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THE EFFECTIVENESS OF MONETARY POLICY IN INDIA: PRE AND POST REFORMS COMPARISONS

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ABSTRACT

In this study, impact of Money Supply on output and inflation level has been analyzed for the time period 1971:M1 to 2017:M12. The Johansen Cointegration Technique and Vector Error Correction Mechanism has been applied for the full period (1971:M1 to 2017:M12), Pre-Reform Period (1971:M1 to 1991:M12 and Post-Reform Period (1992:M1 to 2017:M12). The index of Industrial Production (IIP), Wholesale Price Index (WPI) and Broad Money (M3) has been used as an indicator of output, inflation and monetary policy, respectively. It has been proved empirically that in India, Money Supply (M3) positively and significantly affects the output (IIP) and Inflation (WPI) level for the full period as well as for the post-reform period. On the other hand, during the pre-reform period, money supply was not targeting the price level, rather only satisfying its objective of output growth. This paper has also made an effort to conduct a comparative analysis of direct effect of M3 on WPI and IIP and indirect effects of M3 on IIP through the channel of WPI. It has been found that money supply can alter output level in a better way when it targets IIP directly as compared to an indirect route. Moreover, the impact of changes in money supply changes remains unbothered in both the direct as well as indirect route.

Keywords: Macroeconomics, Monetary Policy, Inflation, Growth Rate, Time Series Analysis

JEL Classification: *E00,E50, E52.*

1. INTRODUCTION

Macroeconomic policies are the major driving force of every economy because these can control the flow of real economic events through targeting certain economic variables on which they have direct control. From domestic point of view, the monetary and fiscal policies are two pillars which provide the foundation to every economy. The effectiveness of both the policies in the best possible manner is inevitable for an economy to flourish domestically as well as internationally. In this study, an effort has been made to analyze the effectiveness of monetary policy framework in achieving the final policy goals of output and price stability. The monetary

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policy is an essential mechanism of an overall economic policy in the process of output stabilization and inflation control. The output and price stabilization are considered as the twin objective of monetary policy and there is always a debate regarding the fact that which out of these two objectives is satisfied better by the monetary policy makers and whether monetary policy directly or indirectly target these objectives. According to classical economics, it is the real sector and not the monetary sector which determines the output level in the economy. Monetary sector is responsible only for price setting mechanism. However, classical economics fails to provide any solution at the time of great depression of 1920's and it was the Keynesian economics which came as a shining star after the depression. John Maynard Keynes has challenged the principles and propositions of classical economics. Keynesian economics has established a nexus between the financial and real sector of the economy by creating a link between demand for money and interest rates in the context of speculative money holdings. In 1956, Keynesian monetary theory was criticised by Milton Friedman in his restatement of the quantity theory of money. Besides the criticism of the Keynesian, monetarists have also attempted to provide some evidence in the support of the claim that money does matter and they are of view that inflation is a monetary phenomenon.

The importance and requirement of every policy in the macroeconomic environment always undergoes a change from time to time. More specifically, every major economic and structural change of an economy influences its policy framework deeply. Accordingly, in case of India, a major economic and structural shift has been taken by the economy in the form of economic reforms of 1991. These reforms have completely changed the outlook of Indian economy as well as the working and efficiency of its macroeconomic policy framework. Thus, monetary policy has also experienced many constructive changes in its working. The role of monetary policy to target inflation was very limited before 1991 because of administered prices of most of the commodities. However, after 1991, exchange rate policy has taken a shift from pegged to market determined liberalised exchange rate management system (LERMS), so as the prices have also become market determined. Therefore, the role of monetary policy as a controller of inflation has become more relevant and desired in the post-reform era. As far as output stabilisation or growth rate is concerned, monetary policy is always a very important tool of every economy to target the output levels. Different economists have different views on the working of monetary policy as a tool for inflation control and output growth and this research endeavour is a little contribution in this ongoing debate. Therefore, the major objective of the study is to check the impact of Money Supply on output and price level of India during the period of 1971:M1 to 2017:M12. A sub-objective is to conduct a comparative analysis of effectiveness of Monetary Policy in pre-reform and post-reform period. In addition, investigation of validity of Keynesian argument of indirect effect of money supply on output through price level changes will also be made for full period, pre-reform and post-reform period.

