

2 Chapter

Review of Literature

2.1 Introduction

The study focuses on the rule-based monetary policy. Which is an important rule to accelerate economic growth, price stability and to avoid excessive volatility in exchange rate etc. there are various arguments on to control inflation, accelerate economic growth and maintain lower rate of unemployment in the economy? It began from classical schools to monetarist to neo-classical and then modern economists for e.g. Adam Smith, Henry Thornton, David Ricardo, Simon, Irving Fisher, Knuth Wicksell, Milton Friedman, McCallum, Henderson, McKibbin, J.B. Taylor and other. The classical paradigm states that economic stability can be achieved by accommodating inflation through money growth. The major discussion on policy rule initiated from contradictorily with evidence on long run and short-run relationship among macroeconomic variables. For instance, rational expectation paradigm poured water on theory of Philips curve (states as inverse relationship between rate of inflation and rate of unemployment). Which did Milton Friedman and Edmund Phelps initially propose.

By adopting the policy rule to achieve monetary policy target or target inflation, such as money rule and interest rate rule is most important instrument of making stability in the economy. Which put forward by McCallum and B.S. Taylor. Thus, it called as McCullum rule and Taylor rule, which is concerned of this study. The macroeconomic relation has two prospects short run and long run phenomena. The long run theory describes that rate of inflation and rate of unemployment have inverse relationship, but in Keynesian point of view, “we all are dead in the long run”. Thus, the New-Keynesian paradigm has mainly focused on short-run phenomena. They believe monetary target can be achieved by changing nominal interest rate as short run phenomena. Which further lead to offset the inflation rate. Thus, the economy can get stable from disequilibrium circumstances. There are many empirical literatures available on policy rule to achieve monetary

target for e.g. see **McCallum** (1988, 1993, 2001); **Taylor** (1993, 1999, 2001). Moreover, monetary policy rule have instrument or instrumental variable, those are money stock and interest rate, money growth rate and exchange rate.

This section of the study giving the glimpse on rule based monetary policy. This helps to archive monetary target of Central Bank or economy.

This chapter divided into four sub-parts namely 2.1 Introduction, 2.2 Theoretical Literature, 2.3 Empirical Literature and last 2.4 Research Gaps, which has found based on available literature.

2.2 Theoretical framework of monetary policy rules

Economists have different views on monetary policy rules in macroeconomics. Adam Smith was the first who presented the concept of monetary policy rules in his book *Wealth of Nation* said that “a well regulated paper-money” would have advantage in maintaining the stability and accelerating economic growth than a pure commodity standard. In the beginning of twenty century, Knut Wicksell (1907) and Irving Fisher (1920) advised monetary policy rules to govern excess monetary growth that, further, led to hyperinflation subsequent to World War 1 and to the Great Depression. Thereafter, Milton Friedman identified the major monetary mistakes of the Great Depression and then introduced his monetary policy rule that was “constant growth rate rule” with the goal of preventing the earlier mistakes too. Later on, modern policy rule came in light that named Taylor Rule (1993) seemed to ignore the severe instability in price and output during the “Great Inflation” of late 1960s and 1970s.

Wicksell (1898) included in neo classical economist and he developed a simple reaction monetary policy. Which stress the “*indirect monetary transmission mechanism*”. He said that if “price raises, the interest rate should increase: and if the price falls, the interest rate should cut... (Interest & prices)”, he invented the main term natural rate of interest he defined it that the interest rate is compatible with stable price level.

2.2.1 Money Rule

During 1970s and 1980s, the empirical models with rational expectations and sticky prices were established, and the monetary policy rules text advanced grounded on the Lucas critique. Milton Friedman introduced rule of monetary policy. Friedman (1960) given k -percent rule, contemporary monetary policy text had taken the opinion that the central bank should regulate to the flattening economic fluctuations through counter-cyclical actions. Taylor (1981) introduced one substitute to the Friedman rule in which the monetary aggregate should respond counter-cyclically to changes in real output, but should not infer the price changes. McCallum (1984) urged that the Friedman constant growth rule might be improve through the adjustable growth rate rule, whereas, the money supply growth rate is accommodate for changes in output and corrected for the irregular changes in the velocity of money. Such a rule would have stronger, and automatic, countercyclical effects on aggregate demand.

