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Testing the Hypothesis of Long-run Neutrality of Money in Bangladesh

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Abstract

Empirical evidence on the key classical macroeconomic hypothesis – long-run neutrality of money is investigated in Bangladesh economy. King-Watson (1997) test procedure based on two-variable structural vector autoregressive (SVAR) model is adopted for testing this long-run hypothesis. Two short run and one long run restrictions are imposed to estimate the long-run test statistic according to this method. Test results based on these identifying restrictions show the empirical evidence on long-run neutrality of money holds using for M2 which is the measure of money supply, while it is rejected in terms of M1 in case of Bangladesh economy.

Keywords and Phrases: Long-run neutrality of money, stationary, unit roots, cointegration.

AMS Classification: $91B_{xx}$.

1 Introduction

Long-run neutrality of money implies that a permanent and unexpected (exogenous) change to the level of money supply has no effect on the level of real output in the long run. Long-run neutrality (LRN) of money is a key classical macroeconomic hypothesis whose modern theoretical foundation was provided by Friedman (1969a, 1969b). Although there are many classical hypotheses to the efficacy of monetary policy, this is widely accepted among the economists and policymakers. The main idea of LRN of money is that changes in the money stock eventually change nominal variables ultimately leaving real variables unaffected. Under LRN, changes in the money supply may or may not have short-run real effects. In the world of monetary theory, nearly all models based on standard economic assumptions embody some form of LRN of money. Most likely this is because monetary theorists generally think LRN of money is sensible, and, therefore, they build it into their models.

These long-run neutrality prepositions have been studied extensively, both theoretically and empirically, and are still very controversial topics among macroeconomic researchers. Although LRN of money is generally assumed to be true in economic theory, the empirical evidence on it has been very mixed and far from convincing. There is a lengthy history of efforts to test for LRN of money and various econometric procedures are available for testing these hypotheses. In the 1960s, the primary method in testing for LRN of money consisted of simple regression, not taking into account any properties of time series data. The results generated were found to be inconclusive in most cases. Lucas (1972) and Sargent (1971) argued that this method was not through enough as it did not first test to find evidence as to whether or not the money stock had been affected by a permanent change; in other words, there was no testing for a unit root. They showed that if money stock did not contain unit root, i.e., it did not contain permanent change; LRN of money could not be tested. This marked the beginning of first testing for a permanent change or unit root on variables being used in LRN of money analysis. In response to the Lucas and Sargent critics, Fisher and Seater (1993), and King and Watson (1992, 1997) have advanced the dominant approaches for testing LRN of money. Fisher and Seater (1993) employ a bivariate structural vector autoregression (SVAR) model to test long-run neutrality and supper neutrality. The orders of integration of the variables determine the model's restriction, while the exogeneity of nominal variable is a necessary condition in their framework. Specifically, LRN of money tests are possible only if nominal money stock as well as real output variables are at least integrated of order one. The neutrality of money hypothesis has been tested for numerous countries using their methodologies. For example, Boschen and Otrok (1994), Olekalns (1996), Serletis and Krause (1996), Haug and Lucas (1997), Coe and Nason (2003), Shelley and Wallace (2006) used Fisher and Seater method, while Weber (1994), Jefferson (1997), Serletis and Koustas (1998, 2001) employed King and Watson methods for testing the LRN and LRSN of money.

In spite of the progress in research on LRN of money, no comprehensive studies are available in for Bangladesh. The empirical testability of these LRN of money hypotheses is important for policy formulation and design, such as the effectiveness in monetary policy, while the determination of the time series properties of the data are crucial for the existing methods. So this paper presents the econometric treatments of time series data for testing the proposition of LRN of money in Bangladesh economy. King-Watson (1997) methods on the long-run neutrality of money are adopted to test this long-run hypothesis. About thirty five years long yearly data over the period 1974-2008 is used in this study. Yearly real GDP and nominal money supplies (money measures) M1 and M2 over the period 1974-2008 are used as the real output and nominal money stock respectively. King-Watson (1997) test procedure based on two-variable SVAR model heavily depends on the time series properties of the data. Recently developed econometric methodologies are used to test the required time series properties of the data. It is shown that our data satisfies all required time series properties, which are necessary for testing long-run neutrality of money.

2 King-Watson method

Let y_t and m_t be the log of detrended real output and nominal money supply respectively, which are I(1) and not cointegrated. That is, y_t and m_t are both I(1) and there is no linear combination of y_t and m_t that is I(0). Then, the structural vector autoregressive (SVAR) representation of the first differences of these two variables can be shown as follows:

$$\Delta y_t = \pi_{ym}\Delta m_t + \sum_{i=1}^{p} \alpha_{yy,i}\Delta y_{t-i} + \sum_{i=1}^{p} \alpha_{ym,i}\Delta m_{t-i} + \varepsilon_{y,t} \tag{1}$$

$$\Delta m_t = \pi_{my}\Delta y_t + \sum_{i=1}^{p} \alpha_{my,i}\Delta y_{t-i} + \sum_{i=1}^{p} \alpha_{mm,i}\Delta m_{t-i} + \varepsilon_{m,t} \tag{2}$$

where, $\begin{pmatrix} \varepsilon_{yt} \\ \varepsilon_{mt} \end{pmatrix} \xrightarrow{i.i.d.} \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_y^2 & 0 \\ 0 & \sigma_m^2 \end{pmatrix} \right]$

