

**MACROECONOMIC DYNAMICS AND FISCAL POLICY
OF INDIA- EVIDENCE FROM AN ASYMMETRIC
APPROACH**

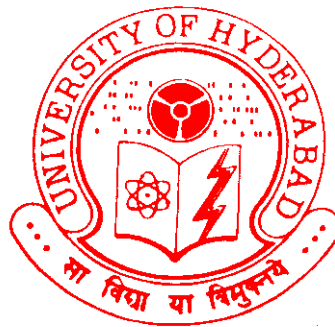
*A Thesis Submitted to the University of Hyderabad in Partial Fulfilment
of the Requirements for the Award of*

**DOCTOR OF PHILOSOPHY
IN
ECONOMICS**

By

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June 2019



DECLARATION

I, **Javed Ahmad Bhat**, hereby declare that the research embodied in the present thesis entitled, “**Macroeconomic Dynamics and Fiscal Policy of India- Evidence from an Asymmetric Approach**” submitted by me under the supervision of **Prof. Naresh Kumar Sharma** is a bonafide research work for the award of **Doctor of Philosophy in Economics** from the **University of Hyderabad**. I also declare to the best of my knowledge that it has not been submitted in part or full to this or any other university or institution for the award of any degree or diploma. I hereby declare that my thesis can be deposited in Shodganga/INFLIBNET.

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CHAPTER 1

1 Introduction and Background

1.1 Introduction:

Doing away with the *laissez-faire* type arrangement, economic science has initiated the application of the macroeconomic stabilization policies to avert any unfavourable outcome not conducive for normal discourse of the economy. De Vroey & Malgrange (2011) rightly asserted about the emergence of macroeconomics or for that matter policy intervention as, “*The offspring of the Great Depression, its overarching aim was to highlight market failures that could be remedied by state action. So, from the onset, it had a decidedly reformist flavour. Unemployment — and in particular involuntary unemployment — was its defining element*”.

Primarily the objective of policy intervention involves the lowering of risks or uncertainties associated with the economic decision making with a view to facilitate stable and growth enhancing economic environment. The distributional dimensions of the society, demanding the parities along many magnitudes, also comes within the purview of policy invention. The macroeconomic policy establishes an economic framework wherein the product and factor markets operate smoothly, leading to desirable outcomes. The economic decisions about the real magnitudes like how much to produce, how many workers to hire or fire, the level of consumption & saving by households, the investment decisions by the private sector and by the government in different sectors or in a more general open economy setting, composition, magnitude and direction of exports and imports are largely directed by the policy actions executed at the different times. Similarly, decisions regarding the nominal magnitudes like lending & borrowing, the interest rate structure, the money stock, the exchange rate stability and overall price level are also governed according to the policy directions.

To be precise, the economists have broadly designed and implemented two distinct macroeconomic policies like monetary and fiscal to direct the economic actions. The applicability of these policy options is decided by the various circumstances,

demanding different kind of treatments. These can be applied separately or in combination, depending upon the requirement. The monetary policy, conducted usually by a central bank or a currency board, either regulates the cost of borrowing (interest rates typically) and /or the money supply. The policy attempts to ensure a desired output growth and a stable price level coupled with the exchange rate stability and sufficient liquidity. By managing the money supply and cost of capital, it exerts its influence on the demand side components to smooth out the fluctuations largely ascribed to the aggregate demand effects & nominal rigidities. The policy actions are conducted by applying various instruments like the quantitative and qualitative controls. However, given its objectives, a trade-off between the output growth & and price stabilization is faced.

The fiscal policy, conducted by the government of an economy, on the other hand involves the adjustments in planned spending and the imposed tax rates to ensure the macroeconomic stabilization. The changes in the amount and composition of public spending and taxes are initiated to change the magnitudes like aggregate demand, level of savings & investment and the distribution of income in the desired directions. Like the monetary policy, fiscal policy also has the substantial potency to minimise the unfavourable ramifications of economic gyrations governed largely by the aggregate demand and nominal rigidities. In this policy framework, the trade-off is between output stabilization and distortions resulting from spending and tax changes.

1.2 Macroeconomic policy in the alternative periods:

1.2.1 The Great Depression and the Keynesian heydays:

The Great Depression of 1930s appeared as a shock to the then prevailing economic wisdom, pioneered by Classicals. Prior to the depressionary phase, the economic actions were conducted along the theoretical contours of Classical economists, who focussed on the supply side factors and the self-correcting mechanism. The notion of *wage price flexibility* and the conventional wisdom of Say's law of "*supply creates its own demand*" led this school to maintain that economy always remains at the full employment level. Any divergence from the potential or full employment level is corrected by the economy on its own through the market forces of demand & supply in both the factor and product markets. Therefore, no role is rendered for policy intervention. As noted Classical economist David Ricardo (1891) maintained that

“there could be temporary periods in which employment would fall below the natural level. But this emphasis was on the long-run and in the long-run all would be set right by the smooth functioning of the price system”. To the Classicals, the economic downturns of *“late 1920s and early 1930s”* were only a temporary anomaly and the economy was believed to self-correct the divergence.

However, contrary to the conventional belief, the downturn episodes resulted in undesirable economic outcomes. The output growth, the real per-capita disposable incomes, the unemployment rates, the business profitability etc. all moved in the deleterious directions and the welfare situation of masses plunged drastically. Disregarding the self-correcting notion of Classical orthodoxy, the Great Depression, however, lasted for quite a substantial period (up to late 1930s). Owing to its catastrophic severity and prolonged existence, it was given a much stronger name than a simple “recession”.

The British economist, John Maynard Keynes recognized that unlike the “temporary effects” of Ricardo or at large Classicals, the Great Depression could last long with substantial negative repercussions. As a possible solution, Keynes (1936) developed an alternative macroeconomic framework in his *“The General Theory of Employment, Interest and Money”*. He shifted the stance of macroeconomic thinking from aggregate supply management, as advocated by the Classical doctrine, to the notion of aggregate demand management. Disregarding the self-correcting tendency of an economy from any aberration, Keynes maintained that the economic down and upturns could be managed or corrected by the adjustments in the aggregate demand. In addition, in response to perfect *wage price flexibility*, Keynes asserted that the prices are quite sticky in the short-run and the existence of this stickiness prevent the instantaneous adjustments towards potential output level. Moreover, the notion of long-run full employment has been dismissed by the Keynes, because according to him *“in the long-run, we all are dead”*.

The understanding of the Great Depression of 1930s provide a clear conformity with the Keynes’s argument, and that the reduction of aggregate demand due to many contributing factors like the collapse in private investments, plummeted business & consumer confidence, magnified volatilities, declining trade volumes and

corresponding export earnings, lead to the economic downturn¹. Thus, with recovery prevented from the supply side and no policy applied to uplift the plunged aggregate demand, the economic discourse continued to be in a recessionary period for a prolonged gap. Recognizing the importance of demand side in his theoretical paradigm, Keynes and the subsequent followers therefore, recommended the application of fiscal and monetary policies to eliminate the recessionary or inflationary gaps². The application of an easy policy action in the terms of public spending hikes has been advocated by the Keynes as the potent policy tool to avoid the depressionary phase through boosting of aggregate demand.

Though, the Keynes theoretical discourse gained widespread popularity among the economists, however, the application of a fiscal expansion as a feasible policy option to manipulate the macroeconomic dynamics received a slower acceptance. After the World War II to 1960, the acceptance of fiscal policy as a stabilization tool was grim, but the following two decades i.e. 1960 and 1970 marked a substantial popularity in western industrialized countries. The expansionary fiscal policies were also complemented with the easy monetary policy actions. Governments actively attempted to base their policy actions according to Keynesian orthodoxy and in the early period of social liberalism and social democracy, large number of capitalist countries reported low unemployment rates coupled with stable and modest inflation; an era popularity known as the *Golden Age of Capitalism*.

1.2.2 The challenge of 1970s Stagflation:

The use of Keynesian monetary and fiscal policies during 1960s appeared to have performed well, however, during 1970s the effectiveness of policy actions was not satisfactory. The experience of 1970s period shook the confidence in the Keynesian policy options. The continued use of these policies led to a series of drastic macroeconomic instabilities in the form of exacerbated inflation together with high

¹ Although, the aggregate supply curve in short-run shifted to the right due to falling wages, however, its magnitude corresponding to declining aggregate demand was not enough to return the economy back towards the potential output level. In addition, blocking of additional downward movements of the prices and wages, assumed to be the contributing factors of depression by the government, stopped the further shifts in aggregate supply.

² However, Keynes doubted the application of monetary stimulus to avert the depressionary situations due to the perfect liquidity preference or what is formally known as liquidity trap wherein to quote John Hicks (1983), “monetary means will not bring down the rate of interest any further”.

unemployment, popularly what has been termed in the literature as the period of *stagflation*. Primarily, it started with the oil price shocks and then the application of excessive stimulative policy stances to counteract the ensued recession due to higher oil prices resulted in *wage-price spiral*³ and the corresponding *stagflation*.

Owing to increased scepticism about the Keynesian theories, economic fraternity, including the Keynesians themselves, devoted their time to seek the explanation for the economic situation prevailed during 1970s. The economists like Milton Friedman (1968) & Edmund Phelps (1967, 1968) advocated the reasoning that the *inflation-unemployment trade-off* or the *Philips curve*, assumed to be stable and mutually exclusive in the Keynesian paradigm, actually exist in the short-run only and that in the long-run no such trade-off is observed due to the non-existence of a perception mismatch between workers and firms like noticed in the short-run. Thus, the *Philips curve* is believed to shift up resulting in higher inflation with unemployment remaining unchanged at the level, to which Friedman refers to as “*Natural rate of unemployment*”. This idea represented a severe attack on Keynesian active stabilization theories. The period of *stagflation* lasted from 1973 to 1982 in seven major economies of the world. To provide a remedy, interest rates were sharply increased from 1979 to 1983 in what has been called as a *disinflationary scenario*. The higher interest rates led to lower inflation, controlling thus the inflation side of stagflation, albeit with a recession⁴. Once the prices started falling, the focal point of economists shifted from pointing out the causes of *stagflation* to factors contributing to increased productivity and the sensitivity of labour demand to real wages.

1.2.3 The Monetarist perspective:

The Keynesian framework also came under the attack of Monetarists, led by Milton Friedman, during 1970s owing to the close association between the money supply and nominal GDP. They maintain that the existence of lags in the stabilization policies like

³ In the case of “wage-price spiral, wages chase prices and prices chase wages” (Blanchard, 1986). It represents a vicious circle wherein wage hikes are followed by price hikes and price hike in turn lead to wage hikes, possibly with no answer to which comes first. It starts either when a higher aggregate demand is coupled with a near full employment or when any supply shock occurs like a hike in oil prices. The result is only a higher price level coupled with higher unemployment.

⁴ Within five to six years of jump of unemployment to its natural rate, it is believed that the policy makers trusted the unemployment to self-adjust and return to the natural rate level within a reasonable time span and hence inflation was prioritised to be addressed through interest rate hikes.

monetary and fiscal are so prolonged and uncertain that any attempt to stabilize the economy may actually turn out to be destabilizing. In addition, according to them consumption expenditure of private sector depends on the permanent income and not on the current income. Likewise, the increase in deficit would raise the interest rates and thereby crowd out the private investment. In the end, the economy always tend towards “*natural rate of unemployment*”, albeit with an accumulated debt (Friedman 1968). Thus, rendering no scope for fiscal policy in affecting output growth. Monetary policy, according to them, does, but they do not favour its application in the discretionary sense⁵. Rather, Monetarists recommended the application of strict monetary policy rules; enabling the monetary authority to enhance the quantity of money at a certain fixed annual rate, importantly, the rate consistent with the growth of potential output. The purpose must be to control the inflation and not impact the real interest rates. Though, it succeeded to lower the inflationary pressures but at the cost of less employment and recession in developed countries and alarming debt crisis in the developing world. The observations contrary to the Monetarist projections like an unreliable short and medium term relationship between price level & quantity of money and the falling velocity of circulation proved detrimental to the Monetarists during the late 1980s.

1.2.4 The Rational Expectations revolution and the New Classical Economics:

While the Friedman shared some qualms of the Keynesian conceptual paradigm, his anti-Keynesian dissensus was primarily focused at the policy actions. However, a new macroeconomic school, led a severe blow to the Keynesian economics along both the conceptual and policy apparatus, i.e. the “*lack of micro foundations and irrational behaviour*” and the famous “*Lucas Critique*” (Lucas, 1976, 1977). It was led by Robert Lucas and has popularly been called as the “*New Classical Economics*”. The prime difficulty faced by the policy makers during the dramatic period of 1970s was basically linked to the shifts in aggregate supply. The Keynesian and the Monetarists advocated the demand management strategies, however, *status quo* of macroeconomic puzzle

⁵ According to them, the self-correction of economy will be more plausible to take care of economic up's and down's, as observed in the short-run, than the activist monetary policy. For that matter, Friedman (1968) maintained that, “Managing the money supply is not a task that should be left to the discretion of the central bank authorities, and even less to that of Ministers of Finance. On the contrary, they should function under strict monetary rules”.

warranted an incorporation of supply side. The New Classicals recognized its importance and hence, advocated their theoretical discourse accordingly. For them, the economy will usually be at or around the “*Natural rate level of output*” and any changes in the economic activity are not due to the aggregate demand gyrations but rather due to the long-run aggregate supply curve shifts. The increased unemployment coupled with inflationary gaps observed during 1970s were not problematic for the New Classicals. Instead, these were considered shifts in the economy’s own potential output.

