Sacrifice Ratio or Benefit Ratio: Controlling Inflation with Tight Monetary Policy

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Chapter 1

Introduction

The primary objective of every public policy is to maximize the welfare of the society. There are economic policies which control the real and nominal variables of the economy and enhance the social welfare. Monetary policy is one of such policies: its role is to stabilize output and along with keeping low and stable inflation. Monetary policy can more effectively manage short run real stabilization. So main objective of every central bank is to maintain output at its natural level and keep inflation stable. Whenever output deviates from its potential level then it will affect inflation in either direction. If actual output is less than potential output it leads to high prices and vice versa, so central bank should minimize output gap.

There are two types of monetary policies, expansionary monetary policy (loose monetary policy) and contractionary monetary policy (tight monetary policy). When inflation is very high in an economy central bank adopts tight monetary policy to control inflation by controlling monetary policy tools (money supply or interest rate) but when central bank increases interest rate, there is corresponding decrease in business activity which leads to decrease in output. So there is short run tradeoff between output and inflation (Philips 1956).

When central bank adopts tight monetary policy which reduces inflation by 1 % it will lead to cumulative loss in output defined in the literature as "Sacrifice ratio". There is short run cost of disinflation but long run benefit of disinflation as well. When central bank adopts tight monetary policy it may initially increase price level; a phenomenon known as "price puzzle" in the literature. This so-called cost channel of monetary policy works when the firm's marginal cost depends on real interest rate (Walsh & Ravenna 2002). Secondly, when interest rate is high it will be very attractive to government debt, but if government is

financing through seigniorage revenue then inflation will high in the future (Sargent & Wallace 1981). This situation refers to the regime of "fiscal dominance "introduced by (Sargent & Wallace, 1981) and then "fiscal theory of price level" by Woodford (1994). There is another aspect of high interest rate that government will not take loan from the banking system and finance its budget from taxes which will reduces consumption of consumers and ultimately reduce the economic activity. Thirdly, when interest rate is high it will induce businesses not to take loan, which will reduce the business activity and ultimately reduce output.

When central bank makes tight monetary policy there is cost of reducing output but at the same time there are also benefits of low inflation. There are two approaches to define benefit ratio in literature. Benefit ratio is described as 1 % increase in inflation leads to how much gain in output (Jordan 1997). There is another view about benefit ratio that how much gain in output is associated with one percent decrease in inflation. When inflation is low it will improve decisions making of consumers and reduce the uncertainty for investors and ultimately increase the economic growth. When inflation is low then interest rate will be low and there will be depreciation of currency, therefore domestic goods are attractive for other countries (Romer 1991).

The neoclassical growth model like Solow (1956) and Ramsey (1928) introduce the new macroeconomic model. Solow model is the foundation of real business cycle models (RBC). Solow model does not assume labor supply as endogenous and there is missing source of fluctuations which was then introduced in real business cycle models (RBC). Dynamic Stochastic Generalized Equilibrium (DSGE) is a framework used in real business cycle models. DSGE models have recently been used by central banks for policy analysis based on rational expectations and on micro foundations. DSGE models focused more on monetary policy rule rather fiscal policy rule. The most notable DSGE model in the literature

is a model of Christiano Eichenbaum and Evans (2005). DSGE models assume three players in the economy; firms, households and the government. When a model consists of all above three players, it is classified as general equilibrium DSGE model.

The economic history of Pakistan shows considerable fluctuations in inflation and output. Inflation was 23 % in 1974 and jumped down to 2.44 % in 2002.While output varied from 8.7% in 1980 to -0.1 % in 1997. After introducing nuclear power the foreign exchange reserves decreased and central bank increased interest rate. But there was an incident of 9/11 which caused increase in foreign exchange reserves and net foreign asset increased which lead to expanded monetary base and ultimately more money supply in the economy. Government spending, in Pakistan, is heavily financed through money creation. So central bank is forced to create more money, which lead to high output and high inflation. The inflation rate rapidly increased to 9.3% in 2005 after a trough of about one percent in 2001. To control inflation, SBP adopts contractionary monetary policy but at the same time there was an oil price shock in 2007 which caused high inflation which reduced the effectiveness of tight monetary policy. All these swings make different phases which may result in different sacrifice ratio.

Keeping in view the economic history of Pakistan and given the dearth of knowledge in the area of sacrifice ratio, this study aims at estimating sacrifice ratio of Pakistan. For that purpose Dynamic Stochastic General Equilibrium Model has been used. To our knowledge this is the first study in Pakistan to calculate the sacrifice ratio by using DSGE model. The findings of the study will help policy makers to take informed policy decisions.

The rest of the thesis is organized as follows: secod chapter describes the theoretical and empirical views regarding sacrifice ratio. Third chapter presents the methodology of how to calculate the sacrifice ratio and description of variables and data sources. The forth chapter explains the results of the study. The last chapter concludes the study.

Chapter 2

Literature Review

2.1 Introduction

Price stability and output stabilization are the first and foremost objectives of every central bank but there is found to be tradeoff between inflation and unemployment in the short run. When central bank controls inflation, there will be cumulative loss of output. Policymakers and researchers analyze how much loss of output is there which is calculated in terms of sacrifice ratio but there is benefit of low inflation which can be calculated in terms of welfare ratio or benefit ratio. A brief literature is presented in section 2.2. Section 2.3 presents the theoretical definition of sacrifice ratio and the next section analyzes some issues regarding sacrifice ratio which includes cost benefit analysis of sacrifice ratio and nonlinearity of Phillips curve. Then the next section 2.4 describes some determinants of sacrifice ratio. The final section 2.5 concludes this chapter.

2.2 Theoretical Framework

The primary objective of monetary policy is to stabilize output and inflation. Price stability is one of the prime objectives of every central bank and central bank sets the target to achieve the stability of economic variables. Central bank has two types of targets; intermediate target and operational target. Central bank's intermediate targets include money supply, exchange rate, interest rate and expected inflation rate to achieve targets while operational targets include short run interest rate and monetary base. There are some policy tools to attain the target for example discount rate, open market operation and required reserve ratio. Pakistan has been setting money supply growth as an intermediate target and reserve money as operational target (Shamshad, 2006).

So the objective of every central bank is to control inflation and to keep output at its natural rate. Price instability is harmful for economic growth as for financial sector, creates uncertainty for investors, consumption decisions and reduce economic efficiency. The debate about the conflict of inflation and unemployment started from 1958. There is a trade-off between output and inflation (Phillips 1958) because when aggregate demand increases firms increase the production but there is no change in wages because labor market is in equilibrium as a result there is increase in prices and decrease in unemployment due to excess demand.

