

Monetary Policy

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Abstract – This paper talks about the design and conduct of monetary policy and also how it's used as a tool to stabilise the economy over the business cycle, why the outcome of monetary policy actions is subject to a high degree of uncertainty. Will look at the macroeconomic policy from the point of view of Keynes and monetarists. Explain the theoretical foundation of inflation targeting policies and then it talks about the inflation targeting regime from the perspective of the U.S. and India. Also presents the debate between precommitment (rules) and discretion in the context of monetary policy and arising time-inconsistency problem from discretion. Finally, we see the main rules designed by the macroeconomists for the conduct of monetary policy and the debate between precommitment and discretion in the context of monetary policy.

Keywords: Inflationary Bias, Discretion, Rules, Time Inconsistency

1 INTRODUCTION

Traditional Keynesian school says that the union of 'Demand Shocks' continuously hitting the economy and slow adjustment of inflation and output due to 'nominal rigidities' are the two basic factors causing macroeconomic instability.

Demand management policies work to stabilize the economy. Combining the IS and LM curve we get our Aggregate Demand curve. So, demand shocks are nothing but IS shocks (unplanned changes in consumer or business confidence) and LM shocks (unplanned changes in money multiplier affecting the whole money supply, while supply shocks are the result of unforeseen changes in cost of production, technological progress and shocks in the labor market. A positive and a negative relationship is shared by inflation and output when there is a demand and a supply shock respectively. Whether or not a macroeconomic policy acts as an effective tool in stabilizing the economy depends on the source and the duration of the shock in the economy. These macroeconomic shocks can be either permanent or temporary, policy makers can act in any way they want in both the scenarios, but no reaction is preferred in case of a temporary shock since it's a short-term effect on the economy and everything comes back to normal on its own over some time.

Economic stability mainly refers to output and inflation stability which helps the economic agents plan for the future with considerable confidence since the economic stability will lead to lower uncertainty. Economic stability benefits growth, inflation and unemployment.

If firms are not confident about the economic conditions in future, they would prefer delaying the investment projects. Inflation volatility has a number of harmful effects such as deformed investment decisions, and high risk of making investment. It's also mostly connected with high inflation.

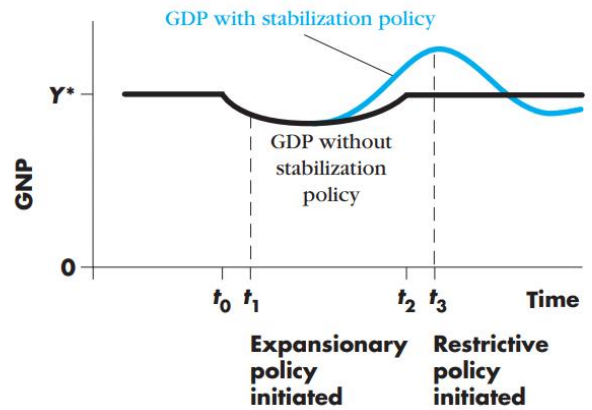
2 ACTIVE VERSUS PASSIVE DEMAND MANAGEMENT POLICIES

This is basically a discussion on whether and to what extent, central banks should react to economic shocks or disturbances.

Monetary policy is an effective tool for stabilization, at least when there is a demand shock, this is what is suggested by the AD-AS framework. Monetary expansions can speed up the recovery from recession, on the other hand monetary contractions can slow down the economy when growing too fast. Central Bankers ought to effectively participate in 'fine-tune' policies to restrict business cycle volatility variation in aggregate demand.

Keynesian economics believes in active macroeconomic policy which depends on the judgment and character of policymakers to seek the optimal long-term policies for the economy., while in the parallel universe monetarist or classical economics challenges this view saying that policymakers should stop using monetary policy as a stabilizing tool since it's difficult for policy makers to foresee the accurate or exact response of economy to policy changes due to the uncertainty in behavior and structure of the economy and also the delay in making, implementation and effects of monetary policy. Decisions cannot be taken instantly and even if policy is made, it takes time till it is actually implemented. Also, monetarists believe that demand-management policies may lead to destabilizing the economy because of the difference in the phase of business cycle in which shock was suffered and phase in which monetary policy actually came into effect. These monetary delays are divided into two types, 'inside lags' which is the time taken for implementation of policy action and 'outside lags' which is the time period between the point in time of actual implementation of a policy and the point when its full effect can be seen. Inside lags are divided into three lags. First is the recognition lag, which is the delay between the time a shock actually occurred and the time the need for an action required is felt by the central bank. This lag is said to be negative if the policymakers can predict the shocks and relevant policy actions can be considered before disturbance even occurs. For example, we know that private sector behavior is affected by the seasonal factor. So as around Christmas, demand for money rises, keeping in mind this fact the Fed increases the supply of money to adjust to this season's demand rather than making the economy go through a restrictive effect. However, often recognition lag is positive i.e., there is a delay between the time of occurrence