The exogenous error terms $\epsilon_{y,t}$and $\epsilon_{m,t}$ are independent and are interpreted as structural shocks. That is, the realizations of $\epsilon_{y,t}$ are interpreted as capturing unexpected shocks to output that are uncorrelated with $\epsilon_{m,t}$, the unexpected shocks to the money supply. It is instructive to look at the SVMA representation for the above bivariate system as

$$\Delta y_t = \theta_{yy,0}\varepsilon_{y,t} + \theta_{ym,0}\varepsilon_{m,t} + \theta_{yy,1}\varepsilon_{y,t-1} + \theta_{ym,1}\varepsilon_{m,t-1} + \cdots \tag{3}$$

$$\Delta m_t = \theta_{my,0}\varepsilon_{y,t} + \theta_{mm,0}\varepsilon_{m,t} + \theta_{my,1}\varepsilon_{y,t-1} + \theta_{mm,1}\varepsilon_{m,t-1} + \cdots \tag{4}$$

Based on the specification of equation (3) and (4), the long-term elasticity of output to monetary shock $\gamma_{ym}$and that of the money stock to output shock γ_{my} are defined below:

$$\gamma_{ym} = LRD_{ym} = \lim_{s\to\infty} \frac{\partial y_{t+s}/\partial\varepsilon_{m,t}}{\partial m_{t+s}/\partial\varepsilon_{m,t}} = \frac{\theta_{ym}(1)}{\theta_{mm}(1)} \tag{5}$$

$$\gamma_{my} = LRD_{my} = \lim_{s\to\infty} \frac{\partial m_{t+s}/\partial\varepsilon_{y,t}}{\partial y_{t+s}/\partial\varepsilon_{y,t}} = \frac{\theta_{my}(1)}{\theta_{yy}(1)} \tag{6}$$

Equation (5) is used to test for long-run neutrality of money. Within this context, we say that the model exhibits long-run neutrality when $\gamma_{ym}$is equal to zero. That is, the model exhibits long-run neutrality when the exogenous shocks $\varepsilon_{m,t}$ that permanently alter money but have no permanent effect on output.

In the context of Equations (5) the long-run neutrality restriction γ_{ym}= 0 can only be investigated when money is integrated. If the money process does not contain a unit root, then there are no permanent changes in the level of m_t and $\theta_{mm}(1)$= 0. In this case, γ_{ym} in Equation (5) is undefined, and the model's final form says nothing about long-run neutrality. This is the point of the Lucas-Sargent critique.

By its nature, the long-run multiplier γ_{ym} is a structural parameter, which requires one identifying assumptions to estimate it. King and Watson (1997) used one of the following identifying restrictions in their LR tests.

1. the impact elasticity of y with respect to m is known (i.e., π_{ym} is known),
2. the impact elasticity of m with respect to y is known (i.e., π_{my} is known),
3. the long-run elasticity of m with respect to y is known (i.e., γ_{my} is known)

First, the short-term restriction specifies a contemporaneous relationship between endogenous variables and shocks by imposing restrictions on the short-term elasticity, such as $\pi_{ym} = 0$ or π_{my}= 0. The former restriction indicates short-run neutrality whereby output does not react contemporaneously to the shock to the money stock. In contrast, the latter restriction indicates the situation whereby the money stock does not contemporaneously accommodate changes in output, and output becomes the predetermined variable. Second, the long-term restriction specifies a long-term relationship between endogenous variables and shocks by imposing restrictions on the long-term elasticity, for example, $\gamma_{my} = 0$. This is equivalent to the situation whereby the money stock does not accommodate shocks to output and therefore the general price level remains unchanged (assuming constant velocity of money). Varying the values of π_{ym}, π_{my} and γ_{my}, they found the evidence of supporting long-run neutrality of money for real output in the postwar U.S. data.

This allows to gauge the robustness of conclusions about γ_{ym} and long-run neutrality to specific assumptions aboutπ_{ym}, π_{my} or γ_{my}. Long-run neutrality of money is not rejected at 5-percent level of significance if γ_{ym}= 0 is contained in the 95-percent confidence interval.

3 Data and their time series properties

Bangladeshi data is used to test for the classical macroeconomic hypothesis of long-run neutrality of money. Thirty five years long yearly data on two types of money measures and real GDP over the period 1974-2008 is used in this study. Yearly real GDP and nominal money supplies M1 and M2 are used as the real output and nominal money stock respectively. The data are collected from World Development Indicators (WDI) where we denote money (current LCU) as M1 and money and quasi money (M2) (current LCU) as M2. The following symbolic notations are used through out this study.

$$y = \log(\text{real GDP})$$
$$m1 = \log(\text{nominal money M1})$$
$$m2 = \log(\text{nominal money M2})$$

Although $m2$ is the major indicator of board monetary aggregate, consideration of two measures of money supply, namely $m1$ and $m2$, serves as a sensitivity analysis of the potential effects of money on real output. It is shown in Bullard (1994) and Olekalns (1996) that the outcome of the test of LRN is sensitive to measure the money involved.