However, this is the debatable issue between two schools of thoughts, Classical vs. Keynesian. According to classical thought, as wages and prices are flexible, so labor market is always in equilibrium then the real output is determined by supply side rather than demand side, so aggregate supply curve is vertical. Whenever some monetary shock, for example money supply increases, it does not have any effect on real variables which is called neutrality of money. Hence disinflationary policy is costless because economy is always at its full equilibrium and sacrifice ratio is zero. While according to Keynesian view, as wages and prices are rigid and aggregate supply curve is positively sloped so disinflationary policy is costly. After the great depression of 1929-1932, Keynesian argued that real output was determined by supply as well as demand side but demand being more important. So neutrality of money does not hold longer and monetary policy has real effects.

In this case disinflationary policy is costly and sacrifice ratio is positive. Then Keynes discussed the issue of whether monetary policy is more effective or fiscal policy for demand management. Keynes argued that it all depends on sensitivity with respect to interest rate of investment or money demand. Finally Keynes concluded that fiscal policy was more effective to control inflation and to keep output at its natural rate.

The next debate started in 1960s between Keynesian and Monetarist regarding different aspects of policy issues. The first issue is that which policy is more effective monetary policy or fiscal policy to sustain the economic growth. Keynesians suggests that fiscal policy is more effective then monetary policy. As they argue that effectiveness of fiscal policy depends on slope of IS –LM curve (as IS –LM was introduced by Hicks in 1963).

When LM is not in liquidity trap then fiscal policy is completely affected because when central bank increase money supply then roughly half of money has been absorbed by money demand which will reduce the interest rate and it will leads to high investment and high output or income. While monetarist suggest that monetary policy will be more effective when central bank increase money supply and as demand for money is perfectly interest inelastic so interest rate will reduce and investment and output will rise. Then there is another interesting debate started between Friedman and Keynesian about Phillips curve. Friedman rejects the theory of Keynes about Phillips curve after in 1970s when an economy faces stagflation (high inflation and high unemployment). Milton Friedman (1968) the father of monetarist and Edmund Phelps (1967) has argued that there is tradeoff between unemployment and inflation only in short run and there is no trades off in long run because of expectations which are missing in the above literature and Friedman (1968) assume that expectations are adaptive which define as expectations are adjusted partially by previous forecast error. So Friedman and Phelps argued that real wages have the actual role in the labor market as real wages incorporate the inflation so when aggregate demand increases, labor demand will increase the wages and wages are adjustable with inflation before their contracts so there will no excess demand and hence level of employment will go back to its natural rate of unemployment. But according to Friedman (1968) and Phelps (1967) natural rate of unemployment cannot influence by demand management policies. When expectations are adjusted nominal wage increase and it will shift upward supply curve which finally

increase unemployment, again this is the situation of stagflation and again classical dichotomy happened and finally monetary policy has no role to control output and inflation. As previously discussed the backward Phillips curve, people does not incorporate all information about the future decision that is unlikely rather agents should assume all information available or we can simply say that basically expectations are subject to Lucas critique which defines that reduce form parameters are policy variables variant .

The concept of rational expectations introduced by Jon Muth (1961) and analyzed by Lucas (1972) and (Sargent & Wallace, 1975) that only unsystematic part effect policy variables. They suggest that discretionary policy is ineffective because of rationality and as agents is rational in the economy. Because if policy makers adopts expansionary policy to increase output but it will reduce real wages as prices are also high. As agents are rational they will adjust their wages then no increase in output and investment so expansionary policy only creates inflation. So discretionary policy is ineffective. Similarly there is another channel through which it proves that discretionary policy is ineffective under the assumption of rationality.

Expansionary policy increase money supply which will leads to increase in prices, lenders will pay interest rate with adjusted inflation and if for businesses interest rate will adjusted by full inflation then there will no increase in output. So credibility is an important factor to smooth the economy. An important debate of Keynesian and Monetarist is on unemployment and inflation trade-off. According to Keynesian unemployment can be reduced only at the cost of inflation. While according to Monetarist suppose policymakers adopts expansionary policy it will increase both output and prices but real wage decrease which leads to rise business profits so there is not permanent tradeoff . Lucas basically focused on three assumptions that there is a micro foundation which has role in determine the macroeconomic real variables. Firms set the prices where price equal to marginal cost and

cost depends on inputs prices. The second assumption is imperfect information, firms did not know the information of prices, prices rises absolutely or relatively. So output depends on deviation of output. Lucas has criticized that there is found to be positive relationship between inflation and output just because of imperfect information of prices. He analyzed that only unanticipated shocks in money supply has effect on real output. The third assumption is rational expectations, as adaptive expectations give systematic errors because it ignores all relevant information. Agents are rational so they use all information past as well as current to forecast inflation.

As previously discussed that deviation of output from its natural level of unemployment depends on either nominal rigidities or imperfect information. New classical economists incorporate the assumption of rational expectations but there was no nominal rigidity of wages and prices. Then Real business cycle theory introduced that has adopts to explain the fluctuations in the economy which assumes the rational expectations, flexibility of wages and prices and technological shocks. Now macroeconomics mainly focused on micro foundation models and role of economic policy and agent's perception on how policy is determined.

New Classical Phillips curve has a criticism for Keynesian economics that monetary policy could systematically affect output even in the short-run. In short Lucas named it expectations augmented Phillips curve with the variations of its assumptions. They said that the basic assumption of economics that is rationality is missing in Keynesian Economics. After that there was a reaction to this criticism has been developed in 1990s based on Micro foundation founded by NEW-KEYNESIAN models; they assumed that households and firms have rational expectations. Fischer (1977), Taylor (1979b), Calvo (1983)) uses micro foundations for macroeconomic model for example menu cost and overlapping wage and price contracts. New –Keynesian models focused on three types of players firms, consumers

and Government, they have the basic idea that output gap also depends on marginal cost. Stanley Fisher and John. B. Taylor assumed that prices and wages are rigid and assume the assumption of rationality even then they prove that there is slow adjustment of output to its natural rate.

There is a brief contribution of Kydland and Prescott (1983) in the literature the first one is that either rule is best policy or discretion is the best policy. Considering the time inconsistency problem central bank should adopt policy rule rather than discretion because discretion is considers as best policy only under current situation whereas rule enhance the economic performance (Kydland and Prescott 1977).

And the second contribution is the use of real business cycle models and real business cycle models the decisions of firms and consumers based on current and expected path for prices and policy variables. Living standards based on long run growth and macroeconomic fluctuations so technological shocks are considered to be cause of business cycle. (Kydland and Prescott 1977).