of disturbance and the recognition that active policy is required. Second is the decision lag (time between feeling of need for action and the actual policy decision, and third is action lag (time between policy design and its effective implementation). These are the lags encountered by the policymakers. Empirical evidence taken from OECD central banks propose that inside lags are relatively shorter. Kareken and Solow (in a classic work) studied the history of policymaking and came to a conclusion that recognition lag is on average about five months. Also, this lag was to a certain degree found out to be shorter and longer when required policy was expansionary and restrictive respectively. Decision lags are even shorter, and action lags are the shortest or calling it practically zero would not be wrong since central banks are discussing and deciding on the monetary policy quite regularly over the year, so decided policy can be applied instantly after a decision has been made. Outside lags are relatively longer since implemented action policy takes several quarters to come into effect and impact spending and output because changes in monetary policy affects, after some time, investment and consumption spending. The consequent changes in aggregate spending leads to a change in output, which may further lead to consequent changes in investment and consumption. The delays because of recognition and action lags signifies that by the time output starts getting affected by the policy changes the recovery phase of the economy may have started. If this is true then the policy implemented to stabilize the economy might either accelerate the process of recovery (which is already started), or destabilize the economy by increasing the output above its potential level. For example, suppose the economy is at full employment and there is a demand shock that reduces equilibrium level of income below full employment. Policy makers were not able to foresee this shock and therefore were not prepared for it. Now they have to decide how to respond to this disturbance or whether to respond at all. As told earlier, that first policymaker needs to identify whether it's a permanent (or at least very persistent) shock or is a temporary shock (short lived). If they interpret it as a transitory demand such as consumption spending will reduce for only one period then they prefer not responding at all since consumption will eventually come back to its original level. Producers will react to this transitory change by making changes to their production and inventory rather than making capacity adjustments. Since there is a lag between the time of implementation of policy and time policy coming into effect, it might be the case that it comes into effect by the time when the economy is close to its initial equilibrium level and then might push the economy away from the full employment level. So, it's better to do nothing when the shock is temporary. Main issue arising from using a policy in case of a temporary shock is illustrated in Figure below.



Lags and Destabilizing Policy
(Source: Macroeconomics - Dornbusch)

Assume that at time t_0 an aggregate demand disturbance reduces output below potential. Without active policy intervention, output falls for a while but then recovers and reaches the full-employment level again at time t_2 . Next, we consider the path of GDP under an active stabilization policy, but will not be preferred because of the lags. Thus, expansionary policy might be implemented at time t_1 and start coming into effect after sometime. Output now tends to recover faster as a consequence of the expansion but, because of the lags, employment level exceeds the full-employment level. By time t_3 , restrictive policy is initiated, and sometime after, output starts turning down toward full employment and may well continue cycling for a while. In this example, "stabilization" policy may actually destabilize the economy. One of the main reasons that policy making is difficult is because it's difficult to analyze whether a shock is temporary or persistent. Some actual examples are - in the case of World War II, it was clear that a high level of defense expenditures would be required for some time. While in another case of the OPEC oil embargo of 1973-1974, nobody could clearly say whether the embargo would last long or whether the high prices of oil are persistent. But still some said that this disturbance was temporary so the oil cartel would not survive and prices would soon decline. "Soon" turned out to be 12 years.

Monetarists are in disfavor of demand management policy also because of the uncertainty encompassing the behavior and structure of the economy and nature of economic shocks. Structure uncertainty means policy makers have to count on rough or imperfect theoretical models of the economy and quantitative forecasts resulting from their empirical estimation. There is an active debate among macroeconomists on the most accurate model to be used for this purpose, which eventually shows that it's impossible to know the exact behavior of the economy and response to policy changes. Nature uncertainty of the economic shocks

arises from the fact that it is hard determining whether the shock is permanent or temporary and also what's its source. Uncertainty of the nature of shocks is pertinent as the effect of a temporary shock is short lived, so macroeconomic variables come back to their original or initial levels once the effect of shock disappears. So, when there is a temporary shock, using policy with permanent effects will lead to destabilization of the economy, so desirable action of the central bank is either a short change in policy or no reaction. Equivalently, detection of the exact source of economic shocks is crucial because it is the first step towards any probably successful or effective policy action. For example, the central bank discovers a sudden rise in output but the source of shock is unknown i.e., whether this sudden rise in output is demand driven or supply driven. If it is a demand shock then desirable policy action is using a contractionary monetary policy which would help to moderate both inflation and output. In contrast, if the adverse shock is a supply shock, then a monetary contraction may not be desired because of its undesirable effects on inflation since it would depress output but would shoot up the inflation further. So, we can see that uncertainty about the duration of lags, uncertainty about structure and behavior of the economy; and uncertainty about nature and source of economic shocks implies that monetary policy essentially depends upon estimates and forecasts leading to high degree of uncertainty in effects of policies for economic stabilization. 'Lucas critique' also undermines the demand management policies as the embodiment of the Lucas critique is that traditional models, when utilized to evaluate the effect of macroeconomic policy changes on the economy, may yield deluding results if there is probability of changes in model parameters as economic agents amend their assumptions when new policy rule is executed. A popular use of the Lucas critique emerges in the analysis of the inflation-unemployment trade-off, and estimates of the cost (sacrifice ratio) of possible disinflation policies. Lucas' logic is that it is erroneous to utilize the underlying estimated of the AD-AS model to survey the likely reaction of the economic system to a changed inflation target as the first estimates of the model were consistent with the old policy and any change in the policy will lead to correspond to changes in the structure of the economy which was the result of the original estimates. Finally, when evaluating the possible effects of macroeconomic policy actions, we need to take into account the implications of the 'rational expectation hypothesis' for policy maker decisions which says that agents base their future plans or decisions on rational behavior, information available and their past experiences, basically, past outcomes influence the future outcomes. This hypothesis suggests that monetary policy cannot systematically manage the levels of output and employment. According to 'policy ineffective proposition' (New Classical Theory based on theory of rational expectations) the belief that people have rational expectations with flexible prices and wages, using policies to create false expectations in the

economy to manipulate the economy would not lead to any better outcomes but more noise i.e., anticipated monetary policy will not have any effect on output and employment in short run, only unanticipated changes in policy can lead to changes in short run level output. Additionally, because the cost of disinflation (fall in the rate of inflation i.e., fall in the rate of general price level of goods and services in a nation's gross domestic product over time) is determined by the way in which private sectors build their expectations. When there are adaptive expectations (idea that people form their future expectations based on past events), a decrease in inflation policy would lead to greater short run increase in unemployment. However, if economic agents are progressive or forward looking and form rational expectations the inflation can be reduced at almost zero cost if the central bank's policy is credible.