Advocating his supply function and disregarding the earlier stances of labour supply being passive and employment decisions being unilaterally taken by the firms (like in Keynesians), Lucas & Rapping (1969) maintain “*changes in the supply of labour, viewed as a result of optimising behaviour in decision-making, play a central role in explaining fluctuations*”. This inter-temporal substitution process by the labour suppliers acts primarily to decide about the gyrations in economic activity over the course of time. On this contention, Lucas (1972) developed a business cycle model, wherein the exogenous monetary shocks (unanticipated) & imperfect information on part of economic agents determine the fluctuations in economic activity. However, later Kydland & Prescott (1982) & Long & Plosser (1983), extended the Lucas’s neo-Walrasian business cycle model to explain the business cycle fluctuations and the developed models have been referred to as “*Real Business Cycle*” (RBC) models. Though the features like rational expectations, a dynamic stochastic environment and inter-temporal substitution is present in both the earlier and newer versions of business cycle theory, however, unlike the imperfect information & monetary surprise shocks as proposed by Lucas, the new theorists attempted to advocate the real technology shocks as the principal factor behind the business cycle fluctuations. In addition, instead of being qualitative, the RBC models are quantitative⁶.

The reporting of observations contrary to the Keynesian projections of fiscal policy effects like in case of Japan and Euro area and the occurrence of “*expansionary fiscal*

⁶ “The real business cycle literature offered a new methodology, both for theoretical analysis and for empirical testing. ... It showed how such models [of the Lucas type] could be made quantitative, emphasising the assignment of realistic numerical parameter values and the computation of numerical solutions to the equations of the model, rather than being content with merely qualitative conclusions derived from more general assumptions”, Woodford (1999). It may, further, be noted that the later versions of RBC models incorporate the other shocks like the government consumption expenditure shocks as well to explain the business fluctuations (Woodford, 2011).

contraction or contractionary fiscal expansion” during the fiscal austerity drives of Denmark and Ireland during 1980s (Giavazzi and Pagano 1995) mandated to provide the strong micro-foundations to standard models. Unlike the Keynesian economics dealing with the aggregate analysis and the Monetarists based on the individual optimizing behaviour with regard to money demand only, the New Classical approach involved an individual investigation of the choices of economic agents related to the diverse range of economic transactions. The transition from the *orthodox Keynesianism* to the *New Classical Economics* has sometimes been referred as a “*Kuhnian Scientific revolution*”⁷. Similar to conventional Classics, this schools focussed on the long-run aggregate supply curve determination and the ability of an economy to reach to this potential output level quickly. However, what contrasts latter from the former was inclusion of sophisticated mathematical models of optimizing behaviour applied to generalize the individual behaviour to aggregate results.

From the doctrine of *rational expectation hypothesis*, the twin assertions of “*agent optimization and market clearance*” has led New Classics to advocate the notion of “*total policy ineffectiveness*” and the absence of “*inflation-unemployment trade-off*” even in the short-run (Lucas and Rapping, 1969; Lucas, 1972; Sargent and Lucas, 1979). Therefore, the scope for active stabilization policies like monetary and fiscal is wiped out⁸. However, except in case the monetary policy actions surprise the economic agents, by using an *over-expansionary or over-contractionary policy than anticipated*, would there be an effect on output⁹. Against the fiscal policy, the stand of New Classics is even more drastic. According to Ricardian Equivalence Hypothesis (REH), with the virtue of rational expectations and complete foresight, rational

⁷ “This expression refers to an episode in the history of a discipline where a period of normal development is disturbed because of the persistence of unsolved puzzles which trigger a drive to change the agenda, the conceptual toolbox and the research methods in radical ways. This is often accompanied by thundering declarations of war (e.g. Keynesian theory is dead), a confrontation between younger and older generations of researchers, the rise of new stars in the profession, and the eclipse of the previous stars”, De Vroey & Malgrange (2011).

⁸ In the New Classical design, business cycles portray the responses of rational optimising agents to the exogenous shocks and that, unlike Keynesians, changes in economic activity are not attributed to market failures. Hence, no role for government exists to avert their occurrence, nor is there any reasoning to act upon them.

⁹ However, Friedman (1968) claims that the rational economic agents cannot be deceived on a continued basis. In addition, on the basis of rational expectation hypothesis, the Kydland & Prescott’s (1977) *credibility argument* against the *intertemporal inconsistency* issue again added against the recurring deception of economic agents & therefore, a substantial narrowing of government discretion.

economic agents will render the fiscal policy actions totally ineffective (Barro, 1974; 1989).

1.2.5 The New Keynesian Economics and the Great Moderation:

During 1980s and 1990s, economists who supported the Keynes arguments developed a new school of thought to counteract the Lucas's or New Classical attack on the Keynesianism. These economists basically attempted to provide micro-foundations to the traditional Keynesian economics in order to explain the macroeconomic phenomenon. Similar to the New Classicals, these also assume the optimising behaviour of economic agents through the rational expectations. However, unlike the perfect competition assumption of former, the new school assume the market imperfections in the price and wage setting in order to explain the price and wage stickiness. Basically, the micro-foundations were aimed to explain the existence of wage and price rigidities which lead to the market imperfections and hence, the *non-clearance* of the markets. During this period, several models supporting the basic Keynesian tenets with certain valid arguments like micro-foundations & rational expectations of New Classicals appear in the form of "*New Keynesian Economics*". These include, "*implicit contract models* (Baily, 1974; Gordon, 1974; Azariadis, 1975); *staggered wage-setting models* (Fisher, 1977; Phelps & Taylor, 1977; Taylor, 1979); *search and coordination failure models* (Diamond, 1982); *imperfect competition models* (Hart, 1982); *staggered contracts model* (Calvo 1983); *efficiency wage models* (Salop, 1979; Shapiro & Stiglitz, 1984); *menu costs and near rationality models* (Mankiw, 1985; Akerlof & Yellen 1985a, 1985b; Blanchard & Kiyotaki, 1987) and *Coordination Failures* (Roberts, 1987; Cooper & John, 1988)". All these models tried to amend, if not to completely overthrow the New Classical assertions and thereby to revive the Keynes mitigated view of market system. The wage & price stickiness coupled with the other market failures existing in the New Keynesian models implied the failure of markets to clear and hence to achieve the full employment. Along these lines, this school advocated the application of macroeconomic stabilization policies like monetary and fiscal for a more efficient economic arrangement. It may further be noted that these economists adopted the relevance of monetary policy of Monetarists in the short-run and aggregate supply of New Classicals in both the short and long run.

During 1990s, New Keynesians and the RBC theorists agreed to end their methodological disagreements and developed the so called "*New Neoclassical*

Synthesis” (Goodfriend and King 1997). Basically, RBC models were dynamic and assume the perfect competition in product and factor markets, whereas the New Keynesians were static and developed on the assumption of imperfect competition. The contribution of two competing schools to the New Neoclassical wedding include “*imperfect competition and sluggishness together with a role of central bank*” from the Keynesians and “*exogenous shocks, the dynamic stochastic perspective, the equilibrium discipline, inter-temporal substitution and rational expectations*” from RBC theorists. To quote Goodfried & King (1997), “*the New Neoclassical synthesis is characterised by features like inter-temporal optimization, rational expectations, imperfect competition and costly price adjustment (menu costs)*”. As related to the policy relevance, although, a role for monetary policy to stabilize the short-run economic fluctuations been advocated, however, the impact of the policy actions is believed to be neutral in the long-run. Similarly, inflation was considered to be deleterious for welfare and hence a check to minimise it from excessive and abrupt swings is recommended through the rule based stabilization policies as opposed to the discretionary stances. To ensure the credibility of the central bank, Taylor (1993) together with Rotemberg & Woodford (1997) & Woodford (1999, 2011) advocated the much celebrated “*Taylor rule*”¹⁰ which illustrates the responsiveness of nominal interest rates to the variations in output-gap, inflation-gap and other economic conditions. The policy implication perspective also led to the development of what has been termed as “*New Keynesian Philips curve*” (Roberts 1995) parallel to Friedman’s short-run “*expectations augmented Philips curve*”, portraying a short-run inflation unemployment trade-off only.

Disregarding the static versions of earlier New Keynesian models and adopting a dynamic stochastic perspective coupled with the developments of 1990s, like “*New Keynesian Philips curve, Taylor rule, dynamic IS curve (derived from optimal dynamic consumption function or Euler equation)*” by Clarida et al. (1999); early 2000s, like “*imperfectly competitive labour markets*” by Erceg et al. (2000); “*habit formation in*

¹⁰ A shift has taken place from money supply (considered as a control variable for monetary policy actions during the Friedman’s period) to the rate of interest which the central bank can vary to ensure macroeconomic stabilization.

preferences for consumers, adjustment investment costs, variable capital utilization and the need for firms to borrow working capital in order to finance the wage bill” by Christiano et al. (2005) and recently like, “*introduction of demand shocks, mark-up shocks and Bayesian estimation procedures*” by Smets & Wouters (2003, 2007) have led to a recent revolution in macroeconomic methodology in the form of “*New Keynesian Dynamic Stochastic General Equilibrium (NK-DSGE) models*”. Basically, these models aim at to improve along the criticisms developed against the traditional Tinbergen’s (1939) & Klein (1950) type econometric models devised to undertake the policy evaluation exercise through the simulations. The NK-DSGE models were applied on a large scale to investigate the monetary policy effectiveness under the alternative economic scenarios.

It may be noted that the period from mid-1980s until the 2007-09 global financial crisis has been characterised by the lowering volatilities of major economic variables like output growth, industrial production, inflation & unemployment rate especially in developed countries. Owing to this marked stability, this period has been referred as the “*period of Great Moderation*”. The central bank independence, rule based policy actions, improvements in information technology & economic structure, enhanced flexibility in employment choices & working practices and the good luck has been considered to be factors contributing to such a moderation.

Rule based monetary policy has been primarily advocated as an active stabilization tool and the economists were the strict opponents of fiscal deficit during this period. More specifically, they believed that the mounting fiscal deficit was the result of an overly expansionary fiscal policy consisting of large tax cuts and increased defence spending. The mix of a contractionary monetary policy and an easy fiscal policy exercised during the concluding two decades of twenty century has contributed to the deleterious effects on the composition of output in many ways. Keynesians maintained that such a policy mix would lead to interest rate hikes and may lead to the displacement of private capital formation at the expense of consumption. In addition, the higher interest rates would appreciate the value of domestic currency through enhanced capital inflows and an imbalance in the external account would be observed due to more imports and less exports. Therefore, to augment the capital base and ensure increased exports for a higher and sustainable growth traverse, the Keynesians supported a mixture of contractionary fiscal policy and an easy monetary policy during this tenure.

Although, the term of *Great Moderation* was coined by Stock & Watson (2002), however, according to Quiggin J. (2009, 2011) and Clarida R. H. (2012) the period lasts up to late 2000s only (1987-2007) owing to the outbreak of economic and financial crisis in 2007¹¹.

1.2.6 The Global Financial Crisis (GFC) and Keynesian Resurgence:

Though, the academicians and the policy planners have started casting their doubts about the free market policies advocated during the Great Moderation owing to 1997 “*Asian Financial crisis*” and the 2000 “*dot-com bubble*”. However, till the onset of “*Great Recession or Global Financial Crisis*” during 2007-09, only a partial shift towards the Keynesian policy intervention took place across the world.

The Global Recession of 2007-09 marked a setback to the much celebrated doctrine of macroeconomics discourse popular since 1970s i.e. the convergence between the New Keynesians and the RBC theorists; symbolised into the development of DSGE modelling. The crisis offered substantial evidence against the “*Efficient market Hypothesis*” and other models of academic macroeconomics together with the policy proposals like the “*trickle-down hypothesis*”, “*business cycle taming*” as claimed by Lucas (2003) and the case for an appreciable “*privatised economic arrangement*” (Quiggin J., 2011). The key concerns evident from the crisis pertain to the disregarding of financial sector in the modelling apparatus prevalent in the pre-crisis period and the exclusion of any possibility of failure of free market operations (De Vroey & Malgrange, 2011)¹².

The irrational and non-optimising reaction of economic agents to the fiscal & monetary policy actions during 1980s casted doubts about the efficacy of rational expectation hypothesis and the Ricardian Equivalence hypothesis, both of which advocated the policy neutrality. However, the severity of crisis during the 2008 period tempted the

¹¹ However, Clarke T. E. (2009) and Coibion & Gorodnichenko (2010) advocated that volatility has returned back to the pre-crisis level and therefore, the episode of 2007 would only be considered a temporary deviation rather than a permanent end to the Great Moderation. Actually, the causes of sudden volatility episodes were reported to be oil price and financial market shocks (bad luck) considered largely to be temporary in contrast to the structural changes usually regarded as permanent.

¹² The situation appeared analogous to the time of Keynes during 1930s depression. “The existing models of the time convey a Panglossian view (all is for the best in this best of all possible worlds) of the working of economy as they rule out the possibility that markets can fail and that agents may find themselves in a state where they are unable to achieve their optimising plans” (De Vroey & Malgrange, 2011).

New Keynesians to re-examine the efficacy of the fiscal policy and intensify their debates with the New Classicals to disregard their “*total policy ineffectiveness*” proposition. Following the GFC, the fraternity of economics started searching for a possible way out across the globe and a unanimity about the Keynesian deficit financing together with controlling trade imbalances & capital controls led to the development of new economic consensus. This basically paved the way for Keynesian resurgence and reassessment of discretionary fiscal policy actions due to:

- The limited simulative capacity of temporary tax rebates introduced from a supply side economics point of view. The increased income proportions were reported to be largely saved rather than consumed.
- Inadequacy of expansionary monetary policy due to “*zero lower bound*” problem and the execution of unorthodox policy stances and untested instruments.
- The relatively voluminous recession observed in the recent past.

The Keynesian fiscal stimulus idea received an overwhelmed response as a panacea to overturn the economic malaise of GFC of 2007-09. The prominent policy planners and government representatives of the time like the Dominique Strauss Kahn, Gordon Brown, Robert Shiller, James Galbriath, Robert Zoellick, Donald Markwell, Alistair Darling, Barack Obama and Paul Volcker among others in the western world endorsed the Keynesian advocacy of a coordinated fiscal and monetary policy response to combat the crisis together with the coordination of international economic institutions like IMF and WB. Simultaneously, the staunch supporters of free-market capitalism like Martin Wolf & Josef Ackermann declared the end of the desire of “*global free market capitalism*”. The application of stimulus packages was not limited to the Europe & America only, but rather the Asian economies also followed the suit¹³.

