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Article: **Probing the Nature of Pakistan's Money Supply: Using Co-integration Analysis and Error Correction Mechanism**

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Probing the Nature of Pakistan's Money Supply Using Co-integration Analysis and Error Correction Mechanism

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Abstract

Historic development of monetary economics encompasses two different schools of thought regarding the role of central banks in managing money supply and the level of economic activities, indirectly. 'Monetarists' argue that "Money supply is exogenously determined", while 'Post-Keynesians' vouch for an endogenously determined nature of money supply. In order to explore if the money supply is endogenously or exogenously determined, empirical studies covering different economies at different stages of development are expressly needed. Hence, the current study was planned to examine the nature of money supply in Pakistan. The study period covered the time span 1995-2019. Semi-annual data was used for analysis. Three hypotheses were tested in this study based on the accommodationist view, the structuralist view, and the liquidity preference view, respectively. The variables included monetary base, bank credit, money multiplier, M2 money supply, and money income. Cointegration analysis and error correction mechanism (ECM) were applied to determine the long-run relationships among the variables as well as the short-run deviations. The results revealed that the structuralist view and the liquidity preference view both hold true in the case of Pakistan. The latter holds true completely, whereas the former was only partially supported by the results.

Keywords: accommodationists, endogenous money supply, liquidity preference view, Pakistan, stability, structuralists, velocity of money supply

Introduction

The hypothesis of 'endogeneity of money' has not established adequate prominence perhaps the reason is that/Endogenous money hypothesis has not gained significant traction, perhaps because it is not incorporated in typical textbooks. Hence, there is a lack of discussion on the endogenous / exogenous nature of money supply. A possible reason is the very limited availability of empirical studies on this subject. If we trace the historic development of monetary economics, we find that there are two different schools of thought indirectly related to the role of central banks in managing money supply and the level of economic activities. Keeping in view the concept (or theory) of Milton Friedman, that is, "Supply of money is determined exogenously", he and his followers are termed as 'Monetarists'. The underlying proposition behind this concept is stated as follows:

$$\text{Supply of Money} = \text{Money Base} * \text{Money Multiplier}$$

So, following this equation and the relationship it postulates, if a central bank is controlling or able to control the former part of the above-mentioned equation, it can also control an economy's money supply. On the contrary, another group of economists known as "Post-

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Keynesians” argue that the supply of money in an economic system is determined endogenously. This may be true if the supply of money is not determined by forces operating outside the monetary system of an economy, rather money is created within an economy’s monetary system (Nayan et al., [2013](#)).

Limited literature is available regarding the endogenous money hypothesis and it covers developed countries only (Moore, [1988](#); Palley, [1994](#); Howells and Hussein, [1998](#); Nell, [2000](#); Vera, [2001](#)). Recently, the discussion on ‘liquidity preference view’ was revived and the main contributors were Asensio ([2017](#)), Bertocco and Kalajzic ([2014](#)), Bertocco and Kalajzic ([2018](#)), Dafermos ([2012](#)), and Palley ([2017](#)). In order to enhance the understanding of endogenous/exogenous money supply hypothesis, a relatively vast amount of empirical literature is required which ought to be grounded in the knowledge/facts of other than developed economies.

A study was conducted by Libena Cernohorska in 2018 on the economy of the Czech Republic. Another study, very similar in nature to our study, was conducted using quarterly data for the period 1996-2017. ADF test and Engle-Granger test (with some others) were applied on the data to check the short- and long-run relationships, in addition to checking the causality. The author found causality between GDP and money supply and concluded that the latter is endogenously determined.

Among those economists who tested this theory empirically, Kaldor ([1982](#)) used OLS on the economic data of UK for the period 1966-1979. His results confirmed that the supply of money is endogenously determined via the demand for bank lending channel. Moore ([1983](#)) contributed by extending the application of this method to the economic data of US, using quarterly data for the years 1964-1979. He concluded that the lending of banks to companies appears to be the/is seemingly determined mainly by the financing for working capital. Panagopoulos and Spiliotis ([1998](#)) in an empirical investigation attempted to analyze the lending behavior of banks in Greece. They concluded that the demand for loans causes the banking system to primarily determine the credit money. The authors also agreed with the Post-Keyensian view that credit money supply is endogenous (in modern economies).