Friedman (1959, 1969, and 1982) money growth is a separate rule to fulfil the objective function (inflation & output gap) from the variable that policy should be directly target to money growth. Then Friedman developed $k\%$ rule it means that central banks maintain a fix rate of money growth is equal to the rate of real GDP growth. He added that the goal of policy should be “a reasonable stable economy in short run and a reasonable stable price level in long run”.

$$\Delta m + \Delta v = \Delta p + \Delta y \dots \dots \dots \text{eq}_1$$

Where, Δm is the growth rate of money, $\Delta p = \pi$ is inflation, Δy is the growth rate of real output , and Δv is the growth rate of the velocity of money . Assuming that the velocity (circulation speed) of money is constant and fixing the growth rate of money at k percent ensures that nominal GDP will also grow at a stable rate of k percent. Therefore, stable money growth also leads to economic stability (see.Orphanides 2007).

New-Keynesian Paradigms came in light, who change the perception or direction of monetary policy and became a backbone of monetary policy rules. Those are as followings:

McCallum (1988,1993,2001), This rule separated for the growth rate of the monetary base-nominal GDP target rule that central banks should provide, rather than the value of the interest rate. This rule the money-base growth rate change in response to deviation of the nominal GDP growth rate from a target value that a fixed growth rate. Velocity of money is also included in McCallum rule.

The money base-nominal GDP targeting rule is:

$$\Delta b = \Delta x^* + \Delta v_t + \theta(\Delta x^* - \Delta x_{t-1})$$

Δb = Rate of growth of the monetary base, percent per year

Δv_t = Rate of growth of base velocity percent per year, average over previous 16 quarters

Δx^* = Sum of target inflation rate (π) and growth rate of output (Y) = target rate of growth of nominal GDP.

Δx_{t-1} = Rate of growth of nominal GDP

2.2.2 Interest rate Rule

Taylor (1993, 1999, 2001) Taylor has suggested a different type of rule that who maintain objective function (inflation & output gap) through the short-run nominal interest rate, not a money supply. A Taylor rule described that short-term policy nominal interest rate to deviation of inflation from their target and deviation of real GDP from its potential.

The rule can be write as following:

$$i_t^* = \pi_t + r^* + \alpha(\pi_t - \pi_t^*) + \beta(\ln Y_t - \ln Y_t^*)$$

i_t^* = Target short-term nominal interest rate, π_t = Rate of inflation as measured by the GDP deflator, percent per year, π_t^* = Target inflation, r^* = equilibrium real rate of interest, α and β are parameter of inflation & Output gap ($\ln Y_t - \ln Y_t^*$) or real GDP, respectively. Y_t = Growth rate of real GDP and Y_t^* is potential output.

Taylor (1996) discussed on effectiveness of monetary policy through policy rule. Where, key issue dealt on rule vs target. Further, monetary target could be achieve through policy rules. Moreover, the article trying to convince that policy makers or central bank should follow the policy rule to achieve the target. Where, target should be dependent on the money rule, velocity stocks rise and interest rule; and money rule with interest rate rule. Which has important role to determine the economic output. The main concerned of him with policy of central bank. Which should be focus on long-run target or a range for inflation variable rather than real variable like the one GDP or Unemployment does not able achieve the adequate policy the target. It depends upon the short-term trade off. Thus, he concluded that both money rule and interest rate rule have positive influence on output growth.

There are two types of monetary policy rules prevailing in the literature. Such as instrument rules and targeting rules. The general discussion, between these two-policy rules which covers the issues of simplicity, robustness, reliability, practicability, technical feasibility, and role of policy maker's judgment in different policy rules. Main difference between two is explain in the following.