Concerning the efficacy of the fiscal stimulus, Anatole Kaletsky (2011) documented the evidence of growth revival and business & consumer confidence in one country after another. Celebrating the Keynesian renaissance, noted economist of the time Paul Krugman (2009) maintained that, “*So it seems that we aren’t going to have a second Great Depression after all. What saved us? The answer, basically, is Big Government*”. Similarly, the then IMF managing director, Dominique Strauss Kahn lauded repeatedly

¹³ Although, the size of stimulus packages was not same across countries, however, the fiscal expansion was observed more or less all over the world.

the robust global policy response to avoid the deleterious repercussions of meltdown and the attempts on part of OECD leaders to avoid termination of the monetary and fiscal expansions too early. Likewise, Mark Zandl and Alan Blinder maintained that the severity and consequences of recession would have been even worse, had the fiscal stimulus packages not resorted. In his book, *“Keynes: The return of the Master”*, Skidelsky (2009) attributed the robust performance of world economy during what he refers to as *“Golden Age”* period of 1951-73 as compared to the *“Washington Consensus”* period of 1981-2008 to the Keynesian active policy intervention. While discussing the experience of U.S. during the depression, the noted post-Keynesian economist Davidson (2009) highlighted the importance of Keynesian policy as a strong policy tool to ensure full employment, prosperity of entire labour force and the price stability in *“The Keynes Solution-the path to global economic prosperity”*.

Academically, a marked shift towards the Keynesian economics took place during 2008, with the economists like Paul Krugman, James Galbraith, Brad Delong, Richard Posner, Martin Feldstein, and Lord Skidelsky were strong supporters of the Keynesian doctrine. In fact, Posner (2009) lamented against the laissez-faire capitalism and its ideas in *“A Failure of Capitalism- The crisis of 08 and the descent into depression”*. However, questioning the magnitude of U.S. stimulus package, George Akerlof & Robert Shiller (2010) in *“Animal Spirits-How human psychology drives the economy, and why it matters for global capitalism”*, argued that it did not account of the confidence lacking or the credit availability. In 2009, Paul Krugman warned economists about the fallacies of neoclassical school and instead recommended the employment of Keynesian ideology. To quote him,

“So here’s what I think economists have to do. First, they have to face up to the inconvenient reality that financial markets fall far short of perfection, that they are subject to extraordinary delusions and the madness of crowds. Second, they have to admit — and this will be very hard for the people who giggled and whispered over Keynes — that Keynesian economics remains the best framework we have for making sense of recessions and depressions. Third, they’ll have to do their best to incorporate the realities of finance into macroeconomics”.

However, some others, like, Sebastian Dullien, Robert Barro, Eugene Fama and Stefan Humborg were criticising the Keynesian policy renewal. By around mid-2010, although, the Keynes ideas were flourishing continuously within the academic arena,

however, the renewed unanimity within the economics profession had started weakening and the revival in the Keynesian policy course stalled to some extent. According to Quiggen (2011), *“the Keynesian lessons were only half learned. As soon as the immediate crisis was past, there was a resurgence of anti-Keynesian and to a large extent pre-Keynesian thinking”*.

1.2.7 Crisis Aftermath & The contemporary debate:

While there was a broad unanimity among the international leaders and policy planners about the coordinated fiscal stimuli response in the immediate period of the crisis, however, by the mid-2010, the established consensus turned into “dissensus”, Farrell & Quiggen (2017). The reversal to the free market economics was not explicitly advocated, however, the unity about the Keynesian revival started receiving the rebuttal.

Scholars like, Robert Barro, Jeffery Sachs, Peer Steinbrück, George Osborne, Edward Prescott, Eugene Fama among others challenged the Keynesian revival and were in favour of fiscal consolidation strategy¹⁴. Critics regarded the Keynesian fiscal policy intervention as counter-productive or deleterious due to the potency of deficit or excessive discretionary spending to lead to inflationary pressures, increasing income disparities, external imbalances, private sector physical or financial displacements etc. These instead recommended lower tax rates coupled with the reduced government spending levels to stimulate the growth dynamics (2009 Petition submitted¹⁵). In addition, Luigi Zingales and Thomas Woods went on to mention that instead of free market policy framework, the crisis of 2008 was a result of remnants of Keynesian policy due to its inherent deficiencies in the form of corruption hiding & political patronage. Following the “Greek debt crisis” an increasing uproar in favour of fiscal austerity was launched especially in the Europe¹⁶, with G20 leaders appreciating the

¹⁴ British Chancellor, George Osborne during late 2008 maintained that, “even a modest dose of Keynesian spending could act as a Cruise missile aimed at the heart of recovery”. Even Edward Prescott, Jeffery Sachs and Eugene Fama disregarded any favourable impact of fiscal stimulus package and these instead regarded it only an anti-growth strategy.

¹⁵ https://www.webcitation.org/5k5PAndsn?url=http://www.cato.org/special/stimulus09/alternate_version.html.

¹⁶ During July 2010, Jean-Claude Trichet, the then leading policy maker and president of the European Central Bank stated that, “it is time for all industrial nations to stop stimulating and start tightening, for a strong, sustainable and balanced growth”.

trends of fiscal consolidation. Even pleading for the continuous stimulus doses to ensure a robust economic revival during 2008-09, the then IMF managing director Dominique Strauss-Kahn marked his satisfaction with the consolidation efforts. The political entities like the U.S. Congress, the British Prime Minister-David Cameron, the Chinese leaders like, Xi Jinping & Li Keqiang and the German Chancellor-Angela Merkel during 2011 and 2012 were less willing to take on the fiscal stimulus strategy pioneered by Keynesian orthodoxy. Likewise, during 2012, Philip Stephens maintained that markets have again started taking dominance on economic policy making and that due to the mounting debt burden, public confidence in the government has lost in both the Europe and the U.S.

However, fiscal austerity program executed in many countries of Europe pushed the economies into more severe recessions, an observation quite contrary to what has been observed during 1980s. No general recovery and satisfactory performance has been reported in any of the countries like U.S. or U.K., where the consolidation strategy has been incorporated even without facing any immediate budgetary crisis. Murphy R. (2011) in *“The Courageous State- rethinking economics, society and the role of government”*, argued for the Keynesian revival again due to his consideration of being the best policy discourse to guide the economic decision making for higher welfare levels. Admitting the fracturing of Keynesian revival, Paul Krugman (2012) again went on to argue optimistically for a lasting shift towards the Keynesianism by propagating the substantial and continued application of fiscal stimulus program in his book, *“End This Depression Now!”*. Similarly, the occurrence of Euro Crisis and the prevalence of high unemployment in the Japan & U.S. again warranted the requirement of stimulus policies to ensure a sustainable recovery with low unemployment malaise.

To criticise the austerity program adopted by the U.S. prior to 2013, Wolfgang Munchau considered it as a repeated mistake like those practised by Europeans in the immediate aftermath of the crisis. Recently, in an IMF study by Ostry et al. (2016), it has been pointed out that the very foundations of neoliberalism like austerity and capital account liberalization may actually turn out to be growth retarding due to their associated increasing social costs like inequality. To combat the problem of inequality,

<https://web.archive.org/web/20100725170608/http://www.ft.com/cms/s/0/1b3ae97e-95c6-11df-b5ad-00144feab49a.html>.

needed for a sustained growth dynamics, the authors have recommended the application of distribution policies like the taxes and public spending. Likewise, in 2019 itself, IMF managing director Christine Lagarde too recommended the intervention of government policies in order to avoid, what she refers to as “*global growth storm*” which may take place due to the dangerous clouds like, “*escalating trade tensions, financial tightening, Brexit uncertainty, oil price gyrations and contagion impact due to Chinese slowdown*”¹⁷. The Modern Monetary Theory (MMT) debate and the inability of monetary policy due to interest rates being at the ebb also add to the contemporary relevance of fiscal policy.

Thus, conflicting views were advocated about whether an active government stabilization/stimulus policy is needed or not. While neoliberals, consistently advocate the reasoning to support their free market policies, the Keynesians also do not left any stone unturned to propagate the incorporation of active stabilization policies for an equitable and growth oriented economic arrangement. However, the issue of deficit as being either “the devil at the door” or “termites in the basement” still struggles with lack of unanimity. Despite its renaissance, the concerns about swelling deficit figures and/or excessive government expenditures and the recessionary tendencies of austerity drive have raised the concerns about the relevance of fiscal policy in the contemporary times.

While the theoretical and empirical work in the field of fiscal policy has reached a well-established and advanced stage, however, no unanimity is reported. The dynamism in the economic discourse together with the external shocks or internal disturbances often warrant an examination beyond the conventional wisdom. The multitude of empirical observations not in accordance with the well-established theories makes it imperative to search for alternatives that would explain the contrary observations and thus, provide a suitable basis to devise the policy actions appropriately. After reviewing the relevant literature, we notice that on the whole, the empirical analysis about the fiscal policy effectiveness, particularly in the Indian context, has largely been conducted in the symmetric/linear frameworks and that the possibilities of asymmetric linkages have not been explored. Further, the existing empirical evidence as related to the effectiveness

¹⁷ “When there are too many clouds, it takes one lightning (bolt) to start the storm,” she said.

<https://www.financialexpress.com/economy/imf-warns-of-global-economic-storm-as-growth-undershoots/1483389/>.

of fiscal policy in case of India is not comprehensive and lacks the unanimity. To fill this gap, the study attempts to investigate the effectiveness of fiscal policy in an asymmetric framework in case of a dynamic & increasingly open economy, namely India. A comprehensive examination of various issues would be imperative for a robust understanding and effectiveness of fiscal policy.

1.3 Fiscal policy in India- A summary

The behavior of fiscal policy has varied over the time. From a conservative policy featured with higher taxes and lower deficit, its nature got changed in 1980s with reduced taxes and increased fiscal deficit. However, the 1991 balance of payment crisis necessitated for a reduction in deficit but these continued to increase in following periods. The relative proportion of financing the budget deficit has increased through market and external borrowings and monetized deficit has reduced considerably (Goyal 2004). By 2003 “*Fiscal Responsibility and Budget management act (FRBM)*” was introduced for *fiscal discipline* & strengthening the *fiscal prudence*. However, due to the financial crisis of 2007-09, fiscal policy responded with tax cuts and increased deficit in order to counteract the recessionary tendencies (De. S, 2017). Even the recent move towards “*Demonetization*” in November 2016 and introduction of “*Goods and Services tax*” (GST) from July 2017, Indian economy has struggled in terms of a fall in consumer demand and unfavorable growth figures. For the purpose of economic revival government has again started to increase the fiscal deficit by suspending the FRBM targets¹⁸.

1.4 Objectives of the Study:

- *To examine the impact of government spending and tax changes on output growth, private consumption and private investment.*
- *To study the impact of fiscal deficit on inflation.*
- *To investigate the effect of fiscal deficit on short-term and long-term interest rates.*
- *To examine the impact of fiscal deficit on current account balance.*

¹⁸<http://www.thehindu.com/business/N.K.-Singh-panel-submits-report-on-FRBM-Act/article17083134.ece>.

1.5 Scope & Relevance of the study:

In the science of economics, there is substantial evidence of the prevalence of asymmetric responses. The asymmetries take several forms such as of *information and addiction asymmetries* with respect to a dynamic demand curve movements, the downward wage and price inflexibility, the Ratchet effect, the investment irreversibility, the *steepness asymmetry* when business cycle contractions are steeper than expansions, the *depth asymmetry* when troughs are deeper than the height of peaks and asymmetries with respect to *hiring and firing* of workers. Even the reaction of various macroeconomic variables to the monetary and fiscal policy changes has also reported to be asymmetric for a multitude of reasons (Scitovsky T. 1978; Sichel D. 1993; Van N & Veldkamp L. 2006). Although, such asymmetries were noted even earlier by scholars such as Keynes (1936); Kaldor (1940); Burns & Mitchell (1946); Hicks (1950), however, the empirical examinations have started lately only.

At the elementary level, the asymmetry¹⁹ is observed in case of simple demand curve in its dynamic interpretation, wherein the whole market responds to a price rise and only a part of it responds to a price reduction, unless the seller advertises about the price decrease. The seller faces an *informational asymmetry* which leads to a kinked demand curve, flatter to the left than to its right. The existence of this asymmetry has been disregarded, may be, due to the presence of a contrary asymmetry i.e. the *addiction asymmetry*. This asymmetry implies that the tendency of people to acquire habits about certain economic entities made them to consume more easily than to abandon them- i.e. the consumption downward rigidity. The evidence from the economic statistics and the psychological experiments convey the near universality of addiction asymmetry. The two asymmetries are mutually conflicting and when taken together, the demand curve would turn out to be steeper than the static one both upward and downward. If, however, the informational asymmetry is eliminated by the seller through the information dissemination about the price decreases, only the addiction asymmetry would be present which leads to a downward pointing kink in the demand curve and discontinuity in the marginal revenue curve at the point of kink.

¹⁹ For a detailed discussion about the various types of asymmetries observed in the economics, refer to Scitovsky T. 1978; Sichel D. 1993; Van N & Veldkamp L. 2006.

Likewise, the asymmetry is observed in case wages are increased or decreased. Labour's bargaining power provides an illustration of why the wages are flexible upwards only or why wages rises are allowed and cuts are rebuffed. However, such wage down-ward inflexibility could also be present in case there is no clear bargaining dominance with either employers or employees, provided a consensus about the wage negotiation is reached through a reasoned discussion. Similarly, in order to cater the increased demand, firms choose to rely on over-time work by existing workers, instead of hiring the additional workforce from the labour market. The increased costs of hiring and firing the workers outweigh the costs associated with the overtime labour; therefore an asymmetry is resulted wherein following a short-run demand hike, employment remains more or less unchanged. However, in addition to factor input bottlenecks, the higher costs associated with the overtime work may also lead to rising prices only. Thus, the limited availability of overtime work and the associated higher costs together with the limited affordability to material input supplies provides an explanation as to why the less persistent or less durable expansionary forces or policies tend to be inflationary only; raising prices rather than output and employment (Scitovsky T. 1978). In a more segregated setting, as related to hiring and firing of labourers, an asymmetry is observed in the form that unemployment is more responsive to economic downturns than it is to economic booms (Shin et al. 2014). This implies that owing to the costs associated with the new recruitments or the firing of existing workers, firms relatively prefer firing over hiring.