There is another challenge for New Keynesian about real business cycle theory which was suggested by Kydland and Prescott (1982). New Keynesian suggest real business cycle model but by assuming that prices are set by monopolistically competitive firms simply we can say that nominal rigidity are now assumed. New Keynesian suggested that main force of RBC is utility maximizing of consumers and profit maximizing of firms in dynamics of macroeconomic variables while Classical suggested technology is the main force of RBC. In RBC monetary policy is not effective so there is no role of stabilization. So Good friend and King (1997) and Rotemberg and Woodford (1997) purposed a model based on microfoundations and nominal rigidities and imperfect competition. So this was criticism on Keynesian which was compensated by introducing dynamic general equilibrium model with RBC called in literature as New Neoclassical synthesis or New Keynesian DSGE model

introduced by (Rotemberg and Woodford (1996), Gal´ı (1999)). Many policymakers and researchers are using DSGE models for policy analysis and forecasting nowadays Christiano et al. (2005), Smets and Wouters (2003, 2007), Adolfson et al. (2007). Christianoet al. (2005) proposed a model assuming wages and prices stickiness, firms and capital accumulation. This approach is widely used by central bank for policy analysis. Levin et al. (2003) and Taylor and Wieland (2011) have analyzed the comparison between earlier New Keynesian models and New Keynesian DSGE models which has an important role for policy analysis.

There are many studies has been found regarding New Keynesian model in Pakistan. Malik,Satii and Saghir (2010) estimate the New Keynesian Phillips curve for Pakistan following Galli and Gertler (1999). For instance Malik (2006) developed a model of dynamics of monetary exchange rate policy. He analyzed that real exchange rate and net foreign asset effect inflation and output. Haider and Khan (2008) developed a model of small open economy of Pakistan. Malik (2006) introduced a model which has more effective , aggregate demand interest rate and cost channel of monetary policy using New Keynesian model and the result found to be cost channel is more effective of monetary policy.

2.3 History of Dynamic Stochastic Generalized Equilibrium (DSGE):

Dynamic Stochastic Generalized Equilibrium (DSGE) modeling has been stared in the world's central bank since 1983-2008 for policy analysis. It is mostly beneficial for monetary policy rather fiscal policy because according to Kydland and Prescott rule is better than discretion as monetary policy follows rule for example Taylor rule or etc while fiscal policy adopt discretion as rule always give path to equilibrium. DSGE models give quick response of real variables to the monetary policy shocks. Basically DSGE models are short run models and it did not include financial sector because it is more difficult to assume financial sector at equilibrium. As Lucas considered rational expectations for policy analysis so DSGE models also considered rules for policy analysis as Kydland and Prescott analyzed that rule is better

than discretion for policy rules. A very important aspect in DSGE modeling is that market adjustment will always go back to its equilibrium position. The reason behind this is depends on four important features, first one is DSGE models assume that consumers always maximize utility underlying the budget constraint and secondly producers always maximize their profits under resource constraint. Thirdly markets are always clear and last point that is very important as critique by Lucas already above mentioned that agents are rational. Shocks which are important for some external disturbances in the economy are following the steady state equilibrium but DSGE models are assuming only small shock or we can say less intensive shocks. Now there raise a question that how DSGE models are handled, so DSGE models are tackled by either through some econometric techniques or Bayesian techniques and computer calibration.

However there are some problems in DSGE framework. DSGE does not incorporate financial sector because it is difficult to assume that financial market is in equilibrium Krugman (2009). Second problem is that DSGE framework cannot use for fiscal policy analysis however fiscal policy has also an important role for policy analysis in an economy. And the last problem is very critical and has been analyzed after financial crisis of 2007. DSGE framework only include less intensive shocks and ignore the high intensive shocks so how can we model an economy after some kind of financial shocks occurred.

2.3 The Sacrifice Ratio

The phenomenon of Sacrifice ratio can be described as costs of a deliberate disinflationary policy. Since 1970,s the analysis of disinflation and how to implement demand management policies have been prominent debate in Economics. Policy makers suggest expansionary monetary policy to reduce unemployment, in response of expansionary monetary policy output would also be reduced and when output is decreasing then inflation

would also be decreasing. So to reduce inflation policy makers adopt disinflation management policies that are contractionary monetary policy.

One strategy for disinflation is suggested as deliberate disinflation while there is a second strategy for disinflation which is known as "the Opportunistic approach of disinflation", Orphan ides and David (1996). Central bank should wait for external circumstances such as adverse supply shock and unforeseen recession to reduce inflation. President Boehne of the Federal Reserve Bank of Philadelphia gave one early statement of this approach during the FOMC meeting in December 1989:

"Now, sooner or later, we will have a recession. I don't think anybody around the table wants a recession or is seeking one, but sooner or later we will have one. If in that recession we took advantage of the anti-inflation [impetus] and we got inflation down from 4-1/2 percent to 3 percent, and then in the next expansion we were able to keep inflation from accelerating, sooner or later there will be another recession out there. And so, if we could bring inflation down from cycle to cycle just as we let it build up from cycle to cycle, that would be considerable progress over what we've done in other periods in history. [FRB, 1989, p.19]"

When Phillips curve is linear and the policymaker's loss function is quadratic in inflation and the deviation of output from potential, the opportunistic approach of disinflation is not the optimal policy. Orphanides and David (1996) analyses that opportunistic strategy act as deliberated disinflation strategy whenever inflation exceeds a certain level of threshold. And when inflation is low then threshold deliberate disinflation strategy reverts to Opportunistic approach.

Activist pursuit of inflation target	Opportunistic pursuit of inflation target	Activist pursuit of inflation target

Deflation	-0 +	Inflation

2.3 Issues regarding sacrifice ratio

Sacrifice ratio is measured as loss calculated by percentage change in output to one percent change in inflation. There are some issues regarding sacrifice ratio, cost and benefits of reducing inflation and non-linearity. There is cost of disinflation as well as benefit of accelerating inflation. When central bank adopts tight monetary policy there will be reduction of inflation which is a good sign for an economy but there will also reduction in output which is harmful for an economy. So there is cost and benefit analysis. The next issue raised by economists is non-linearity of Phillips curve which will discuss as below.

2.3.1 Cost and Benefit Analysis

There are two approaches to analyze the cost benefit measurement in the literature by "Sacrifice ratio (Ball (1994)) and second by Robert Barro (1995). When central bank adopts tight monetary policy which reduces inflation say by 1 %, it will lead to cumulative loss in output defined in literature as "Sacrifice ratio". But Barro (1995) have different view about disinflation that is measure the benefit of disinflation. There is however some points that needs to be discussed. When central bank adopts tight monetary policy it will increase price level defined in literature as "price puzzle". Cost channel rises due to increase in interest rate which has positive increase on prices (Walsh & Ravenna, 2002; and Malik, 2005).Secondly, when interest rate is high government try to finance deficit through seignior age revenue. In this case inflation will be high in the future (Sargent & Wallace, 1981).This situation refers to the regime of "fiscal dominance "introduced by (Sargent & Wallace, 1981) and then "fiscal theory of price level "by Woodford (1994). There is another aspect of high interest rate that government instead of taking loan finance its budget from taxes which will reduce consumption and ultimately reduce the economic activity. Thirdly when interest rate is high

it will discourage loan for industrialist and investors which will reduce the business activity and ultimately reduce output.

