Presaging Catch-up Inflation vis-a-vis Economic growth: An Extended Monetary Conditions Index(EMCI) Approach in the frame of India

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Abstract

There are debates on the Monetary Conditions Index(MCI) which have been prevalent in many policy circles. The key objective of this paper is to assess the role of house price as an information variables to Monetary Conditions Index. The Extended Monetary Conditions Index is just an extension of the monetary conditions index with combines moments in different financial variables such as short term interest rate, exchange rate and housing price. This study seeks to examine the predictive capacity of monetary conditions index on inflation and economic growth in India and then a comparative study is done to examines which index has more predictive capacity to predict macro economic variables . This study constructed the Monetary Conditions Index using a principal component analysis and tried to forecast inflation and economic growth by out-sample forecast. Here Root mean square error (RMSE) is used to check the predictive capacity of MCI. The results of this study reveals the extended MCI is more efficient for prediction of inflation and economic growth than other individual variables and monetary conditions index, as it takes more relevant financial variables into accounts for prediction.

Keywords: Housing Price Index, Monetary Policy, Monetary Conditions Index, RESIDEX, NHB.

1. Introduction:

It is well enough that people of the nation do not understand our banking and monetary system, for if they did , I believe there would be a revolution before tommorw morning. (Henry Ford)

The monetary stabilty in economy is the main aim of the monetary authourity of a country with more economic growth and less inflation. Sound financial conditions plays an important role for proper functioning of the financial economy and monetary stability. The Monetary conditions index is a weighted average index of changes in monetary variables where the weights are reflected the effect of each indvdual variables on macro economic variables such as inflation and economic growth. MCIs have been used in a number of inflation targeting countries as an indicator of the policy stance (Hongkong Monetary Authority, 2000). The Monetary conditions index (MCI) was proposed by Freedman in 1994 and argued that MCI is preferable to individual indicators like interest rate and exachange rate as an operating target in small open economy. A change of the MCI suddenly corresponds to monetary conditions of an economy and the value of an MCI depends on the monetary conditions of that country (Costa, 2000). The MCI can be used as an indicator of stance of monetary policy and this is calculated as a simple weighted average of the short-term rate of interest and effective exchange rate. Assigned weights to selected variables are respective of the relative importance of these variables. MCIs are continuing to be calculated by international organizations and central banks as an indicator for the stance of monetary policy. The financial variables volatility can be controlled with the help of Monetary Conditions Index (Xiong, 2012). In empirically an MCI is just a simple weighted average of changes in some monetary variables which are more important for monetary policy like interst rate, exchange rate. So Monetary Conditions Index is more informative than individual variables

for predicting inflation and economic growth. Developing countries have been struggling with high inflation rates and a very low growth rate. Therefore, main macroeconomic goal of growing nations is to sustain price stability. On the other hand, there are developing countries that are focusing only on economic growth. Each developing nation needs a different type of monetary policy arrangement, based on its macroeconomic interests.

1.2 Statement of study

There is no consensus about which regime works best for India. For decades, economists have investigated the performance of Monetary Conditions Index. However, in current turbulent markets, the effects of Monetary Condition Index have become even more important. Therefore there is a need to study the predictive capacity of Monetary conditions index on inflation and economic growth for India contest, which can play a pivotal role in the growth of the global economy.

1.3 Research Gap

A few studies related to Monetary conditions Index (MCI) are done in context of India. And an other problem to this particular topic is weightage to variables for constructing MCI. Many works are done with giving equal weight but in reality different variable should give different weights according to their importance. The past studies have not taken some of the important variables such as housing price in the construction of MCI. So there is a scope of the study to focus on expanding MCI with some more important variables which is reflect monetary conditions more accurately by giving a proper weight to those variables.

1.4 Research Questions

The study would seek to answer the following questions.

a) What is the level of monetary conditions in India?

b) How predictive is extended Monetary Conditions Index for inflation and economic growth in India?

c) Which Index is better for prediction of inflation and economic growth of India?

1.5 Objective of the study

To check the short term monetary conditions, MCI has served as a crucial indicator in Indian economy. The extended MCI is very much helpful to forecast the turning points in monetary conditions of a nation. This study mainly focuses on three objectives:

1. Constructing an Extended Monetary conditions index (EMCI) for India.

2. Testing the predictive ability of Extended Monetary conditions Index (EMCI) for inflation GDP.

3. Comparing Monetary conditions index (MCI) and Extended Monetary conditions index (EMCI) in predictive prospective.

2. Review of Literature

In the economic literature there are mainly three major approaches that explains the choice of monetary policy indicator. They are: (i) Individual Indicator Approach, (ii) Financial Conditions Index, and (iii) Monetary Conditions Index. Here an attempt has been made to review the earlier studies relating to Monetary Condition Index, Inflation and Growth.