The behaviour of macroeconomic variables like private consumption, private investment, exchange rate, prices, employment, growth rate, current account balance, stock prices, interest rates etc. are also observed to report the asymmetries (Ajaz et al. 2016, 2017). The different types of asymmetries observed in the business cycle fluctuations include the *steepness asymmetry*- when contractions are steeper than expansions and; *depth asymmetry*- when troughs are deeper than peaks are tall and the two could exist separately or simultaneously. Moreover, the impact of stabilization policy actions on the key macroeconomic variables could also be asymmetric. As related to the fiscal policy changes, government expenditure changes could be more effective in mitigating the economic downturns than muting the booms and tax changes could be more effective in muting booms than avoiding the economic downturn (Tagkalakis, 2008). The asymmetric impact of public spending changes on the growth

performance of a country may arise due to its asymmetric impact on the aggregate demand through its components like consumption and investment inflexibility and the existence of liquidity constraints (Tagkalakis, 2008). Likewise, the more pronouncing effect of tax hikes than tax cuts could be ascribed to differential response to different types of tax shocks, difference in the volume of private & public debt, difference in centralization of taxation and the overall monetary environment (Jones et al. (2015; Hussain and Malik 2016). Similarly, an expansionary fiscal stance could be inflationary than a corresponding contractionary stance due to the existence of liquidity constraints and the downward price stickiness (Mohanty and John, 2015; Barnichon et al. 2017). As related to the monetary policy shocks, research has provided evidence in favour of contractionary policy stances being more effective than easy ones. Again the theoretical reasoning for this monetary policy asymmetry can be attributed to the changing outlooks of firms and consumers, the binding liquidity constraints and the downward price rigidity (Morgan 1993; Barnichon et al. 2017).

Given the above account, it appears that disregarding the presence of asymmetries may thus turn out to be disastrous as related to the designing of appropriate policy or the forecasting about the future economic discourse (Shin et al. 2014). Although the effectiveness of fiscal policy has been analysed in a nonlinear setup by applying the switching regressions, however, the existence of possible asymmetric effects have been largely ignored. Researchers have generally assumed that the cuts & hikes in the government expenditure and taxes or the deficits would have similar impact and therefore, design the stabilization policies by estimating one multiplier coefficient only. This study is therefore, an attempt to scrutinize the efficacy of fiscal policy from an asymmetric viewpoint. We believe that this is the first study of its kind which examines fiscal policy effectiveness in an asymmetric analytical framework in case of a developing country namely India. The choice of an emerging economy, India, for the asymmetric investigation of fiscal policy changes is also motivated by the prevalence of liquidity constraints among a large section of population together with persistent inequalities (Mazumdar et al. 2017). Our study will, therefore, enrich the existing literature along the lines of asymmetric linkages.

1.6 Data & Empirical Methodology:

1.6.1 Data:

To investigate the impact of various fiscal policy instruments and other control variables on the major macroeconomic variables, we have resorted to secondary data sources. The data is both of annual and quarterly frequency to address the research questions quite comprehensively. The period of analysis varies from chapter to chapter. Appropriate dummies are included in the analysis wherever required to take care of structural breaks or outliers observable in the data.

1.6.2 Empirical Methodology:

Several econometric methods like various *VARs & SVARs models, switching regression, NK-DSGE models, Structural Macroeconometric models, 2SLS, GMM* have been employed to assess the fiscal policy impacts in various countries with different data sets and country characteristics. The existing methodologies, however, assume that the long-run association among the group of non-stationary variables is symmetric. To overcome some of these difficulties associated with the existing methodologies, we have used a *non-linear asymmetric cointegration* method developed by Shin et al. (2014) in our empirical analysis. For the causality examination, in some of the empirical exercises, well-known Toda-Yamamoto (1995) test for time domain and Breitung and Candelon (2006) test for frequency domain causality are applied.

1.7 Organization of the Study:

The study is comprised of six chapters; an introduction, four empirical chapters and a conclusion. Each empirical chapter has its own structure. Though the chapters enjoy some free-standing, however, the issues examined are substantially related to each other. An evaluation of some relevant issues of fiscal policy in the Indian context has been explored in each of the empirical chapters.

The study starts with the introduction chapter which provides an account of the relevance of stabilization policy (monetary and fiscal) in the alternative schools of macroeconomics under various economic circumstances. The research objectives, scope of study and the empirical methodology adopted in the analysis are also presented in this chapter.

In chapter 2, an attempt is made to estimate the fiscal multipliers from an asymmetric viewpoint in the Indian context. Specifically, the impact of positive and negative changes in government spending and taxes on the economic growth, private consumption and private investment has been examined. In addition, to control for the monetary policy influence, the interest rate is incorporated as a control variable in addition to the private investment. The study uses a quarterly data set from 1998q1 to 2017q4 according to the availability of data.

Chapter 3 scrutinizes the impact of fiscal deficit on the inflationary tendencies in Indian economy. The study adopts a broader analytical framework to include all the potential determinants of inflation in addition to fiscal deficits. Data for the period 1970-2016 has been examined to provide an evaluation of Indian inflationary problem with some recent evidence. To serve the purpose, NARDL is applied for asymmetric investigation and well-known Toda-Yamamoto (1995) test is applied for time domain causality and Breitung & Candelon (2006) test is applied for the frequency domain causality analysis owing to their technical feasibility.

Chapter 4, investigates the impact of fiscal deficits & other control variables on the interest rates in an economically integrated and financially deregulated economy, India. Two different data sets with different frequencies have been used to scrutinize the transitory and permanent impacts of fiscal shocks. Quarterly data set (1996q2 to 2016q2) with a short term interest rate is used to explore the short-term versions of relationship and an annual data set (1970 to 2016) together with long-term interest rate is used to analyse the long-term attributes of relationship. Unlike the previous studies, we have employed an IS-LM and extended open economy loanable fund model specifications for the analytical framework. The study has used an “*Auto regressive distributed lag model (ARDL)*” (Pesaran et al. 1998, 2001) to conduct the empirical exercise. To address the issue of causality, Toda-Yamamoto (1995) test has been applied.

Chapter 5, tests the validity of “*twin-deficit hypothesis*” the “*Ricardian Equivalence Hypothesis*” in case of India. Annual data set from 1970- 2015 has been investigated in an asymmetric econometric framework to examine the impact of fiscal deficits on the current account balance coupled with the other control variables like the output growth and trade-openness.

Finally, Chapter 6 summarizes the main findings of the study along with the possible policy recommendations and limitations & scope for further research in the area.

1.8 Methodology:

1.8.1 Nonlinear Autoregressive Distributed Lag Model (NARDL):

Primarily the study aims at the investigation of effectiveness of fiscal policy on the key macroeconomic variables in an asymmetric framework. There exist a number of linear tests to check for the cointegration relationship between the variables²⁰. However, these tests are based on a rather limiting presumption of the symmetrical relationship among the variables. To serve the purpose, an asymmetric framework developed by Shin, et al. (2014) has been used throughout the thesis (except chapter 3, where a *Linear ARDL* model has been applied) to ascertain the existence, if any, of asymmetries among the variables, included. The nonlinear dynamics of various macroeconomic variables has been identified quite a long ago. Keynes (1936, p.314), for instance, in one of his popular remarks noted that “*the substitution of a downward for an upward tendency often takes place suddenly and violently, whereas there is, as a rule, no such sharp turning point when an upward tendency is substituted for a downward tendency*”. The consolidated efforts in the recent times like those of Kahneman and Tversky (1979) and Shiller R. J. (1994; 2015) provided an appreciable motivation for the asymmetry modelling and maintain that “*nonlinearity is endemic within social sciences and that asymmetry is fundamental to the human condition*”.

Research fraternity has therefore, cautioned about the misleading repercussions of assuming a linear functional form and has suggested to take cognizance of possible asymmetries (Shin et al. 2014). Since the mid-nineties, voluminous literature has evolved and studied the joint issues of non-stationarity and nonlinearity. The modelling of nonlinearity in the context of long-run relationships gained the substantial fame and led to the development of models like, “*switching models: the threshold error correction models (ECM)* developed by Balke and Fomby (1997), the *Markov-switching ECM* associated with Psaradakis et al. (2004) and the *smooth transition*

²⁰ Engle & Granger (1987), Philips & Ouliaris (1990) (single equation residual tests), Johansen (1988) and Johansen & Juselius (1990) (system cointegration approach), ARDL-Bounds test by Pesaran and Shin (1998), Pesaran, Shin and Smith (1999; 2001) (a modified single equation approach with a positive edge over Johansen procedure).

regression ECM of Kapetanios et al. (2006)”. The development of these models clearly pointed out the inadequacy of linear models to ensure a more precise statistical inference and to produce authentic forecasts in case of situations featured with positive transaction costs and where policy implications are observed in-sample (Shin et al. 2014). However, the development of a unified model combining the long-run asymmetries with the short-run error correction model was highly challenging. Besides, the selection of “*regime-switching variables* and the *transition functional forms*” made the switching regression models sensitive to subjective choices.

Scholars have attempted to analyse the nonlinear cointegration²¹. However, majority of these studies adopted a “*two-step Engle-Granger*” procedure considered to be less convenient than the “*single-step ECM*” procedure and the studies involving a simultaneous modelling of both long and short-run asymmetries were limited. To fill this gap, Shin et al. (2014) developed what has been popularly known in the literature as “*Nonlinear Autoregressive Distributed Lag*” model (*NARDL*).

This method applied in the present study has some definite merits over the other conventional linear approaches. It is a convenient approach as it provides a dynamic error correction specification combined with the asymmetric long-run cointegration regression by decomposing a given time series z_t into its oppositely signed partial sums (z_t^+ and z_t^-) in order to take account of possible asymmetries in both the short-run and long-run. It permits the simultaneous modeling of cointegration and asymmetric nonlinearity in a single equation setup and unlike the conventional cointegration techniques, performs better in small samples (Romilly et al. (2001). Second, it provides *Bounds based test statistic*, used to check for the existence of stable long-run association among variables. The results are valid irrespective of whether the variables under investigation are $I(0)$ or $I(1)$ or a combination of both (Shin et al. 2014; Nusair 2016). Third, the method can with the help of *cumulative dynamic multipliers*, be used to trace out the adjustment patterns to an equilibrium position from any short-run disequilibrium, following the positive and negative shocks to explanatory variables. The model is simple and comprehensive enough to permit any *asymmetry switching*

²¹ “Like those by Park and Phillips (2001); Granger and Yoon (2002); Schorderet (2001; 2003); Saikkonen & Choi (2004); Escribano et al. (2006); and Bae & de Jong (2007); Saikkonen P. (2008)” Shin et al. 2014.

from short-run to long-run or vice versa²². It accommodates different specifications for the various possibilities of asymmetry. Additionally, the *NARDL model* allows to test for the “*hidden cointegration*”, not apparent in a linear framework²³. Thus, the methodology of Shin et al. (2014) differentiates between “*linear cointegration, nonlinear (asymmetric) cointegration and lack of cointegration*” (Katrakilidis & Trachanas 2012)

NARDL is basically an asymmetric extension of the *ARDL* model developed by Pesaran and Shin (1998) and Pesaran et al. (2001). The framework of the basic asymmetric econometric model has the following representation.

$$a_t = \alpha^+ z_t^+ + \alpha^- z_t^- + \epsilon_t \quad 1.8.1$$

Here z_t a $k \times 1$ vector of segregated explanatory variables, α^+ and α^- measure the long-run coefficients, a_t is the dependent variable and ϵ_t is a white noise error term. An explanatory variable, z_t , is defined as:

$$z_t = z_0 + z_t^+ + z_t^- \quad 1.8.2$$

z_t^+ & z_t^- denote the “*partial sum decompositions*” of positive & negative changes in z_t derived as:

$$z_t^+ = \sum_{i=1}^t \Delta z_i^+ = \sum_{i=1}^t \max\{\Delta z_i, 0\} \text{ and } z_t^- = \sum_{i=1}^t \Delta z_i^- = \sum_{i=1}^t \min\{\Delta z_i, 0\}.$$

Δz_i denote the difference of the values of variable z . It may be noted that the explanatory variable z_t is segregated into z_t^+ and z_t^- around a “*zero threshold value*” and hence making a contrast between the positive & negative changes in the growth rates of z_t .

The basic model specification 1.8.1 appears to be quite useful for elucidation and may be applied to certain empirical investigations. However, by not taking care of *weak*

²² A positive shock may have a larger impact in short-run and a negative shock may be found to be more influential in the long-run (or vice-versa).

²³ The concept of “*hidden cointegration*” was advocated by Granger and Yoon (2002) and is usually employed in the situations where the two time series lack the existence of cointegration in the linear setup, but cointegration is established between the positive and negative components of underlying variables.

endogeneity and *serial correlation* problems, model 1.8.1 is quite restrictive²⁴. Despite the different solutions suggested to eliminate these twin problems in the linear cointegration setup like in a static framework by Phillips and Hansen (1990) & Saikkonen (1991) and in the dynamic framework by Pesaran and Shin (1998), Shin et al. (2014) however, followed the later approach to develop a *flexible & dynamic parametric framework* inclusive of long and short-run asymmetries. To incorporate the asymmetry into a fully developed dynamic model, the basic *ARDL* (p, q) model as given by Pesaran et al. (2001) in its non-linear form can be extended as:

$$a_t = \sum_{i=1}^p \Phi_i a_{t-i} + \sum_{i=0}^q (\delta_i^+ z_{t-i}^+ + \delta_i^- z_{t-i}^-) + \epsilon_t \quad 1.8.3$$

Here again z_t is a $k \times 1$ vector of multiple regressors defined earlier as in equation 1.8.2, Φ_i is an *autoregressive coefficient*, δ_i^+ and δ_i^- are the asymmetric *distributed-lag* parameters and ϵ_t is an *iid* white noise error term.