Despite the cost associated with tight monetary policy there are also benefits of low inflation Robert Barro (1995). There are two approaches to define benefit ratio in literature. Benefit ratio is described as 1 % increase in inflation leads to how much gain in output, (Jordan 1997).There is another view about benefit ratio that how much gain in output due to one percent decrease in inflation. When inflation is low it will improve decisions for consumers and reduce the uncertainty for investors and ultimately increase the economic growth. When inflation is low then domestic country goods are attractive for other countries (Romer 1991). When inflation is low during tight monetary policy there will be appreciation of domestic currency. It has two effects on inflation output trade off; first, inflation is normally measures as consumer price index so prices of imports will be low and output gain will be high if foreign goods are used as inputs Temple (2002). Low inflation will improve the consumers decisions and for investors which ultimately leads to high economic growth.

2.3.2 The Issue of Non-linearity

The original Phillips curve was non linear. Alban W. Phillips (1958) analyzed the relationship between money wage change and unemployment. But at that time relationship was called as short run Phillips curve linear relationship with time invariant slopes. The slope of Phillips curve analyzed to be endogenously over time Emmanuel De Veirman (2007). Laxton, Meredith, Rose (1995) analyzed that Phillips curve is convex. The cost of disinflation is not constant when Phillips curve is convex. The slope of Philips curve depends on supply shocks and aggregate demand, so any productive shock or aggregate demand has large impact on firm's production rather on inflation. Supply shocks has an effect on inflation but have zero effect on unemployment so if there is some supply shock occurred in an economy then Phillips curve become convex (Gomez & Julio,2000). That why Phillips curve is flattens in

this scenario Lucas (1973). Albeit Philips curve is linear but it slope is random walk (change in slope is unpredictable). Non linear Phillips curve also impact on conduct of monetary policy. If monetary policy adopts linear rule while originally Phillips curve was nonlinear then it will lead to inflation biass. Empirical evidence proposed that optimal monetary policy rule becomes nonlinear Shaling (1999), Dolado *et al*. (2003). So it is possible to estimate non linear Taylor rule. When Phillips curve is linear demand and supply shocks has impact of the same magnitude but if Phillips curve is non linear then demand shock has impact of high magnitude instead of supply shock. As supply has an important role for determining the monetary policy, according to Keynes (1936) the slope of supply curve is horizontal which implies that supply is inelastic of price level above full employment but elastic below full employment level. After a long time supply curve convert to new phase that is the negative relationship between wage inflation and unemployment Phillips (1958). The idea of aggregate supply function has changed after Muth (1961) who proposed the notion of rational expectations. Phelps (1967) and Friedman (1968) introduce augmented Phillips curve in which inflation is related to expected inflation. When expectations are rational and wages and prices are flexible so aggregate supply curve is vertical. So demand shock has greater impact on inflating. There is a relationship found between nonlinear Phillips curve and output cost of fighting inflation. The cost of disinflation is low when Phillips curve is nonlinear Hyeon-seung and Jang (2007).

2.4 Determinants of Sacrifice Ratio

Disinflations are major cause of recessions may be the prominent cause. Disinflation opens the room for cost of low output as well. Is there any policies reduce or eliminate these costs. There are two aspects to be discussed mainly cost benefit analysis and determinants of sacrifice ratio. There are some determinants of sacrifice ratio which are discussed below.

2.4.1 Speed of disinflation

Many authors have emphasized for successful disinflation without output loss, the major role played by speed and timing of disinflation. The first and foremost important determinant is speed of disinflation Ball(194) and Sandeep (2012). The controversy between "gradualism " and "cold turkey" is central issue in macroeconomics. According to Taylor(1983) disinflation is less expensive if it occurs slowly because wages and prices need time to adjust to a monetary tightening. While in the contradiction Sargent (1983) view is that disinflation is less expensive if it is quick. As firms and workers set current and future nominal wages and prices in large part as functions of their expected rates of inflation. On the short run cost of disinflation "cold turkey" disinflation implemented through an interest rate is less costly as compared to implementation through money supply rule Ascari and Tiziano (2010). Speed of disinflation is also concerned by central bank independence, high central bank independence leads to low speed of disinflation (Jordan (1997, 1999)).

2.4.2 Nature of labor contracts

The phenomenon of price adjustment is the central issue of aggregate fluctuations in employment and output. Many government employees suggest wage controls in terms of wage flexibility and unemployment for anti inflationary policy during 1960s and 1970s. Researchers extended the models of wage and price staggered setting during 1980s. Initially wages are determined by the interaction of firms and workers but as time passes there are different changes occurred in economic environment such as change in tax law or rise in inflation. Cost of disinflation can be explained in two ways credibility and nominal price rigidity. Credible disinflation is costless Sargent (1983) while Taylor (1983) analysis suggests that price rigidity is an important factor of disinflation. There are two aspects on which the degree of wage and price flexibility depends, first, when inflation is high firms change prices more frequently so wages and prices are more flexible in high inflation, therefore in high

inflation countries cost of reducing inflation is low as compare to low inflation countries. Second issue is credibility so high flexibility of wages and credibility leads to low cost of inflation.

2.4.3 Central bank independence

The primary objective of monetary policy is to stabilize inflation. Government sets the target for economic variable and the role of every central bank is to achieve the target set by Government. Central bank has two types of targets, intermediate target and operational target. Central bank has following intermediate targets include money supply, exchange rate, interest rate and expected inflation to achieve targets while operational targets include short run interest rate and monetary base to achieve goal. There are some policy tools to attain the target for example discount rate, open market operation and required reserve ratio. Central bank independence means that it should be transparent and credible. There are two types of, goal independence and instrument independence. Goal independence proposed to define and determine policy objectives without government intervention, for example central bank could maintain price stability without government intervention Grilli, Masciandaro, and Tabellini (1991).Where as instrument independence, Central bank independence freely choose policy tools to achieved the objectives of monetary policy Debelle and Fischer, (1994). More central bank independence leads to more credibility on inflation or they obtain "Credibility bonus". When more credible central bank announced to reduce inflation then the expected inflation should fall but not output. The countries with higher independence leads to more output losses during recessions this suggest that no credibility bonus exist in high central bank independence. Empirical evidence found to be negative relationship between inflation and central bank independence. The solution of dynamic inconsistency is that central bank independence should be credible to reduce inflation. Rogoff (1985), Kydland Prescott (1987) and Barro and Gordan (1985) analyses that the more central bank

independence produces low level of inflation. There is a controversy about central bank independence and sacrifice ratio. When central bank is more independent which means that central bank is more credible, so there is negative relationship between credibility of disinflation and its cost Ball (1995) and Sargent (1983) because firms set their prices according to money growth of central bank, if central bank fulfill its promises and money growth reduces then expected then there will be boom in the economy and if money growth rises then expected then there will be recession in the economy.