Vera ([2001](#)) conducted an empirical investigation using the time series data of Spain, spanning the years 1987-1998. Granger causality test was employed to test the hypothesized relationship using the following variables: money base, lending of banks, and money multipliers. He concluded in favor of the endogeneity of credit money. He also found that money supply is credit and demand driven and these results are in line with the endogenous money hypothesis. Granger causality test showed the causality from “bank lending to the base” and “from bank lending to the money supply”. The study confirmed that causality is not from “the base to the money supply and to the loans”. Keeping in view these findings, Yulia (2006) examined the Russian economy and concluded that inflation leads to the growth of money supply. Although her results are different from the previously conducted empirical studies, yet they are in line with the endogenous money supply hypothesis.

Lavoie ([2005](#)) empirically analyzed the endogenous money supply hypothesis for the Canadian economy. The results showed that the hypothesis of endogenous money supply holds true for the Canadian economy. Ahmad and Ahmad ([2006](#)) conducted a study on Pakistan using monthly data for a period of twenty-four years (1980 to 2003). They concluded that the endogenous money supply hypothesis holds true only in the short-run. The results indicated

that in the long-run, the central bank of Pakistan has considerable influence on the money supply. Cifter and Ozun (2007) also conducted a similar empirical study for/on a developing economy. The authors used Granger causality test and vector error correction model (VCEM) to test the endogenous money supply hypothesis. They used seven variables including money base, money supply, credit capacity, industrial production index (the proxy for the GDP), interest rates, inflation, and the real exchange rate. Quarterly data of the above-mentioned variables was used to test the hypothesis over a period ranging from 1997-2006. The results supported the endogenous money supply hypothesis in line with the accommodationist view. Moreover, the results did not support either the structuralist view or the liquidity preference view.

These days, central banks restrict the printing of money in order to smoothen the economic and financial system. In spite of all the measures taken by central banks, we can still witness a continuous increase in the money supply which has led the economies towards inflation and induced slow economic growth. Monetarists argue for one-way causality of ‘money base’ and ‘money supply’ with bank credit to support their exogenous money supply hypothesis. They also vouch for a unidirectional causality from money supply to the GDP.

The main aim of the current study is to provide sufficient evidence regarding the nature of Pakistan’s money supply problem, whether it is endogenous or exogenous. The study period spanned over the years 1995-2019. Semi-annual data was analysed to achieve the objectives. Three hypotheses were tested in this study based on the accommodationist view, the structuralist view, and the liquidity preference view, respectively.

Objectives

The main objectives of the study were to investigate the velocity and nature of money supply. The first objective was to check whether the velocity of M2 is stable or not. The second objective was to check whether the nature of M2 is exogenous or endogenous.

Methodology

Materials and Methods

In the view of mainstream monetarists, the growth of money supply in an economy is controlled by the central bank. It implies that quantity of monetary base can be increased or decreased by the central bank. According to the monetarists, money supply is targeted (by the central bank) through exogenously controlling the base. This is because the money multiplier, which is calculated as the ratio of total deposits to the base, is empirically stable.

The endogenous money supply hypothesis poses a direct challenge to the mainstream monetarist approach. This study used three different (but not mutually exclusive) theoretical views to discuss the nature of money supply, whether it is endogenous or exogenous.

- i) Accommodationist view
- ii) Structuralist view
- iii) Liquidity preference view

The Accommodationist View

Kaldor (1982), Kaldor and Trevithick (1981), and Moore (1988, 1989a) advocated strongly for the accommodationist view. This view poses a challenge to the mainstream monetarist thought, that is, monetary base is exogenously determined by the central bank and money supply can be seen as a multiple/multiplier of base.

According to the accommodationist view, the monetarist approach is not applicable in the real-world. In the real-world, commercial banks are credit suppliers; hence, they set prices and take quantity in the lending and deposit market (Moore, [1989a](#)). On the other hand, a central bank provides reserves on demand in order to ensure the liquidity of the financial system. As *the role of last recourse* (Moore [1989b](#)). The lending rate of a commercial banks covers the cost of borrowing from the discount window plus some/along with markup. The accommodationist view states that “deposits are created through loans, this implies that deposits are created endogenously. It means, eventually, increase or decrease in money supply are caused by increase or decrease in money supply and money supply is not a determinant of changes in money income and of course said relationship varies in relation to output and price” (Kaldor & Trevithick [1981](#)).