3 MONETARY POLICY: TARGETS AND INSTRUMENTS

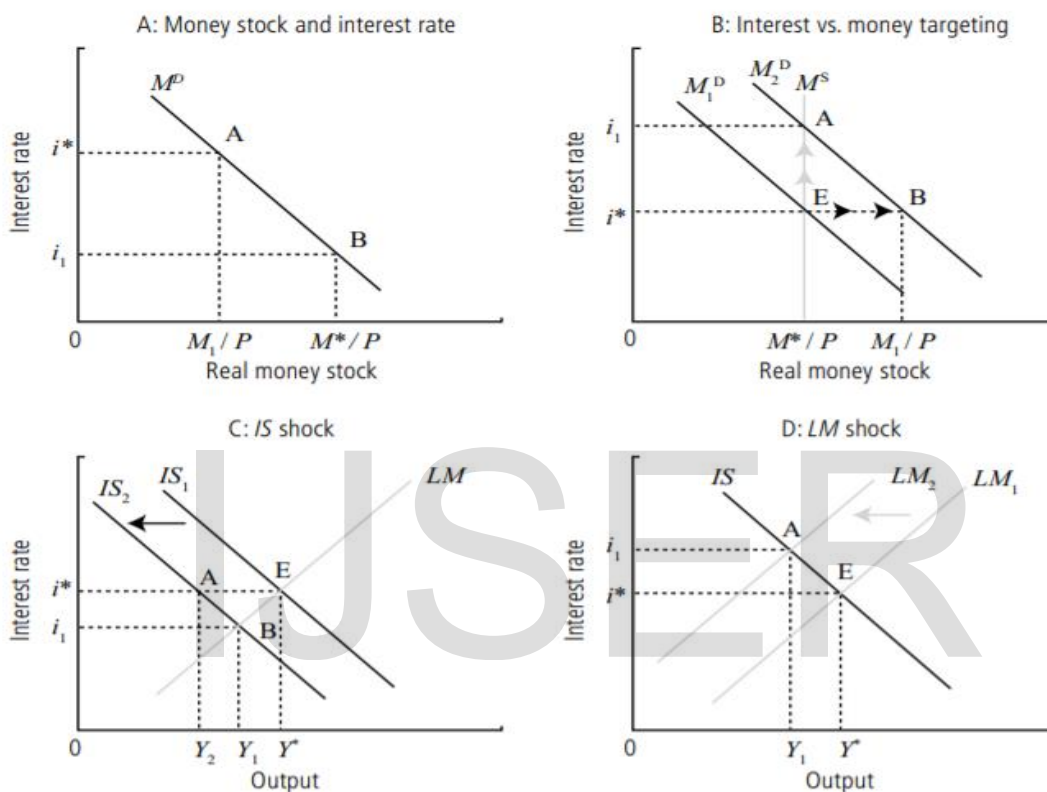
Now we are concerned with the overall conduct and design of the monetary regime. And we try to find out the central bank's objectives and efficient instruments used in order to fulfill the objective. The main objective of most of the modern central banks is to use a policy to maintain price stability and maintain a low inflation rate. As central banks can easily change both the supply of money and short-term nominal interest rate, that is why central banks have two main instruments to conduct their policy actions. Central bank cannot target levels of both the money stock and the interest rate at the same time. Either the central bank increases interest rate to decrease inflation but then this leads to a fall in money supply, or the central bank decreases interest rate to help with employment which increases money supply.

As shown in Panel A of Figure1, given a price level P , a central bank cannot, for instance, simultaneously target an interest rate i^* and a stock of money M^* , because any combination is constrained by the slope of the money demand curve. Panel B in Figure1 illustrates this issue from a different angle. Consider a central bank that targets an interest rate i^* and a money supply M^* , which are jointly consistent with the initial money demand curve $M1D$, and equilibrium at point E . Next, suppose that money demand rises from $M1D$ to $M2D$. Targeting the interest rate i^* means that because of the money demand increase, the central bank must allow the money stock to deviate from M^* . Conversely, targeting a money supply equal to M^* implies that the central bank must let the interest rate rise above i^* .

Prior to 1990, a number of OECD countries' central banks tried to achieve medium-term nominal money growth targets by determining the relevant money growth rate in the short run. This was basically done because of the idea that according to the classical quantity theory of money the inflation rate is solely driven by money growth rate in the medium run. In this manner, close control of nominal money growth should - as per this hypothesis - convey close

command over inflation. However, under the quantity theory of money, the link between inflation and money growth exists only till the time money demand (measured by velocity) is consistent over the long run. But velocity of money has been continuously changing since the last 20 years because of continuous variations in money demand which is the influence of technological innovations that have affected the costs of holding or obtaining money. This resulted in loosening the relationship between inflation and

money growth which has created difficulty in controlling inflation using the money supply. Therefore, after 1990 most of the OECD countries' central banks have started targeting inflation directly instead of using nominal money growth rate targets which is an indirect way to control price levels. Central banks have shifted to work with a short run nominal interest rate as the main policy instrument to reach their target.