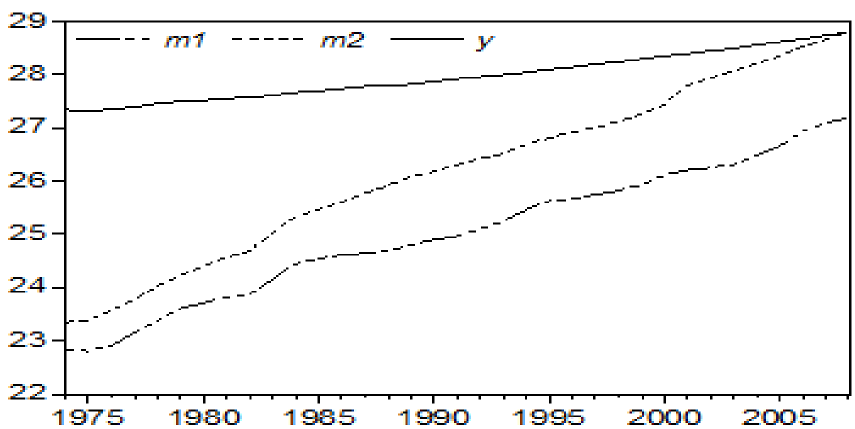

Figure 1. Logarithm of annual real GDP (y) and nominal money supplies($m1$ & $m2$)

Time series properties of the data are crucially important for testing LRN of money. This proposition has not proven easily either to verify or to dismiss. Fisher and Seater (1993) and King and Watson (1997) have shown that conclusions regarding the proposition depend critically on the time series properties of the data, specifically the orders of integration of money and real output.

Since the issue of variable integration is central to testing for neutrality, yet is a relatively recent development in time series analysis, some earlier findings regarding neutrality are suspect. So required time series properties would be investigated in the next section.

3.1 Test for the order of integration

Identification of the orders of integration of nominal money and real GDP is an important issue before testing long-run neutrality of money. We determine the order of integration of each variable by implementing the unit root tests. Unfortunately, it is well known that unit-root tests have low power and that results can vary with the types of test used and the number of lags included in the test equations. For this reason, it becomes a strategy among the researchers to examine the results of several test procedures in order to draw conclusions regarding variable integration. With this in mind, three unit root tests are performed: (i) most widely used Augmented Dicky-Fuller (ADF) test of Dicky and Fuller (1979, 1981) (ii) the asymptotically most powerful DF-GLS test of Elliott *et al.* (1996) and (iii) the Kwiatkowski *et al.* (1992) LM test (KPSS). The null hypothesis of ADF and DF-GLS tests is that a time series variable has a unit root while KPSS test is that a variable is stationary. A common strategy is to present results of both ADF/DF-GLS and KPSS tests, and show that the results are consistent (e.g., that the former reject the null while the later fail to do so and vice-versa). The lag length is selected by using the Akaike Information Criteria (AIC), setting the maximum lag at 10.

Before beginning the formal tests for unit roots, the variables should be plotted against time to visually determine if a trend exists in the time series. The necessity of this step is simply due to the fact that the critical values of the tests depend on the sample size and the inclusion of deterministic components, i.e., the inclusion of a constant and a time trend. All variables in level have been graphed against time in Figure 1 over the period 1974-2008. It is visually evident that $m1$, $m2$ and y present upward trends but it is difficult to guess whether the trends are linear or quadratic. The results of ADF, DF-GLS and KPSS tests have been reported in Table 1.

From the Table 1, we see that, the variable y is nonstationary to include intercept and intercept and trend by the three unit root tests. By ADF test the variable $m1$ is nonstationary when only the intercept term is include in the test, but when the intercept with trend term is include in the test, the test suggest that the variable $m1$ is stationary at 5% level of significance. Again by DF-GLS test the variable $m1$ is non-stationary when only the intercept term is include in the test, but when the intercept with trend term is include in the test, the test suggest that the variable $m1$ is stationary at 5% level of significance. Also KPSS test suggest that the series $m1$ is non-stationary. Similarly the three unit root tests suggest that the variable $m2$ is nonstationary to include intercept and intercept with trend.

For first difference series, we see from the Table 1 that the variable Δy is stationary when the intercept and trend term is include in the ADF test and KPSS test. But DF-GLS test suggests that the variable Δy is stationary when the intercept term is include in the test. For the series $\Delta m1$, all the tests suggest that the variable $\Delta m1$

Table 1: Unit root tests for levels and first differences series for our data

Variables	ADF		DF-GLS		KPSS	
	Constant	Constant & Trend	Constant	Constant & Trend	Constant	Constant & Trend
Level						
y	1.86 (0)	-0.47 (2)	3.64 (0)	-0.66 (0)	0.90*** (5)	0.22*** (5)
$m1$	-0.31 (0)	-3.80** (1)	-0.10 (1)	-3.42** (10)	0.70** (5)	0.13* (3)
$m2$	-1.02 (0)	-1.50 (0)	-0.04 (1)	-1.42 (0)	0.70** (5)	0.15** (4)
First difference						
Δ y	-1.95 (4)	-4.78*** (10)	-1.75* (4)	-2.25 (4)	0.47** (2)	0.08 (3)
$\Delta m1$	-4.26*** (0)	-4.23** (0)	-3.22*** (0)	-3.87*** (0)	0.14 (9)	0.13* (9)
$\Delta m2$	-4.60*** (0)	-4.80*** (0)	-3.65*** (0)	-4.31*** (0)	0.20 (0)	0.09 (2)

Note: Figures in parentheses show the values of lag length. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels of significance respectively. The lag length was determined using AIC, with a maximum of 10 lags considered.

is stationary except KPSS when the intercept and trend term is include in the test. For $\Delta m2$, the entire tests suggest that, the variable $\Delta m2$ is stationary at any level of significance.

Thus, it is concluded that the time series variables y, $m1$ and $m2$ are integrated of order one, that is, I(1).