Freedman (1994) discussed different types of shocks to the exchange rate. The reason for emphasis on monetary conditions is that there can be exogenous movement in the exchange rate and aggregate demand. It viewed that the MCI is a weighted sum of the short-term interest rate and the exchange rate is preferable to the individual indicators for a small open economy.

Gichuki and Moyi (2013) used a time series approach to MCI. This study found that there is a positive relation between MCI and inflation. MCI works as an effective tool to assess the stance of monetary policy and has more ability to predict inflation than individual indicators.

Monetary policy affects aggregate demand and inflation through several channels, Ideally indicators of monetary stance should capture all of these channels. Batini and Turnbull (2002) computed MCIs for the United Kingdom and discussed their main theoretical and empirical shortcomings. They developed an alternative index to monetary conditions that incorporates features to overcome many of the shortcomings of traditional indices called as 'dynamic MCI' (DMCI). The DMCI is strongly correlated with both growth and inflation.

The Monetary Conditions Index is the combination of the change in short-term interest rates and the exchange rate. 'Both interest rate and exchange rate need to account when assessing monetary conditions, and outliers approach used by central banks to combining both variables in to a single indicator' (Reserve Bank of India, 1996).

Mishkin (1996) analyzed the transmission mechanism of the monetary policy. Its overviews started with a traditional interest rate-channels, then discussed channel operating through asset price and finally on the credit channel. Implications for how central banks might best conduct monetary policy is discussed in this paper. Due to the opening of the economy and coming of flexible exchange rate more attention is given to monetary transmission operating through exchange rate effect on net export. Exchange rate affects the monetary policy through exchange rate-channel which also involves the effects of interest rate because the fall in the exchange rate of a currency occurs with a fall in domestic real interest rate.

Dannis (1997) explained how both short term interest rate and real exchange rate are effects on overall stance of monetary policy. Here three output gap equations are estimated which reveals

that both real interest rate as well as the real exchange rate affect excess demand but real interest rate is faster acting policy transmissing channel. RBN(1998) describes sources of shock matter. This paper analytically constructed the MCIs then discussed the uses of MCIs and concludes that there is a trade off between interest rates and the exchange rate.

Costa (2000) discussed about the interpretation of the monetary conditions index (MCI). Here MCI often used as an indicator of monetary policy stance. The MCI is calculated as a weighted average of short term rate of interest and effective exchange rate. In the long run, inflation is a purely monetary phenomenon so monetary aggregates are important to evaluate tok effects of monetary policy on inflation. For estimation of the MCI, weights has been based on three types of alternative methodologies. These are small structural models, VAR models and large-scale macro-econometric models.

Ireland (2004) discussed how policy-induced changes in short-term nominal interest rate affect real variables by interest rate channel. This paper emphasizes on how the channels work in the dynamic, stochastic general equilibrium models. Change in the money stock or the short-term nominal interest rates affect the aggregate output and employment by monetary transmission mechanism.

Kannan et al (2006) attempts to construct a monetary conditions index (MCI) for India by taking both interest rates-channel and exchange rate-channel simultaneously into account in evaluating the monetary policy and evolving monetary conditions. The result reveals that the interest rate is more important than the exchange rate in influencing the monetary policy in India, and the MCI has been more effective to put to gather than individual indicator in order to provide a better assessment of the stance of monetary policy. The quarterly aggregate demand equation is estimated for deriving the relative weights of the components of the MCI. They took quarterly

data for the period 1996 to 2007 in this model. The purpose of constructing an MCI for India is to assess the efficiency of the conduct of monetary policy by recognizing the evolving importance of the various monetary transmission channels. They have found supplementing to the existing set of indicators, the MCI is a potential variable indicator of monetary policy in India to monetary authority.

Jean et al (2010) did a comparison between pre 1980 with post 1980 decades monetary policy innovation on real activity and inflation. Empirical evidence on impact of monetary policy on real and inflation is given in this paper and how channels of policy transmission affect the total real activity is discussed. Here relatively unrestricted factor-augmented vector auto-regression (FAVAR) and DSGE model are taken for present new evidence of changes in the effect of monetary policy actions on real activity and action. Empirical results show monetary policy innovation has a more effect on real activity and inflation in after 1980 decades compared to before 1980. This is the effect of changes on expectation.