Monetary policy under interest rate and money targeting
(Source: Macroeconomics – Polito and Brendon)

Whether to use money stock or interest rate as the policy instrument depends on the source of macroeconomic shocks. It is best for the central bank to keep money supply constant if there is an IS shock. This is shown in the above figure. Initially, economy is at Y^* output and i^* interest rate, which is the point of equilibrium E. An adverse IS shock leads to a fall in output and interest rate to Y_1 and i_1 respectively leading to shifts in the IS curve from IS_1 to IS_2 and LM curve being unaffected because of constant money supply. On the contrary, if interest rate is held constant at point E, then the central bank has to decrease money supply leading to further fall in output to Y_2 . If LM disturbances result in macroeconomic shocks, then it is desirable for the central bank to keep interest rate constant. This can be seen in panel D of above figure. Initially economy is at point E which is the point of equilibrium. LM curve shifts upwards due to an adverse money demand shock leading to fall in output to Y_1

and rise in the interest rate to i_1 .

Central bank's response to this shock depends on which policy instrument is being kept constant. If money supply is constant then central bank does not respond to this shock and if interest rate is constant at i^* then central bank has to increase the money supply to bring output back to its initial level Y^* .

3.1 Inflation Targeting

In the early 1990s numerous OECD countries' central banks adopted inflation targeting policy to perform their monetary policy action so largely inflation targeting is characterized as the authorized responsibility of the central banks for fulfilling the central bank objective of achieving and maintaining the general price level stability. Practically speaking, either of explicit or implicit quantitative inflation

targets describe the inflation targeting policies. These inflation targets can either be intervals or point targets where there is a variation in center of these policies of about 1 to 3 percent depending on country to country. To achieve a desired inflation, a careful and relevant manipulation of short-term nominal interest rate is carried out. Expectedly, economists who think that the macroeconomy is largely self-correcting (i.e., those who think the Phillips curve is vertical over a fairly short time horizon) prefer nominal targets. Economists who think that a flat Phillips curve persists for some time think that the benefit from hitting the output and unemployment target dominates the risk of inflation. The root of inflation target policies can be appraised by considering the expectations-augmented Phillips curve. The equation of augmented Phillips curve can be seen below:

$$\pi_t = \pi_t^e - \alpha(u_t - u_n)$$

The Phillips curve shows that unemployment is greater than its natural rate if the expected inflation rate is higher than the current rate. If the central bank's inflation target is indicated with $\bar{\pi}$, and expectations are fixed to this target so that $\pi_t^e = \bar{\pi}$, then the Phillips curve implies that

$$\pi_t = \bar{\pi} - \alpha(u_t - u_n)$$

which shows that if the central bank is able to achieve its targeted level of inflation in some period, then unemployment will equal to the natural level of unemployment. Under this framework stabilizing fluctuations in output caused by demand shocks will also mean stabilizing deviations in inflation from its target level. We can see this by Okun's law which says that deviations of output from its potential level are inversely related to deviations of unemployment from its natural level. Therefore, the Phillips curve in above equation can also be written as:

$$Y_t = Y_n + \gamma(\pi_t - \pi_t^e)$$

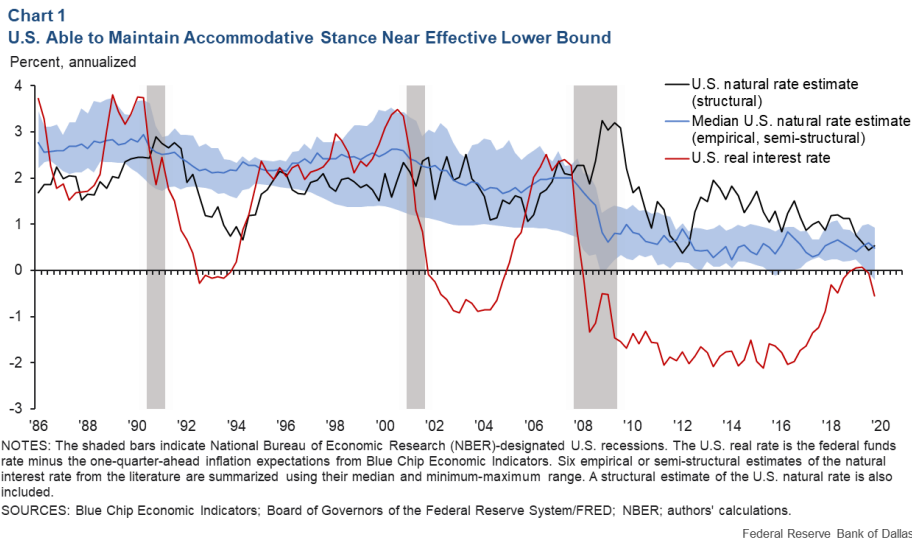
for some parameter $\gamma > 0$, which shows that if the central bank hits the inflation target, then output is at its potential level. This implies that while manipulating the short-term nominal interest rate to achieve its inflation target, the central bank will also indirectly stabilize real output. For instance, the above equation says that an adverse demand shock will reduce inflation below target while triggering an economic recession. In this

situation, a cut in nominal interest rate helps in bringing back the inflation to its targeted level, but also restores the real economy. The coherence between the needs of inflation stabilization and output stabilization in such circumstances is sometimes known as the 'divine coincidence'.