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2. REVIEW OF LITERATURE

Mathew (1965) suggested that monetary policy fails to bring desirable results in the underdeveloped economies due to lack of an organized banking system and well established money market. Thus, the establishment of an organized money market and price stability should be the main goals of monetary policy in the underdeveloped countries. Huchappa (1965) concluded that the success of monetary measures would depend to a on the extent integration of fiscal policy of the Government and the monetary policy of central bank of the particular economy. Kulkarni and Huth (1988) have proved empirically that Money supply cannot change the real output levels significantly. It is the only the higher real GNP of the last period which can generate a higher real GNP in the current period. Amaresh (2003) proved that and in the short-run monetary policy impacts the level of real output positively and significantly, while in the long run, money neutrality proposition holds good for the Indian economy mainly through the rate channel and particularly in the post-reform period. Srithilat and Sun (2017) has conducted an empirical study to check the effectiveness of monetary policy during the period of 1989-2016 and concluded that there is a positive relationship between money supply and real GDP per capita in the long run as well as in the short run. Another research effort has been made by Padmasani and kasthuri(2018) to check the impact of monetary policy on inflation and growth for the post-reform period. Their conclusions are also in favour of positive effects of money supply on growth and inflation in the Indian economy in the post-reform scenario.

Chaudhary and Dao (1995) have proved that in case of Bangladesh economy, there is positive and significant bi-directional relationship between broad money and inflation, and a unidirectional relationship between money supply and real growth rate. Ehigiamusoe (2013) has empirically tested the relationship between monetary policy and economic growth of Nigerian economy and concluded that money supply is negatively and significantly affecting the growth rate of Nigeria. Romer and Romer (2002) have studied monetary policy of 110 countries and have found that in most of the economies, money supply growth rates are very high, but correlation between money supply and output is not present.

3. RESEARCH METHODOLOGY

- *Data Sources*

The empirical analysis conducted under this study is based upon the monthly data confined to the period from 1971 to 2017. In the study, Broad Money (M3) has been taken as an indicator of monetary policy stance, Index of industrial production (*IIP*) has been used as a proxy variable for real output due to unavailability of the monthly series of GDP for the Indian economy for the period covered under the study and Wholesale Price Index (WPI) is used as an inflation variable.

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Data on IIP and WPI has been retrieved from International Financial Statistics (IFS) - database of International Monetary Fund (IMF), while the data on M3 series has been taken from St. Louis Federal Reserve Economic Database. The base period for all the three data series is July 2011.

- *Model Specifications*

The preliminary analysis is compulsory in case of time series data which comprises of seasonal and regular unit root testing and structural break identification testing. The seasonal variations can complicate the interpretation of data in case of monthly and quarterly series. Therefore, a seasonal adjustment is necessary to remove the effects of seasonal fluctuations. Accordingly, F-test and Kruskal-Wallis Chi-Squared test Statistics have been applied to check the presence of seasonal unit root and further, X-12 ARIMA method has been used to deseasonalise the series to neutralise the effect of seasonal adjustments. Further, it is also mandatory to check the order of integration of the data series in order to avoid the spurious regression. Therefore, for the detection of regular unit root and to confirm the integration order of all the data series, four alternative test statistics namely Augmented Dickey-Fuller (ADF), Phillips Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Dickey-Fuller Generalised Least Square (DF-GLS) have been applied. It is imperative to mention here that null hypothesis of ADF, PP and DF-GLS is of stationarity, whereas, KPSS test assumes the null hypothesis of non-stationarity. Moreover, existence of structural breaks in data series can lead to existence of multiple regression relationships between the dependent and independent variables with different intercepts and/or slopes. Therefore, identification of structural break is also must in case of time series data and in case of existence of a break, it is always recommended to include dummies to identify actual/true regression relationships between variables. Accordingly, structural break identification is done through ADF-break test statistics. After checking the properties of the time series data and taking all the necessary actions, to achieve the actual objective of analyzing the effects of money supply on output and price of Indian economy, Johansen Cointegration technique[i] has been applied.