The *asymmetric ARDL* model 1.8.3 could be connoted through the following error correction specification:

$$\begin{aligned} \Delta a_t = & \gamma a_{t-1} + \delta^+ z_{t-1}^+ + \delta^- z_{t-1}^- + \sum_{i=1}^{p-1} \tau_i \Delta a_{t-i} + \sum_{i=0}^{q-1} (\beta_i^+ \Delta z_{t-i}^+ + \beta_i^- \Delta z_{t-i}^-) \\ & + \vartheta_t \end{aligned} \quad 1.8.4$$

Or

$$\Delta a_t = \rho \xi_{t-1} + \sum_{i=1}^{p-1} \tau_i \Delta a_{t-i} + \sum_{i=0}^{q-1} (\beta_i^+ \Delta z_{t-i}^+ + \beta_i^- \Delta z_{t-i}^-) + \vartheta_t \quad 1.8.5.$$

Where $\xi_{t-1} = a_t - \delta^+ z_{t-1}^+ - \delta^- z_{t-1}^-$ and ρ measures the “*speed of adjustment*” from any short-run disturbance to the new long-run equilibrium position. $\delta^+ = -\gamma\alpha^+$ and $\delta^- = -\gamma\alpha^-$ are long-run parameters, β_i^+ and β_i^- represent the short-run asymmetric coefficients and $\vartheta_t \sim iid(0, \sigma_\vartheta^2)$. It is to be noted that the construction of NARDL model in its error correction specification provides a solution for *endogeneity*

²⁴ “The presence of these issues affect both the asymptotic and small sample properties of the estimators and particularly, the resulting OLS estimator of the cointegrating parameter would be poorly determined in small samples” (Shin et al. 2014)

of any non-stationary regressor²⁵ and if the lag structure is correctly chosen, the residual *serial correlation* is also corrected (Shin et al. 2014). The parameters included in the model are linear, therefore equation 1.8.4 or 1.8.5 can reliably be estimated by standard *OLS*.

The empirical procedure of *NARDL* involves the following three steps. In the first step, the *ECM* as given by equation 1.8.4 or 1.8.5 is estimated. Second step involves the testing of the presence of cointegration and Shin et al. (2014) provided two different tests. The first test t_{BDM} , introduced by Banerjee et al. (1998) tests $(\gamma = 0)$ or $(\rho = 0)$ i.e. the “*null of no cointegration*” against $(\gamma \neq 0)$ or $(\rho < 0)$ i.e. an “*alternative of cointegration*”. The second is the F_{PSS} test, advocated by Pesaran et al. (2001), tests the “*joint null of no cointegration*” i.e. $(\gamma = \delta^+ = \delta^- = 0)$, “against an *alternative of cointegration*” $(\gamma \neq \delta^+ \neq \delta^- \neq 0)$ by using the *bounds-based* F_{PSS} statistic. It may be noted that the “*asymptotic distributions*” of both the test statistics are *non-standard* under their respective null hypothesis and due to the complex dependence structure between the positive sum z_t^+ and negative sum z_t^- decompositions, their exact “*asymptotic distributions*” are complicated, especially in case the means of Δa_t and Δz_t are non-zero. Shin et al. (2014) therefore, advocated the application of pragmatic “*bounds testing*” approach of Pesaran et al. (2001) wherein the *lower bound* (all variables are $I(0)$) and *upper bound* (all variables are $I(1)$) critical value bounds of F_{PSS} test statistic are provided for different lag lengths k , under alternative specifications of: “(i) *without intercept or linear trend*; (ii) *with restricted intercept only*; (iii) *with unrestricted intercept only*; (iv) *with intercept and restricted linear trend* and (v) *with intercept and unrestricted linear trend*”. Similarly, for t_{BDM} distinction between the cases of (i), (ii) and (iii) is considered and critical value bounds for different k 's are provided in Pesaran et al. (2001).

Another caveat that arises in the process of partial decompositions is the choice of *lag length*. In the *NARDL* framework, the dependence between the partial sum decompositions make the choice of lag length ambiguous. In a simple two variable case wherein the long-run cointegration relationship is established between a_t , z_t^+ and z_t^- ,

²⁵ The model resorts to *reduced form* data generating process for the weakly endogenous variables by appropriately extending the lag lengths to correct for autocorrelation and endogeneity (Pesaran and Shin 1998; 2001 & Shin et al. 2014).

the value of true lag length varies between 1 and 2. Choice of $k=1$ *undersize* the test and $k=2$ *oversize* it (Shin et al. 2014). In the former case critical values will be relatively high than in the latter case or when partial sum decompositions are treated as individual regressors. Thus, at the pragmatic level, refutation of the null of no cointegration in case of both F_{pss} and t_{BDM} by using the higher critical values of $k=1$ provide substantial evidence in favour of long-run association.

In the third step the short-run and long-run asymmetry is tested by standard Wald's tests. Equation 1.8.4 incorporates the following three possibilities: “(i) there exists a *long-run symmetry* i.e. $\delta = \delta^+ = \delta^-$ (ii) there exists a *short run symmetry*, $\sum_{i=0}^q \beta_i^+ = \sum_{i=0}^q \beta_i^-$ and (iii) there exists a combination of both short period and long period symmetry”²⁶ (Shin et al. 2014).

The study finally employs the *non-linear cumulative dynamic multipliers* to trace out the route between disequilibrium position of short period and new long-run equilibrium of the system. The multipliers permit us to find the *asymmetric adjustment patterns* following positive and negative shocks to explanatory variables (Fousekis et al. 2016). The diagrams provide a way to illustrate the *traverse* to a new stable equilibrium position following any short-run disturbance from long-run relationship (Shin, et al. 2014). The cumulative dynamic multiplier effects of z_t^+ and z_t^- on a_t can be evaluated as follows:

$$l_h^+ = \sum_{i=0}^h \frac{\partial a_{t+i}}{\partial z_t^+} \text{ and } l_h^- = \sum_{i=0}^h \frac{\partial a_{t+i}}{\partial z_t^-}, h = 0, 1, 2 \dots \quad 1.8.6.$$

Where l_h^+ and l_h^- approach towards the respective non-linear steady state coefficients $\alpha^+ = \frac{-\delta^+}{\gamma}$ and $\alpha^- = \frac{-\delta^-}{\gamma}$ as $h \rightarrow \infty$. In this case again the regressor z_t is decomposed into the positive and negative sum components around a “*zero threshold value*” in order to sketch out the response of a_t to the respective components of z_t . However, it would rather be hard to believe that the dynamic adjustment patterns as portrayed through l_h^+

²⁶ In this case the model boils down to the standard symmetric ARDL model given by Pesaran and Shin (1998). Basically the NARDL is so flexible that different specifications can be designed to accommodate the asymmetric interactions which are theoretically motivated. These include either both short and long run asymmetry, only short-run asymmetry, only long-run asymmetry, neither short nor long-run asymmetry and finally the partial asymmetric model wherein a group of regressors enter into the error correction specification symmetrically.

and l_h^- should be symmetric (Shin et al. 2014). Thus, even without an explicit modelling of asymmetric error correction (*i.e. without allowing for regime-dependence of ρ* in model 1.8.5), the asymmetric adjustment traverse and/or a duration of disequilibrium may still be observed. Therefore, the very construction of *NARDL* may in fact enable us to distinguish between *long-run or reaction asymmetry*, *impact or short-run asymmetry* and *adjustment asymmetry* captured by the design and decoration of dynamic multipliers through the “*speed of adjustment*”. In addition, adjustment asymmetry follows from the interactions of short and long-run asymmetries together with the *error correction term ρ* . However, the shape of dynamic multipliers is sensitive to the specification chosen for error correction model 1.8.4 or 1.8.5 related to the incorporation of different types of asymmetries.

1.8.2 Relevance:

Several econometric methods have been employed to assess the fiscal policy impacts, or for that matter, to estimate the magnitude of fiscal multipliers in various countries with different data sets and country characteristics. From a technical stand point, the VAR studies are sensitive to the identification schemes like those advocated by “*Ramey & Shapiro (1998); Blanchard & Perotti (2002); Fatas & Minhov (2001); Mountford & Uhlig (2009)*” or the long-run restrictions imposed to identify the fiscal shocks. Moreover, the division of samples into the expansions & recessions in a standard SVAR regression sharply reduces the degrees of freedom & disregard the possible nonlinear responses to the fiscal policy shocks (Riera-Crichton et al. 2015). To avoid this caveat, scholars have applied the *non-linear regime-switching regressions*. In particular, Fazzari et al. (2015) extended the Chan & Tong’s (1986) work on *Threshold Autoregressive model (TAR)* to a multivariate *Threshold SVAR (TSVAR)*. In this methodology the parameters are permitted to switch depending upon whether the variable of interest crosses the threshold value or not. However, obvious limitation of this methodology is the subjectivity of threshold value. In a slightly different approach, following the *Smooth Transition Autoregressive models (STAR)* of Granger and Teravistra (1993), Auerbach and Gorodnichenko (2010) offered a solution to the arbitrariness of threshold selection by developing the *Smooth Transition VAR (STVAR)* in order to permit the simultaneous equation analysis. In this framework, transition to the alternative states is governed by an underlying logistic distribution with a probability given by moving average of real GDP growth. Prior restrictions are

incorporated to determine the size of alternative regimes and therefore, inculcate an arbitrariness in the selection of duration. To eliminate the probable bias, Auerbach and Gorodnichenko (2012) applied the methodology developed by Jorda (2005) & Stock & Watson (2007). It estimates a separate regression for each regime and the impulse responses are constructed accordingly. This method is devoid of any dynamic restrictions tacitly implanted in the VARs and can take care of probable non-linearities in the response function. To avoid the smoothness of transition probabilities as assumed in above mentioned *switching regressions*, Arin et al. (2016) employed a *Markov-switching* framework to provide the estimates of fiscal multipliers during the course of business cycle. This framework is flexible enough to allow for various shifts or regimes, however, the transition is directed by the value of transition probabilities. Though it permits the calculation of probability of staying in each of the regimes, however, the probability process is assumed to follow a *first-order Markov chain*²⁷.

The *NK-DSGE* models are substantially theory driven and involve excessive data requirements. These models require heavy mathematical involvement, appreciable information about the behaviour of rational economic agents and face the subjectivity regarding the choice of utility functions, production functions and the monetary policy actions. Likewise, the *structural macroeconometric models* suffer from Lucas critique. The arbitrary categorization of variables into exogenous and endogenous and use of numerous equations & identities makes them less attractive for the empirical evaluation. Finally, the single equation approaches like, *2SLS*, *GMM* require the use of instruments which are subjective and sometimes imprecise.

In addition to the above deliberations, the existing methodologies, however, assume that the long-run association among the group of $I(1)$ variables is symmetric. The possible implication is that it may lead to weak inference and may yield unreliable forecasts (Shin et al. 2014). To overcome some of the caveats associated with the existing methodologies, we therefore, applied the recently developed “*non-linear asymmetric cointegration*” method given by Shin et al. (2014) for the empirical introspection of fiscal policy.

²⁷ The persistence in a state or regime is completely determined by the value of the state in the previous period.

CHAPTER 2

2 Asymmetric Fiscal Multipliers

2.1 Introduction:

Researchers and policymakers have tested the significance of fiscal policy as a macroeconomic stabilization tool for quite some time. The expansionary fiscal policy stance executed to avert the macroeconomic ramifications of oil price shocks during 1970s, however, failed to provide the results expected according to the orthodox Keynesian framework (Beetsma and Guilidori 2011). These cast doubts on the efficacy of fiscal policy as a potent tool to control business cycle fluctuations. In another episode during 1980s, contrary to the Keynesian projections, the fiscal consolidation programs implemented in Europe appeared to be favourable for output growth and therefore, it led the policymakers and economists to challenge the standard theories of fiscal policy. A possible theoretical exposition for this surprising result of fiscal consolidation has been provided in Alesina et al. (2002). A negative shock, for instance, to government wages and salaries lead to lower labour demand and lower wages, improve the business profits and investment and hence enhance the economic activity both in the long and short-run.

The “*global financial crisis*” of 2007-09 and the ensuing downturn led to renewed interest for scrutinizing the fiscal policy relevance as a policy tool to stabilize the economy. Large number of countries, both industrial and emerging responded with the fiscal stimulus packages to enhance the aggregate demand for an economic recovery. Subsequently, heated discussions started about the relevance of fiscal policy actions by recollecting the observations of the impacts of fiscal policy actions during oil price shocks of 1970s and the consolidation plans of 1980s. The projections made by the then Chair of the President Obama’s Council of Economic Advisers, Christina Romer, about the job gains following a fiscal stimulus package of USD 787 billion approved by Congress, were challenged in the United States (US) (Romer & Bernstein 2009; Arin et al. 2015). Similarly, in the Europe, fiscal austerity program executed in several economies pushed them into more severe recessions, an observation diametrically opposite to what has been reported during 1980s. While before the crisis, it was broadly admitted that the fiscal stimulus packages would play a little role beyond the automatic

stabilizers, however, with the onset of crisis, all the major economies resorted to the stimulus packages (Agnello et al. 2013). In the debate on the fiscal policy efficacy to counteract the economic downturn, renewed interest has emerged among the researchers and policymakers. Likewise, the “*zero-bound problem*” of monetary policy actions and the execution of unorthodox policy stances and untested instruments also contributed to the revival of fiscal policy as a tool for macroeconomic stabilization. Finally, the curiosity about finding a reliable estimate of fiscal multiplier made the economists to investigate the fiscal policy effectiveness and thereby provide a fresh evidence concerning the possible responses.

From the theoretical perspective, substantial and long-standing dissent exists among the competing schools concerning the impact of fiscal policy actions. The theoretical contours, like those by Classicals, Keynesians, Neo-Classicals, Monetarists, New-Classicals, Real Business cycle theorists and New-Keynesians, vary appreciably regarding the possible impact of spending and tax changes on the major macroeconomic variables. The disagreement about the fiscal policy efficacy is thus, not only about the size of the impact, there is a lack of unanimity about the sign as well (Yadav et al. 2012). The empirical examinations also highlighted the diverse results. Scholars have assessed at length the multiplier effects of fiscal policy changes on the key macro variables like output growth (GDP), private consumption and private investment by applying the different methodologies such as vector auto-regression (VAR), NK-DSGE studies, structural macroeconometric model studies and single equation studies (OLS, GMM and 2SLS). From the empirical review the diversity of results can be inferred from the fact that spending and tax multipliers range from negative to greater than unity, multiplier values were reported to be sensitive to the prevailing economic conditions & country characteristics and spending multipliers were relatively more effective than tax multipliers.