Feds and RBI on Inflation Targeting

The 2007-09 crisis led the feds to review their monetary policy framework for the first time. In which some major changes in monetary policy were carried out including moving from flexible inflation targeting to flexible average inflation targeting. The Federal Open Market Committee (FOMC) gave its first assertion of longer-run objectives and strategy system in 2012 and consequently corrected it in 2019. That assertion incorporated the Fed's first commitment to an inflation rate of 2 percent, as estimated by the yearly change in the price index for personal consumption expenditures (PCE). That is flexible inflation targeting. The growing awareness of structural transformations of the economy and diminished sensitivity of inflation to resource slack prompted feds to carry out their most recent review (2019-2020). This isn't only a U.S. experience; nations all throughout the world have had comparable encounters. Ongoing exploration recommends the descending float in longer-term inflation assumptions and the disinflationary pressures emerging from reducing pricing power and globalization have been significant variables holding down inflation. The fall in the natural rate of interest – the real rate consistent with full employment and inflation at its target was another important structural change. Estimates of the natural rate in the U.S. have fallen notably from their pre-2007-09 recession levels above 2 percent to less than 1 percent (Chart 1). The decrease in the natural rate was a global happening because of the maturing population, easing back usefulness development and globalization.

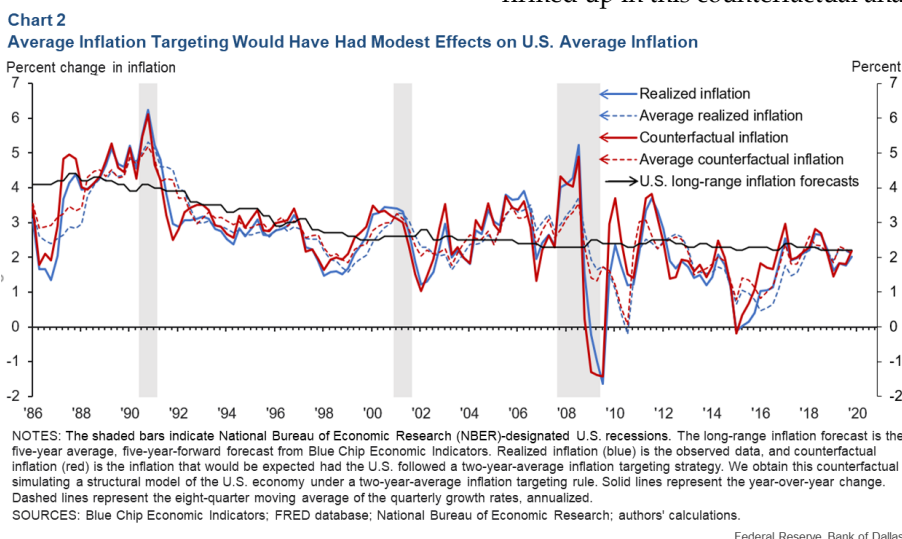
A decrease in the normal rate lessens the space to restore the U.S. economy through cuts in the fed's funds rate, leaving the Fed more dependent on other policy tools, for example, monetary record approaches i.e., balance sheet policies and forward guidance (Commitment by the central bank's commitment on the future action of the policy rate). The probability of being limited by the successful lower bound – that is, when interest rates can't go beyond zero – is more prominent in low interest rate conditions.



By diminishing the Fed's extension to help the economy through interest rate cuts, the lower bound leads to a downward increase to employment and inflation. Also, the Fed instead of committing to a 2 percent inflation target, said that it will aim for the inflation that averages 2 percent over time. This is the withdrawal from the earlier inflation targeting regime. Which was symmetric i.e., reacting equally to undershooting and overshooting of the target but it didn't make up for the past deviations from target. While average inflation targeting means that policymakers would take into account the past deviations and inflation will be allowed to move up or down the target to make up for the past deviations.

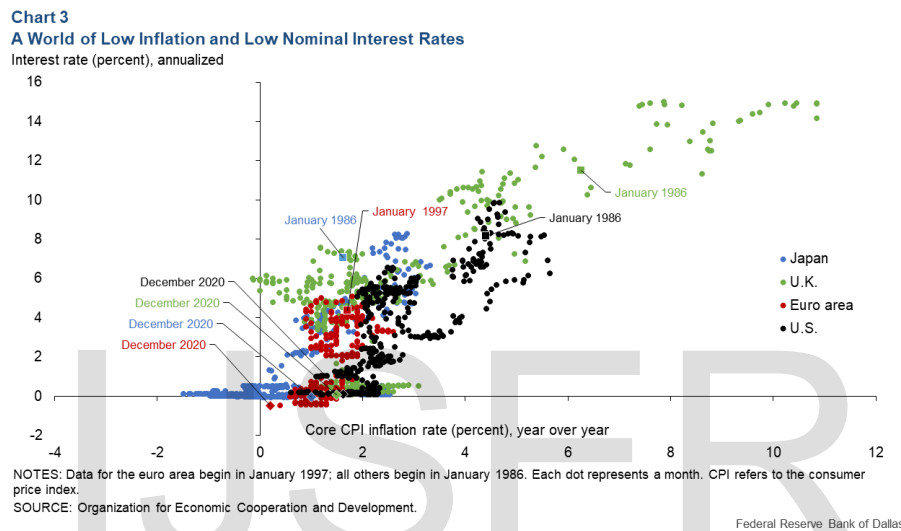
Based on an estimated structural model of the U.S. and global economies (2020), Enrique Martínez-García, Jarod Coulter and Valerie Grossman (2021) explored how inflation would have acted had the Fed's adopted the flexible average inflation targeting regime from 1986. Fully informed and rational economic agents were assumed.