2.2.3 Instruments Rules

Instrument rules specify monetary policy instrument as a function of the state of the economy (information about which is available to the central bank). These rules are simple to follow and require little amount of information. They are also robust and technically feasible in the sense that commitment to them is easily verifiable. To know the rules see e.g. Meltzer (1987), McCallum (1988), Taylor (1993), Henderson and McKibbin (1993) etc.

Perhaps, there may be alternative definition of a monetary policy rule, as Taylor (1999) define

“A monetary policy rule is defined as a description-expressed algebraically, numerically or graphically- of how the instruments of policy, such as the monetary base or the federal fund rate, change in response to economic variable”.

2.2.4 Target Rules

It is about, to regulate inflation or to soothe price stability is represent by Inflation Targeting Framework. There is positive relationship of exchange rate and monetary aggregates targeting, the inflation targeting has an improvement in the form of transparency for the public. A strong promise in terms of price stability is associated in policy terms and deviations are curtail over the longer period. It, like monetary aggregates targeting, also give room to monetary policy to tackle economic essentials in the short run with the compulsory flexibility. It resolves the difficulty of velocity shocks since monetary policy is not liable on the money-inflation relationship.

Inflation targeting presented in the studies in different way. An explicit inflation target usually may be a point target or a range target announced then central bank uses instrument independently under this framework to achieve that target. Hence, the stumpy and steady inflation is main objective of monetary policy. A target as an assignment given to central bank then commitment to it shared with public as an objective of monetary policy, and hence, the transparency and accountability of central bank highlight the issues of credibility. Svensson (1997) calls this framework an optimal monetary policy as loss function of the central bank defined and subjected to the constraint of transmission mechanism of the economy, the first order conditions derived are implicit monetary policy reaction function. Bernanke et al. (1999) best describes inflation targeting as follows:

“Inflation targeting is a framework for monetary policy characterized by the public announcement of official quantitative targets (or range) for the inflation rate over one or more horizons, and by explicit acknowledgment that low and stable inflation is monetary policy’s primary long-term goal. Among other important features of inflation targeting are vigorous efforts to communicate with the public about the plans and objectives of the monetary

authorities, and, in many cases, mechanism that strengthen the central bank's accountability for attaining those objectives".

In monetary economic literature, types of targeting rules are two, "general targeting rule" and "specific targeting rule". In general targeting rule, operational loss function is identify. Through commitment of monetary policy, the loss is minimize. Notwithstanding advantages of inflation targeting as a preferred way to control inflation, there are certain obstacles, which an emerging economy may face while adopting inflation targeting. The complications arise because of high pass through effect, difficulty in forecasting inflation, liability dollarization and credibility issues of the central bank (Eichengreen, 2002).

2.2.5 Rule vs. Dictionary Policy

Let us make more or deep discussion of monetary rule. As broader classification defined, such as Money rule and Interest rate rule, then point come on rule vs discretionary policy. Which one lies where? The general argument is central bank act or follow as rule and discretionary as well. Or we call it through his statement that "mid path" should adopt by central bank (Taylor,1993).

Discretion, defined as monetary authority has freedom to perform in accord with its own judgment. Let us assume if legislation instructed the central bank to do its best to accelerate the economy's performance and provided the monetary authority the instruments that it has, the central bank would have a discretionary monetary policy. On the other hand, rule monetary policy is a constraint on the monetary authority's discretion. A rule deals with the control over the monetary authority in such a manner that confines the monetary authority's actions. However, Rules can directly bound the actions taken by a monetary authority. For instance, central bank holds the constant monetary base. Therefore, it infers that confines the use of judgment.

This restriction to the monetary base as the single instrument could be accomplished by removing the discount rate and changes in reserve requirements as instruments and creating some technical changes in the relationship between the central bank and the Treasury monetary base at zero inflation, which nearly certainly needs judgment. Faithfulness to a rule obviously increases the transparency of policy actions and may contribute to policy credibility. Both of these are considered highly desirable. Discretion suggests period-by-period re-optimisation by the central bank, whereas following a rule means period-by-period application of the contingency formula (McCallum 1999). While Taylor and Williams (2011) states that in the initial monetary policy, from the text it is believed that a simple rule that permits the money supply to grow smoothly would contribute to evading monetary shocks and thus helps tame the rotations of recession, inflation, and deflation.