Xiong (2012) constructed the monetary conditions index for china over quarter one 1987 to quarter two 2010. Here the emphasis is given to China's monetary conditions and aggregate demand in terms of the monetary conditions index (MCI). MCI has been widely used as an important indicator for central banks, financial institutions, and scholars. Here three channels are taken; through which monetary conditions might influence aggregate demand. These channels are the primary lending rate, the real effective exchange rate, and the bank credit. For obtaining weights of component variables, here estimation is done both by the IS equation and the vector autoregressive model (VAR. Empirical results show that the MCI has useful information about future output growth and inflation in China, so it can predict inflation and future output growth

over the short term and medium term in china. This article concludes, that derived MCI is informative than individual monetary variables for predicting inflation and output growth.

Gichuki and Moyi (2013) calculated monetary conditions index (MCI) for Kenya. Here quarterly time series data for the time period 2000 to 2011 was taken for construction of MCI. The computation of MCI is done from a simple aggregate demand function. The result of this study reveles the existence of correlation between the real exchange rate on GDP. And also this study the claims a existence of co-integration between private sector and the short-term interest rate. It was finally concluded that, the MCI is a good indicator of inflation and that can be used to monitor the interest rate and exchange rate movements and their effect on the aggregate demand.

3. Model

As the main objective of this study is to check the relationship between Monetary Conditions Index(MCI) and Macroeconomic variables. Next most important objective of this work is to examine which Index is better among Monetary conditions index (MCI) and Extended Monetary conditions index (EMCI) to predict Macroeconomic performance in India. For this work some time series tests and statistical tools are used. Here a detailed description is given to those time series models which are used for this paper. For calculating the weights to chosen variables for construction of MCI the Principal Component Analysis(PCA) is used. To checking unit root here dickey-fuller (ADF, 1984), Phillips-Perron (1988) are used. The Granger causality test, correlation test, Vector Vector autoregression (VAR) and information content test are used to check effectiveness of MCI. Here Root mean square error (RMSE) is used to check the predictive capacity of MCI. In this session several time series tests which are used in this work are described. This study has covered quarterly observations and its data has been collected from

various secondary sources. The time span from Q4, 2008 to Q4, 2016. All these variables were used in this study are of quantitative nature.

3.1 Unit-root Test

The Unit root test is mainly used to check stationarity of time series data. For meaningful relation between two variables, high value of R^2 is a necessary condition but not a sufficient condition. Spurious regression may be case where high value of R^2 is mainly for similar and high trend in variables. So it is important to check unit root before estimating a meaningful relation. For this study Augmented Dickey and fuller (1979) and Phillips perron (1988) are used to check stationarity.

3.2 Estimation of Information Content and the Indicator Models

The following steps were to be carried out for the exercise, first Extended Monetary conditions index (EMCI) is were estimated by using Principal component Analysis(PCA) model. Then Correlation test, Granger causality test, Information content test and ARDL model are used to check relation among EMCI and inflation, EMCI and GDP growth.

i.   Granger-Causality test:

To determine the direction of relation between the EMCI, inflation and growth Granger-Causality test is used. This test was conducted with a view to knows ,which type of cause and effect relation is present between EMCI, inflation and real GDP growth.

ii.   Principal component Analysis(PCA)

The Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. The number of distinct

principal components is equal to the smaller of the number of original variables or the number of observations minus one. The Principal component analysis (PCA) is related to factor analysis. Factor analysis typically incorporates more domain specific assumptions about the underlying structure and solves eigenvectors of a slightly different matrix. For assign weight to different variables the Principal component analysis (PCA) model is used.

iii.   ARDL Model

The autoregressive distributed lag (ARDL) model is being used for decades to model the relationship between (economic) variables in a single-equation time-series setup. Its popularity also stems from the fact that cointegration of nonstationary variables is equivalent to an error correction (EC) process, and the ARDL model has a reparameterization in EC form (Engle and Granger, 1987; Hassler and Wolters, 2006). The existence of a long-run or cointegrating relationship can be tested based on the EC representation. A bounds testing procedure is available to draw conclusive inference without knowing whether the variables are integrated of order zero or one, I(0) or I(1), respectively (Pesaran, Shin, and Smith, 2001).

iv.   Root Mean Square Error (RMSE)

The Root Mean Square Error (**RMSE**) otherwise called as the Root Mean Square Deviation (RMSD), is a frequently used measure of the difference between values predicted by a model and the values actually observed from the environment that is being modelled. These individual differences called as residuals, and the Root Mean Square Error serves to aggregate them into a single measure of predictive power.