They assume that the economy is hit with the same sequence of shocks and estimated values of parameters on preferences and technology remain the same and policymakers react to two-year average inflation rather than to existing one alone. Their counterfactual analysis suggested that had long-run inflation expectations remained same as observed in the data, there would have been only an average 0.1 percentage increase of the cyclical part of U.S. inflation under average inflation targeting regime than the older regime. These findings did not consider the intent of policymakers and thus the monetary policy implementation could have been different or more aggressive under the average inflation targeting regime. Staying fixed with the idea of long-run expectations is a significant rationale for average inflation targeting regime. They also didn't take into account that it would have probably resulted in higher overall realized inflation if long-run inflation expectations would have firmed up in this counterfactual analysis.



Even then they are in favour of average inflation targeting, when the economy is at the effective lower bound because of the aggregate demand shocks, according to the theory there is also a sustained downward pressure on inflation by the overall effect. The thing that may bother Feds is that the outcomes below the target level might become fixed in lower, below-target inflation expectations and which would make it difficult for the Fed to achieve their dual-mandate goals. There can be a number of reasonable long-run outcomes for the economy. One of them agreeing the monetary policy followed in U.S. since the '80s and another

possibility being low-nominal-interest-rate, deflationary regime observed in Japan during the same period (Chart 3). Average inflation targeting regime allows the Fed to balance the loss in inflation to maintain the initial equilibrium and by adopting this regime Fed is showing that 2 percent is not the limit to inflation and it may let inflation go beyond 2 percent coolly and temporarily to account for past low inflation. The major aim of this shift in regime is anchoring inflation expectations. They concluded that this new regime has provided the Fed more flexibility to pursue maximum employment and price stability in the current low interest rate environment.



Inflation targeting regime is being followed by India and this policy has helped in reducing inflation and improve transparency and thus centre continues to work with it. In May 2016, some changes were made in the Reserve Bank of India Act (1934) to form a constitutional basis for applying flexible inflation targeting (FIT) framework. The Act says that the Centre sets the inflation target once every five years consulting with RBI. RBI got the mandate to keep inflation at 4 percent with a margin of 2 percent on either side. The average inflation rate which is measured by the GDP deflator has fallen under the inflation targeting regime. In the pre-inflation targeting period, the average inflation was 5.69 percent and in the last five years, which is the period of inflation targeting, inflation declined to 3.47 percent. Also, there has been a substantial fall in average inflation volatility in the inflation targeting period. The average inflation volatility was 7.39 percent and 0.89 percent in the pre and post inflation targeting regime respectively.

4 ACTIVIST VERSUS NON-ACTIVIST POLICY AND RULES VERSUS DISCRETION

The issue of rules versus discretion comes from the question that if there is a risk that policymakers can react to economic shocks in unpredictable ways, and in way that is highly influenced by the notion of the day, and if this risk may be

responsible for macroeconomic instability, why not put

policy on automatic pilot? So, the issue is should monetary authority conduct policy actions by pre committing to the policy rules that those rules will describe in detail how their policy will be determined in all future situations, or should they be allowed to change their policy actions with time? This issue has been discussed since the Henry Simons

(1936) essay. The nature of argument has changed its shape many times. And some time back it has been recognized that the issue of rules versus discretion is not the same as activist versus nonactivist policy issue.

To illustrate this difference, suppose a nation's monetary authority sets Δm_t (growth rate of money stock) in each quarter according to the following formula:

$$\Delta m_t = 0.01 + 0.5(u_{t-1} - 0.05)$$

where u_{t-1} represents economy's unemployment rate for quarter t

This formula shows that at 5 percent unemployment, money growth rate is 1 percent. If unemployment rises above 5 percent, money growth automatically increases. Thus, with $u_{t-1} = 0.07$ (7 percent unemployment in the previous quarter), money growth would be 2 percent. Conversely, if unemployment dropped below 5 percent, monetary growth

would be lowered below 1 percent. This equation represents activist monetary policy which means setting the policy instrument which is money stock growth rate in each period depends in an active or nontrivial manner on the details of the current state of the economy. Here, the relevant detail or aspect is the unemployment rate but could be other variables also, such as inflation rate or an interest rate.

Now consider another equation such as

$$\Delta m_t = 0.01 + 0.0002t$$

This formula shows that setting is increasing over time, this is nonactivist policy because it doesn't incorporate any policy response to the state of the economy. It's difficult to say by looking at the equation whether it displays an example of rules or discretion. If by looking at the first equation we can say that this formula is implemented by the monetary authority in each period then it can be considered as a monetary rule. But we can also interpret the formula as the representation of the outcome of discretionary policymaking. This difficulty arises because rules versus discretion difference depends on the process by which the values of Δm_t or any other instrument used are determined and not what actually those values turn out to be.

Let's consider different policy strategies. Central bank or the monetary authority will optimize relative to some objective function and some perception of how the economy works. But the optimization happens in the policy processes at different stages under two different policymaking. Discretionary policy exists when the monetary authority sets value of Δm_t in each period on the basis of a new optimization calculation or has a new optimized value for each period. Thus, discretionary policy is conducted on a period-by-period basis irrespective of what monetary authority did in last periods. Rule based policy making exists when in each period, policymakers implement a rule or formula applicable for large number of periods and not the one applicable only to the current situation. Under rule-based policy making, authority's optimization lies in the design of the formula to be used rather than the choice of any single period's action. So, if first equation is designed in way that it is applicable for all the periods then it is rule based even though it reflects an activist policy. So, we can say that the rule therefore gears the amount of monetary stimulus to an indicator of the business cycle. By linking monetary growth to the unemployment rate, an activist, anti-cyclical monetary policy is achieved, but this is done without any discretion.

