Review of empirical and Theoretical literature | Canada, and USA | Accommodative View |

[6] This table is modified version of the table presented by Nell (2001).
[7] For a complete critical survey of Post-Keynesian Monetary Economics, see Cottrell (1994).

The above reported empirical studies are only for high-income countries. The pitfalls are that no one has tested the proposition that money supply is endogenous for less developed countries in the short run and long run. Therefore, we attempt to test this presumption for Pakistan's economy that money supply is exogenous in the short run and long run using monthly data from 1980 to 2003.

## 3. Data and Methods

Monthly data for the period 1980 to 2003 on Bank Advances is taken from various issues of the Statistical Bulletin of the State Bank of Pakistan (SBP). Data on narrow money and broad money is taken from International Financial Statistics (IFS) database 2005. Narrow money includes transferable deposits and currency outside deposit money banks (line 34; IFS).[8] Broad money is the sum of narrow and quasi money (line 35; IFS). Quasi money includes time, savings, and foreign currency deposits of resident sectors other than the central government. The ratio of Broad money and Narrow money is used to represent money multiplier. All the above-mentioned series are taken in log monotonic transformation. Index of industrial manufacturing has often been used in literature to proxy GDP.[9] Since the monthly series on GDP is not available, we have used the Quantum Index Number of Manufacturing as proxy. The index is taken from the IFS.

Using monthly data described above, we use Granger causality test to examine the endogeneity of money supply. Granger (1969) causality test is used to infer statistical precedence of information. 'y' is said to be granger caused by 'x' if 'x' helps in the prediction of 'y'. In Two-way causality there is a feedback mechanism. 'x' granger causes y does not imply that 'y' is the manifestation of 'x'. Following is the formulation of granger causality test: The fundamental assumption of granger causality test is that the concerned series should be a stationary process.

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \text{-----} + \alpha_T Y_{t-T} + \beta_1 X_{t-1} + \text{------} + \beta_T X_{t-T} + \varepsilon_t \qquad (1)$$

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \text{-----} + \alpha_T X_{t-T} + \beta_1 Y_{t-1} + \text{------} + \beta_T Y_{t-T} + \mu_t \qquad (2)$$

Where T is the time lag and ($\varepsilon_t$, $\mu_t$) are independently and normally distributed random variables with zero mean and constant variance. Assuming that the

[8] The discussant at the SBP conference was of the view that transferable deposits are not the subject matter for policy-making of the Bank. However, the central bank is indeed responsible for the maintenance of transferable deposits as means of payments.

[9] Shanmugam (2003), Nell(2000-1) have used similar indices.

underlying series is stationary, a simple F test or Wald test can be applied to test the null hypothesis of joint insignificance of independent variable(s).

To check the stationarity of all the series, we apply Augmented Dickey Fuller (ADF) test on each variable [Dickey and Fuller, (1979,1981)]. If we cannot reject the null hypothesis of a unit root at a reasonable confidence level, we may conclude that the series are non-stationary in levels. We then take first difference and follow the same ADF test. If we reject the null hypothesis of a unit root, we conclude that the series are stationary in first difference; that is, I (1).

## 4. Empirical Results

Figure 1 shows the presence of trend in the underlying series.