The fundamental reasoning in favour of rule-based policy over discretion is that obedience to a rule in setting monetary policy enables one to avoid the time inconsistency problem. The seminal papers by Kydland and Prescott (1977), followed by Barro and Gordon (1983) have greatly advanced the use of policy rules as optimal guides to central banks in the literature. Time inconsistency arises in the context of policy decisions when policymakers have an incentive to deviate from the previously announced policy in order to improve the economic outcome. Without a commitment, the optimal policy for the monetary authority is to create more inflation than the public expects. However, in the presence of rational expectations, surprise inflation cannot happen systematically, since the public understands policymakers' incentives, and can correctly anticipate such policy changes. The only optimal policy is to constrain credibly the monetary authority so that the future policy accords with economic agents' expectations. Chari, Kehoe and Prescott (1989) state that the rules versus discretion discussion – where rules are seen as commitment to certain policies and discretion as policies without a commitment – is misguided in that societies cannot choose between commitment and non-commitment. In their interpretation, commitment technologies do or do not exist in a given society. Therefore, rather than rules versus discretion, the debate should focus more on how much authority should be delegated to central banks. McCallum (1999) also stresses that neither of the central bank behaviour types – rule-based or discretionary – has yet been firmly established empirically relevant.

2.3 Empirical literature

Mohanty and Klau (2003) focused on multi-country studies in this area; they extend data from 1995 to 2002 for thirteen emerging economies including India. They found in Indian context the measured inflation coefficient is relatively low, whereas output gap and real exchange rate change are significant determinants of short-term interest rate. They measured an open economy Taylor rule for India, as well as other emerging market economies. Where, the relationship between the short-term interest rate and inflation rate outcome came with relatively weak. However, the output gap was statistically significant.

Xiong and Ping (2003) employed the historical analysis and the reaction function method to inspect China's monetary policy in the structure of the Taylor rule during 1992q1-2001q4. By making comparison between the rule values with the actual values of the interest rate, they revealed that Taylor rule could provide a useful standard for measuring the stand of China's monetary policy. Deviations of actual value from rule value happen when the policy operation falls behind of the request of the development of economic situation. Taylor rule may improve the transparency of China's monetary policy and may support implement of "forward-looking monetary policy" and curtail the policy lag with the greater transparency. Strengthening the communication between the central bank and the public may also improve the transparency of monetary policy. The GMM estimate of reaction function of China's monetary policy shows that the adjustment coefficient of the interest rates to the inflation rates is lower than 1. In such an unstable monetary policy regime, the generation and development of inflation or deflation is of a self-fulfilling mechanism. They suggested that China's monetary policy ought to transform from an unstable rule to a stable rule; it noises for an application of interest rate reform and change to a new monetary policy regime with the interest rate of money market as the intermediate target.

Esanov et. al. (2004) investigated the monetary policy in Russia during the period of 1993–2002. They measured the Taylor rule and the McCallum rule, by taking both monthly and

quarterly data. The regression output revealed that a simple Taylor rule and its different variations, where the short-term interest rate was used as a policy instrument, explains poorly the interest rate setting behaviour of the Bank of Russia. On the other side by McCallum rule the policy instrument was a monetary aggregate, turned best the data. Again, given that the bank of Russia officially adopts a money supply as an intermediate entity to policy and that, even interim period, and its main actual instrument of monetary policy was deposit auctions, that was a consistent result. The estimated coefficients are significant and persist unchanged across different equation specifications. The estimation results of the Ball rule, or hybrid, where a weighted average of the interest rate and the exchange rate is practise as a policy instrument, draw a mixed picture. Depending on the choice of the weights, results change and most of the time, the estimated coefficients are insignificant. The output of estimations was backward looking, in the logic that they characterise the relationships that existed so far in the data.