3.2 Tests for cointegration

Another related caveat is that, even if it were known that money and real GDP are indeed nonstationary, the testing procedure for long-run neutrality of money still relies critically on the variables being noncointegrated. This is important not only because a violation makes the SVAR model misspecified, thus making their estimates suspect, but also because the presence of cointegration is by itself sufficient for rejecting the neutrality proposition. So, we test for cointegration between y and $m1$, and y and $m2$ respectively. We test the null hypothesis of no cointegration between real GDP and nominal money using both the Engle and Granger (1987) two-step procedure as well as Johansen's (1988, 1991) maximum likelihood method for the data over the period 1974-2008. Table 2 summarizes the outcomes of the cointegration analysis for the data.

Table 2: Cointegration tests

	Engle-Granger	Johansen		
Variables	ADF test	Number of cointegration (r)	Trace test	Maximum eigenvalue test
y, $m1$	-1.9407 (0.31)	$r = 0$	22.7816	14.4230
		$r \leq 1$	8.3585	8.3585
y, $m2$	-1.1909 (0.67)	$r = 0$	18.1158	11.6010
		$r \leq 1$	6.5148	6.5148

Note: P-values are presented in the parentheses.

The Johansen cointegration trace test statistic and maximum eigen-value test statistic can not reject the null of no cointegration ($r = 0$), as well as the null hypothesis of at most one cointegration vector ($r \leq 1$) at the 5% level of significance for the money (both $m1$ and $m2$) and real GDP. Accordingly, Engle-Granger ADF test statistic indicates that the residual from the OLS static regression for such a relation contain a unit root, which implies no evidence of cointegration between such variables. So money has no impact on real GDP in the long run, as predicted by basic classical economics.

4 Test for long run neutrality of money

In the previous sections, it is shown that nominal money stocks $m1$and $m2$ and real GDP y are integrated of order one and are not cointegrated. These time series properties of the data are necessary in testing long-run neutrality of money using King-Watson (1997) method. We now follow the method used in King and Watson (1997) to test for long-run neutrality of money based on the Bangladeshi time-series data from 1974 to 2008. Specifically, we make there sets of calculations using a bivariate structural VAR model under the three different identifying restrictions: (1) the short-term elasticity of the money stock to real output (π_{my}) is known; (2) the elasticity of real output to the money stock (π_{ym}) is known; and (3) the long-term elasticity of the money stock to real output (γ_{my}) is known.

4.1 Long-run neutrality of money in terms of M2

The LRN of money in terms of M2 is tested in this section. Empirical results for the short-run identifying restrictions on π_{my} ranging from -1 to 1 is presented in Figure 2. Estimated values of γ_{ym} are shown by solid line and 95-percent confidence intervals are defined by dashed lines. The precise value of π_{my} depends on the money supply process. For example, if the central bank's reserve position is adjusted to smooth interest rates, then m_t will adjust to accommodate shifts in money demand arising from changes in y_t. In this case, π_{my} corresponds to the short-run elasticity of money demand, and a reasonable range of values is $0.1 = \pi_{my} = 0.6$. For all values of π_{my} in this range, the null hypothesis of long-run neutrality cannot be rejected.

Estimated values of long-run dynamic γ_{ym} and 95-percent confidence intervals for a wide range of values of the short-run restriction π_{ym} between -1 and 1 are shown in Figure 3. Estimated values of γ_{ym} are shown by solid line and 95-percent are defined by dashed lines. Figure 3 shows that long-run neutrality is not rejected at the 5 percent level of significance when $\pi_{ym} = 0$, that is, the long-run dynamic $\gamma_{ym} = -0.011$ lies between -0.055 and 0.033 for this identifying restriction. It is also evident from the Figure 2 that long-run neutrality cannot be rejected at the 5 percent level for any value of π_{ym} in the interval $-0.045 = \pi_{ym} = 0.054$. But the traditional monetary models of the business cycle imply that the short-run effect of money to real GDP should be non-negative, that is, $\pi_{ym} = 0$ — output does not decline on impact in response to a monetary expansion. Thus, the interpretation of the evidence on long-run neutrality depends critically on the assumed value of π_{ym}.

Now, for the long-run restriction γ_{my} over the range -1 to 1, the estimated value of long-run dynamic γ_{ym} with their 95-percent confidence are depicted in Figure 4.