4. RESULTS AND FINDINGS

In this study, time series econometric tools have been applied in order to confirm the relationship of Money supply with output and price variables. While conducting empirical analysis, two hypotheses have been framed i.e. i) M3 does not affect significantly the IIP and WPI of Indian economy. ii) Effect of M3 on IIP and WPI does not differ in Pre-reform and Post-reform period. The empirical analysis is comprised of two sub-sections. First section deals with the preliminary analysis performed to check the seasonality, stationarity, and structural break issues of the time

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series under evaluation. Section two covers with the co-integration analysis using Johansen Cointegration technique and Vector Error Correction Mechanism.

- *Preliminary Analysis: Testing Regular and Seasonal Unit-Root and Structural Break*

A preliminary analysis has been conducted to detect the presence of regular and seasonal unit roots along with the estimation of the structural breaks existence. As a first step, seasonality has been detected with the help of F-test and Kruskal-Wallis Chi-Squared test Statistics and results are reported in Tabe-1. Both the test statistics in case of all the three data series of IIP, WPI and M3 confirm the presence of seasonal unit root. Therefore, IIP, WPI and M3 data series are deseasonalised with the help of X-12 ARIMA method.

Table-1 Seasonal Unit Root Results

F-test Statistics	
IIP	148.270* (0.000)
WPI	52.345* (0.000)
M3	49.699* (0.000)
Kruskal-Wallis Chi-Squared test Statistics	
IIP	371.168* (0.000)
WPI	372.366* (0.000)
M3	315.000* (0.000)

Note: Figures in the parenthesis of type ( ) are *p-values* and * denotes the significance at 1 per cent level.
Source: Authors' Calculations.

In the second step, property of stationarity of time series data has been checked by application of ADF, PP, KPSS and DF-GLS regular unit root detection techniques. The results statistics are shown in Table-2 which validates the rejection of null hypothesis in case of ADF, PP and DF-GLS and acceptance in case of KPSS in all the candidate series. Therefore, the presence of unit root and the first order integration in IIP, WPI and M3 has been confirmed through the unit root analysis. However, ADF-break test has been applied to identify the presence of Structural Break and it has been concluded that no potential break is present in any of the data series considered for the empirical analysis in the study.

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Table 2: Regular Unit-Root Testing Results

Panel A: Augmented Dickey-Fuller Test Results

Variables	At Levels			At First Difference		
	With Drift and Time Trend	With Drift	Without Drift and Time Trend	With Drift and Time Trend	With Drift	Without Drift and Time Trend
IIP	-2.985 (0.137)	0.083 (0.964)	8.514 (1.000)	-24.590** (0.000)	-24.609** (0.000)	-6.092 (0.000)
WPI	-1.218 (0.905)	-2.813 (0.057)	4.846 (1.000)	-9.350** (0.000)	-8.210** (0.000)	-3.972*** (0.000)
M3	-2.544 (0.306)	1.291 (0.999)	13.794 (1.000)	-24.986** (0.000)	-24.897** (0.000)	-3.248 (0.001)

Panel B: Panel B: Phillips-Perron Test Results

Variables	At Levels			At First Difference		
	With Drift and Time Trend	With Drift	Without Drift and Time Trend	With Drift and Time Trend	With Drift	Without Drift and Time Trend
IIP	-4.448** (0.002)	-0.019 (0.955)	8.647 (1.000)	-42.732** (0.000)	-42.924** (0.000)	-33.176** (0.000)
WPI	-1.081 (0.930)	-2.783 (0.067)	6.074 (1.000)	-18.494** (0.000)	-18.405** (0.000)	-15.704** (0.000)
M3	-2.766 (0.210)	0.992 (0.996)	11.145 (1.000)	-25.449** (0.000)	-25.494 (0.000)	-25.944 (0.000)

Panel C: Kwiatkowski-Phillips-Schmidt-Shin Test Results

Variables	At Levels			At First Difference		
	With Drift and Time Trend	With Drift	Without Drift and Time Trend	With Drift and Time Trend	With Drift	Without Drift and Time Trend
IIP	0.166 [0.146]	3.067 [0.463]	N.A.	0.063* [0.146]	0.067* [0.463]	N.A.
WPI	0.610 [0.146]	3.041 [0.463]	N.A.	0.033* [0.146]	0.597 [0.463]	N.A.
M3	0.488 [0.146]	3.054 [0.463]	N.A.	0.051* [0.146]	0.195* [0.463]	N.A.