The accommodationist approach implies a unidirectional causation between “bank credit and the money base”, that is, bank credit → money base and from “total bank credit to the money supply”. Moreover, there is/it also implies a bidirectional causation between “money income and money supply”.

The Structuralist View

Structuralists admit that the process of money supply is of an endogenous nature; however, they also advocate/argue that both central and commercial banks put quantity constraints on the demand for credit (at least to some extent). According to Pollin ([1991](#)), central banks can restrict the quantity of reserve disposal through an open market operation. Structuralists advocate/claim that each time commercial banks borrow from the discount window, the marginal cost of borrowing rises, since there is a direct positive relationship between discount rate and the level of borrowed funds (Palley, [1994](#)).

The structuralist view on the endogenous money supply hypothesis is different from that of the accommodationist view. Accommodationists argue that the money supply function is perfectly interest rate elastic (Moore, [1989a](#)), whereas the structuralists argue for an upward sloping function (Palley, 1996). A major difference between them is that the structuralists claim that the demand for reserves made by commercial banks is not fully accommodated by the central bank of a country. It implies that when bank lending increases, it leads to a corresponding increase in the demand for reserves and this process ends with increased interest rates (Palley, 1996). According to the structuralists, central bank retains some control over the supply of reserves. Whereas, according to the accommodationists, central bank has/can exercise control only over the interest rates (Palley, [1998](#)).

The Liquidity Preference View

The liquidity preference view states the same as the accommodationist view on the basis of a core theoretical argument which claims that “money supply is endogenously determined”. This view criticizes the minimum basic assumption of the accommodationist view postulating that “credit can never be in excess supply and hence there is no independent money demand function” (Goodhart, [1989](#); Arestis & Howells, [1996](#)).

In the case of endogenously determined money supply, the hypothesis will predict causality from “total bank credit to the money supply”. If the demand for money is independent, then the direction of causality could be vice versa, that is, causality could be from “the money supply to the total bank credit”.

Variables

1. Monetary Base = LH
2. Total Bank Credit = LTC
3. Money Multiplier = LMM
4. M2 Money Supply = LM2
5. Money Income = LGDP

Data was taken from the websites and data banks listed below.

1. WDI
2. IFS
3. State Bank of Pakistan.
4. Economic Survey of Pakistan

Theoretical Hypotheses

The table below gives a brief introduction and specifications of our empirical hypotheses about the nature of money supply, that is, whether the money supply process is exogenous or endogenous.

Table 1

Different Views on the Nature of Money Supply

Accommodationist / Horizontalist Theory¹	Structuralist / Verticalist Theory²	Liquidity Preference Theory³
<i>LTC => LM2, LH</i> <i>LGDP <=> LM2</i>	<i>LTC <=> LMM, LH</i> <i>LGDP <=> LM2</i>	<i>LTC<=> LM2</i>
<p>Representations key: <i>LTC</i> = Total bank credit in logs <i>LMH</i> = Money base in logs <i>LMM</i> = M2 money multiplier in logs <i>LM2</i> = Money supply in logs (M2) <i>LGDP</i> = Total money income (nominal GDP) in logs</p> <p>1- (Moore, 1989) 2- (Palley, 1994) 3- (Howells & Hussein, 1998)</p>		

Econometric Methodology

Granger causality test was applied on the models as mentioned above (see Table 1). The short- and long-run causality were determined by using the Granger procedure and through cointegration analysis. The methodology / specification presented by Pesaran and Shin was employed for the analysis. This methodology is commonly termed as ARDL (Auto Regressive Distributed Lag).

Granger causality test runs bi-variate regression of the form

$$y_t = a_0 + a_1 y_{t-1} + \dots + a_l y_{t-l} + b_1 x_{t-1} + \dots + b_l x_{t-l} + \epsilon_t$$

$$x_t = a_0 + a_1 x_{t-1} + \dots + a_l x_{t-l} + b_1 y_{t-1} + \dots + b_l y_{t-l} + \mu_t$$

$$\beta_1 = \beta_2 = \beta_3 \dots \beta_t = 0$$

for all possible pairs of (x,y) series in the group. The reported F-statistics are the Wald statistics for the joint hypothesis.