The RMSE of a model prediction with respect to the estimated variable X_{model} is defined as the square root of the mean squared error:

$$RMSE = \sqrt{\frac{\sum_{j=1}^{m}(X_{obs,j} - X_{model,j})^2}{m}}$$

where X_{model} is modelled values and X_{obs} is observed values at time/place j.

3 Extended Monetary Conditions Index

Monetary conditions index(MCI) is just an composit index of real exchange rate and real interest rate to capturing the financial stress. MCI is a weighted sum of the short-term interest rate and the exchange rate, is preferable to the interest rate and exchange rate alone as an operating target for a small open economy. In empirically the MCI is a simple weighted average of changes in an interest rate and an exchange rate relative to their, values in a base period. To identify a suitable Monetary Conditions Index which can bring the inflation rate down and boost the economic growth of that country, it is necessary to include some most fluctuating variables in to MCI. In the context of the India, a thorough investigation of the following variables will provide valuable insights into the appropriateness of the current Monetary Conditions Index, besides a much-needed understanding of the issues related to the monetary conditions index. The extended MCI is an extension of the MCI covering a major set of indicator will become easier to understand information variable. Past MCIs are didnot included many important indicators like stock market volatility, trade openness, external debt but these variables are helpful to forecast financial volatility more accurately. This research contributes to a better understanding of the behaviour of the monetary condition in India and facilitates further research in the area.

For construction of individual index, here the same method is used which is used for construction of HPI and HDI by UNDP. For assign weights to the variable in MCI the Principal Component

Analysis(PCA) method is used.   Variable specification and recommended extended MCI is present in table 1 and table 2.

Insert table 1

Insert table 2

Otherwise, MCI function also can express as:

MCI=f (interest rate, exchange rate)

Where I stand for index, CMR is the call money rate, which taken proxy for the short term rate of interest, ER is the exchange rate. The mci is constructed summarising two sub-indices. Each individual sub- index is computed by using the following formula:

$$SIi=(A_i-x_i.)/(X_i-x_i) \tag{1}$$

where, A. = actual value of the indicator i, x_i= minimum value of the indicator i , Xi = maximum value of the indicator i.

By giving weightage to our individual variables the MCI is constructed. Weights are calculated by using Principal component analysis (PCA) model from its principal components value.

$$MCIt = W_1(r_t − r_0) + W_2(e_t − e_0) \tag{2}$$

Extended Monetary Conditions Index nothing just an extension of Monetary Conditions Index(MCI) with some more important variables. By giving weightage to our individual variables the EMCI is constructed.

$$EMCIt = W_1(r_t − r_0) + W_2(e_t − e_0) + W_3(h_t\text{-}h_0) \tag{3}$$

Where r is stand for call money rate, e is stand for the natural logarithm of the Exchange rate, h represents Housing Price Index and w represent the weightage.

A. Weighting to the Variables

The equal or different weight can be given to the variables for construction of an index by their relative importance. For calculating weights to different variables mainly simulation in a large scale macro-econometric models, reduced-form aggregate demand equations, Vector Autoreggression (VAR) impulse response functions method and the Principal Component Analysis(PCA) are used. These methods have some good points as here weights are assigned by their importance to macro variables. By giving equal weight has some demerits. Here for calculating the weight PCA method is used.

4. Empirical Analysis

This section constructs Extended Monetary conditions Index (EMCI) and describes the predictive power of the Index for macro economic variables with the help of RMSE and ARDL model.

Primary data required for this study was obtained from secondary source. Then we discuss the empirical result accordance with the objectives set out in the chapter one namely,

i.   Construction of Extended Monetary conditions index (EMCI) for India.

ii.   Testing the predictable capacity of Extended Monetary conditions index (EMCI) for inflation and Economic Growth.

The Extented Monetary Conditions Index is a weighted sum of the short-term interest rate, housing price and the exchange rate. Here EMCI is constructd for India. It is important to check the trend of all variables and EMCI for checking its fluctuations and its importance for monetary

policy. So before going for econometric analysis, we need to present the trend of EMCI components such as interest rate, exchange rate. Trend of all the variables with diagrams is discussed below.