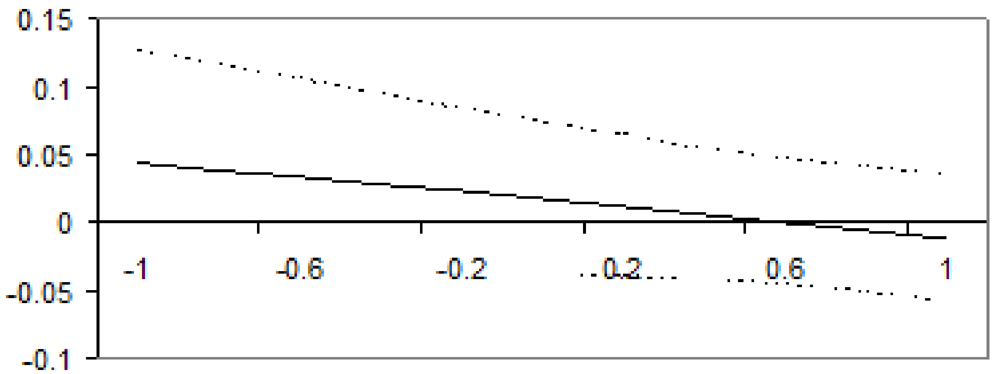

Figure 2. Long-run non-neutrality of money in terms of $m2$ when π_{my} is known

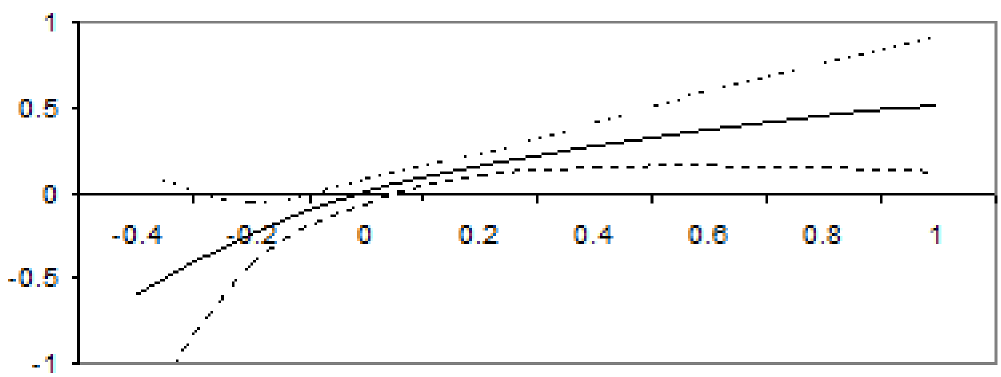

Figure 3. Long-run non-neutrality of money in terms of $m2$ when π_{ym} is known

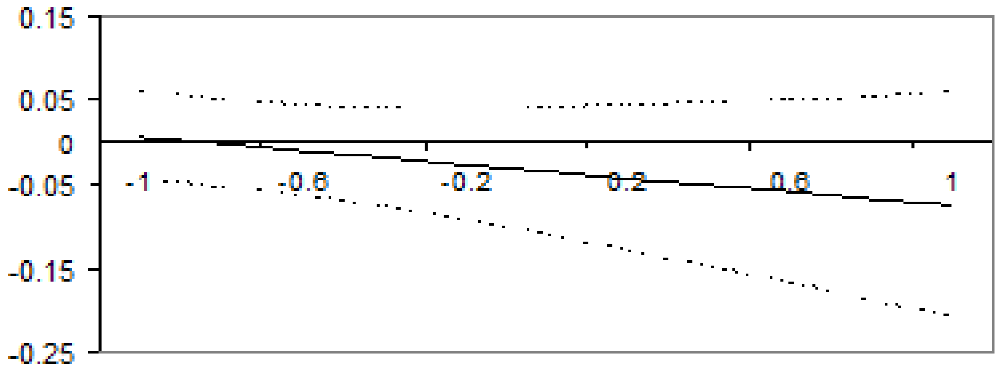

Figure 4. Long-run non-neutrality of money in terms of $m2$ when γ_{my} is known

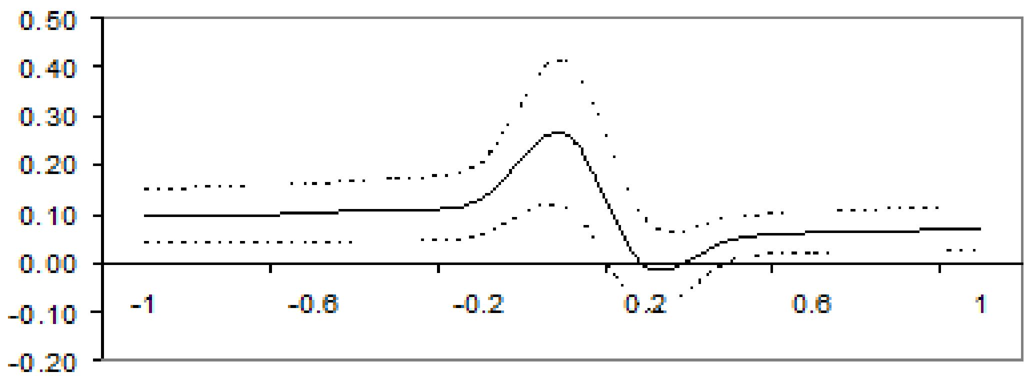

Figure 5. Long-run non-neutrality of money in terms of $m1$ when π_{my} is known

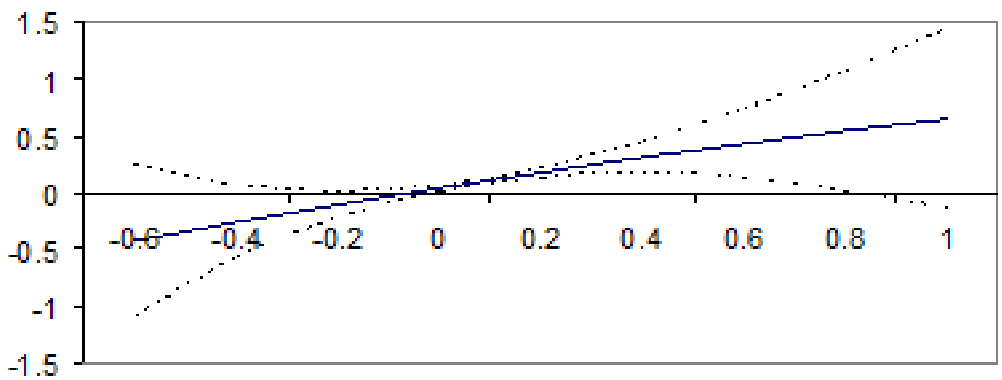

Figure 6. Long-run non-neutrality of money in terms of $m1$when π_{ym} is known

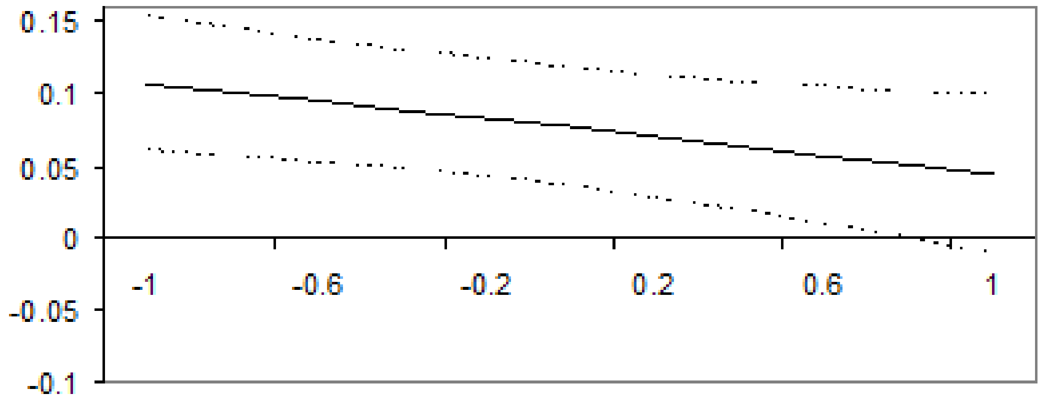

Figure 7. Long-run non-neutrality of money in terms of $m1$when γ_{my} is known

The result in Figure 4 suggests that the long-run neutrality hypothesis cannot be rejected for the entire range of values of the long-run restriction of γ_{my}.

To interpret the results in this figure, recall that γ_{my} represents the long-run response of m to exogenous permanent shifts in the level of y, if money velocity is reasonably stable over long periods.

It is evident from the Figures 2, 3 and 4 that long-run neutrality of money in terms of $m2$ can be supported in Bangladesh economy.

4.2 Long-run neutrality of money in terms of M1