For each equation, the null hypothesis states that x does not Granger cause y in the first regression/equation and y does not Granger cause x in the second equation.

Following the ARDL (p,q) model, after having the variables integrated of/into order 1 “I(1)”, a long-run relationship is established between the dependent and independent variables

$$y_t = a_0 + \sum_{i=1}^p \theta y_{t-i} + B' x_t + \sum_{i=0}^{q-1} B^{*i} \Delta x_{t-i} + \varphi_t$$

where x_t is I(1) φ_t is the error term. In order to specify the lag length, the most commonly used procedures were employed, that is, AIC (Akaike information criterion) and SBC (Schwarz Bayesian criterion), respectively.

Using the above mentioned equation, a long-run relationship between the dependent and independent variables is given below:

$$y_t = a_1 + \aleph x_t + \mu_t$$

Here, a_1 is the constant, \aleph represents the parameter of the regressor, and μ is the random error term (all parameters give long-run estimates).

Using errors from the above equation, the following error correction model was tested

$$\Delta y_t = a_2 + \sum_{i=1}^l B_{yi} \Delta y_{t-i} + B' x_t + \sum_{i=0}^m B_{xi} \Delta x_{t-i} + a_3 \mu_{t-1} + \epsilon_t$$

where μ_{t-1} is the lagged ECT obtained from the errors of the above-mentioned equation and ϵ_t shows short-term disturbance (random). Based on the above-mentioned equation, the null hypothesis states that “variable x does not Granger cause variable y”. It means that the null hypothesis will be rejected if the coefficients of B are found to be significant using F-test. When Δy_t is replaced by Δx_t , null hypothesis become vice versa/the relationship suggested by the null hypothesis is also reversed.

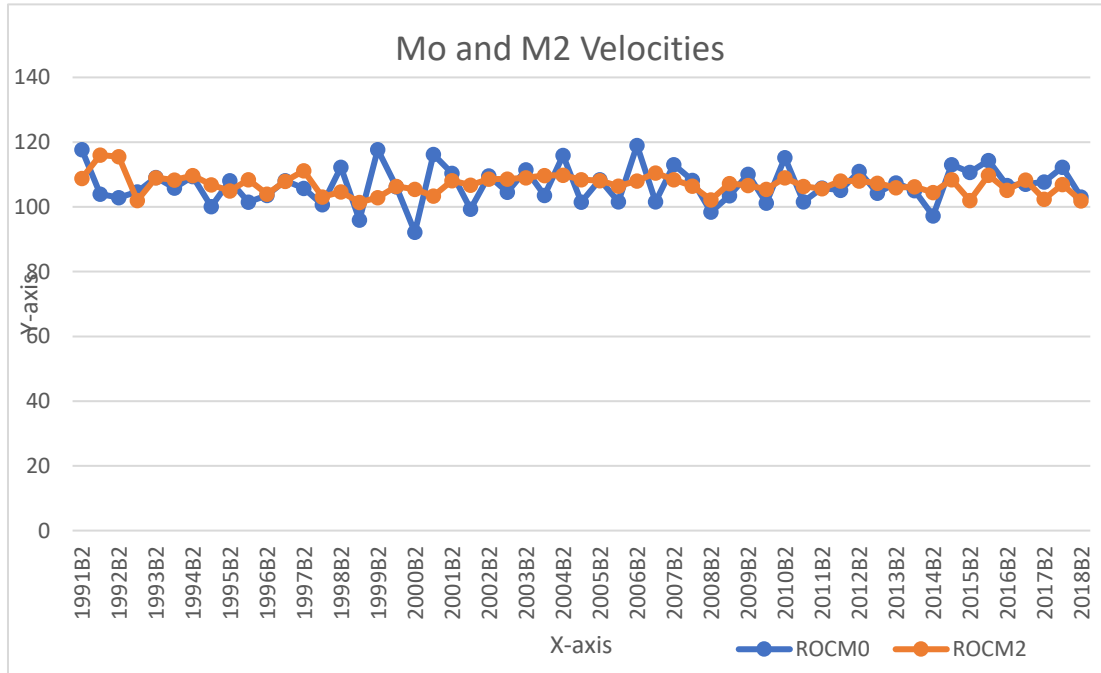
Since Granger causality test provides/estimates only the short-run causality, so calculating ECT is very useful because it helps in detecting the long-run estimates of causality. Hence, at least in one direction, causality must be there if concerned variables are cointegrated. The application of the Granger test alone cannot detect such a relationship.

