# Co-integration, Causality, Money and Income in India

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***Abstract***

*This paper investigates empirically the existence of a long-run relationship between money supply (MS) and national income (GNP) using annual data for India over the period 1950-51 to 2006-07. Necessary, time series data on money supply (broad money) and national income (GNP at factor cost) has been collected from, Handbook of Statistics on Indian Economy, 2007, RBI.*

*In order to take care of the shifts in the series due to the start of the economic liberalization in the early 1990s, the direction of causation between real money and real income and between nominal money and nominal income, has been examined by classifying the data into three samples viz., 1950-51 to 2006-07 (full period), 1950-51 to 1989-90 (pre-liberalization period) and 1990-91 to 2006-07 (post-liberalization period).*

*To examine the short-run direction of causality between money supply and national income Granger Causality Test has been applied and in order to investigate the existence of long-run relationship, co-integration analysis has been employed.*

*The Granger causality results did not reveal a uniform direction of causality between money and income in India. The direction of causation between real money and real income was found to be uni-directional from real GNP to real MS during the full period of analysis where as no direction of causation was found between real money and real income, during pre and post-liberalization periods. However, a feedback direction of causation was found between nominal MS and nominal GNP during the full period where as, a uni-directional causality between nominal money and nominal income was found in both the pre and post-liberalization periods.*

*Further, the co-integration analysis established that the money supply and national income (both real and nominal) were found to be co-integrated suggesting a existence of long-run relationship.*

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# I

## Background

In an economy, Money and Income are important macroeconomic variables which play a crucial role particularly in determining the level of prices and interest rates. The monetarist view, mainly headed by Friedman states that an expansion in the quantity of money may generally expected to result in a rise in general price level and in turn impacts the level of national income. As noted, price stability is an essential condition for stability in economic life as well as economic growth. Fluctuations in prices, on the contrary, create an atmosphere of uncertainty which is not conducive to development activity. Further, if prices rise steadily over a long period, redistribution of national income and wealth takes place to the disadvantage of the poor, which eventually influences the aggregate demand pattern and in turn impacts the level of economic activity in an economy.

Thus, the supply of money or stock of money at any period of time has a tendency to impact prices and income levels in the economy and is one of the important active macroeconomic variable which the policy makers have to keep a check on it. Thus, according to monetarists view, the direction of causation runs from money to income and prices without any feedback. However, Keynesians argue that money does not play an active role in changing income and prices. In fact income plays the leading role in changing money stocks via demand for money implying that the direction of causation runs from income to money without any feedback. Similarly, changes in prices are mainly caused by the structural factors.

In light of this contradiction, Sims (1972) tested the causal relationship between money and nominal GNP in the bivariate framework. His study found that causality is uni-directional running from money to income in the post-war quarterly data for U.S as claimed by the Monetarists. However, he rejected the hypothesis that causality is uni-directional from income to money as claimed by the Keynesians.

However, the subsequent studies on the issue did not support Sims' findings. For instance, Fiege and Pearce (1976), using similar data, have found little or no causal relationship between money supply and GNP. Likewise, Pierce (1977) draws the

conclusion that independence or lack of causal relationship characterizes important economic variables.

To examine the generality of Sims' results (1972), Williams, Goodhart, and Gowland (1976) undertook a similar study using U.K. data. They find that neither the causal relationship from money to income nor the reverse causality from income to money is significant. Rejection of the first hypothesis that causality is uni-directional from money to income was found to be decisive, but rejection of the second hypothesis that causality is uni-directional from income to money was found to be marginal at the 5 percent significance level.

On the other hand, Barth and Bennett (1974) replicating Sims test in Canadian economy, Lee and Li (1983) investigating causality among money, income, and prices in Singapore, Joshi and Joshi (1985) examining causality between money and income in India, Dyreyes, Starleaf, and Wang (1980), examining the pattern of causality between money and income for six industrialized countries, found a bi-directional causality contrary to Sims (1972).

Along with the direction of causality, the existence of long-run equilibrium relationship among money and income represented by a money demand function also has significant implications for monetary policy. For instance, the existence of the long-run equilibrium relationship between money and income implies that a monetary policy, using money as a policy instrument can influence fluctuations in income and prices otherwise, it is impossible for the central bank to use money as a policy instrument, and to control prices and income by controlling money.