Virmani (2004) evaluated monetary policy response function for Indian economy, with monetary base (McCallum rule) and interest rate as alternative operating target. He finds that a back-looking and forward-looking McCallum rule and Taylor rule tracks, the evolution of monetary base over the sample period (1992q³ to 2001q⁴) but back-looking McCallum rule tracks reasonable well, and suggesting the RBI acts as if it is targeting nominal policy.

Rotich et.al. (2007) employed the recent conduct of monetary policy rule-based behaviour in Kenya. By using both backward and forward-looking policy rules with appropriate modification to take into account the features in developing countries. They tested whether the Central Bank of Kenya (CBK) reacts to changes in inflation, GDP growth and the exchange rate in a consistent and predictable fashion. Outcome revealed that during the period after liberalization (1997-2006), CBK employed monetary aggregates as a key policy instrument in conducting monetary policy. The estimate of the coefficient on the inflation gap infers that an increase in expected annual inflation of one percent brings the CBK to lower the growth of broad money (M3) by 4.2 percent. Similarly, the coefficient of inflation with respect to repo rate is 2.4. Which is consistent with Taylor's non-accommodative policy. The outcomes direct that CBK followed a rule to target inflation with some allowance for output stabilization. They also found a statistically significant response to exchange rate, perhaps clarifying the relative stability of exchange rate during the larger portion of the sample period.

Diez de los Rios (2008) also supported the proposal of McCallum (1987) which suggest the need for a monetary rule that will guide policymakers to the possibility of fluctuations in exchange rates. He estimates monetary policy reaction function using an affine term structure framework for Canada, Germany and the U.K for the period January 1979 to December 2005. The results suggest that, unlike the earlier results, the monetary authorities of the studied countries react to movements in nominal exchange rate.

Ghatak and Moore (2008) examine the monetary policy reaction function based on both Taylor and McCallum rules for the transition economies of the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Bulgaria and Romania between 1994 and 2006 using vector autoregression. The results show that while monetary aggregate in Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia, react to inflation variants in the long-run, the deviation of exchange rates from the potential level can be attributed to the vagaries of short-term interest rates. They submitted that the Taylor rule is far more applicable to exchange rate targeting, whereas McCallum rule is suitable for inflation targeting.

Kong (2008) in this study using type of rule in Chinese monetary policy such as Taylor rule, modification Taylor rule, McCallum rule and modification McCallum rule. Empirically the study suggested Taylor rule (including modification Taylor rule) better performed over the McCallum rule (including modification McCallum rule) for china during the period 1994q1 to 2006q4. Although these four type rule work with less firmly in terms of stability and its behaviors has as in term of fitness of monetary policy. General movement methods and Ordinary least squares has employed as econometric tools to described Taylor rule (as forward looking) and McCallum rule.

The investigation study emphasizes on behavior of McCallum and Taylor rules based monetary policy in European Union member state during the period 1994m1 to 2006m12. Taylor rule and McCallum rule using short run nominal interest rate and money supply respectively as instrument to describe the monetary policy. We find out the inflation gap was more likely influenced on monetary aggregate demand and supply than other. Short run interest rate more reacted to the exchange gap Czech Republic, Poland, Slovakia, Slovenia. Both instruments (nominal interest rate and money supply) had better worked with significantly react to inflation

gap for Hungary and Romania. Empirical almost studies said that Taylor rule better worked in developed countries than developing countries.

Inouse and Hamori (2009) discussed on an analysis on India's monetary policy rule by applying simple Taylor rule with the close economy (e.a., output gap and inflation gap) and open economy (plus exchange rate). The duration of period of study was from April 1998 to December 2007. When the simple Taylor rule was employing in India, the coefficient of output gap was statistically significant and inflation coefficient was not statistically significant. When the Taylor rule estimated with exchange rate, the coefficient of output gap and exchange rate had statistically significant, whereas the result of inflation coefficient remained the same before. These commonly suggested that the inflation target not played a crucial rule in economy.