In this section, the empirical results on long-run neutrality of money in terms of M1 are displayed. King and Watson (1997) method is used under a wide range of identifying restrictions. Two short run identifying restrictions π_{my} and π_{ym} and one long run identifying restriction γ_{my} are used in this test. Figures 5, 6 and 7 show the estimates of long-run dynamics γ_{ym} with 95 percent confidence intervals for the identifying restrictions on π_{my}, π_{my} and γ_{my} respectively with the values ranged between -1 and 1. Horizontal axis of the figures represents the value of identifying restrictions π_{my}, π_{ym} and γ_{my} and vertical axis represents the estimates of the long-run dynamics γ_{ym} and 95% confidence interval. The solid line represents the estimated coefficient γ_{ym}. The dashed lines represent the 95-percent confidence intervals of the identifying restrictions respectively in Figures 5, 6 and 7.

It is evident from the Figures 5, 6 and 7 that long-run neutrality of money in terms of M1 cannot be supported in Bangladeshi economy.

5 Robustness of the estimation results for M2

Next, we check the robustness of the estimation results for $m2$ shown above by examining the effects of including data under the inflationary period especially after 2000.

We estimate γ_{ym} by sequentially extending the end of the sample period (2 years period basis) from 2000 to 2008, using identifying restrictions $\pi_{my} = 0$, $\pi_{ym} = 0$ and $\gamma_{my} = 1$ respectively. The results are presented in Figures 8, 9 and 10 respectively which shows the point estimate of γ_{ym} as a circle and their 95 percent confidence interval as vertical line.