The above discussion clearly indicates firstly, that the empirical evidence regarding the direction of causation between money and income remain inconclusive, and secondly, the direction of causation assumes importance especially for a developing economy like India, for effective implementation of its monetary policy. To add to this, the current debate on the causal relationship between money and income in India is certainly, inconclusive especially since India adopted new economic reforms in 1991.

Thus, in a developing economy like India, one of the important task of the central bank in framing its monetary policy is to understand the causal relationship between

money and income and understand the dynamics of future movements of some relevant aspects of the real economy.

Detecting the true causal directions among macroeconomic variables between money and income therefore assumes importance and is essential for effectiveness of its monetary policy and design of an appropriate policy. Therefore, this study attempts to investigate the causal relationship between money and income in India. Specifically, the direction of causation between real money and real income and between nominal money and nominal income has been investigated for three periods viz., 1950-51 to 2006-07 (full period), 1950-51 to 1989-90 (pre-liberalization period) and 1990-91 to 2006-07 (post-liberalization period).

The paper is organized as follows. Section II presents the data used and the methodology followed to examine the nature and direction of causality between money and income in India. Section III presents empirical results and Section IV provides concluding remarks of the paper.

## II

## Data and Research Strategy

### The Data

The macroeconomic data under examination consist of Gross National Product (GNP) at factor cost, and Money Supply (MS) both in real and nominal terms in Rs. crore from 1950-51 to 2006-07, which were collected from *Handbook of Statistics on Indian Economy*, 2007, RBI. The component of money supply used in the study is Broad Money ($M_3$), which consists Narrow money i.e., currency with public, other deposits with RBI and demand deposits of banks ($M_1$) plus time deposits. In the present study, the direction of causation between money supply and national income has been examined both between real money supply (RMS) and real national income (RGNP) and nominal money supply (NMS) and nominal national income (NGNP). To capture the possible effects of economic liberalization initiated in the early 1990s in India, the causation relationship between RMS and RGNP and between NMS and NGNP is examined by classifying the data into three samples viz., 1950-51 to 2006-07 (full period), 1950-51 to 1989-90 (pre-liberalization period) and 1990-91 to 2006-07 (post-liberalization period).

**The Research Strategy**

To test the short-run nature and the direction of causality between money supply and national income in India, Granger *Causality Test* has been employed. The specification of the models is given below:

$$MS_t = \gamma_0 + \sum_{i=1}^{n} \lambda_i GNP_{t-i} + \sum_{j=1}^{m} \delta_j MS_{t-j} + u_t \text{ ---------- (1)}$$

$$GNP_t = \pi_0 + \sum_{j=1}^{m} £_j GNP_{t-j} + \sum_{i=1}^{n} \theta_i MS_{t-i} + v_t \text{ ---------- (2)}$$

Where, $u_t$ and $v_t$ are mutually uncorrelated white noise error terms such that $E(u_t u_{t'}) = E(v_t v_{t'}) = 0$ for all t and t'(t≠ t'). In order to estimate the above two models and conduct Granger Causality Test, the selected variables should be stationary. For the purpose, unit root tests like Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) are employed to check the stationarity of the selected variables.

To determine the existence of a long-run relationship between money supply and national income a co-integration test is applied. In the present study the Engle and Granger (1987) two step procedure for modeling the relationship between co-integrated variables has been employed. The co-integration between the two series, here $MS_t$ and $GNP_t$, is tested by conducting the ADF and the PP test on residuals obtained from running the OLS regression, called the co-integrating regression: $MS_t = \alpha_1 + \alpha_2 GNP_t + u_t$.

The residuals from the co-integrating regression are retained and the ADF and PP tests are applied to the residuals, as follows: $\Delta\hat{u}_t = \Phi\hat{u}_{t-1} + v_t$.

The ADF and the PP test on residuals obtained from running the co-integrating regression is tested, $H_0 = 0$ against $H_1 < 0$ using MacKinnon, 1991 critical values. Here, the null hypothesis of the co-integration test is that the series formed by the residuals of each co-integrating regressions are non stationary while under the alternative hypothesis, the residuals are stationary. Hence, if the null hypothesis is not rejected, there is no long-run co-integration between the two underlying time series.