If firms fixed their contracts and low speed of disinflation and high credibility leads to low sacrifice ratio. Taylor (1983) and Fischer (1984) have analyzed that high speed of disinflation leads to high output cost. So according to Sargent and Ball view that more central bank independence reduces disinflationary cost while according to Taylor and Fischer view there is positive relationship between central bank independence and cost of disinflation. Jordan analyses that there is also benefit of disinflation as well as sacrifice ratio.

Jordan suggested that benefit ratio is ratio of output gain to change in trend inflation during accelerating disinflation. Central bank increases output loss during disinflation Jordan (1997). Central bank independence affect sacrifice ratio through level of inflation, disinflation is cheaper in high level of inflation. If speed of disinflation is high then it will lead to weakens recession whereas large amount of disinflation leads to high recession. While during accelerating inflation central bank independence has no influence.

There is found to be negative relationship between credibility and output loss Sargent and Ball (1983) and Cuikerman (2002). Diana and Sidiropoulos analyzed the positive relationship between sacrifice ratio and central bank independence on the basis of inflation persistence. Whereas Taylor and Fisher analyzed the positive relationship between speed of disinflation and its real cost. So according to Sargent and Ball view they found that high independence off central bank (leads to high credibility) reduces sacrifice ratio. A contrasting

view of Taylor and Fisher proposed the positive relationship between central bank independence and sacrifice ratio. The existing literature proposed positive relationship between sacrifice ratio and central bank independence Alsenia and Summers (1993). An efficient instrument held by central bank independence enhancing credibility lowers the costs of disinflation**.**

2.4.4 Trade Openness

The out-put inflation trade off is captured by sacrifice ratio. The real exchange rate depreciation is caused by unanticipated monetary policy expansion and real exchange rate depreciation is more harmful for open economies. As openness is endogenous so it is inverse relationship with inflation. Therefore central bank do not generate surprise inflation in open economy because it will leads to steeper Phillips curve, it will leads to high inflation cost and reduction in output gain. So greater openness leads to lower sacrifice ratio. Openness is important determinant of sacrifice ratio ball (1994). Ball (1994) analyses that coefficient of trade openness is insignificantly positive for quarterly data while it has negative effect for annual data. Openness has also impact on sacrifice ratio during acceleration Jordan (1997). Central bank independence leads to high inflation in open economies. Empirical evidence shows that monetary policies are more effective in open economies while fiscal policies are more effective in closed economies. When inflation is high during expansionary monetary policy there will be depreciation of currency. It has two effects on inflation output trade off, first; inflation is normally measures as consumer price index so the effect of depreciation on the domestic price of imports leads to inflation cost through expansionary monetary policy. Second; output gain will be reduced if foreign goods are used as inputs Temple (2002). Two important factor that affect Phillips curve is capital mobility and exchange rate regime. As empirical evidence shows that domestic interest rate and real exchange rate has opposite effect so capital mobility will have ambiguous effect on trade off Loungani, Razin and Yuen (2001) but Papell (1988) suggest that real exchange rate has dominant effect on domestic interest rate which implies steeper Phillips curve and lower sacrifice ratio.

2.5 Conclusion

The above literature shows the importance of the topic of sacrifice ratio and analyze that there are sacrifice of low inflation in terms of loss of output but there is also found to be benefits or welfare ratio of low inflation. The research regarding to this topic is missing in Pakistan. This research area has been an important role after 1970s because there was an oil price shock.

Chapter 3

Methodology and Data

3.1 Introduction

This study estimates sacrifice ratio using Dynamic Stochastic General Equilibrium (DSGE) framework. The next section discusses theoretical modeling in which there are three players; households, firms and government. The section 3.3 defines the steady state values and the final section discusses the sacrifice ratio.

3.2 Dynamic Stochastic General Equilibrium Framework

We start with Christiano Eichenbaum and Evans (CEE 2005) model which shows the operational medium scale New Keynesian DSGE model. The model is neoclassical growth model containing both real as well as nominal frictions. Real frictions include monopolistic competition in goods and labor markets, internal habit in consumption, variable capital utilization and adjustment cost in investment decisions while nominal frictions include prices and wages stickiness *a la* Calvo (1983).

There are two methods to go along the DSGE model; through calibration or through Bayesian estimation method. Through calibrations every parameter is evaluated by microfoundations and is taken from other studies, while the other method explains the solution by estimation through Bayesian or Maximum likelihood method. We have taken the first approach and calibrated the model's parameters.

3.2.1 Theoretical Model

We are considering three types of economic agents in the economy including consumers, firms and government. Consumers consume according to their preferences and firms have two tasks in living in monopolistically competitive environment; firms set their prices and decide on how much to produce. Lastly monetary authority set interest rate rule as

an instrument to achieve their target and budget is financed through seignorage revenue and lump-sum taxes.

3.2.2 Households

The utility function for households is

$$U_0 = E_0 \{\sum_{t=0}^{\infty} \beta^t \text{ u } (c_t - \text{b } c_{t-1} ; h_t^s; m_t^h)\} \quad (1)$$

Where E_0 denotes the mathematical expectations, β is the subjective discount factor and utility function depends on consumption, money holdings and hours worked and b is the degree of habit persistence . Utility function has positive relationship with money balances and consumption.

Next we will consider labor market which consists of labor demand and labor supply. The demand for labor is set to be as $(W_t{}^j/W_t)^{-\eta\sim} h_t{}^d$, where $W_t{}^j$ denotes the nominal wage charged by the labor in market j and $h_t{}^d$ represents the aggregate labor demand by firms. There are the following constraints.