**Figure 1. Graphs on Actual, Fitted Trend and Residuals (Time period 1980—2003)**

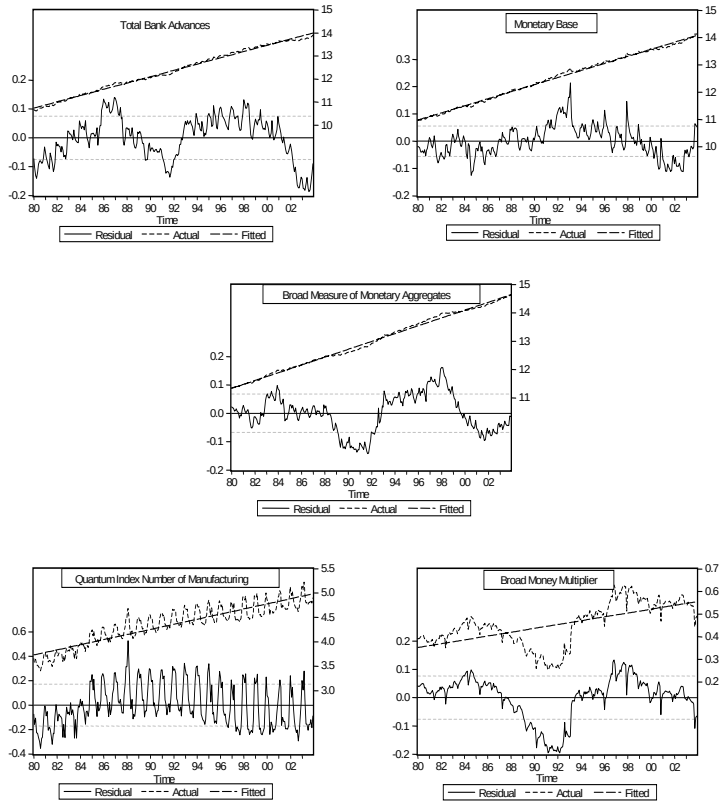

**Table 3. Regression Results for Equation (3)**

| | Constant | Trend | F- Statistics |
|---|---|---|---|
| ADV | 10.07(863) | 0.011(213) | 45647* |
| BASE | 10.34(1189) | 0.01(273) | 74544* |
| BROAD | 10.65(1013) | 0.011(240) | 57871* |
| MUL | 0.31(26) | 0.0007(13) | 171* |
| M_INDEX | 3.47(130) | 0.0043(36) | 1292* |

* Indicates 1% level of significance. Figures in parenthesis are t-values. ADV= log-level of total bank advances; BASE=log-level of monetary base; BROAD=log-level of broad measure of monetary aggregate; MUL=log-level of the Broad money multiplier; M_INDEX=log-level of Quantum Index Number of Manufacturing.

Consequently we detrend each series by running the following regression.

$$Y = \alpha + \beta T + u \qquad (3)$$

Where Y is the respective log transformed time series, T, time trend and u is the residuals. The results are reported in Table 3.

After removing the effect of intercept and trend, we have applied DF/ADF test to determine the presence of unit root. The results are reported in Table 4.

All the series are trend stationary process. It is evident that in all the time series, the proposed filter is highly significant even at less than 1 percent. Furthermore, for all the series, the null hypothesis of non-stationarity is rejected at 5 percent significance level.

Since all the variables are trend stationary, standard Granger (1969) causality test is applied to the detrended time series. Table 5 tabulates the results of the Granger causality test with twelve different lag lengths that begins with three lags and end with thrity-six lags.

**Table 4. DF/ADF Test Statistics (Without drift and trend)**

| **Variables** | **Test Statistics** |
|---|---|
| ADV | -2.54 |
| BASE | -3.88 |
| BROAD | -2.06 |
| MUL | -2.23 |
| M_INDEX | -5.60 |

ADV= log-level of total bank advances; BASE=log-level of monetary base; BROAD=log-level of broad measure of monetary aggregate; MUL=log-level of the Broad money multiplier; M_INDEX=log-level of Quantum Index Number of Manufacturing. MacKinnon critical values for rejection of a null hypothesis of unit root assuming no drift and trend are -2.57, -1.94, and -1.6 for 1%, 5%, and 10% level of significance respectively.

**Table 5. Standard Granger Causality Test**

| Lag length | ADV ⇒ BROAD | BROAD ⇒ ADV | ADV ⇒ BASE | BASE ⇒ ADV | ADV ⇒ MUL | MUL ⇒ ADV | M_INDEX ⇒ BROAD | BROAD ⇒ M_INDEX |
|---|---|---|---|---|---|---|---|---|
| 3 | 4.75 | 6.56 | 5.18 | 9.37 | 2.26 | 3.67 | 2.84 | 3.06 |
| | (0.003) | (0.000) | (0.001) | (0.000) | (0.08) | (0.012) | (0.037) | (0.028) |
| 6 | 4.57 | 4.01 | 5.50 | 5.78 | 2.84 | 2.74 | 2.4 | 2.27 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.01) | (0.013) | (0.028) | (0.037) |
| 9 | 3.04 | 2.69 | 6.46 | 4.55 | 3.9 | 2.38 | 3.9 | 2.49 |
| | (0.001) | (0.005) | (0.000) | (0.000) | (0.000) | (0.013) | (0.000) | (0.009) |
| 12 | 2.01 | 2.00 | 3.84 | 3.55 | 2.86 | 1.83 | 3.55 | 1.05 |
| | (0.023) | (0.024) | (0.000) | (0.000) | (0.001) | (0.042) | (0.000) | (0.401) |
| 15 | 1.66 | 1.78 | 2.17 | 2.17 | 1.59 | 1.12 | 1.52 | 1.64 |
| | (0.057) | (0.037) | (0.007) | (0.007) | (0.075) | (0.33) | (0.098) | (0.063) |
| 18 | 1.73 | 1.72 | 2.00 | 1.98 | 1.76 | 0.99 | 1.38 | 1.51 |
| | (0.034) | (0.036) | (0.01) | (0.011) | (0.03) | (0.469) | (0.138) | (0.084) |
| 21 | 1.48 | 1.62 | 1.94 | 1.71 | 1.50 | 0.95 | 1.13 | 1.32 |
| | (0.085) | (0.044) | (0.009) | (0.029) | (0.076) | (0.521) | (0.308) | (0.157) |
| 24 | 1.32 | 1.97 | 1.58 | 1.84 | 1.28 | 1.23 | 0.96 | 1.39 |
| | (0.152) | (0.005) | (0.046) | (0.012) | (0.176) | (0.217) | (0.516) | (0.109) |
| 27 | 1.24 | 1.74 | 1.34 | 1.63 | 1.08 | 1.06 | 0.80 | 1.28 |
| | (0.196) | (0.016) | (0.13) | (0.029) | (0.36) | (0.38) | (0.74) | (0.167) |
| 30 | 1.19 | 1.61 | 1.16 | 1.51 | 1.01 | 0.93 | 0.85 | 1.33 |
| | (0.231) | (0.029) | (0.267) | (0.05) | (0.45) | (0.56) | (0.69) | (0.126) |
| 33 | 1.17 | 1.43 | 1.08 | 1.51 | 0.92 | 0.97 | 0.95 | 1.19 |
| | (0.247) | (0.070) | (0.349) | (0.045) | (0.594) | (0.514) | (0.542) | (0.231) |
| 36 | 1.10 | 1.40 | 0.94 | 1.32 | 0.72 | 0.97 | 0.99 | 1.41 |
| | (0.321) | (0.078) | (0.562) | (0.116) | (0.874) | (0.50) | (0.484) | (0.072) |