A. Short term interest rate (Call money Rate)

Short term interest rates are generally the rate at which borrowing for a short term, are effected between financial institutions. The Short term interest rate is measured as a percentage and these are generally the average of daily rates. Ths rate is based on the three month money market rates, typically the money market rate and treasury bill rate. This study used call money rate as a proxy for interest rate.

Insert figure 1

The trend of the call money rate is shown in the figure 1 where the X-axis present the time horizon and Y-axis presents the call money rate. It has shown a greater volatility and fluctuated widely due to supply and demand sides of the Indian money market. Starting from about 8% during the last quarter of 2008-09 CMR has fallen drastically to below 4% during Q2 of 2009-10 owing to the effects of global meltdown. Further, it remained stable till Q1 of following year and then showed a steady increase till the Q1 of 2012-13 owing to macroeconomic stability. The rate again followed the declining trend till Q2 of 2012-13 making an average of around 4% during the year and then with a steep increase in Q1 to Q3 of 2013-14 and relative falling trend during the recent period; the rate is averaged to around 7.20%.

B. Exchange rate

Exchange rate is defined as the price of domestic currency in the terms of other countries currency. As we cannot present exchange rate of more than two currencies in a two dimensional plane, we take the exchange rate between rupee and the US dollar.

Insert figure 2

Sources: Reserve Bank of India The US dollar is considered as the foremost reserve currency in world wide. The Indian rupee also effects from the global financial crisis, evidence from the figure 2. The rate increases from around 49/$ during the last quarter of crisis to around 67/$ till the last quarter of following year. The rate declined steeply to a level of around 45 during the first quarter of 2010-11 and then remained more or less stable during the second quarter of 2011-12 due to various policy regulations of the Reserve Bank. The rate reaches to the peak during third quarter 2013, mainly due to fall in oil price, trade deficit .The rate continued its depreciating mode even during the recent period and has remained more or less around 66.59 during 2016-17.

C. Housing Price Index

The India housing finance market is very complex. The housing price index (HPI) of a country measures changes in the price of residential housing. For estimating change in the mortgage defaults, prepayments and housing affordability housing price index price index provide a tool. Housing price data reveals there is a positive trend.

Insert figure 3

D. Construction of the Extended Monetary Conditions Index

Monetary Conditions Index (MCI) is used as a tool in many developed as well as developing countries, which is widely used to identify the state of monetary conditions in a country. This is

simply a composit index which takes a set of information from different variables in a single composit indicator. The Extended Monetary Conditions Index (EMCI) is extended version of MCI with including some more economic variables which are also impacting on macro economic variables such as inflation and economic growth. The EMCI allows for analyzing the general behavior of monetary conditions of a country in a brief manner. In this section construction of the MCI for India is made. To capture the financial stress and monetary conditions EMCI of India is constructed. In order to construct the EMCI, need to classify the elements that affecting the monetary conditions. The short-term rate of interest and real exchange rate are most important variable which related to fluctuation of monetary conditions of a country. The Extended Monetary Conditions Index is explained in figure 4.

Insert figure 4

Where I stand for index, CMR is the call money rate, which taken proxy for the short term rate of interest, ER is the exchange rate,

$$IEMCI=W_1\ ICMR+W_2\ IER + W_3\ IHP \qquad (10)$$

For construction of individual index here same method is used which is used in construction of HDI and HPI. The new index is described to be more appropriate than individual indicators like interest rate, housing price and exchange rate in explaining the goal variables.

The figure-4 presents the trend of the EMCI and MCI. The evidence from figure 4 by taking the synoptic view, both EMCI and MCI on an average has shown an upward movement. If we emphisised on recent period then MCI has declined during Q3 2009-10 and EMCI has seen to be stable in recent period. But suddenly a recovery followed by it and finally it stabilized during the recent periods.

5. Emperical Result

This section explains the empirical results from data analysis. The present study mainly used the secondary data. The principal component analysis is used for calculating weight for all variables. PCA result is given in table 3.

Insert table 3

For checking non stationarity, here Augmented Dickey and fuller (1979) and Phillips perron (1988) test is used. Result of ADF as well as PP test shows all the variables are stationary after first difference can be observed in Table 4 which presents the unit root test result.