Baoli (2010) has examined the usefulness of the McCallum rule for modeling the implementation of monetary policy for mainland china over the period 1999-2009. Our result suggested the nominal income targeting could be a useful tool for analyzing the monetary policy stance and for providing information about inflationary pressures in Chinese economy. Interest rate is likely to assume a bigger role as major operating target for developed economies.

Shuzhang (2010) analyse the importance of McCallum rule to the Chinese monetary policy guideline and applied a structural VAR to China's quarterly data from the first quarter of 1994 to the first quarter of 2009. Output of the above case strongly recommend the use of the McCallum rule as a criteria to long term policy frame for the monetary policy and also capable to stabilizing the economy, decrease policy uncertainties, boost the credibility and improve the transparency of monetary policy.

Singh (2010) observed the behavioural pattern of monetary policy in India and the method followed by him like the Taylor rule. A series of estimated result indicates that the monetary policy appeared more responsive to the output gap then to inflation during the period from 1950-51 to 1987-88, a shift in the policy sass through the period 1989-89 to 2008-09 have a comparatively powerful response to inflation then to output gap. Impact of inflationary coefficient also increased over the period. Inspite of this a thorough analysis of monetary policy and backward & forward looking of monetary policy across the India. He founds that the

inflation gap to be more consistent and statistically significant than output gap for the above period.

Giray (2012) tried to estimate an output function of the Central Bank of the Republic of Turkey (CBRT) on the basis of Taylor rule, as well as he also referred to Hybrid McCallum-Taylor rule. The data covered from the period 2003(Q1) to 2012(Q1). He also used Generalized Methods of Moments (GMM) and Limited Information Maximum Likelihood (LIML) methods to determine the reaction function of inflation on the above period targeting, with nominal interest rate as the instrument of monetary policy in Turkey. The output disclose that Taylor rule descriptions are more relevant to the monetary policy guidelines to the Central Bank of Republic of Turkey (CBRT).

Michael and Kapur (2012) tried to find the functional performance of McCallum rule, Taylor rule and their respective advanced categories for the India by using quarterly data from 1996 to 2011. They obtained that, the forward-looking nominal output objective formulations of the above rules, using interest rate as an operating instrument, performed efficiently than the backward-looking specifications. Therefore, they strongly preferred the adoption of the forward-looking formulations of the rules for India.

Mohanty (2013) period taken from 2001 to 2013, examined and focus on nominal interest rate targeting Taylor rule reliability for India. He founds and suggested that the Taylor rule could be a relevant additional tool to understand the interrelationship among the growth, inflation and policy interest rate, as the interest rate instrument of monetary transmission strengthen.

Abubakar and Yaaba (2014) determined the applicability of McCallum rule, within the context of bounds test, to Nigeria's monetary policy framework, using data from 1989Q1 to 2013Q2. With a positive monetary response factor and potential output as well as negative velocity, monetary base can be varied to enhance output growth at low inflation rate, thus guarantees output stability perhaps in the long-run, hence supports the application of the rule by the Central Bank of Nigeria (CBN). The study, however, suggested the introduction of additional monetary variable to the rule to make it more robust as well as constant monitoring of velocity of monetary base considering the observed volatility of the variable during the studied period.

2.4 Research gaps

Every research has its own limitations. Various literatures has been studies & it has found that in maximum of studies consumer price index (CPI) and Whole sale index (WPI) have been taken as measurement of inflation rate. While this study has emphasized a GVA deflator for measuring inflation rate. Instead of GDP study has done on the basis GVA at basis prices which made the study more reliable because of the deduction of indirect taxes which shows real picture of the economy. Mostly, Index of Industrial production (IIP) has taken as output, which explains only 20% of total output of GDP, Real GVA at basis prices has taken to explain output instead of IIP. Money base has taken as dependent variable in Hybrid McCallum-Taylor rules.