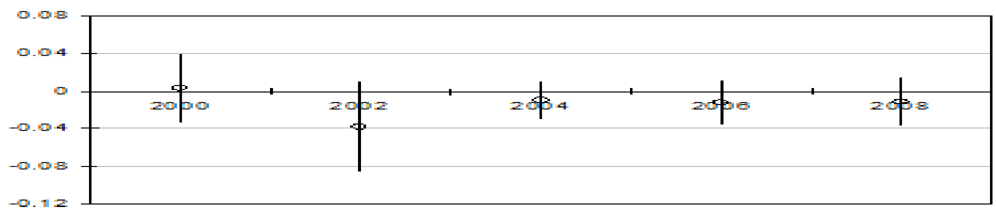

Figure 8. Long-run neutrality of $m2$ when $\pi_{my} = 0$

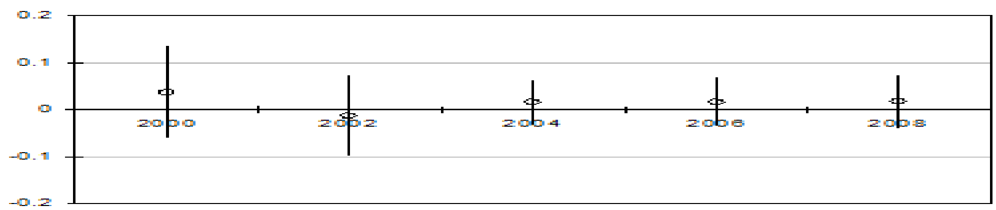

Figure 9. Long-run neutrality of $m2$ when $\pi_{ym} = 0$

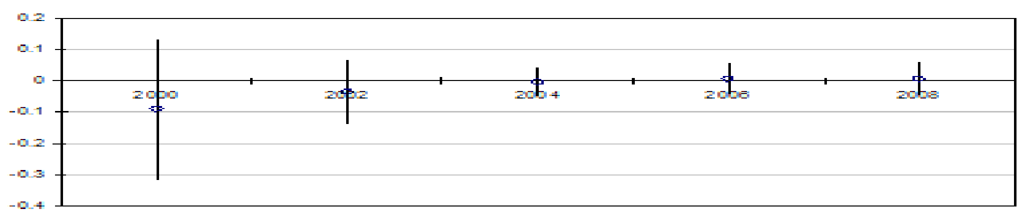

Figure 10. Long-run neutrality of $m2$ when $\gamma_{my} = 0$

As can be seen from Figures, the point estimate of γ_{ym} remains near the zero line regardless of the end of the sample period after 2000 in terms of $m2$. All confidence intervals contain zero, implying long-run neutrality of money generally hold for $m2$ as a monetary variable for the identifying restrictions $\pi_{my}= 0$, $\pi_{ym} = 0$ and $\gamma_{my} = 1$ respectively.

Thus, $m2$ is not sensitive for supporting the neutrality hypothesis to the inclusion of data for the period of unusual events happened in Bangladesh economy after 2000 and the long-run monetary neutrality generally holds.

6 Conclusion

The hypothesis on long-run neutrality of money in Bangladesh economy over the period 1974-2008 has been tested by using the King and Watson (1997) method. Using this annual data, it is shown that long-run neutrality of money is supported for M2 as the measure of money supply, while it is rejected in terms of M1. These conclusions are robust to a wide range of identifying assumptions when a restriction imposes on the sort run as well as long run. The robustness of the results is examined in terms of M2 also by including data under the inflationary events in Bangladesh economy after 2000. It is shown that this economic shock cannot affect the long-run neutrality of money in terms of M2 in Bangladesh.

These conclusions are predicated on the two-shock model that forms the basis of the bivariate specification. That is, the analysis is based on the assumption that money and output are driven by only two structural disturbances, here interpreted as a monetary shock and a real shock. This is clearly wrong, as there are many sources of real shocks (productivity, oil prices, tax rates, etc.) and nominal shocks (factors affecting both money supply and money demand). However, deducing the effects of these omitted variables on the analysis is difficult, since what matters is both the relative variability of these different shocks and their different dynamic effects on real GDP and nominal money. Indeed, as shown in Blanchard and Quah (1989), a two-shock model will provide approximately correct answers if the dynamic responses of real GDP and nominal money to shocks with large relative variances are sufficiently similar.

References

[1] Andersen L. C. and D. S. Karnosky (1972), "The Appropriate Time Frame for Controlling Monetary Aggregates: The St. Louis Evidence", in *Controlling Monetary Aggregate II: The Implementation*, Federal Reserve Bank of Boston.

[2] Andersen L. C. and J. L. Jordan, (1968), "Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization", *Federal Reserve Bank of St. Louis Review*, 68, pp.11-24.

[3] Blanchard, O. J. and D. Quah (1989), "The Dynamic Effects of Aggregate Demand and Supply disterbances", *The American Economic Review*, vol. 9, No. 4, pp. 655-673.

[4] Boschen, J. F. and C. M. Otrok (1994), "Long-Run Neutrality and Superneutrality in an ARIMA Framework: Comment", *American Economic Review*, 84, pp. 1470-1473.

[5] Bullard, J. (1994), "Measures of Money and the Quantity Theory", *Federal Reserve Bank of St. Louis Review*, 76, pp. 19-30.

[6] Coe, P. J. and J. M. Nason (2003), "The Long-horizon Regression Approach to Monetary Neutrality: How Should the Evidence be Interpreted?", *Economics Letters,* vol. 78, pp.351-356.

[7] Dickey, D. A. and W. A. Fuller (1979), "Distribution of Estimators for Autoregressive Time Series with a Unit Root", *Journal of the American Statistical Association*, 74, 427-431.

[8] Dickey, D. A. and W. A. Fuller (1981), "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", *Econometrica*, 49, pp. 1057-1072.

[9] Elliott, G., T. J. Rothenberg and J. H. Stock, (1996), "Efficient Tests for an Autoregressive Unit Root", *Econometrica*, 64, pp.813-836.

[10] Fisher, M. E. and J. J. Seater (1993), "Long-run neutrality and superneutrality in an ARIMA framework", *American Economic Review*, 83, pp.402-415.

[11] Friedman, M. (1969a), *The Optimum Quantity of Money and Other Essays*, Chicago: Aldine.

[12] Friedman, M. (1969b), "The Role of Monetary Policy", *American Economic Review*, 59(1), pp.1-10.

[13] Granger, C. W. J. (1969), "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods", *Econometrica*, 37, pp.424-438.

[14] Haug, A. A. and R. F. Lucas, (1997), "Long-Run Neutrality and Superneutrality in an ARIMA Framework: Comment", *American Economic Review*, 87, pp.756-59.

[15] Jefferson, P. N. (1997), "On the Neutrality of Inside and Outside of Money", *Economica*, 64, pp.567-586.

[16] King, R. G. and M. W. Watson (1992), "Testing Long-run Neutrality", Working Paper No. 4165, National Bureau of Economics Research.