Values in the cells are F-values while Figures in brackets are P-values. Entries are against Lag length. '⇒' indicates direction of causality.

Notes: ADV= log-level of total bank advances; BROAD=log-level of broad measure of monetary aggregate; BASE=log-level of monetary base; MUL=log-level of the Broad money multiplier; M_INDEX=log-level of Quantum Index Number of Manufacturing.

The empirical results support the two-way causality between broad money (BROAD) and income (M_INDEX) in the short run. By short run we mean a period of 18 months. Thus, our results support liquidity preference view on money endogeneity. However, for duration greater than eighteen months, our results exhibit no causality between money income and broad monetary aggregates. The absence of causality between broad aggregate measure of money supply and the

**Table 6. Symbolic Representation of Granger Causality Results**

| IN THE SHORT RUN | IN THE LONG RUN |
|---|---|
| BANK ADVANCES ⇔ BROAD MONEY | BROAD MONEY ⇒ BANK ADVANCES |
| BANK ADVANCES ⇔ BASE MONEY | BASE MONEY ⇒ BANK ADVANCES |
| BANK ADVANCES ⇔ MONEY MULTIPLIER | BANK ADVANCES ⇒ MONEY MULTIPLIER |
| INCOME ⇔ BROAD MONEY | No relationship b/w INCOME and BROAD MONEY |

income implies that money does not determine economic activity in the long run. Hence our empirical results support the long-standing notion of monetary neutrality in the long run.

For a period of twenty-four months, empirical results support the hypothesis that two-way causal relationships exist between broad money and total bank advances. However, for lag length exceeding twenty-four months, unidirectional causality runs from broad money to the total bank advances. Our empirical findings exhibit non-accommodative behavior of the central bank, thus negating Moore's (1988b) contention who considers one-way causality running from total bank credit to broad money and base money and that a two-way causal relationship between money income and broad money.

In the case of base money and total bank advances, a two-way causal relationship exists for lag length up to twenty-four months, however for longer lag lengths, this causal relationship exists only in one direction, i.e. from base money to total bank advances. Again, for a short duration not exceeding twelve months, there exists two-way causality between total bank advances (ADV) and broad money multiplier (MUL). Hence our empirical findings support the Structuralists' view. While it exhibits one-way causality from total bank advances to broad money multiplier for an extended period of twenty-four months. The above empirical results are summarized in Table 6.

## 5. Conclusions and Policy Implications

Using detrended series of narrow money, broad money, broad money multiplier, total bank advances, and quantum index for manufacturing as proxy variable for GDP, we ran the standard granger causality test to examine the different testable hypotheses of the Post-Keynesian view on money supply endogeneity in the case of Pakistan.

Contrary to the general perception in the academic circle that economic time series are differenced stationary we find that both the different measures of monetary aggregates and money multiplier and the proxy for the GDP series are trend stationary process. In other words, all the series are not integrated series; hence these series are not persistent to shocks.

In the short run, our empirical findings suggest that there is partial support to accommodative endogeneity. Our results also support, in the short run, liquidity preference theory of money endogeneity and are consistent with the Structuralists' view on money endogeneity. Thus, we conclude that money supply in Pakistan is endogenously determined in the short run—a time span of not wider than eighteen months. However, in the long run money supply is exogenous. Our findings of one-way causality that runs from base money to bank advances and from broad money to bank advances point to the fact that over the longer period, a time period beyond twenty-four months, SBP can effectively determine money supply.

The policy implication of this analysis is that the monetary policy can indeed influence financial environment in the long run. Since money supply is endogenously determined in the short run, instead of pursuing active monetary policy SBP should, in unison with other institutions, establish market-creating and market-facilitating institutions that facilitate economic growth and development, such as transparency and enforcement of debt contracts, stable aggregate price level and consistent monetary policies that facilitate economic activity.

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