Majority of the existing studies have been conducted in a symmetric framework, although some studies analysed the fiscal policy effectiveness in a nonlinear setup by using the switching regressions and estimating multipliers separately for different economic scenarios. The possibility of asymmetric response to the positive and negative changes in fiscal policy tools has been largely ignored. Scholars have assumed that the hikes and cuts in the spending and taxes would have similar impact and therefore, design the stabilization policies by estimating only one multiplier coefficient

usually associated with spending and tax hikes. The repercussions of this practice of assuming a symmetric association may lead to incorrect policy actions as may be needed for consolidation or stimulation purposes (Shin et al. 2014). The present study is therefore, an attempt to scrutinize the fiscal policy efficacy from an asymmetric viewpoint. We believe that, this is the first study of its kind which examines separately the responses of hikes and cuts in government spending & taxes on the output growth, private consumption and private sector investment in case of a developing country, namely, India. The choice of an emerging economy, India, for the asymmetric investigation of fiscal policy changes is motivated by the prevalence of a large section of liquidity constrained population together with significant inequality magnitudes (Mazumdar et al. 2017; Bhat and Sharma 2018). The limited purchasing power, liquidity tightening and a distorted credit allocation system as prevalent in India suggest that the response to the fiscal policy changes may not be symmetric. The study will employ an asymmetric cointegration framework by Shin et al. (2014) to incorporate the possibility of the asymmetric impacts of spending and tax shocks explicitly. Unlike the single equation, VAR and *NK-DSGE* or macroeconometric approaches, this method is not sensitive to the validity of instruments, the restrictions to identify the fiscal shocks or heavy data requirements and cumbersome mathematical appeal. Moreover, due to the lack of exogenous tax and spending measures in case of India, like those constructed by Romer & Romer (2010) and Ramey (2011) to avoid the potential endogeneity of fiscal policy actions, the application of asymmetric cointegration procedure will handle the problem of endogeneity econometrically.

2.2 Theoretical Debate:

Before the advent of Keynesian General Theory, the Classical school advocated an economic paradigm featured with wage-price flexibility and consequently a vertical aggregate supply curve. There is no space for policy intervention either fiscal or monetary to avert any macroeconomic destabilization due to the automatic adjustment through the market forces. The economy is always assumed to be at full-employment level and Say's law, according to which supply creates its own demand is followed. Following the 1930s Great Depression, Keynesian economics developed as a rebuttal to the aggregate supply focussed Classical orthodoxy. This school laid emphasis on the demand side problem in a setting characterised by price stickiness and response of consumption to the current income. In this paradigm, expansionary fiscal policy was

considered as an active stabilization tool, to stimulate the economy, at least in the short-run, with multiplier effects. In its basic version, characterized by price inflexibility and existence of idle capacity, aggregate output and employment can be enhanced through the aggregate demand augmentation. In a more general setting, the exchange rate and interest rate gyrations following an expansionary fiscal stance would lead to the displacement of private investment. This may lower multiplier value (with its sign unchanged), although the final impact would be an output growth coupled with consumption and investment levels. The neo-Classical school contrasted the Keynesian view and maintained that a deficit financed “*expansionary fiscal policy*” would lead to displacement of private sector capital formation as well as private consumption in the economy. They advocate that the economic agents consider any hike in current deficits by the government as higher taxes in future. As a result, the private consumption response to the rise in current disposable income due to a tax cut would be less than proportional and the investor’s willingness to invest will also stand reduced in the expectation of lower future profits. Thus, unlike the Keynesian projection, the final outcome of an easy fiscal policy stance could lead to a contraction of the economy according to neo-Classicals. During 1960s and 1970s, the Monetarists also put up serious criticism against the Keynesians. The Monetarists maintain that private consumption depends on the permanent income and not on the current income. In addition, the increased deficit raise the interest rates (the cost of capital) and hence, lower the private investment. The final impact of the fiscal expansion thus would be return to “*natural rate of unemployment*” together with an increased level of public debt (Friedman 1968). Thus, in the short-run, the size of multipliers would be small, however, statistically significant.

The reporting of “*non-Keynesian effects*” of fiscal policy as in case of Japan and Euro area and the occurrence of “*expansionary fiscal contraction or contractionary fiscal expansion*” during the fiscal stabilization drives of Denmark and Ireland during 1980s (Giavazzi and Pagano 1995) called for provision of strong micro-foundations to the conventional models. To address the issue, theoretical research has attempted to develop the micro-founded inter-temporal aggregate relations which provide explanations to the rampant macroeconomic fluctuations and to the reporting of “*non-Keynesian effects*”. With the *rational expectations revolution*, New Classical School denounced the Keynesian size of multiplier on the basis of their twin assumptions of

agent optimization and market clearance (Laidler 1986). This School attempted to provide micro-foundations to the neo-Classicals and also to provide an explanation to the 1970s problem of stagflation (Robert Lucas along with the leading Monetarist, Milton Friedman). On the basis of rational expectations theory, this school advocated the notion of *total policy ineffectiveness* and thereby eliminated the role of any stabilization policy either monetary or fiscal.

Likewise, the Ricardian equivalence hypothesis (REH) also documented the neutrality of fiscal policy on private consumption or aggregate demand. According to REH, consumers will consider the contemporary increase in fiscal deficit as higher deferred future taxes. Therefore, any hike in the fiscal deficit, tax or debt financed, make the rational economic agents to increase the savings currently in order to be able to pay the higher future tax liabilities. There would thus be a rise in private savings, leaving the total national savings of the country unaffected together with private consumption, interest rate, private investment and output growth; hence, the mode of financing the deficit i.e. either debt or taxes is immaterial (Barro 1989). As an extension, the New Classical models were further advanced to the “*Dynamic Stochastic General Equilibrium (DSGE) models and Real Business Cycle (RBC) theory*”. The assumptions of price flexibility and the perfect competition in all markets enable the RBC theorists to predict a deleterious impact of government spending on private consumption & a favourable impact on output. According to RBC theory, any hike in government expenditure financed by the future lump-sum taxes fabricates a negative wealth effect. Thus, lowering the private consumption, however, leads to an employment augmentation. The increased employment enhances the return to the capital and thereby investment and output. Similarly, in a standard *DSGE* framework private consumption responds inversely to any fiscal expansion, although, the results are sensitive to the suppositions about the nature of households, the kind of utility and production functions incorporated into the modelling structure and the monetary policy rules adopted by the central banks.

To counteract the New Classical notions of *agent optimising behaviour and rational expectations*, New Keynesians highlighted that in the presence of market power, asymmetric information or transaction costs, both these notions are prone to *market failures* and are characterised by *wage-price rigidities* (Greenwald and Stiglitz 1987). They maintain that the validity of REH requires an important condition of the perfect

capital markets. However, if, some of the economic agents are finance-constrained, increase in the current income would have positive impact on private consumption. More specifically, New Keynesians typically consider the presence of a share of “*Ricardian (rational) consumers*” which are not liquidity constrained and a share of “*rule-of-thumb consumers or non-Ricardian consumers*”, assumed to be liquidity constrained (Mankiw 2000). Any expansionary fiscal stance would lead to an increase in current income of the latter and thereby increase their consumption and hence aggregate demand. Thus, in contrast to *total policy ineffectiveness* as argued by New Classical School, New Keynesians renewed the stabilization potency of fiscal policy. During the late 90s and early 20s, the possibility of *wage-price rigidity* and existence of *rule-of-thumb consumers*, as advocated by the New Keynesians, were incorporated into the *DSGE models* to conduct the macroeconomic policy analysis in a new setup. This amalgamation of the elements of New Keynesians with those of New Classicals is popularly known in the literature as “*New Synthesis or NK-DSGE*” (Woodford 2009). The incorporation of non-Ricardian consumers along with price stickiness in the model structure renders the effect of an expansionary fiscal policy shock positive and substantial (Gali et al. 2007). As a result price rigidity, the real wage of the rule-of-thumb consumers increase following a rise in government spending, and thereby increases their current income. These consumers would respond positively in terms of their consumption expenditures and therefore aggregate demand is enhanced. It may however, be noted that the influence of the shock is short-lived because the model is built along the fundamentals of neo-Classical school. Moreover, if the monetary authority of the concerned economy follows a “*Taylor-rule reaction function*”²⁸, the size of fiscal multipliers, though positive, would be smaller than the conventional Keynesian ones.

While the New Classical School advocated the *total policy ineffectiveness* proposition, Giavazzi and Pagano (1990) went a step further and coined the term “*expansionary fiscal contraction*”. Examining the impact of a “*cyclically adjusted primary balance (CAPB)*” on private consumption & output growth in Ireland and Denmark during 1980s, they documented that an appreciable trimming in public expenditure tend to have a favourable (positive) impact on private spending and finally on output. The

²⁸ For details refer to Taylor J. B. (1993)

favourable outcome of consolidation appears to be possible in case following a substantial reduction in public expenditures, economic agents expect an additional fall in the spending and taxes. However, the positive impact of fiscal contractions on growth and consumption is reported to be biased and overstated (Leigh et al. 2011). The scholars maintain that the changes in CAPB (considered as a measure of fiscal balance) do not in fact represent a contraction in government expenditures. Instead, it could be ascribed to the other changes and developments different from the policy shocks like a stock market boom.

With the onset of “*global financial crisis*” (GFC) in 2007-09, the question of fiscal expansion gained the renewed emphasis. Most of the countries resorted to substantial financial rescue packages (including the government spending and bank rescue packages) in order to avoid the deleterious repercussions of global meltdown. However, several European countries adopted restrictive fiscal consolidation strategy²⁹. The ongoing political debates on the *austerity program* resulted in a reshaping of Keynesian theoretical statements (Blyth 2013). The New Keynesians maintain that in a recessionary situation accompanied by excessive unemployment, prices may fall. Owing to “*zero-lower Bound (ZLB)*” issue of monetary policy, the potency to reduce the interest rates any further is ceased. In a *NK-DSGE* paradigm, the real interest rates would rise if the nominal interest rates are fixed at zero, and hence result in a deflationary spiral. In this instance, to avoid the deflationary spiral, expansionary fiscal stance comes handy which drives down the real interest rates and leads to an appreciable increase in the output (Christiano et al. 2011). In addition to the *ZLB* position, the fiscal policy is also effective in the case of a depressed labour market (Michailat 2012). The presence of excessive unemployment in the private sector makes a fiscal expansion more successful in case the spending is financed by labour tax, which in turn will enhance the public employment. Similarly, during the banking crisis, the impact of fiscal policy is reported to be higher due to the presence of both non-Ricardian consumers and the households which are liquidity constrained due to the value of their collateral (Turini et al. 2012). Eggertson and Krugman (2012) also documented the evidence of strong Keynesian features in a *NK-DSGE* design with households having

²⁹ During 2008-10, Hungary and Ireland, for instance, lowered the public spending by 4.4% and 0.9% percent of GDP respectively. https://en.wikipedia.org/wiki/Financial_crisis_of_2007–2008.

varying rates of time preference and finance constraints binding. These constraints are eliminated through a fiscal expansion and subsequently a substantial impact on the output is observed. Likewise, advancing the *hysteresis effects*, DeLong and Summers (2012) also reported the positive long run impact of a fiscal expansion.

From the above account, it can be inferred that there is substantial and long-standing dissent about the fiscal policy efficacy. The debate about the role of fiscal policy is thus not only about the magnitude of the impact, there is a lack of unanimity about the sign as well (Yadav et al. 2014).

2.3 Empirical Review:

2.3.1 General Literature:

Scholars have assessed at length the multiplier impacts of fiscal policy changes on the important macroeconomic variables. On the basis of econometric methodology employed, the existing studies can be categorized into four major groups like *vector auto-regression (VAR)*, *NK-DSGE studies*, *structural macroeconometric model studies* and *single equation studies (OLS, GMM and 2SLS estimations)*.

Being an econometrically system driven approach, VAR involves the estimation of a system of equations along with the long-run restriction imposition needed to identify the system. The system is estimated to segregate the innovations in the fiscal instruments and the response of output and other variables. However, the exact influence of the fiscal shocks depends on the identification scheme applied for these shocks and the sample under study³⁰. Applying the different specifications or restriction approaches to identify the fiscal shocks, the scholars reported diverse results with numerous magnitudes for the fiscal multipliers. In a narrative approach using the Event-study VAR (EVAR) to the United States (US) data over the period 1947-1996, Ramey and Shapiro (1998) reported the negative reaction of private consumption and positive retaliation of output to the unanticipated public defence spending hikes. In United States (US) with a recursive VAR scheme as proposed by Sims (1980), Fatas and Minhov (2001) documented the positive effect of public spending hikes on the consumption and employment and the impact becomes stronger when the government wage expenditures

³⁰ Caldara and Kamps (2008) provide a detailed account of the technical issues and comparative analysis of alternative approaches.

are increased. Using a mix of Structural VAR (SVAR) and EVAR on the quarterly data set over the period 1960-1997 for US, Blanchard and Perotti (2002) reported that output responded positively to the positive government spending shock and negatively to the positive tax shock. However, the response of private spending was found to be negative to both the positive spending and tax shocks. Unlike Ramey and Shapiro, Burnside et al. (2004) in an EVAR framework found the small positive movements in private consumption and a temporary rise in private investment. Perotti (2005) while applying a structural VAR approach to investigate the effectiveness of fiscal policy shocks in case of 5 OECD economies found that the multiplier value exceeds unity in case of US in the pre-1980s period, however, for the other examined countries the magnitude of multiplier is reported to be less than unity over 1960-2001. Moreover, the author finds no evidence in favour of tax cuts being more effective than the spending increases. Using a sign restrictions approach (MH-VAR), Mountford and Uhlig (2009) reported the smaller & temporary positive and negative response of output and private consumption to the government spending hikes in case of US. Likewise, in a SVAR setting in case of Euro area & US over the period 1981-2007, Burriel et al. (2010) documented the positive short-lived impact of fiscal expansion on GDP and private consumption. However, the impact of positive spending shocks is reported to be more pronouncing than the net-tax cuts. Using a narrative approach to develop exogenous tax measures, Romer and Romer (2010) found that increase in the exogenous tax rates have a contractionary impact on output and tax multipliers were found to be larger than the conventional ones obtained via changes in broader measures of taxes. Similarly, Ramey (2011) by constructing a defence news variable for government expenditure reported the spending multipliers of the size 0.6 to 1.2 approximately. On the contrary, using a Bayesian SVAR (B-SVAR), Afonso and Sousa (2012), found the insignificant impact of public sending shocks on GDP and private consumption, but crowds out the private investment.