The issue of rules versus discretion has been blurred by the way that most defenders of rules have been nonactivists, whose favored monetary policy is a constant growth-rate rule. Thus, the contention has would in general focus on if activist policy is desirable or not. The central highlight perceived is that we can plan activist rules. We can plan rules that have countercyclical features without, simultaneously, leaving any discretion about their activities to policymakers. The fact of the matter is made by the first condition, which is an activist rule since it increases and decreases money

growth when unemployment is high and low respectively. The equation rules out discretion and in this regard is a rule. And talking about equation 2 one cannot be certain it's a rule-based policy making even though the result from the formula is the same in each period. This was the distinction between activist versus nonactivist policy and rules versus discretion.

4.1 Rules versus Discretion

Now, talking about the difference between rules and discretion. A significant issue concerning the conduct of inflation targeting monetary policy is that should a central bank use full discretion or instead commit to a pre-committed policy rule when setting the nominal interest rate. It has been being discussed for a very long time and even today whether discretion is preferred to rules or not. According to many economists, pre-commitment to a policy rule is superior to discretion because of the so-called time-inconsistency issue, which emerges whenever policymakers have an incentive to deviate from a preannounced policy once the private sector has formed its expectations based upon that initial announcement. To illustrate the time-inconsistency argument consider the expectation augmented Phillips curve obtained from rearranging equation

$$u_t = u_n - \beta(\pi_t - \pi_t^e)$$

where u_t is the current unemployment rate, u_n is the natural unemployment rate, π_t is the current inflation rate, π_t^e is the expected inflation rate, and the parameter $\beta = 1/\alpha$ measures the response of unemployment to surprise inflation.

Suppose that the following loss function L represents the central bank's preferences:

$$L(u, \pi) = \gamma_u(u_t - u_n) + \gamma_\pi \pi_t^2$$

where γ_u and γ_π are the parameters that measures how much the central bank dislikes deviations of unemployment from its natural level and inflation volatility respectively. If $\gamma_u = 0$ so central bank doesn't care about unemployment and thus it is inflation targeting and if $\gamma_\pi = 0$ then the central bank cares only about deviation of unemployment from its natural level and thus it is unemployment targeting. We are assuming that the central bank cares about inflation and unemployment both. Let's consider that the central bank believes in commitment or rule-based monetary policy. Assuming that central bank directly controls inflation rate, suppose it commits to an inflation target $\bar{\pi}$. Provided central bank's commitment is credible, people set their expectation equal to the pre committed target i.e., $\pi_t^e = \bar{\pi}$. Phillips curve then implies that if the central bank sticks to its target i.e., if the central bank is committed then there will be no surprise inflation and there is no deviation of unemployment from its natural rate. And the desired rate of inflation will be zero given the loss function.

Now suppose the central bank chooses discretion over rules. Central bank still has direct control over the inflation rate but is not pre committing to any target. Assuming that economic

agents know that central bank are using discretionary policy they will set their π_t^e accordingly. Central bank sets the current inflation rate π_t . Under discretion, the central bank takes inflation expectation as given then conducts its policy action i.e., deciding about the actual rate of inflation. Substituting Phillips curve into the loss function gives us:

$$L(u_t, \pi_t) = -\gamma_u \beta (\pi_t - \pi_t^e) + \gamma_\pi \pi_t^2$$

Now minimizing the loss function for the optimal value of inflation rate by differentiation with respect to the inflation rate (control variable) and then equating to zero, we get:

$$\pi_t = \frac{\gamma_u \beta}{2\gamma_\pi}$$

This shows that the inflation rate set by the central bank under discretion is different from zero.

Therefore, rational economic agents set their expectation as:

$$\pi_t^e = \frac{\gamma_u \beta}{2\gamma_\pi}$$

Which means inflation is positive when unemployment is at its natural level. Now comparing the results under the two types of policies. Under both pre commitment and discretion, unemployment is at its natural rate. However, pre commitment and discretion leads to zero and positive inflation respectively. Therefore, precommitment is preferred to discretion since it results in lower value of inflation volatility. Under discretionary monetary policy, central bank has an incentive to cheat from pre announced target, for example announcing a zero-inflation target but then choosing the optimal positive inflation rate: $\pi_t = \frac{\gamma_u \beta}{2\gamma_\pi}$

This would result in surprise inflation with low unemployment. This is inflationary bias which is caused by time inconsistency (or dynamic inconsistency). Since the public knows that the central bank has an incentive to deviate from its announcement in order to reduce unemployment, the public will not believe the central and thus zero inflation rate policy is not credible under discretion. Also, as there is no long run tradeoff between unemployment and inflation, there is no benefit from keeping inflation high for reduced unemployment. The inflation rate under discretionary policy also can be very low or even around zero if parameter γ_π is much larger than the parameter γ_u which means the central bank dislikes inflation volatility much more than the deviation in unemployment. This favors the idea of appointing conservative central bankers when delegating monetary policy. Conservative central bankers are someone who uses discretionary policy to carry out its actions but is highly concerned with decreasing inflation than anyone else in the economy. Which is why a conservative central bank will generate a least possible equilibrium inflation rate. The main possible solutions to the time inconsistency problem are:

Constitutional Rules or low inflation rules i.e., written commitment of central bank to a low inflation in the constitution, preventing the policymaker from making

discretionary choices. Second, Reputation, this means that if central bank is concerned about their future credibility, then they have an incentive to stick to their announced policies. The government can choose more anti-inflationary policymaker so that the policymaker will lean against inflationary pressures. Another solution is an Independent Central Bank, which means holding the central bank solely responsible for the conduct of monetary policy which should be focused on achieving price stability.