The first constraint is about budget constraint

$$E_t r_{t,t+1} x_{t+1}^h + c_t + i_t + m_t^h + a(u_t)k_t = \frac{x_t^h}{\pi_t} + h_t^d + + \int_0^1 w_t^j \left(\frac{w_t^j}{w_{t)}^{-\eta\sim}} dj + r_t^k u_t k_t + \tau_t + \right.$$

$$m_{t-1}^h/\pi_t \quad (2)$$

The next constraint is regarding the consumption function which shows that consumers consume a part of income and rest is saved. The equation (5) represents the composition of goods. And for composition we need demand function for individual which requires to minimize the expenditure and we get the following equation as below

$$P_t = \left[\int_0^1 P_{it}{}^{1-\eta} \, di\right]^{\eta/(\eta-1)} \quad (3)$$

And

$$c_{it} = \left(\frac{P_{it}}{P_t}\right)^{-\eta} c_t \quad (4)$$

Equation (3) represents the general price level for example CPI and equation (4) represents the demand for individual good where income elasticity is one and price elasticity is η.

$$c_t = [\int_0^1 c_{it}^{(\eta-\frac{1}{\eta})} \text{di}] \wedge (\eta/\eta - 1) \qquad (5)$$

Labor services is also an important constraint which includes labor supply and labor demand. The following equations (6) and (7) both make the constraint of labor market

$$h_t^d = [\int_0^1 h_{jt}^{\frac{\eta-1}{\eta}} \text{di}] \wedge (\eta/\eta - 1) \qquad (6)$$

$$h_t^s = \int_0^1 h_{jt} \text{ dj} = h_t^d \int_0^1 (w_{jt}/w_t) \wedge (-\eta\sim) \qquad (7)$$

The final constraint is about capital accumulation

$$\text{Kt} + 1 = (1 - \delta)\,\text{kt} + \text{it}\,[1 - \text{S}\,(\frac{\text{i}_\text{t}}{\text{i}_{\text{t}-1}})] \qquad (8)$$

Now what will be the level of consumption that will maximize the utility? So we will maximize utility function by dynamic optimization in which we make the value function and taking derivatives with respect to choice variables.

The choice variables are c_t , h_t , x_{t+1}^h ,w_t^j,K_{t+1}, i_t , m_t^h and u_t.When we maximize the utility function subject to above constraint we get the following first order conditions by using value function.

$$u_{ct}\,(c_t - \text{b}c_{t-1};\, h_t^s\,; m_t^h) + u_{ct}\,(c_{t+1} - \text{b}c_t; h_{t+1}^s; m_{t+1}^h) = \lambda_t \quad (9)$$

$$u_{ht}(c_t - \text{b}c_{t-1};\, h_t^s\,; m_t^h) = -\lambda_t \frac{w_t}{\mu_t^{\sim}} \qquad (10)$$

$$q_t = \beta \frac{\lambda_{t+1}}{\lambda_t} [q_{t+1}(1-\delta) + r_{t+1}^k u_{t+1} - \text{a}(u_{t+1})] \qquad (11)$$

$$q_t\lambda_t \;\; [1 - \text{S}\,(\frac{i_t}{i_{t-1}}) - [S_i(\frac{i_t}{i_{t-1}})]i_t] - \beta\, q_{t+1}\lambda_{t+1}S_i(\frac{i_{t+1}}{i_t})\, i_{t+1} = \lambda_t \quad (12)$$

$$a_{ut}(u_t) = r_t^k \qquad (13)$$

$$u_{m_t^h}(c_t - \mathrm{b}c_{t-1};\ h_t^s\ ; m_t^h) + \beta \frac{\lambda_{t+1}}{\pi_{t+1}} = \lambda_t \qquad (14)$$

Wages are taken to be rigid as we are using DSGE framework with New Keynesian assumptions. So according to Calvo (1983) we define that 1-α is the probability that firms reset wages for the next period and α denote the probability that firms will not set the wages. So α denotes the degree of wage rigidity. If wages cannot be re-optimized, then according to CEE model wages are set according to past inflation. So maximize the utility function subject to $h_{jt} = (\frac{w_{jt}}{w_t})^{-\eta\sim} h_t^d$ and the probability of not being able to re-optimize in future periods. So we get the first order equation

$$E_t =$$

$$\sum_{s=0}^{\infty}(\beta\ \alpha\sim)\ \text{^s}\ \lambda_{t+s}\ (\frac{w_t\sim}{w_{t+s}})^{-\eta\sim}\ h_{t+s}^d\ \prod_{k=1}^{s}(\frac{\pi_{t+k}}{\pi\chi\sim_{t+k-1}})\text{^}(\eta\sim)[\frac{\eta\sim-1}{\eta\sim}\ \frac{w_t\sim}{\prod_{k=1}^{s}(\frac{\pi_{t+k}}{\pi_{t+k-1}\chi\sim})}\ -$$

$$\frac{w_{t+s}}{\mu\sim_{t+s}}]\ = 0 \qquad (15)$$

As all firms are homogenous so the firms, which set their wages at the same time, set the same wage rate.

3.2.3 Firms

Now we consider the firms in the model. Firms maximize their profit subject to production function, downward slopping demand curve as there is monopoly so consumers demand is now constraint and the final one is each period all firms are not able to re-set their price. Basically, there are two decisions of firms, input demand and price setting. We define the technology which produces goods

$$Z_t\ \mathrm{F}\ (k_{it}, h_{it}) - \Psi \qquad (16)$$

Where Ψ denotes a fixed cost of production.

Each firm has a demand function given as follows:

$$y_{it} = \left(\frac{P_{it}}{P_t}\right)^{-\eta\sim} y_t \quad (17)$$

$$y_t = c_t + i_t + g_t + \mathrm{a}\,(u_t)k_t \quad (18)$$

Newt we will presents the cash- in- advance constraint (CIA)

$$m_{it}^f \geq \upsilon\, w_t h_{it} \quad (19)$$

The budget constraint of firms is given as follows

$$E_t r_{t,t+1} x^f{}_{it+1} + m^f{}_{it} + r^k{}_t + k_{it} + w_t h_{it} + \emptyset_{it} = \frac{x^f{}_{it} + m^f{}_{it-1}}{\pi_t} + \left(\frac{P_{it}}{P_t}\right)^{1-\eta} y_t \quad (20)$$

Where $E_t r_{t,t+1} x_{it+1}{}^f$ represents the total cost in real terms which the firms purchase in period t.

Maximize the expected value of future profits subject to the constraint (17) and (20). Then we have following first order conditions:

$$\mathrm{mc}_{it} z_t \,\mathrm{F}\,(k_{it}, h_{it}) = r_t^k \quad (21)$$

$$\mathrm{mc}_{it} z_t \,\mathrm{F}\,(k_{it}, h_{it}) = w_t[1 + \upsilon \frac{R_t}{R_t} - 1\,] \quad (22)$$

As prices are set as Calvo (1983), so the procedure follows price setting, the first order condition for the optimal price is as follows

$$E_t \sum_{s=0}^{\infty} r_{t,t+s}\, P_{t+s} \alpha^s \left(\frac{P_t^{\sim -\eta\sim}}{P_t}\right) y_{t+s} \prod_{k=1}^{s} \frac{\pi_{t+k-1}{}^{\chi}}{\pi_{t+k}} - \mathrm{mc}_{i,t+s}] = 0 \quad (23)$$

As same for wages, firms which are setting prices in the same period set the price for all identical goods.