Insert table 4

For construction of EMCI weight is calculated by using PCA model. The result of PCA model is given in table 3. For checking whether there is any kind of relationship is exist among the variables or not here correlation test is used and for long run relation ARDL model is used. The correlation test result reflects there is inverse relation is exist between EMCI and inflation and has a positive relation with GDP growth. The result of correlation test is shown in table 5**.**

Insert table 5

The Granger Causality test is used for examine the derection of relation. The result of granger causality reveals there is an unidictional relationship be present between EMCI and inflation, EMCI and Economic growth, that is EMCI granger cause inflation as the null hypothesis(EMCI does not granger cause inflation) and EMCI granger cause inflation as the null hypothesis is rejected. The Granger causality test result is given in table 6.

Insert table 6

The autoregressive distributed lag (ARDL) model is being used for decades to model the relationship between (economic) variables in a single-equation time-series setup. Long Run Coefficients (Dependent Variable: GDP GROWTH). The ARDL result present in Table 7.

Insert table 7

It reflects there is long run relationship exist among EMCI and Inflation, MCI and Inflation. RMSE model result (table 8) reflects extended monetary condtions index has more predictive power.

Insert table 8

4   Conclusion

In recent decades, economists have investigated the impacts of monetary conditions Index on macroeconomic performance. However, in the current turbulent markets, the effects of financial conditions index become even more important. But no one specifies exactly, which financial variables should be included in the monetary conditions index for its best prediction of economic goal variables. No doubt there are some important financial variables that are excluded in construction of financial conditions index in previous works, which should be included. This study seeks to examine the effects of monetary conditions conditions index on inflation and growth in India countries by using better methodology. The whole study uses quarterly data for the period Q4 2008 to Q4 2016 for testing the predictive capacity of extended MCI for inflation. Using the Principal Component Ananalysis methodology developed by Hatzius et al. (2010), extended Monetary Conditions Index for India were constructed and found to closely mark, Extended MCI can

predict inflation betterly than MCI as it involves interest rate, exchange rate and housing price in a single index, particularly characterized by large external financial and economic shocks. The results of the present study imply that to increase forecasting accuracy, a broader range of financial variables is needed and a better pre-selection of indicators are suggested.

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Tables and Graphs

Table-1: Variables Specification

Variables	Definitions and Sources
IR	Call Money Rate(RBI)
ER	Real Exchange rate of India in terms of Dollar(RBI)
HPI	Housing Price Index(RBI)
GDP	Gross Domestic Product(RBI)
INF	WholeSale Price Index(RBI)

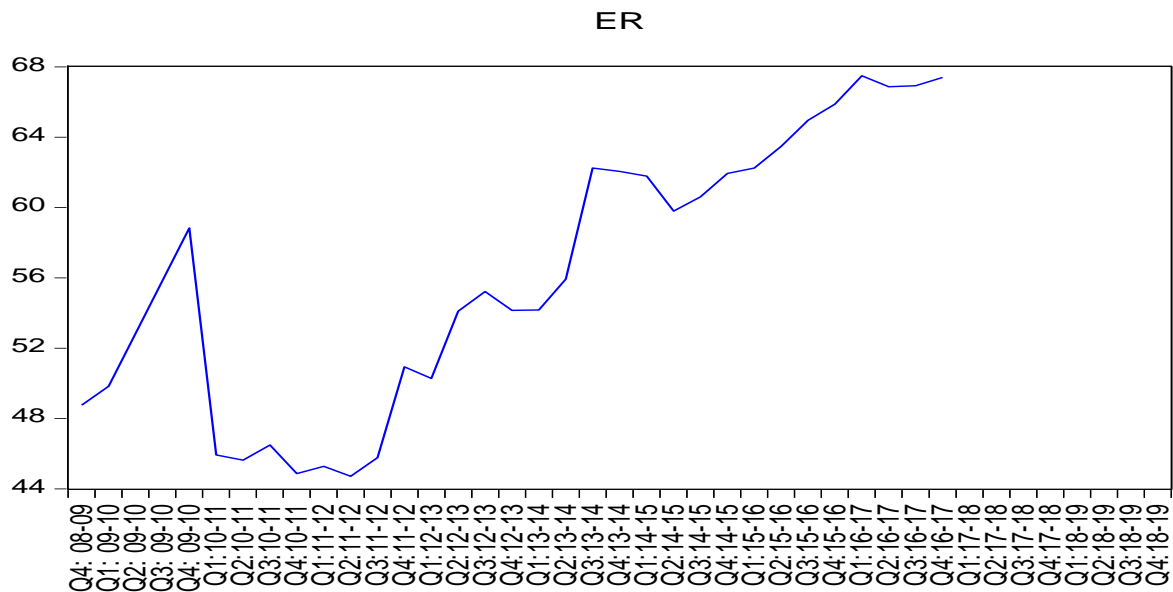Table 2: Recommended   MCI

Mnemonic	Component
MCI	Short term rate of interest + exchange rate
EMCI	Short term rate of interest + exchange rate + Housing Price Index