## III

## Empirical Discussion

### Tests of Stationarity: The Unit Root Tests

The tests for unit roots are closely related to the investigation of stationarity (or non-stationarity) in a time series. As mentioned earlier, unit root tests like Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) are employed to check the stationarity of the selected variables. The estimated t-value of the associated coefficient is stationary if the estimated coefficient is negative and significant. The stationarity of selected time series variables (RMS, RGNP, NMS, NGNP) conducted both at levels and at first differencing using unit root tests viz., ADF and PP are reported in Table 1 and Table 2 respectively.

All the chosen macroeconomic variables viz., RMS, RGNP, NMS, NGNP appeared to be stationary in their levels in all cases as per both ADF and PP tests as suggested by their respective test statistic which are significant at 1 percent level. Similarly, applying the same tests to first differences to determine the order of integration, the critical values are less (in absolute terms) than the calculated values of the test statistic for all selected variables in all cases. This shows that all of the series are integrated of order one [I(1)], and become stationary after differencing once. Since all of the series are integrated of the same order, the series may be tested for the existence of a long-run relationship between them, i.e. a co-integrating relationship. Thus, co-integration analysis can be applied to the selected variables in the present analysis as all the series are found to be stationary in first differences.

**Table 1: Unit Root Tests of Stationarity of selected variables**

| Tests in Levels | | | | |
|---|---|---|---|---|
| Variables | ADF (Intercept) | ADF (Intercept and Trend) | PP (Intercept) | PP (Intercept and Trend) |
| RGNP | -4.919413* (-3.5547) | -6.433291* (-4.1348) | -7.987080* (-3.5523) | -9.699599* (-4.1314) |
| RMS | -3.817477* (-3.5547) | -4.510289* (-4.1348) | -5.021877* (-3.5523) | -5.893029* (-4.1314) |
| NGNP | -4.213378* (-3.5547) | -4.951115* (-4.1348) | -5.558143* (-3.5523) | -6.601921* (-4.1314) |
| NMS | -3.817477* (-3.5547) | -4.510289* (-4.1348) | -5.021877* (-3.5523) | -5.893029* (-4.1314) |

** Significant at 1 % level*
*Figures within parentheses indicate critical values*
*MacKinnon (1991) critical values for rejection of hypothesis of unit root are applied*
*Source: Authors Estimations*

**Table 2: Unit Root Tests of Stationarity of selected variables**

| Tests in First Differences | | | | |
|---|---|---|---|---|
| Variables | ADF (Intercept) | ADF (Intercept and Trend) | PP (Intercept) | PP (Intercept and Trend) |
| RGNP | -10.58297* (-3.5572) | -10.52995* (-4.1383) | -19.52622* (-3.5547) | -19.45530* (-4.1348) |
| RMS | -6.928264* (-3.5572) | -6.861331* (-4.1383) | -11.66764* (-3.5547) | -11.80708* (-4.1348) |
| NGNP | -9.854477* (-3.5572) | -9.766504* (-4.1383) | -15.53706* (-3.5547) | -15.59098* (-4.1348) |
| NMS | -6.928264* (-3.5572) | -6.861331* (-4.1383) | -11.66764* (-3.5547) | -11.80708* (-4.1348) |

** Significant at 1 % level*
*Figures within parentheses indicate critical values*
*MacKinnon (1991) critical values for rejection of hypothesis of unit root are applied*
*Source: Authors Estimations*

**Granger Causality Results**

As mentioned earlier, the present study has adopted the Granger Causality Test to examine the pair wise causal relation between real money supply (RMS) and real national income (RGNP) and nominal money supply (NMS) and nominal national income (NGNP). Similarly as noted earlier, in the present study, the direction of causation between RMS and RGNP and between NMS and NGNP is examined by classifying the data into three samples viz., 1950-51 to 2006-07 (full period), 1950-51 to 1989-90 (pre-liberalization period) and 1990-91 to 2006-07 (post-liberalization period).

Granger Causality Test is sensitive to the number of lags used in the analysis. In the present study the above models were estimated up to three lags to see the changes or variations in the results (if any). However, no considerable changes and variations in the estimated different lag models were found. The results of pair wise Granger Causality Test conducted between RMS v/s RGNP and NMS v/s NGNP is reported in Table 3 and Table 4 respectively for lag 2.