Results and Discussion

Biannual data (of Pakistan) spanning the years 1995-2019 was used in the current research. Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests were applied to check the stationarity of the concerned variables. It was found that all variables were I(1) in levels and I(0) in first differences,

Figure 1

Velocities of Narrow Money and Broad Money



On Y-axis: Velocities of Narrow Money and Broad Money (in million Rs.)

On X-axis: Time Span (Years)

where M_0 represents “Narrow Money” and M_2 represents “Broad Money”

We can witness two points by viewing this velocity graph/The graph manifests two important points:

- 1- Broad money is more stable than the money base.
- 2- The velocity of broad money was more stable during the years 2002-2006 and 2009-2014.

Table 2

Results of Cointegration Analysis

Sr. no.	Regression	LR elasticities solved from/through ARDL model	Wald Test for unitary LR elasticities	Order of lag in ECM	Joint Significance β_{yi} and β_{xi}	Error Term (α_3)
1	Δ LTC on Δ LH	0.57*** [2.72]	3.93**	(2,0)	---	3.91**
	Δ LH on Δ LTC	1.32*** [23.40]	2.02	(1,1)	6.18**	4.33**

2	Δ LMM on Δ LTC	22.21 [0.923]	1.20	(0,0)	---	2.83*
	Δ LTC on Δ LMM	0.02 [1.09]	3.03*	(2,1)	8.10*	9.92***
3	Δ LM2 on Δ LGDP	0.31*** [50.15]	8.58***	(1,2)	5.84	2.39
	Δ LGDP on Δ LM2	2.99 *** [26.64]	5.16**	(1,0)	---	7.97***
4	Δ LTC on Δ LM2	0.67*** [5.12]	5.20**	(1,1)	5.66	3.60*
	Δ LM2 on Δ LTC	1.25*** [35.31]	12.85***	(1,2)	16.87***	9.31***

Table 3***Error Correction Mechanism Results***

Sr. no.	Regression	ECM Results	Final Result
1	Δ LTC on Δ LH	0.058 (0.3795)	Lh \rightarrow Ltc
	Δ LH on Δ LTC	-0.139 (0.0103)	
2	Δ LMM on Δ LTC	-0.005 (0.4404)	Ltc \rightarrow LM
	Δ LTC on Δ LMM	-0.321 (0.0014)	
3	Δ LM2 on Δ LGDP	-0.263 (0.0053)	LGDP \leftrightarrow Lm2
	Δ LGDP on Δ LM2	-0.119 (0.0197)	
4	Δ LTC on Δ LM2	-0.964 (0.0634)	Lm2 \leftrightarrow Ltc
	Δ LM2 on Δ LTC	-0.197 (0.0008)	

Effect of Bank Credit on Monetary Base (LTC on LH)

In the computation of/While estimating the short-run relationship, the sign of the coefficient of error correction term (ECT_{t-1}) is positive, which is statistically insignificant

because the p-value is greater than the level of significance at 10%. The positive sign of ECM/ECT_{t-1} shows that there is no convergence and it is statistically insignificant, which depicts that there is no adjustment in the long-run equilibrium.

Effect of Monetary Base on Bank Credit (LH on LTC)

In the calculation/estimation of the short-run relationship, the sign of the coefficient of error correction term (ECT_{t-1}) is negative, which is statistically significant with the p-value of 0.01. It supports the presence of a long-run relationship in the model. The value of the coefficient (-0.139) shows that 14% of disequilibrium in the short-run is corrected yearly for reaching/attaining the long-run equilibrium (a steady state position). The coefficient value of -0.139 of ECT_{t-1} shows that the series is non-explosive and adjusts in the long-run. In the short-run, the effect of the monetary base on bank credit was found to be insignificant. However, in the long-run it remains significant. Our results are in line with the findings of Deleidi and Levrero (2017) and Ahmad and Ahmad (2006).