Figure 1: Trend in call money rate
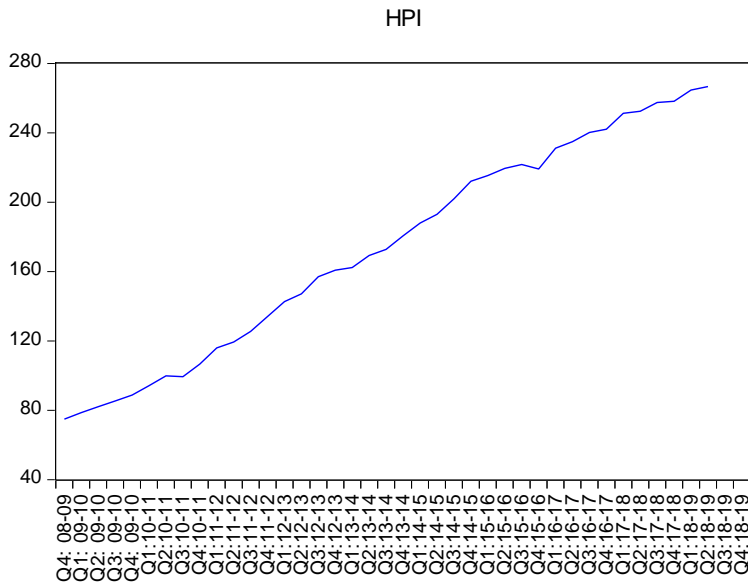
CMR
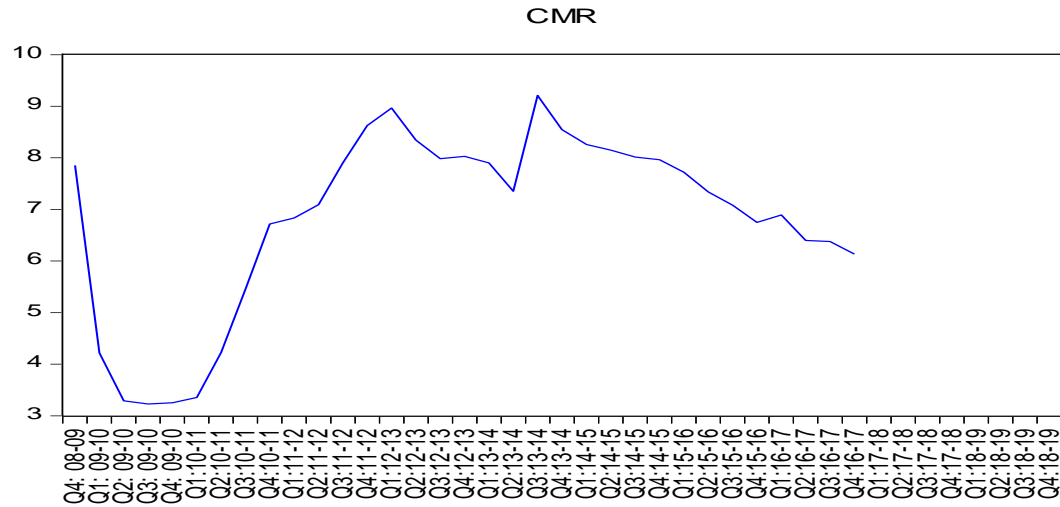
Sources: Reserve Bank of India