Some studies went a step further to scrutinize the fiscal policy efficacy under different economic circumstances and different country characteristics. For example, using the annual data of 19 OECD countries, Tagkalakis (2008) examined the nonlinear effects of fiscal policy changes over the period 1970-2002. Taking into consideration the existence of binding liquidity constraints on the households, spending hikes and tax cuts are found to be more effective in augmenting the consumption expenditures during

an economic downturn than in an expansion. The impact is more pronouncing in case of economies featured with less developed credit markets. Similarly, taking cognizance of the possibility of a nonlinear response, Auerbach & Gorodnichenko (2012) applied a smooth transition probability regime switching VAR (STVAR) to examine the impact of spending hikes over the business cycle. Using the quarterly data for the period 1985-2010, the study reported that the impact on the GDP of US is positive and more prominent in recessions than in expansions. Likewise, using STVAR in case of Greece for the period 2000-2012, Thomakos (2012) also found the pronouncing impact of public spending hikes during recessions than in normal times. Similarly, in a regime switching framework, De Cos and Moral-Benito (2013) found that the multiplier effect of government spending is stronger during recessions & when there occurs a banking crisis during the strained public finance position, the impact is reported to be lower or even negative. Following the Blanchard and Perotti (2002) identification scheme to identify the fiscal shocks, Ilzetzki et al. (2013) investigated the fiscal policy efficacy in case of a mixed panel of 44 countries. The impact of spending shocks is found to be higher in high income countries than in developing ones, is more pronouncing in economies working under fixed exchange rates than in flexible ones, is stronger in closed economies than in open ones and finally the impact is reported to be negative in case of high-debited countries. Jha et al. (2014) applied a sign restricted SVAR as designed in the Mountford and Uhlig (2009) to explore the effectiveness of countercyclical fiscal policy on the output growth of 10 Asian economies. The study found that tax cuts are more effective countercyclical fiscal instruments than the spending hikes. Caggiano et al. (2015), while analysing the nonlinear impact of government spending shocks in case of US also reported the stronger impact of fiscal spending during recessions. The authors also document that the nonlinearities are possible in the extreme events of deep recessions and strong expansions. Following asymmetric methodology as developed by Cover (1992), Jones et al. (2015) examined the impact of tax hikes and tax cuts on the economic performance of UK and US economies. By using the data sets developed by Romer and Romer (2010) and Cloyne (2013), the authors reported that in case of US, tax hikes have a neutral impact on output and tax cuts have a substantial positive impact, whereas in case of UK, the exact opposite is observed. In a similar study, Hussain and Malik (2016) also reported the same results in case of US. Applying the Blanchard & Perotti (2002) restrictions

approach, Kasselaki and Tagkalakis (2016) scrutinized the impact of fiscal policy on the non-residential investment and output in Greece for the period 2000-2014. The study reported that tax based consolidation is more effective than spending based consolidation because the former is found to affect the output and private investment more negatively than latter. Auerbach and Gorodnichenko (2017) using a slightly different methodology than in Auerbach & Gorodnichenko (2012) to estimate the government expenditure multipliers over the period 1960-2012 also found the larger spending multipliers during recessions than in expansions. However, the estimates are reported to be less stable and weakly effective than the earlier ones. More recently, Ramey and Zubairy (2018) applied two different methodologies to examine the impact of public spending hikes during the economic slacks or when the ZLB interest rate problem exists. The authors maintain that the size of multipliers is not sensitive to the magnitude of slacks in the economy and multipliers well below unity are reported. However, the multipliers estimated at the *zero lower-bound* are mixed with some exceeding unity.

The *NK-DSGE* models are appreciably theory driven and are sensitive to the theoretically motivated restrictions. These restrictions are applied to the choice of utility or production functions and the monetary policy guided by a *Taylor rule*. Unlike structural models, *NK-DSGE* models provide strong micro-foundations to conventional theoretical schools. The main studies belonging to this group include the following. Gali et al. (2007), reported the evidence of positive spending multipliers in a standard *NK-DSGE* setup that allows for the sticky prices and existence of non-Ricardian consumers. Forni et al. (2009) in case of Euro area over 1980-2005 reported the mild and short-lived Keynesian impact of spending shocks on private consumption, whereas the impact is appreciable for government transfers to the households. Similarly, on the revenue side, a cut in labour income and consumption tax rates influence the private consumption and output more strongly compared to cut in the capital income tax rates which boosts private investment and output in the medium run. Likewise, for the time period 1981-2006 in case of Euro area, Ratto et al. (2009) reported the negative response of Ricardian consumers to the government consumption, public investment and transfers. However, non-Ricardian consumer's consumption responds positively. In addition, a lump-sum tax hike also leads to a cut in the consumption of liquidity constrained consumers in the medium term. On average, private consumption

responded negatively and spending multipliers were below unity. To account for the nonlinear effects in a *NK-DSGE* framework, Christiano et al. (2011) reported the multiplier value of less than one in case monetary policy follows a “*Taylor-rule*” and a value above unity if the problem of *ZLB* is present. Zubairy (2014) in a *DSGE* framework document the evidence of spending multipliers being larger in magnitude than the labour and capital tax cuts. In a small-scale *DSGE* model, Dupaigne and Feve (2016) found that investment multiplier increases with the persistence of government spending shocks and the short-run impact on output and consumption is strongly influenced by the response of investment to the spending shocks. In another study, Brinca et al. (2016) estimated a *DSGE* model to examine the sensitivity of fiscal multipliers to the concentration of wealth inequality. The authors found that the fiscal multiplier increases in magnitude with the increase in fraction of liquidity constrained and wealth constrained individuals. Likewise, Bhattarai and Trzeciakiewicz (2017) investigated the impact of fiscal policy shocks on the macroeconomy of United Kingdom (UK). The authors reported the stronger response of GDP to government consumption and investment changes in the short-run, whereas the dominant long-run impact is reported for capital investment tax and public investment. Moreover, the response to the various fiscal instruments is reported to be sensitive to the *ZLB* problem of monetary policy.

The single equation approach is the simplest approach to examine the influence of fiscal policy shocks. This approach involves the use of either independent proxies for the fiscal policy instruments (like military spending and exogenous tax changes) or the application of two-stage procedures like 2SLS or GMM to avoid the problem of endogeneity econometrically. Neither system of equations are estimated nor are the theoretical restrictions incorporated like those in VAR or *NK-DSGE* type studies. For example, Afonso and Fuceri (2010) applied a panel OLS regression to investigate the spending and tax shock impacts on the growth dynamics of OECD & EU countries. The study reported the negative impact of different fiscal policy instruments on the economic growth. In another study, Afonso and Alegre (2011) estimated an endogenous growth model with a panel GMM methodology in case of 15 EU countries over the period 1971-2006. The study reported the positive effects of public spending and budget deficit, however, the impact of government consumption is found to be negative. Similarly, using a 2SLS procedure, Acconcia et al. (2014) documented a

government spending multiplier of about 1.5 to 1.9 in case of Italy for the time period 1990-1999. Agnello et al. (2013) incorporated a three tier procedure to evaluate the fiscal policy effects in case of 132 countries for the period 1960-2008. Applying fixed effect estimator along with a two-step robust GMM approach, the study found the growth enhance impact of an expansionary policy stance in the short-run only and an adverse impact in the medium run. Moreover, the findings are reported to be sensitive to the individual country characteristics. Riera-Crichton et al. (2015) examined the procyclical and countercyclical fiscal multipliers in case of 29 OECD countries. The study documented that by taking into account the actual movements in government spending, the value of long-run multiplier is found to be higher in case government spending actually increases compared to a lower multiplier value if only a classification between recession and expansion is considered. Applying a 2SLS methodology, Qazizada and Stockhammer (2015) reported the larger multiplier value during recessions and a relatively lower one during expansions. However, no difference in the multiplier effects is noted in case interest rate is constrained at *ZLB*. In a regime switching framework, Arin et al. (2015) examined the size of fiscal multipliers in case of US. The study reported that spending multipliers are larger during recessions and tax multipliers are larger during expansions. Recently, applying the robust panel estimation procedures, Attinasi and Klemm (2016), found the negative impact of fiscal consolidation on the growth with spending measures tend to have lower negative impact than the revenue measures.

2.3.2 Studies Specific to India:

Very few attempts have been made to assess the fiscal policy potency as a growth enhance and stabilization tool in India owing to the non-availability of sufficient data (usually quarterly data as recommended by Blanchard and Perotti (2002) and many others for the identification purposes in the SVAR procedures). In India, various examined issues include; business cycle impact on fiscal deficits (Rao, 2002); political budget cycles (Rajaraman, 2004); debt sustainability (Rangarajan & Srivastava, 2005); fiscal consolidation (Pattnaik et al. (2006); cyclicalities (Chakraborty and Chakraborty, 2006). In a SVAR and recursive VAR specifications, Guimaraes (2010) found that the size of government revenue expenditure is lower than that of capital spending multiplier. Relatively, the magnitude of tax multiplier is double to that of current expenditure multiplier, however, same as capital spending multiplier over the period

1996-2009. Yadav et al. (2012) scrutinized the effects of fiscal policy shocks on the Indian economy over the period 1997q1-2009q2. Tax shocks are observed to be more effective than the corresponding spending shocks so far as their impact on the GDP and private consumption is concerned. However, the expansionary fiscal shocks follow the Keynesian paradigm in the short-run, whereas in the long-run the response is mixed. Similarly, Jain and Kumar (2013) also used SVAR approach to estimate the size of fiscal multipliers at the central and state government levels for the period 1980- 2012. The study reported the relatively larger size of state government spending multipliers than that of the central ones. In addition to methodologies adopted in the earlier studies, some scholars have also attempted to assess the effectiveness of fiscal policy shocks in structural macroeconometric modelling framework³¹ like Bhattacharya (1984); Krishnamurthy et al. (1984); Rangarajan and Mohanty (1998); Bose and Bhanumurthy (2015). Bose and Bhanumurthy (2015) for instance applied a macroeconomic modelling framework to estimate the size of fiscal multipliers in India for the period 1991-2012. The study reported the stronger impact of capital expenditure on output than the other expenditure components and the tax multiplier was found equal to -1. Recently, Goyal and Sharma (2015, 2018) applied the SVAR approach to estimate the size of spending multipliers in case of India. The size of capital spending multiplier is reported to be higher than the revenue expenditure one. However, the monetary policy accommodates the capital expenditure multiplier and tightens in response to revenue expenditure. The lack of monetary accommodation during the supply shocks lower the value of capital expenditure multiplier.

The above literature survey highlight some important points. First, the studies are largely based on VAR methodology which is sensitive to the approach of identifying the fiscal shocks. Second, the relevance of fiscal policy as a tool to either boost the growth performance or to avoid the cyclical fluctuations has been largely analysed in the developed countries (US, UK, OECD and G7) and only a few studies are reported in case of developing ones. Third, the empirical evidence about the magnitude & sign of multipliers is inconclusive. The studies reported a wide range of multiplier values

³¹The structural macroeconometric models basically are theoretically eclectic large macroeconomic models. A large number of equations and identities are incorporated into the framework to evaluate the dynamics of macroeconomic aggregates like output, employment, inflation, capital formation etc. In addition, these are applied to compare the alternative theoretical contours & policy scenarios.

ranging from negative to more than unity. Fourth, the size of fiscal multiplier is sensitive to the economic conditions, as multipliers are found to be higher in recession than in expansion, country characteristics and modes of financing the fiscal shocks. Fifth, on average, the size of spending multipliers is found to be higher than the tax multipliers, except a few (Guimaraes 2010; Romer and Romer 2010; Jha et al. 2014 etc.) where the opposite holds. Sixth, majority of the studies are conducted in a linear framework, although some studies take the consideration of possible nonlinearity by using switching regressions, estimating multipliers separately for expansions and recessions. However, only a few like Jones et al. (2015); Riera-Crichton et al. (2015) & Hussain and Malik (2016) take into account the possibility of an asymmetric impact of hikes and cuts in fiscal policy instruments like spending and taxes. This may lead to incorrect policy implications leading to severe destabilizing interventions (Shin et al. 2014). Moreover, studies have assumed the hikes in spending or taxes in both the recessions and expansions whereas the normal discourse of economy warrants an easy fiscal policy during an economic downturn and a tight one to avoid the overheating during an upturn. The present study, therefore, attempts to analyse the effectiveness of fiscal policy shocks in an asymmetric framework. The study will employ an asymmetric cointegration framework to incorporate the possibility of the asymmetric impacts of spending and tax shocks explicitly. Unlike the single equation, VAR and *NK-DSGE* or macroeconometric approaches, this method is not sensitive to the validity of instruments, the restrictions to identify the fiscal shocks or heavy data requirements. Moreover, due to the lack of exogenous spending and tax measures in case of India, like those constructed by Ramey (2011) and Romer & Romer (2010) to avoid the potential endogeneity of fiscal policy actions, the application of asymmetric cointegration procedure will handle the problem of endogeneity econometrically.