Panel D: DF-GLS Test Results

Variables	With Drift and Time Trend	With Drift	Without Drift and Time Trend	With Drift and Time Trend	With Drift	Without Drift and Time Trend
IIP	-2.088 (0.137)	6.965 (1.000)	N.A.	-23.036** (0.000)	-23.034** (0.000)	N.A.
WPI	-0.255 (0.799)	3.038 (0.002)	N.A.	-4.118** (0.000)	-2.747** (0.006)	N.A.
M3	0.948 (0.343)	3.901 (0.001)	N.A.	-4.444** (0.000)	-2.547** (0.011)	N.A.

Notes: i) Figures in parenthesis of type ( ) are *p-values*; ii) * denotes significance at the 5 percent level and ** denotes significance at the 1 percent level of significance; and iii) N.A. stands for *Not Available*.

Source: Author's calculations.

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- *Cointegration Analysis: Johansen Cointegration Approach and Vector Error Correction Mechanism*

The preliminary analysis has confirmed that all the candidate series are integrated at order one, therefore, the Johansen Co-integration technique has been applied because it is most suitable one in this case. The Johansen's co-integration approach is sensitive to the selection of lag length. Hence, it is always vital to adopt a consistent procedure to choose an appropriate lag length for the co-integration analysis as well as for the error correction model. In this reasoning the VAR system for various lag lengths has been applied assuming all selected variables as endogenous without any exogenous variable in the model. The estimation of VAR (p) process has been done for the full period data as well as sub-periods of pre and post reform periods. Four criterion have been used to verify the number of lags namely, Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), Hannan-Quinn information criterion (HQ). the results have been reported in Table-3 and the minimum value has been reported in the table as the model which minimizes the value of these criteria is selected as the one with the optimal lag length (Asteriou and Hall, 2006). Majority of the criterions have validated the inclusion of three lags in case of IIP, WPI and M3 for the full period analysis and post-reform analysis, but two lags for the pre-reform analysis.

Table 3: Lag Length Selection Criterion

	Full Period		Pre-Reforms		Post-Reforms	
Criterion	**Value of Criterion**	**Optimum Lag Length**	**Value of Criterion**	**Optimum Lag Length**	**Value of Criterion**	**Optimum Lag Length**
AIC	-18.46052*	3	-18.694*	2	-18.699*	3
SBC	-18.23523*	2	-18.392*	2	-18.359*	2
FPE	1.93e-12*	3	1.53e-12*	3	1.52e-12*	3
HQ	-18.36998*	3	-18.570*	2	-18.554*	3

Source: Author's calculations.

After completing the process of optimum lag length selection, Johnson Co-integration technique has been applied. The analysis reveals that trend in VAR (p=3) for full period and post reform period and in VAR (p=2) for pre-reform period, is statistically insignificant along with significant intercept term. Hence, three consecutive models i.e. i) full period analysis, ii) Pre-Reform analysis, and iii) Post-reforms analysis, have been executed with intercept to recognise the existence and rank of co-integration matrix and Table-4 provides the results of trace statistics of johansen cointegration method. It is quite evident from the result statistics that the null hypotheses of no co-integration relationship and at most one relationship have been rejected,

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and, the null of at most two vectors has been accepted in all the three models. Thus, one can specify two equations with two variables in each equation.

Table 4: Johansen Co-integration Results

	Model1(Full Period)		Model2(Pre-Reforms)		Model3(Post-Reforms)	
Hypothesized No. of CE(s)	**Trace Statistic**	**P-Value**	**Trace Statistic**	**P-Value**	**Trace Statistic**	**P-Value**
None**	55.01610	0.0021	55.403	0.000	41.018	0.001
At most 1*	26.09310	0.0546	18.763	0.044	14.448	0.051
At most 2	6.814123	0.3643	3.058	0.124	3.379	0.077
Note: i) Values in parenthesis of type ( ) are *p-values*; ii) *(**) denotes rejection of the hypothesis at the 5% (1%) level; and iii) Trace test indicates 2 co-integrating equation(s) at the 5% level in all the three cases.						
Source: Author's Calculations.						