Figure 2: Trend in Exchange rate

ER

Sources: Reserve Bank of India

Figure 3: Trend in HPI

HPI

Sources: Reserve Bank of India

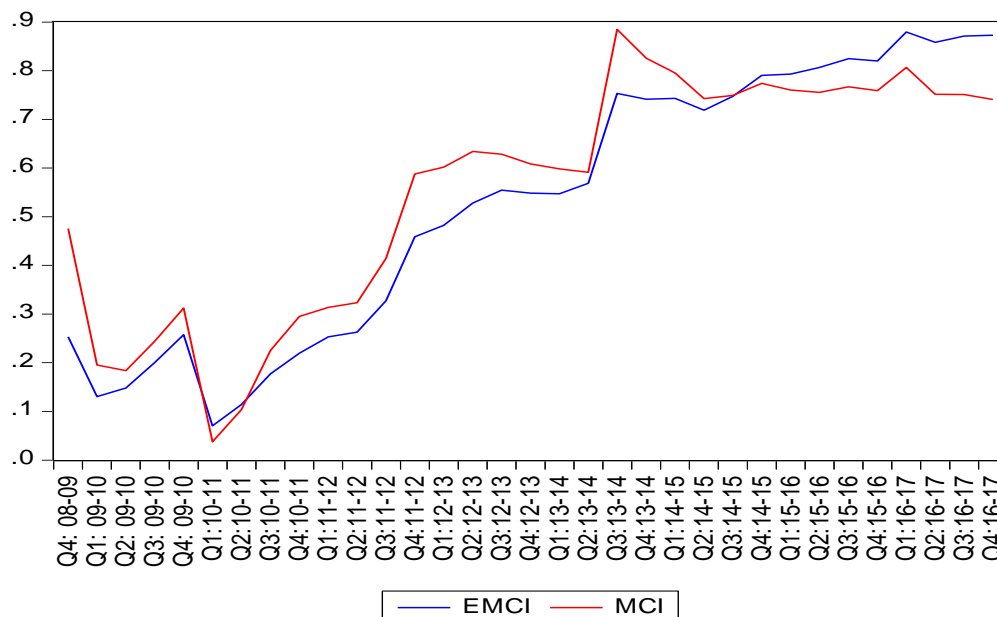**Figure 4: Extended Monetary Conditions Index(EMCI) And Monetary Conditions Index(MCI)**

Table-3: Principal Component Analysis (PCA)

Varibale	factor loading	factor score	Weight
CMR	0.415085	0.244119972	0.24
ER	0.612845	0.36042667	0.36
HPI	0.672402	0.395453359	0.40
Total	1.700332	1.000000000	1.00

Table-4: Unit-root test result

Variables	Augmented Dickey-Fuller test statistic					Phillips-Perron statistics				
	Test critical values	**Prob. value (level)**	t-Statistic (level)	t-Statistic (first difference)	**Prob. value (level)**	Test critical values	**Prob. value (level)**	t-Statistic (level)	t-Statistic (first difference)	**Prob. value (level)**
EMCI	-2.9980	0.9327	-0.1459	-7.9862	0.0000	-2.9862	0.8309	-1.7463	-20.2689	0.0001
Inflation	**-3.0048**	**0.9825**	0.4966	-8.0762	0.0000	-2.9918	0.8500	-1.6017	-7.5239	0.0000
GDP Growth	**-3.0123**	**0.4796**	**-1.5701**	-17.8069	0.0000	-2.9918	0.8242	-0.7161	-8.3553	0.0000

Table-5: Correlation result

Variables	INF	GDP Growth
MCI	-0.59	0.083
EMCI	-0.32	0.085

Table-6: Causality test result

Null hypothesis	F- statistics	Prob.	Granger cause	Direction
EMCI does not Granger Cause Economic GROWTH	2.44324	0.1151	NO	None
Economic GROWTH does not Granger Cause EMCI	0.05632	0.9454	NO	None
INFLATION does not Granger Cause EMCI	1.64676	0.2121	NO	None
EMCI does not Granger Cause INFLATION	0.08004	0.9233	Yes	Uniderectional(GDP Growth → MCI)
MCI does not Granger Cause Economic GROWTH	5.10902	0.0134	NO	None
Economic GROWTH does not Granger Cause MCI	0.66299	0.5238	NO	None
INFLATION does not Granger Cause MCI	0.3241	0.7273	NO	None
MCI does not Granger Cause INFLATION	3.360	0.0575	YES	Uniderectional(MCI → INFLATION)

Table-7: ARDL Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MCI	-0.004473	0.007571	-0.590818	0.5604
Extended MCI	-0.001860	0.007241	-0.256876	0.7996

Dependent Variable: Inflation				
MCI	-0.014878	0.005101	-2.917021	0.0068
EMCI	-0.012749	0.004696	-2.714989	0.0110

Dependent Variable: GDP growth

Table 8: RMSE test result

RMSE		
	EMCI	MCI
INFLATION	0.010774	0.012849
GDP GROWTH	0.039752	0.040262