The result of the causality test depict, that there is uni-directional causation from RGNP to RMS suggesting real national income Granger causes India's real money supply (RGNP→RMS) during 1950-51 to 2006-07 (full period), since the estimated F-value is significant at 10 percent level. However, on the other hand, there is no reverse causation noted from India's real money supply to national income, since the computed F-value is not statistically significant.

The causality between real money supply and real national income during both the pre and post liberalization periods were found to be independent as suggested by the respective low F-statistic and high probability values in both the models respectively.

However, contrary to above evidence, a bi-directional or feedback causal relationship between noninal money supply and nominal national income (NMS↔NGNP) is reported as the estimated F-statistic value is significant at 10 percent and 1 percent level respectively during the full period of the analysis.

However, again (as evidenced in case of causality between real money and real income during full period analysis) a uni-directional causation from nominal income to nominal money supply (NGNP→NMS) in India is also reported during the pre and post liberalization periods as the estimated F-statistic value is significant at 1 percent and 10

percent level respectively in pre and post liberalization periods. This suggests that as the country's national income increases, the money supply also increases.

Thus, it can be observed that the causation between money and income (real and nominal) in different period of analysis stands different. The important point to be realised here is that, during pre-liberalization and post-liberalization period, the direction of causation between money and income stands same within real and nominal variables. For instance, during both pre and post-liberalization period, as evidenced by Granger causality results, the causality between RMS v/s RGNP was found to be independent where as, in case of NMS v/s NGNP a uni-directional causation from NGNP to NMS was established in both the pre and post-liberalization periods. This, suggests that there are other real, economic, social and institutional factors which are influencing the level of money and income in India.

**Table 3: Granger Causality Tests: Real GNP v/s Real Money Supply (Lag 2)**

| **Full Period (1950-51 to 2006-07)** | | | | |
|---|---|---|---|---|
| Null Hypothesis | F-Statistic | Probability | Observations | df |
| RGNP does not Granger Cause RMS | 2.07865 | 0.13599 | 54 | 49 |
| RMS does not Granger Cause RGNP | 0.79234 | 0.45850 | 54 | 49 |
| **Pre-Liberalization period (1950-51 to 1989-90)** | | | | |
| RGNP does not Granger Cause RMS | 1.23897 | 0.30321 | 37 | 32 |
| RMS does not Granger Cause RGNP | 0.19702 | 0.82217 | 37 | 32 |
| **Post-Liberalization period (1990-91 to 2006-07)** | | | | |
| RGNP does not Granger Cause RMS | 0.6197 | 0.55957 | 14 | 9 |
| RMS does not Granger Cause RGNP | 0.1260 | 0.88315 | 14 | 9 |

*Source: Authors Estimations*

**Table 4: Granger Causality Tests: Nominal GNP v/s Nominal Money Supply (Lag 2)**

| **Full Period (1950-51 to 2006-07)** | | | | |
|---|---|---|---|---|
| Null Hypothesis | F-Statistic | Probability | Observations | df |
| NGNP does not Granger Cause NMS | 2.03176 | 0.142 | 54 | 49 |
| NMS does not Granger Cause NGNP | 7.83298 | 0.00112 | 54 | 49 |
| **Pre-Liberalization period (1950-51 to 1989-90)** | | | | |
| NGNP does not Granger Cause NMS | 5.85611 | 0.0068 | 37 | 32 |
| NMS does not Granger Cause NGNP | 1.5693 | 0.22379 | 37 | 32 |
| **Post-Liberalization period (1990-91 to 2006-07)** | | | | |
| NGNP does not Granger Cause NMS | 2.81826 | 0.11210 | 14 | 9 |
| NMS does not Granger Cause NGNP | 0.1587 | 0.85558 | 14 | 9 |

*Source: Authors Estimations*

**Co-integration Results**

As evidenced by the Granger causality results, there exists some short-run causal relationship between money and income in India. In order to assess the nature of causation and to determine long-run or equilibrium relationships between any two macroeconomic series, the concept of co-integration can be applied which was first introduced into the literature by Granger (1981). As pointed out, by Thomas, 1993, co-integration is the statistical implication of the existence of a long-run relationship between economic variables. In other words, from a statistical point of view, a long-term relationship means that the variables move together over time so that short-term disturbances from the long-term (if any) trend will be corrected (Manning and Andrianacos, 1993). The basic idea behind co-integration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary (Hall and Henry, 1989). A lack of co-integration suggests that such variables have no long-run relationship: in principal they can wander arbitrarily far away from each other (Dickey et. al., 1991).