Figure below gives a graphical illustration of the time-inconsistency problem. LRPC must intersect with the point of long-run equilibrium of the economy. Of all such possible equilibria, both the public and the central bank prefer point A1 since it delivers full employment at zero inflation. But suppose that the central bank had announced a zero-inflation target, consistent with point A1. Then the economy will be operating on SRPC1, and the central bank has an incentive to boost the economy to point B, at which point the marginal benefit from lower unemployment is equal to the marginal loss from higher inflation. At point B inflation is higher than anticipated, so the Phillips curve shifts from SRPC1 to SRPC*. The new long-run equilibrium is at point A2, at which output is at the natural level but inflation is positive and equal to π^* , even though everyone prefers zero inflation. If the central bank says that it will return to zero inflation (pre announcement), this promise is not credible or trustable as everyone knows that once the central bank is on SRPC1, the central bank has an incentive to back out on its initial commitment and to choose point B.

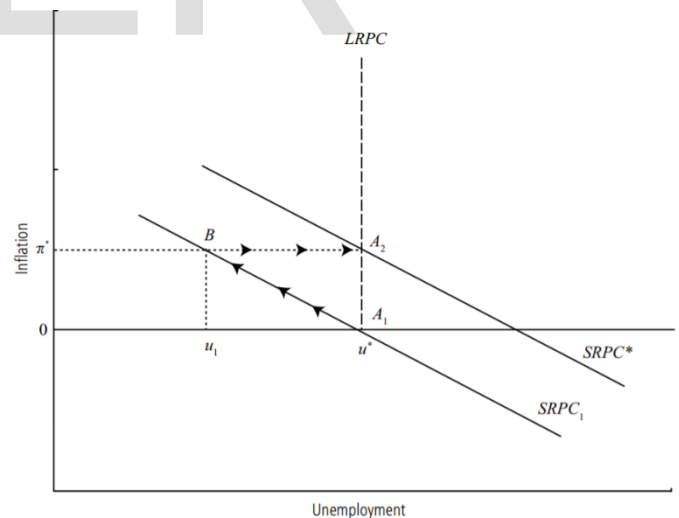


Illustration of Time Inconsistency Problem
 (Source: Macroeconomics –Brendon)

5 CONCLUSION

About twenty to thirty percent of output fluctuations at business cycle frequencies are due to the aggregate demand shocks and nominal rigidities which doesn't let output and inflations to adjust in case of shocks. Macroeconomic stability means avoiding uncertainty and disruption, which is necessary for high and sustainable growth rates and also for economic agents (firms and households) to form long term plans so that they can plan their future with confidence. Decision making and policy implementation take time and also the effect of policy can be seen slowly with an uncertain speed, unpredictable changes in the expectations of economic agents due to changes in policy or a new policy and also the uncertainty in choosing the right model of the economy, all these reasons cause the uncertainty in policy actions. Monetary policy instruments have a significant role to play in the economy - they support price stability or promote lower inflation rates. When a consumer of some goods and services is certain about the price of that particular good and service then there is a high probability of a transaction taking place. Since the value of money used is consistent so price structure stability is achieved. The inflation rate in the U.S. between 2009-2018 was under 10 percent which means \$1 in 2009 was valued at \$1.09 in 2018, maintaining the wealth earned. The U.S. prefers an average inflation targeting regime to inflation targeting regime. 2 percent is not a ceiling for inflation, they allow it to move inflation above 2 percent modestly and temporarily to make up for the past low inflation. This shift from inflation targeting to average inflation targeting has been one of the most significant changes in the U.S. monetary system providing the central bank the flexibility to pursue maximum employment and price stability in the low interest rate environment. It also supports well anchored inflation expectations. As the economy and the understanding of the monetary policy evolves, feds will continue to adapt to achieve broad based growth consistent with its long run inflation target. Inflation targeting in India has been a success story as it has provided transparency in monetary policy. The correlation between the past inflation expectations and current inflation expectations was significantly higher before inflation targeting, but it fell after this regime. This means economic agents form their inflation expectations using current and future information and consequently monetary transparency has helped in low inflation expectations in India. When policymakers have an incentive to deviate from the pre announced policy once the public has formed their expectations based upon the earlier announcement, then there arises the problem of Time Inconsistency. Whether or not Monetary Policy ought to be directed by administered rules or left to the discretion of the policymaker has been a subject of discussion since the

beginning of central banking. Time inconsistency is not that the government's view of what is best changes, but rather its scope to exploit fixed expectations. Thus, rules that prevent policymakers exercising discretion may be good for the economy in that they solve the time inconsistency problem by preventing policy-makers from deviating from the announced policy. We saw that rule or pre commitment is better than discretion otherwise the economy has to face inflation bias. When unemployment is at its natural level under both pre commitment and discretionary type of policies, zero and positive inflation respectively is seen. Under discretionary monetary policy, the central bank has an incentive to cheat from pre announced target, for example announcing a zero-inflation target but then choosing the optimal positive inflation rate, this would result in surprise inflation with low unemployment. This is inflationary bias. Also, there is discussion that there is a difference between activist versus non-activist policy and rules versus discretion.

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