Effect of Money Multiplier on Bank Credit (LMM on LTC)

The results showed that the coefficient is statistically insignificant with the p-value of 0.4, suggesting the absence of a long-run relationship. Furthermore, the results indicated that the series is explosive (does not adjust in the long-run). Our results are in line with the findings of Kevin S. Nell (2000).

Effect of Bank Credit on Money Multiplier (LTC on LMM)

The results indicated the existence of a long-run relationship at 1% level of significance. They further indicated that 32% of disequilibrium in the short-run is corrected yearly for reaching/attaining the long-run equilibrium (a steady state position). The value of the coefficient suggests that the series adjusts in the long-run. The effect of bank credit on money multiplier remains insignificant, both in the long- and short-run. Our results are in line with Kevin S. Nell (2000).

Effect of Money Supply on Money Income (LM2 on LGDP)

The results suggested a long-run relationship between LM2 and LGDP, which remains significant at 5% level of significance. The results also indicated that 26% of disequilibrium in the short-run is corrected yearly for reaching/attaining the long-run equilibrium (a steady state position). Moreover, the series adjusts in the long-run. In both the short- and long-run, the effect of money supply on money income remains significant.

Effect of Money Income on Money Supply (LGDP on LM2)

While checking the impact of money income on money supply, it was found that there exists a long-run relationship at 1% level of significance. The value of coefficient (-0.119) shows that there is 12% of disequilibrium in the short-run, which is corrected yearly for reaching/attaining the long-run equilibrium (a steady state position). It was also found that the series adjusts in the long-run. In the both the short- and long-run, the effect of money income on money supply remains significant.

Effect of Money Supply on Bank Credit (LM2 on LTC)

The estimates of the equation “money supply on bank credit” suggested that there is a long-run relationship in the model. The results are significant at 1% level of significance. The estimated model manifested 19% convergence. Also, it was determined that the series adjusts

in the long-run. In both the short- and long-run, the effect of money supply on bank credit remains significant. Our results are in line with Kevin S. Nell (2000).

Effect of Bank Credit on Money Supply (LTC on LM2)

The results showed that the effect of bank credit on money supply is insignificant in the short-run. However, the results of unit root test showed that the residual is stationary and there is no unit root. Therefore, a long-run relationship exists between money supply and bank credit. The value of the coefficient of ECM (-0.96) shows that there is 96% of disequilibrium in the short-run, which is corrected annually. Our results are in line with Kevin S. Nell (2000) and Dedeoglu and Ogut (2018).

The results obtained in this study are summarized as below. There is two-way causality between “money income and money supply” and “money supply and total credit”. Whereas, two one-way relations can be witnessed, that is, from “money base to total credit” and from “total credit to money multiplier”.

Conclusion

The results of the current study are interesting because they showed that a mixture of two views holds true in the case of Pakistan. Firstly, the liquidity preference view holds true as the variables ‘total bank credit’ and ‘money supply’ have two-way causality. Moreover, the results also indicated a long-run relationship between the two variables. Secondly, the findings of our study also supported the structuralist view, albeit only partially.

Two-way causality between “bank credit and money supply” was observed as a result of the application of the causality test. It clearly indicates that the liquidity preference view holds true in the case of Pakistan. Two-way causality between “money income and money supply” shows that, to some extent, the structuralist view also holds true in the case of Pakistan. It also shows that money supply determines economic growth, that is, with the increase in broad money, economic growth expands/is enhanced.

Furthermore, unidirectional causality from “bank credit to money multiplier” again proves credit as an exogenous variable. The results support the implications suggested by (Nayan et al., 2013); an economy with endogenous money supply should target interest rate as an exogenous variable. Hence, interest rate targeting would be more appropriate in such economies.

The policy implication of our study is that since money supply is endogenously determined, so a lower interest rate may lead financial institutions to increase their investment. This may, in turn, lead to an increase in the money supply; hence, a resultant increase in economic growth. This work can be extended by employing the quarterly data of the variables used in this study. It will give more accurate insights.

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