As mentioned earlier, the present study applied Engle and Granger (1987) two step co-integration procedure to determine the existence of a long-run relationship between the selected macroeconomic variables. As noted earlier, before testing for co-integration, that is, in order to establish the existence or otherwise of a long-run

relationship between two economic time series, say *y* and *x* it is first necessary to test whether variables are integrated to the same order. As found earlier, by applying the unit root tests the variables used in the analysis are integrated of order one [I(1)], and become stationary after differencing once. Since all series are integrated of the same order, the series can be tested for the existence of a long-run relationship between them, i.e. co-integration.

The null hypothesis of the co-integration test is that the series formed by the residuals of each of the co-integrating regressions is not stationary. To test the null hypothesis of non-stationarity of the residuals, the ADF and PP unit root tests are employed on the residuals of each of the sample periods of real money supply v/s real income and nominal money supply v/s nominal income co-integrating regressions.

Table 5 and Table 6, presents the results of the ADF and PP unit-root tests for the residuals series from the different sampling periods co-integrating regressions respectively. The estimated results suggest that the null hypothesis of non-stationarity can be rejected for all the sampling periods depicting a long-run relationship between real money supply and real income and nominal money supply and nominal income. The 1 percent critical values (MacKinnon, 1991) are smaller (in absolute terms) than the calculated *test statistic*. Thus, the null hypothesis of non-stationarity can be rejected and the alternate hypothesis of stationarity can be accepted clearly indicating that there is long-run relationship between money supply and national income (both real and nominal) in India.

## IV

## Concluding Remarks

The present paper attempted to examine the long-run causation between real money and real income and between nominal money and nominal income in India over the period of 1950-51 to 2006-07. For the purpose, accordingly, necessary macroeconomic variables, viz., broad money ($M_3$) as a measure of money supply and GNP at factor cost as a measure of national income were collected from Handbook of Statistics on Indian Economy, 2007, RBI.

To investigate the causation between money and income (both real and nominal), the data was classified in to three samples viz., 1950-51 to 2006-07 (full period), 1950-51

to 1989-90 (pre-liberalization period) and 1990-91 to 2006-07 (post-liberalization period) in order to capture the effects of time shifts due to the liberalization process which India initiated during the early 1990's.

To test the short-run direction of causality between money supply and national income (real and nominal) Granger Causality Test was employed and to determine the existence of long-run relationship, co-integration analysis was employed.

The Granger causality test did not reveal a uniform direction of causality between money and income in India. The direction of causation between real money and real income was found to be uni-directional from RGNP to RMS during the full period of analysis. However, no amount of causation was found between real money and real income, during pre and post-liberalization period of analysis, suggesting an independent relationship between the two. More surprisingly, a feedback or a bilateral direction of causation was found between nominal money and nominal income during the full period of analysis. However, contrary to the causation of real money and real income, a uni-directional causality from nominal income to nominal money supply was found in both the pre and post-liberalization periods. Thus, overall from the evidence observed, one can assume that there are probably some other real, economic, social and institutional factors rather than money supply that have played a major role in the growth of national income of India.

Thus, due to the mixed direction of causation found between money and income (real and nominal) one finds it difficult either to accept or reject the monetarists or the Keynesians view in India.

Further, the co-integration analysis has established that the money supply and national income (both real and nominal) were found to be co-integrated suggesting a existence of long-run relationship between the two macroeconomic variables. Thus, the long-run direction of causation can be established by using error correction model and the direction of causality can be determined in a multivariate framework by including other macroeconomic variables, such as prices and interest rates (in a multivariate analysis) which are the limitations of the present study.