3.2.4 Government

Now consider the government constraint which defines as government expenditures is financed through lump-sum taxes and seigniorage revenue.

$$g_t = \tau_t + m_t - \frac{m_{t-1}}{\pi_t} \quad (24)$$

3.2.5 Equilibrium

Monet Market: $m_t = m_t^h + m_t^f$ (25)

Labor Market: $h_t^s = \int_0^1 h_{it}^d$ di (26)

Capital Market: $\int_0^1 k_{it}$ di $= u_t k_t$ (27)

Good i market: z_t F $(k_{it}, h_{it}) = (c_t + g_t +$ i + a $(u_t)k_t)$ $(\frac{P_{it}}{P_t}^{-\eta\sim})$ (28)

Aggregate Goods Market: $z_t h_t^d$ F $(\frac{u_{tk_t}}{h_t^d}, 1) = (c_t + g_t +$ i + a $(u_t)k_t)$ $\int_0^1$ $(\frac{P_{it}}{P_t}^{-\eta\sim})$ di (29)

3.2.6 Monetary Policy

We assume the central bank sets the short term interest rate

$\frac{1+i_t}{1+i^*} = (\frac{1+\pi_t}{1+\pi_*})^{\emptyset}$ (30)

Assuming that $\emptyset$ >1, π_t denotes the inflation rate, π^* represents the inflation target and i^* represents nominal interest rate target.

3.3 The Steady State

As we are using dynamic model so after finding first order conditions, we will explain the percentage deviation of a variable around its steady state. (See Appendix)

3.4 Sacrifice Ratio

Suppose the economy is at steady state; to control inflation central bank permanently reduces inflation target which leads to reduced output. When central bank targets the inflation rate, interest rate would increase which reduces the aggregate demand, household consumption and decrease in investment spending. Similarly it will affect firm's costs, so finally high interest rate reduces the output. So we find sacrifice ratio as follows:

SR= - $\frac{1}{\pi^*_{old-}\pi^*_{new}}$, where $\pi_{new}{}^*$ denotes steady state inflation rate.

3.5 Welfare gain ratio

As there is cost of low output but also there is some benefit of low inflation. So we will estimate how much there is benefit of low inflation in the economy. Using DSGE models we will find welfare ratio by defining value function which represents household utility. So welfare based sacrifice ratio is defined as

$$\text{WSR} = -\left(V_0 - V_{old} / \pi_{old}^{*} - \pi_{new}^{*}\right)$$

$$\sum_{t=0}^{\infty} \frac{Y_{t-Y_{new}}}{Y_{new}}$$

Where Y_{new} represents output in steady state and Y_t denotes output at different time periods. $V_0 - V_{old}$ represents welfare loss by disinflation. V_0 is the value at time when disinflationary policy is implemented by central bank and V_{old} is the time period when central bank has not implemented the disinflation. As the main role of policies is to maximize the welfare of society, so the actual welfare loss can be calculated by consumers. The initial value function at $\pi_{old}^{*}$is given as

$$V_{old} = \frac{1}{1-\beta}\left(\ln(1-\mathrm{b})c_{old} - \frac{\emptyset_0}{2} h_{old}^{2} + \frac{m_{old}^{h^{1-\sigma_m}}}{1-\sigma_m}\right)$$

Where c_{old} , h_{old} and m_{old} are consumption, hours worked and real money balance by the households in the initial steady state . σ_m and $\emptyset_0$ are structural parameters. For the given value of v_0, we will find value constant fraction of steady state consumption i-e λ

$$V_o = \frac{1}{1-\beta}\left(\ln(1-\mathrm{b})(1-)\lambda c_{old} - \frac{\emptyset_0}{2} h_{old}^{2} + \frac{m_{old}^{h^{1-\sigma_m}}}{1-\sigma_m}\right)$$

$$\lambda = 1\text{- exp }[(1\text{- }\beta\text{)}\,(V_0 - V_{old})]$$

Finally welfare based sacrifice ratio is given as

$$SR^{w} = \frac{\lambda}{\pi_{old}^{*} - \pi_{new}^{*}}$$

3.6 Calibration

Some parameters we have taken from the previous studies of Pakistan while some parameters we have to estimate. The parameters which we have taken from the previous studies are $\{\beta, \alpha$ $,\delta$, b, χ , $\chi^{\sim}$,z,$\theta\}$. Discount rate (β) is 0.5 taken from Ahmed, Haider and Iqbal (2012). We set θ as 0.50 taken as average of capital shares from other developed countries as reported by Liu (2008). We have taken δ as 0.08 by (Ahmad, Pasha, and Khan 2012). $\propto$ the price stickiness which is found to be 0.33 (Malik 2005) and wage stickiness ($\alpha^{\sim}$) is found to be 0.88 by (Malik,Satti and Saghir 2008). We set b as 0.5, χ, $\chi^{\sim}$, z was taken by the study of DSGE models (Ascari and Ropele , 2012). Some parameters like fixed cost, elasticity of substitution, intertemporal elasticity of money investment, investment adjustment cost parameter, and capital utilization cost function parameter we have estimated.

3.7 Parameters of the Model

Following Ascari and Ropele (2012) different variables have been used for calibration in Dynamic Stochastic General Equilibrium (DSGE) framework. Firstly the model follows Calvo style of wage and price contracts so we have used a parameter which shows the probability of wage and price contracts. Then the underlying model incorporates share of capital, time discount rate, and capital depreciation, degree of habit persistence and steady state value of technology shock. Utilization of capital plays a very important role to see the inertia in inflation and persistence in output. Because firms set prices as a markup style so firms' marginal cost depends on rent of capital. Due to positive monetary policy shock there is increases in rent of capital and prices so there is increase in persistence of output. Now we will discuss these parameters in detail one by one.

3.7.1 Wage and Price stickiness

Following Erceg, Handerson and Levin (2000) we assume the monopoly of labor services and define the labor demand and finally get the equilibrium wage. Households set

their wages according to behavior of firm's price setting. So each household has a specific probability to re-optimize the wages. In Pakistan wage stickiness has been measured and founded as 0.36.

3.7.2 Capital Utilization

As previously we have explained that capital utilization is important for inertia in inflation and persistence in output. The value of this parameter is taken from Ascari and Ropele (2012).

3.7.3 Time Discount Rate

In the utility function discount factor discount the consumption for future. In Pakistan, discount rate is calculated as 0.5 by taken from (see Ahmed, Haider and Iqbal, 2012).