[17] King, R. G. and M. W. Watson (1994), "The Post-War U.S. Phillips Curve: A Revisionist Econometric History", *Carnegie-Rochester Conference Series on Public Policy*, 41, pp.157-219.

[18] King, R. G. and M. W. Watson (1997), "Testing Long-run Neutrality". *Economic Quarterly*, Federal Reserve Bank of Richmond, 83, pp.69-101.

[19] Kwiatkowski, D., P.C.B. Phillips, P. Schmidt and Y. Shin (1992), "Testing the Null Hypothesis of Stationarity Against the Alternatives of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root?", *Journal of Econometrics,* 54, pp.159-178.

[20] Lucus, R. E., Jr. (1972), "Expectations and the Neutrality of Money", *Journal of Economic Theory*, pp.103-124.

[21] MacKinnon, J. (1991), "Critical Values for Cointegration Tests," in, Engle, R. and C. Granger, (eds.), *Long–Run Economic Relationships: Readings in Cointegration*, Oxford University Press, Oxford.

[22] McCallum, B. T. (1984), "On Low-Frequency Estimates of Long-Run Relationships in Macroeconomics", *Journal of Monetary Economics*, 14, pp.3-14.

[23] Moosa, I. A. (1997), "Testing the Long-run Neutrality of Money in a Developing Country: The Case of India", *Journal of Development Economics*, 53, pp. 139-155.

[24] Nelson, C. R. and C. I. Plosser (1982), "Trends and Random Walks in Macroeconomic Time Series: Some Evidences and Implications", *Journal of Monetary Economics*, pp. 139-162.

[25] Newey, W. K. and K. D. West (1987), "A Simple, Positive Semidefinite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", *Econometrica*, 55, pp.703-208.

[26] Olekalns, N. (1996), "Some Further Evidence on the Long-run Neutrality of Money", *Economics Letters*, 50, pp.393-398.

[27] Noriega (2004), "Long-Run Monetary Neutrality and the Unit Root Hypothesis: Further International Evidence", *North American Journal of Economics and Finance*, 15, 179-197.

[28] Perron, P. (1989), "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis", *Econometrica*, 57, pp. 1361-1401.

[29] Rahman, M. J. and T. Toyoda (2008), "Financial Anxieties and Long-run Neutrality of Money in Japanese Economy", *Studies in Applied Economics*, 2, pp. 107-132.

[30] Rahman, M. J. and T. Toyoda (2008), "An Empirical Study on Long-run Neutrality of money in Japanese Economy", *The Japanese economy*, M.E. Sharpe, NY, Vol. 35, No. 3, pp. 87-117

[31] Rahman, M. J., S. Miyagawa and Y. Morita (2005), "Financial Anxieties in Japanese Economy", *Journal of the Faculty of economics, KGU*, 15-1, pp. 19-32.

[32] Rahman, M. J., S. Miyagawa and Y. Morita (2005), "Financial Anxieties of Large, Mediam and Small Enterprises in Japan", *Journal of the Faculty of economics, KGU*, 15-2, pp. 19-32.

[33] Rahman, M. J., Y. Morita and S. Miyagawa (2006), "Modelling of Financial Anxieties as Precautionary Demand Function", *International Journal of Innovative Computing, Information and Control*, 2, pp. 1069-1082.

[34] Sargent, T. J. (1971), "A Note on Accelerationist Controversy", *Journal of Money, Credit and Banking*, 3, pp.721-725.

Sargent, T. J. (1976), "Observational Equivalence of Natural and Unnatural Rate Theories of Macroeconomics", *Journal of Political Economy*, 84, pp.631-640.

[35] Schwert, W. (1989), "Tests for unit roots: A Monte Carlo Investigation." *Journal of Business and Economic Statistics* 7, 147-159.

[36] Serletis, A. and D. Krause, (1996), "Empirical Evidence on the Long-run Neutrality Hypothesis Using Low-frequency International Data", *Economics Letters*, 50, pp.323-7.

[37] Serletis, A. and Z. Koustas (1998), "International Evidence on the Neutrality of Money", *Journal of Money, Credit and Banking*, 30(1), pp.1-25.

[38] Serletis, A. and Z. Koustas (2001), "Monetary Aggregation and the Neutrality of Money", *Economic Inquiry*, 39(1), pp.124-138.

[39] Shelly, G. L. and F. H. Wallace (2006), "Long Run Effects of Money on Real Consumption and Investment in the U.S.", *International Journal of Applied Economics*, 3, pp.71-88.

[40] Toda, H. Y. and T. Yamamoto (1995), "Statistical Inference in Vector Autoregressions with Possibly Integrated Process", *Journal of Econometrics*, 66, pp. 225-250.

[41] Weber, A. A. (1994), "Testing Long-Run Neutrality: Empirical Evidence for G7 Countries with Special Emphasis on Germany", *Carnegie- Rochester Conference Series on Public Policy*, 41, pp.67-117.

[42] Yamada, K. (1997), "Nihon ni okeru Kahei no Choki Churitsusei (Long-Run Monetary Neutrality in Japan)", *Osaka University Economics Journal*, 46(3), pp. 46-54 (in Japanese).

[43] Zivot, E. and D. W. K. Andrews (1992), "Further Evidence on the Great Crash, the Oil-Price Shock, and Unit-Root Hypothesis", *Journal of Business & Economic Statistics*, 10, pp. 251-270.