**Table 5: Estimates of OLS and Engle-Granger Residual Based on Co-integration Test Results between RMS and RGNP**

Co-integrating regression model $MS_t = \alpha_1 + \alpha_2 GNP_t + u_t$

| **Full Period (1950-51 to 2006-07)** | | | |
|---|---|---|---|
| Variable | Coefficient | t-Statistic | Probability |
| C | 0.117622 | 8.920215 | 0 |
| RGNP | 0.261247 | 1.076894 | 0.2863 |
| $R^2$ | 0.021 | D-W | 0.56 |
| **Engle-Granger Residual Based on Co-integration Test Results** | | | |
| Variable | ADF (1) Test Statistic | | |
| $\hat{u}_t$ | -3.965962* (-3.5547) | | |
| | PP (3) Test Statistic | | |
| $\hat{u}_t$ | -5.180246* (-3.5523) | | |
| **Pre-Liberalization period (1950-51 to 1989-90)** | | | |
| Variable | Coefficient | t-Statistic | Probability |
| C | 0.115375 | 7.510252 | 0 |
| RGNP | 0.057722 | 0.187891 | 0.852 |
| $R^2$ | 0.095 | D-W | 0.41 |
| **Engle-Granger Residual Based on Co-integration Test Results** | | | |
| Variable | ADF (1) Test Statistic | | |
| $\hat{u}_t$ | -3.912170* (-3.6171) | | |
| | PP (3) Test Statistic | | |
| $\hat{u}_t$ | -4.318098* (-3.6117) | | |
| **Post-Liberalization period (1990-91 to 2006-07)** | | | |
| Variable | Coefficient | t-Statistic | Probability |
| C | 0.148894 | 6.847304 | 0 |
| RGNP | 0.143279 | 0.421618 | 0.6797 |
| $R^2$ | 0.0125 | D-W | 2.07 |
| **Engle-Granger Residual Based on Co-integration Test Results** | | | |
| Variable | ADF (1) Test Statistic | | |
| $\hat{u}_t$ | -5.978279* (-4.0113) | | |
| | PP (3) Test Statistic | | |
| $\hat{u}_t$ | -4.108019* (-3.9635) | | |

** Significant at 1 % level*

*Figures within parentheses indicate critical values*

*MacKinnon (1991) critical values for rejection of hypothesis of unit root are applied*

*Source: Authors Estimations*

**Table 6: Estimates of OLS and Engle-Granger Residual Based on Co-integration Test Results between NMS and NGNP**

Co-integrating regression model $MS_t = \alpha_1 + \alpha_2 GNP_t + u_t$

| **Full Period (1950-51 to 2006-07)** | | | |
|---|---|---|---|
| Variable | Coefficient | t-Statistic | Probability |
| C | 0.085702 | 5.456418 | 0 |
| NGNP | 0.411637 | 3.089312 | 0.0032 |
| $R^2$ | 0.15 | D-W | 0.961 |
| **Engle-Granger Residual Based on Co-integration Test Results** | | | |
| Variable | ADF (1) Test Statistic | | |
| $\hat{u}_t$ | -4.201528* (-3.5547) | | |
| | PP (3) Test Statistic | | |
| $\hat{u}_t$ | -6.103259* (-3.5523) | | |
| **Pre-Liberalization period (1950-51 to 1989-90)** | | | |
| Variable | Coefficient | t-Statistic | Probability |
| C | 0.083797 | 4.562119 | 0.0001 |
| NGNP | 0.346268 | 2.123719 | 0.0404 |
| $R^2$ | 0.109 | D-W | 0.80 |
| **Engle-Granger Residual Based on Co-integration Test Results** | | | |
| Variable | ADF (1) Test Statistic | | |
| $\hat{u}_t$ | -3.783485* (-3.6171) | | |
| | PP (3) Test Statistic | | |
| $\hat{u}_t$ | -4.888744* (-3.6117) | | |
| **Post-Liberalization period (1990-91 to 2006-07)** | | | |
| Variable | Coefficient | t-Statistic | Probability |
| C | 0.111062 | 3.937696 | 0.0015 |
| NGNP | 0.373832 | 1.690905 | 0.113 |
| $R^2$ | 0.169 | D-W | 2.32 |
| **Engle-Granger Residual Based on Co-integration Test Results** | | | |
| Variable | ADF (1) Test Statistic | | |
| $\hat{u}_t$ | -4.697378* (-4.0113) | | |
| | PP (3) Test Statistic | | |
| $\hat{u}_t$ | -4.711540* (-3.9635) | | |

** Significant at 1 % level*

*Figures within parentheses indicate critical values*

*MacKinnon (1991) critical values for rejection of hypothesis of unit root are applied*

*Source: Authors Estimations*

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