3.7.4 Degree of Habit Persistence

Some economists analyzed that habit persistence is important for monetary policy transmission mechanism [Furher (2000), McCallum and Nelson (1998)]. After a positive monetary policy shock low interest rate will decrease consumption relative to future. The value of this parameter is taken from Ascari and Ropele (2012).

3.7.5 Capital Depreciation

Household assets involve investment of capital and capital depreciates at some specific level. We have taken δ as 0.15 taken from (Ahmad, Pasha and khan 2010)

3.7.6 Elasticity of Substitution

This is a measure of sensitivity of growth rate of consumption to real interest rate. If real interest rate increases, it may increase the future consumption.

3.7.7 Investment Adjustment Cost

Adjustment cost is important because when there is a positive monetary policy shock it will decrease the real interest rate so rate of return on capital falls. But presence of adjustment cost adjusts the return on capital.

Chapter 4

Results and Discussion

4.1 Introduction

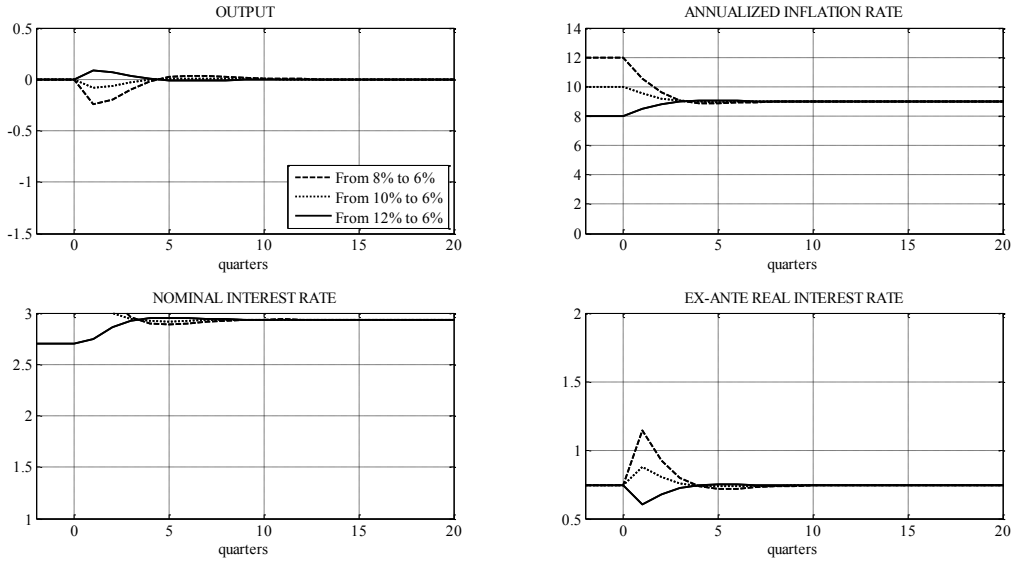
In the first section we have defined the empirical modeling and describe the results of calculated sacrifice ratio in the short run. A very important thing is missing in literature that was benefit ratio of low inflation. So we have found the benefit ratio in short run as well as in long run in terms of welfare ratio.

4. 2 Sacrifice Ratio

The economy is in steady state with positive inflation π and central bank reduce the inflation to π^*_{new}. So for the new inflation target we consider three cases π^*_{new} = {8%, 10%, 12%}. We have taken coefficient of inflation in Taylor rule by (Malik, 2010) as $\emptyset$ = 1.11.

Figure 1 describes the dynamic response of inflation, output, real and nominal interest rate after achieving the disinflation from 8% to 6% and assuming $\emptyset$ = 1.11. When central bank reduces the inflation from 8% to 6% we have calculated the sacrifice ratio as 3.99. Central bank, while reducing the inflation rate, increases the policy rate by adopting tight monetary policy. So interest rate will be high and it will affect positively on firms cost through cash in advance equation and ultimately real wages falls and households supply less labor which finally reduces the level of output. At the trough output falls by 0.14% for a disinflation from 8% to 6% while it falls by 0.27% during the disinflation from 10% to 6%. So we have found that disinflation creates output losses but how much it costs is yet to be determined. This figure also shows that not the qualitative dynamic adjustment and the time duration for inflation to reach the new steady state are affected by initial level of trend inflation.

Figure 1: Impulse Response Functions



To find the answer of this question we will use Gordan and King (1982) and define the sacrifice ratio as

$$\text{SR} = -\frac{1}{\pi^*_{old} - \pi^*_{new}} \sum_{t=0}^{\infty} \frac{Y_t - Y_{new}}{Y_{new}}$$

Where Y_{new} represents output in steady state and Y_t denotes output at different time periods. Similarly $\pi_{new}{}^*$ denotes steady state inflation rate. We have found the sacrifice ratio as cumulative output loss and consider the T time period.

In the Table 1 third column shows the percentage output drop which is the deviations from new steady state.

Table1: Cost of Disinflation in Short run and Output Trough in Percentage Deviation

$\pi^*{}_{old}$	$\pi^*{}_{new}$	Output trough	Sacrifice Ratio
8%	6%	0.14	3.99
10%	6%	0.27	1.99
12%	6%	0.40	1.33

4.3 Benefit Ratio

As we have calculated the sacrifice ratio by reducing 1% inflation leads to cumulative loss, similarly we can find the benefit ratio by increasing 1 % inflation and see how much gain in output can be achieved. We have found that when central bank increases inflation from 12% to 14% then the benefit ratio is 2.499.

CHAPTER 5

SUMMARY AND CONCLUSION

Although Sacrifice Ratio is a very important topic for research in Pakistan but unfortunately this topic has been neglected so far. We have estimated the sacrifice ratio using Dynamic Stochastic Generalized Equilibrium (DSGE) framework following Ascari & Ropele (2012) in which we have take values of different parameters from different research studies of Pakistan. Our main finding is that sacrifice ratio takes different values according to different inflation rates we have taken in this study. We have estimated the sacrifice ratio at 3.99 when inflation rate is reduced from 8 % to 6%; it is 1.99 when inflation is reduced from 10 % to 6 %; and finally sacrifice ratio is found 1.33 when inflation rate is reduced from 12 % to 6%.

As policymakers are more concerned about price stability but also has the mandate of real stabilization therefore this study recommends that State Bank of Pakistan to carefully conduct monetary policy to control inflation rate. As sacrifice ratio is high so SBP should consider output loss while increasing interest rate. The issue becomes especially important during stagflation as output loss due to tight monetary policy may render the economy in the prolonged recession.

The present study has focused on estimation of sacrifice ratio but even though it is not a perfect research but it has opened a room for further research for estimation of Sacrifice Ratio. Further research may do by inclusion of fiscal dominance that is what the sacrifice ratio is when there is fiscal dominance. Moreover, different econometric techniques can be used to estimate the Sacrifice Ratio.

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