As two alternative level relationships among the variables under consideration have been found, therefore, johansen cointegration analysis test has been executed with two cointegration vectors and results based upon these relationships are reported in Table-5. On the basis of these co-integration vectors, the two equilibrium relationships in each model can be established as follows:

i) Full Period Model (1971M1-2017M12)

$$\left.\begin{aligned} IIP &= -3.397 + 0.720^{**}[M3] + \varepsilon_{1t} \\ WPI &= -2.956 + 0.676^{**}[M3] + \varepsilon_{2t} \end{aligned}\right\} (1)$$

ii) Pre-Reform Period Model (1971M1-1991M12)

$$\left.\begin{aligned} IIP &= -3.581 + 0.744^{**}[M3] + \varepsilon_{1t} \\ WPI &= -5.109 + 0.918[M3] + \varepsilon_{2t} \end{aligned}\right\} (2)$$

iii) Post- Reform Period Model (1992M1-2017M12)

$$\left.\begin{aligned} IIP &= -3.107 + 0.691^{**}[M3] + \varepsilon_{1t} \\ WPI &= -1.429 + 0.539^{**}[M3] + \varepsilon_{2t} \end{aligned}\right\} (3)$$

Given the two equilibrium level relationships in Table 6, the Money Supply (M3) has been observed to be positively and significantly affecting IIP and WPI for the full period analysis as well as for the post-reform analysis because the coefficients are significant at 5 per cent. On the other hand, in case of pre-reform analysis, the coefficient of M3 with respect to IIP is negative and statistically significant, but for WPI, it is insignificant. Meaning thereby that in the pre-reform period, increasing money supply was only able to alter the level of output but not the

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level of inflation. Hence, this analysis reveals that the economic reforms of 1991 have significantly contributed in increasing the effectiveness of monetary policy. Many banking and financial reforms introduced in 1991 has created a conducive environment for the efficient working of monetary policy in the post-reform period and made it efficient enough to work as a tool for price stabalisation policies as well.

Table 5: Estimated Cointegration Vectors

	Full Period		Pre-Reform Period		Post-Reform Period	
Variables	**Vector 1**	**Vector 2**	**Vector 1**	**Vector 2**	**Vector 1**	**Vector 2**
IIP	1 (N.A.)	0.000 (N.A.)	1 (N.A.)	0.000 (N.A.)	1 (N.A.)	0.000 (N.A.)
WPI	0.000 (N.A.)	1.000 (N.A.)	0.000 (N.A.)	1.000 (N.A.)	0.000 (N.A.)	1.000 (N.A.)
M3	-0.720** (0.016)	-0.676** (0.054)	-0.744** (0.036)	-0.918 (0.068)	-0.691** (0.021)	-0.539** (0.024)
Constant	3.397	2.956	3.581	5.109	3.107	1.429

Notes: i) if IIP is interpreted as the dependent variable in a causal model, then the other coefficients must be multiplied by (-1); ii) values in parentheses represent *z-values*; and iii) * represents that the coefficient is significant at 5 percent level.

Source: Author's Calculations.

Keynesian Argument regarding the effect of money supply on price and output is somewhat different. As per Keynesian argument government starts pumping more money supply into the system with an illusion of trade-off between unemployment and inflation and consequently the price level rises. This increase in price level further leads real wage rate to decline and induces the employers to employ more labour. (see for detail Levacic and Rebmann, 1976; pp. 345). Hence, price level is targeted through money supply, which further target the output level. Thus, as per the Keynesian framework, the money supply indirectly affects aggregate output. In this study, an additional objective has been framed to check the validity of Keynesian argument related to the relationship of money supply with output and price level. Therefore, two theoretical restrictions have been imposed in the model to derive the direct impact of money supply (M3) on price level (WPI) and indirect effect on output level (IIP). The results of cointegration analysis with these theoretical restrictions are reported in Table-6. By looking at the resultant Table-6, the co-integration relationships in all the three models under Vector Error Correction Mechanism (VECM) framework have been normalized as follows:

i) Full Period Model (1971M1-2017M12)

$$\left.\begin{aligned} IIP &= -0.247 + 1.065^{**}\left[WPI\right] + \varepsilon_{1t} \\ WPI &= -2.956 + 0.676^{**}\left[M3\right] + \varepsilon_{2t} \end{aligned}\right\} (1)$$

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ii) Pre-Reform Period Model (1971M1-1991M12)

$$\left.\begin{aligned} IIP &= -0.566 + 0.811[WPI] + \varepsilon_{1t} \\ WPI &= -5.109 + 0.918[M3] + \varepsilon_{2t} \end{aligned}\right\} (2)$$

iii) Post- Reform Period Model (1992M1-2017M12)

$$\left.\begin{aligned} IIP &= -1.277 + 1.280^{**}[WPI] + \varepsilon_{1t} \\ WPI &= -1.429 + 0.539{**}[M3] + \varepsilon_{2t} \end{aligned}\right\} (3)$$

It can be noticed from the above mentioned models that model (1) and Model (3) money supply is positively and significantly affecting the price level of Indian economy and effect of price level is also positive and significant on output level. In the pre-reform period neither the relationship of M3 with WPI nor the relationship of IIP with WPI is statistically significant.

Table 6: Estimated Co-integration Vectors with Structural restrictions based on Keynesian Argument.

	Full Period		Pre-Reform Period		Post-Reform Period	
Variables	**Vector 1**	**Vector 2**	**Vector 1**	**Vector 2**	**Vector 1**	**Vector 2**
IIP	1.000 (N.A.)	0.000 (N.A.)	1.000 (N.A.)	0.000 (N.A.)	1.000 (N.A.)	0.000 (N.A.)
WPI	-1.065** (0.054)	1.000 (N.A.)	-0.811 (0.066)	1.000 (N.A.)	-1.280** (0.031)	1.000 (N.A.)
M3	0.000 (N.A.)	-0.676** (0.043)	0.000 (N.A.)	-0.917 (0.062)	0.000 (N.A.)	-0.539** (0.024)
Constant	0.247	2.956	-0.566	5.109	1.277	1.429

Notes: i) if IIP is interpreted as the dependent variable in a causal model, then the other coefficients must be multiplied by (-1); ii) values in parentheses represent *z-values*; and iii) ** represents that the coefficient is significant at 5 percent level.

Source: Author's Calculations.

Thus, Keynesian argument is valid in case of Indian economy for the full period analysis and post-reform analysis, yet it is also very clear from the comparative analysis of Johansen Cointegration results model with and without theoretical restrictions that if Indian economy target output level indirectly through the route of price level then it can increase it more as compare to the direct route. One other important observation is that in both the cases, effect of money supply on price level is exactly the same. Therefore, India should always target price level directly and output level indirectly through the route of price level.

5. SUMMARY AND CONCLUSIONS

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This study is based upon effectiveness of Monetary policy in ensuring output growth and inflation stability. Monthly data series on M3, IIP and WPI have been used for the time period 1971 to 2017. The Full period analysis as well as comparative analysis of pre and post- reform analysis has been constituted. The Johansen Cointegration technique and Vector Error Correction Mechanism has been applied to analyze the short run as well as long run relationship between Money supply (M3) with IIP and WPI. It has been concluded that money supply is positively and significantly affecting the price level as well as output level during the full period as well as during the post-reform period analysis. However, it has been found that in the pre-reform period, Money supply changes were only able to alter the levels of output in the positive direction and not the price levels. This type of situation is completely a true reflection of administered price policy of the Indian economy in the post-reform period. In addition, another hypothesis of testing the validity of Keynesian argument of indirect effect of money supply on output through WPI has been tested for full period (1971:M1-2017M:12), Pre-Reform Period (1971:M1- 1991:M12) and Post-Reform Period (1992:M1- 2017:M12). The empirical analysis has validated this hypothesis in full period and post-reform analysis, but rejected for pre-reform period. However, by comparing the cointegration results of with and without restrictions of Keynesian type of relationships, it can be said that that output level will experience more increase (decrease) if targeted indirectly through the route of price level. One other important conclusion is that effect of money supply on price level is exactly the same in both the cases. Therefore, India should always target output level indirectly through the route of price level.

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