2.4 Data Description & Methodology:

2.4.1 Data Description:

The selection of the variables for empirical analysis is guided by the prevalent theoretical prepositions and the existing empirical evidence. The data set is of quarterly frequency covering the period 1998-99q1 to 2017-18q4³². The application of the

³² The period of analysis is decided by the availability of the data at the quarterly frequency. Q1, Q2, Q3 & Q4 connote April-June, July-September, October-December & January-March quarters respectively.

quarterly data in the estimation of fiscal multipliers is usually recommended by the pioneering studies by Blanchard and Perotti (2002); Ilzetzki et al. (2013) and many others³³.

Table 2-1: Variable Description

Variables	Symbol	Description	Units	Source
Growth Rate	GR	Quarterly variation in Gross-domestic Product at Factor cost	Percentage terms	Authors calculated
Consumption	CON	Private Final Consumption Expenditure	Constant 2004-05 Rupees Billion	FRB
Private Investment	PI	Gross Fixed Capital Formation	Constant 2004-05 Rupees Billion	FRB
Gross Domestic Product	GDP	Gross Domestic Product at Factor cost	Constant 2004-05 Rupees Billion	RBI
Call Money Rate	CMR	Weighted Average Call Money Rates	Percent per annum	RBI
Government Expenditure	GE	Total Government expenditure both revenue and capital.	Constant 2004-05 Rupees Billion	CGA
Tax Revenue	TR	Total Revenue Receipts less non-tax revenue, capital receipts, recovery of loans and other receipts	Constant 2004-05 Rupees Billion	CGA

Note- “FRB= Federal Reserve Bank of ST. Louis, RBI= Database on Indian Economy-Reserve Bank of India, CGA= Controller General of Accounts, Ministry of Finance, Government of India”.

Although, no shock identification is required in the present analysis, however, for a comprehensive analysis of inherited dynamics, quarterly data set may prove beneficial. Moreover, no exogenously constructed measures for government spending and tax

Moreover for the model with economic growth as the dependent variable the sample period will be from 1998-99q2 to 2017-18q4, since one observation is consumed during the calculation of growth rate from the GDP series.

³³ Blanchard and Perotti (2002) maintained that “we use quarterly data because, as we discuss below, this is essential for identification of fiscal shocks” (p.1332). Similarly, Ilzetzki et al. (2013) asserted “it is reasonable to assume that fiscal authorities require a quarter to respond to output shocks, it is unrealistic to assume that an entire year is necessary”.

changes like those constructed by Ramey (2011) and Romer and Romer (2010) are used due to their non-availability in case of India.

To account for the possibility of any feedback causality between the output growth and spending and tax changes (due to the operation of automatic stabilizers & implicit or explicit policy rules; Ilzetzki et al. 2013), we apply an asymmetric cointegration approach which adopts the reduced form data generating process for endogenous regressors. Like the studies by Agnello et al. (2013); Qazizada and Stockhammer (2015); Attinasi and Klemm (2016), we addressed the issue of endogeneity econometrically. The details of the variables incorporated into the empirical exercise are outlined in Table 2.1.

2.4.2 Empirical Methodology:

To overcome some of the difficulties associated with the existing methodologies, we have used a non-linear asymmetric cointegration method given by Shin et al. (2014) in our empirical analysis. The econometric method has been discussed at length in the Chapter 1 (Section 1.8), however, regarding the variables incorporated in the study, we estimate the following nonlinear error correction models based on specification 1.8.4 as:

$$\begin{aligned}
\Delta GR_t = & b + \psi GR_{t-1} + \delta_1^+ LPI_{t-1}^+ + \delta_1^- LPI_{t-1}^- + \delta_2^+ LGE_{t-1}^+ + \delta_2^- LGE_{t-1}^- \\
& + \delta_3^+ LTR_{t-1}^+ + \delta_3^- LTR_{t-1}^- + \delta_4^+ CMR_{t-1}^+ + \delta_4^- CMR_{t-1}^- \\
& + \sum_{i=1}^{p-1} \sigma_i \Delta GR_{t-i} + \sum_{i=0}^q \beta_{1,i}^+ \Delta LPI_{t-i}^+ + \sum_{i=0}^q \beta_{1,i}^- \Delta LPI_{t-i}^- \\
& + \sum_{i=0}^q \beta_{2,i}^+ \Delta LGE_{t-i}^+ + \sum_{i=0}^q \beta_{2,i}^- \Delta LGE_{t-i}^- + \sum_{i=0}^q \beta_{3,i}^+ \Delta LTR_{t-i}^+ \\
& + \sum_{i=0}^q \beta_{3,i}^- \Delta LTR_{t-i}^- + \sum_{i=0}^q \beta_{4,i}^+ \Delta CMR_{t-i}^+ + \sum_{i=0}^q \beta_{4,i}^- \Delta CMR_{t-i}^- \\
& + \epsilon_{1,t}
\end{aligned} \tag{2.1}$$

$$\begin{aligned}
\Delta LCON_t = & c + \lambda LCON_{t-1} + \pi_1^+ LGDP_{t-1}^+ + \pi_1^- LGDP_{t-1}^- + \pi_2^+ LGE_{t-1}^+ + \pi_2^- LGE_{t-1}^- \\
& + \pi_3^+ LTR_{t-1}^+ + \pi_3^- LTR_{t-1}^- + \pi_4^+ CMR_{t-1}^+ + \pi_4^- CMR_{t-1}^- \\
& + \sum_{i=1}^{p-1} \mu_i \Delta LCON_{t-i} + \sum_{i=0}^q \Omega_{1,i}^+ \Delta LGDP_{t-i}^+ + \sum_{i=0}^q \Omega_{1,i}^- \Delta LGDP_{t-i}^- \\
& + \sum_{i=0}^q \Omega_{2,i}^+ \Delta LGE_{t-i}^+ + \sum_{i=0}^q \Omega_{2,i}^- \Delta LGE_{t-i}^- + \sum_{i=0}^q \Omega_{3,i}^+ \Delta LTR_{t-i}^+ \\
& + \sum_{i=0}^q \Omega_{3,i}^- \Delta LTR_{t-i}^- + \sum_{i=0}^q \Omega_{4,i}^+ \Delta CMR_{t-i}^+ + \sum_{i=0}^q \Omega_{4,i}^- \Delta CMR_{t-i}^- \\
& + \epsilon_{2,t}
\end{aligned} \tag{2.2}$$

$$\begin{aligned}
\Delta LPI_t = & d + \rho LPI_{t-1} + \theta_1^+ LGDP_{t-1}^+ + \theta_1^- LGDP_{t-1}^- + \theta_2^+ LGE_{t-1}^+ + \theta_2^- LGE_{t-1}^- \\
& + \theta_3^+ LTR_{t-1}^+ + \theta_3^- LTR_{t-1}^- + \theta_4^+ CMR_{t-1}^+ + \theta_4^- CMR_{t-1}^- \\
& + \sum_{i=1}^{p-1} \omega_i \Delta LPI_{t-i} + \sum_{i=0}^q \varphi_{1,i}^+ \Delta LGDP_{t-i}^+ + \sum_{i=0}^q \varphi_{1,i}^- \Delta LGDP_{t-i}^- \\
& + \sum_{i=0}^q \varphi_{2,i}^+ \Delta LGE_{t-i}^+ + \sum_{i=0}^q \varphi_{2,i}^- \Delta LGE_{t-i}^- + \sum_{i=0}^q \varphi_{3,i}^+ \Delta LTR_{t-i}^+ \\
& + \sum_{i=0}^q \varphi_{3,i}^- \Delta LTR_{t-i}^- + \sum_{i=0}^q \varphi_{4,i}^+ \Delta CMR_{t-i}^+ + \sum_{i=0}^q \varphi_{4,i}^- \Delta CMR_{t-i}^- \\
& + \epsilon_{3,t}
\end{aligned} \tag{2.3}$$

The definition of various variables is given in Table 2.1. Equation 2.1 estimates the asymmetric impact of fiscal policy shocks on the economic growth, whereas in the extensions, equations 2.2 and 2.3 provide an analysis of asymmetric responses of private consumption and private investment to the spending and tax changes. We also incorporated the impact of interest rate changes in all the three specifications to account for the monetary policy actions or as a proxy for credit conditions as in Arin et al. (2015) and Barro & Redlick (2011). The inclusion of interest rate also helps to avoid the downward estimation bias of fiscal multipliers due to the omission of financial variables (Gechert and Mentges, 2013). It may also be noted that although the framework permits for “complete symmetry, short-run asymmetry only, long-run asymmetry only, both short & long-run asymmetry and the partial asymmetry specifications”, we applied a full asymmetry model in both the long and short-run. The motivation for choosing such a specification is provided by the various theoretical arguments for the existence of

asymmetric linkages. As usual, b, c and d constitute constants, ψ, λ, ρ denote the AR coefficients, $\delta_i^+, \delta_i^-, \pi_i^+, \pi_i^-, \theta_i^+, \theta_i^-$ and $\beta_i^+, \beta_i^-, \Omega_i^+, \Omega_i^-, \varphi_i^+, \varphi_i^-$ were $i=1,2,3,4$, are the long-run and short-run asymmetric coefficients and finally, $\epsilon_{i,t} \sim iid(0, \sigma_{\epsilon_{i,t}}^2)$ respectively.

2.5 Empirical Results and Discussion:

2.5.1 Seasonality and Unit Root Analysis:

The empirical exercise starts with the investigation of seasonal patterns of the variables, since the low-frequency data (daily, weekly, monthly or quarterly) usually suffer from the problem of seasonality. To serve the purpose, parametric, non-parametric and moving seasonality tests were applied³⁴. Of the various variables, the presence of seasonality is reported in case of GE, TR, CMR and GDP, whereas GR, CON and PI do not show any seasonal patterns as shown in Table 2.2.

Table 2-2: Seasonality Tests

Variable	Parametric F-statistic	Nonparametric Kruskal-Wallis test	Moving seasonality F-statistic	Combined Test for Identifiable seasonality
GR	-	-	-	-
CON	0.132	1.445(69.49)	2.406*	Not present
PI	1.557	3.126(37.25)	2.112**	Not present
GE	3036.133*	74.074(0.00)	1.598	Present
TR	4501.207*	74.074(0.00)	1.040	Present
CMR	6.183*	25.802(0.00)	2.926*	Present
GDP	88.292*	61.374(0.00)	13.336*	Present

“*indicates statistical significance at 1% level. The values in the parenthesis of Kruskal-Wallis test are corresponding p values”.

The *NARDL* model can be applied irrespective of stationarity or otherwise of the variables, provided none of them is integrated of order higher than one³⁵. However, before de-seasonalization, we applied unit root tests to check the order of integration of variables³⁶. Three different types of tests are applied for a robust examination. We

³⁴ The parametric F-stat and non-parametric Kruskal-Wallis statistic tests the null of no seasonality against an alternative of the presence of seasonal patterns, whereas Moving seasonality F-stat tests the null of no moving seasonality against an alternative of moving seasonality.

³⁵ “If the series is integrated of order two i.e. I (2), then the estimated test statistic stands invalid”, Ouattara (2006).

³⁶ “If the seasonally adjusted data is used to apply unit root tests, this will result in the biased test statistics for ADF, PP or other conventional test towards the non-rejection of null of unit root. Therefore in an

started with the standard ADF, PP and KPSS tests³⁷. For a more reliable analysis of the conventional unit root testing, NG and Perron (2001) test is applied. The presence of seasonality may lead to misleading conclusions about the stationarity or otherwise of a time series variable, the study also uses the *HEGY test* constructed by Hylleberg et al. (1990). The HEGY test will enable the identification of seasonal unit roots at different frequencies³⁸.

Tables 2.3, 2.4 & 2.5 report the test results. Table 2.3 reports that CON, PI, GDP & CMR is I(1), GR is I(0) and due to the less power of conventional tests, particularly in presence of seasonality, no conclusive order of integration has been assigned to GE and TR. Applying Ng-Perron test, the results reported in Table 2.4 appear to be more consistent. CON, PI, GDP, GE and TR are reported to be I(1) and GR and CMR as I(0). Finally, Table 2.5 reports the results of HEGY test. It corroborates with the results of 2.3 & 2.4. For GR and CMR, the three null hypotheses, testing for non-stationarity, are rejected, whereas in case of PI and CON, the null of the presence of non-seasonal unit root is accepted and the null of presence of seasonal unit root is rejected. Finally, for the GE and TR, all the three null hypotheses have been accepted. Thus, like the NG-Perron test according to HEGY test, CMR and GR are I(0) and CON, PI, GDP, GE and TR are I(1), although the later too are with a seasonal unit root.

asymptotic manner, it is preferred to study the seasonally unadjusted data for more power of unit root tests” (Maddala and Kim, 1998)

³⁷ Among the ADF, PP and KPSS tests, the first two test a null of non-stationarity against an alternative of stationarity or trend stationarity, depending upon the choice among the alternative test specifications like a random walk, a random walk with a drift and/or a random walk with a drift and trend specification. The KPSS test on the contrary, tests a null of stationarity (trend stationarity) against an alternative of unit root. It may further be noted that the absence of a unit root in case of KPSS test does not guarantee that the variable is stationary but by the design of test, confirms about the trend stationarity because it may be possible for a time series variable to be non-stationary i.e. have a unit root and still be trend-stationary.

³⁸ The identification of seasonal unit roots is necessary because contrary to the standard tests, to remove the seasonal unit root by taking differences will leave the series both non-stationary and will convert the series into very complex specifications. For further details about the HEGY test refer to Hylleberg et al. (1990); Ghysels et al. (1993).

Table 2-3: Unit Root Tests

Variables	Test	C		C+T	
		Level	First difference	Level	First difference
GR	ADF	-8.564*	-	-8.511*	-
	PP	-8.523*	-	-8.582*	-
	KPSS	0.138 (5%)	-	0.144 (1%)	-
CON	ADF	7.249	-1.115	1.251	-10.038*
	PP	9.787	-8.392*	1.069	-14.391*
	KPSS	1.158	1.162**	0.319**	0.072 (5%)
PI	ADF	3.891	-7.264*	-1.389	-8.840*
	PP	3.695	-7.581*	-1.384	-8.857*
	KPSS	1.229**	0.859**	0.277**	0.072 (5%)
GDP	ADF	2.619	-2.944**	-1.596	-4.266*
	PP	1.578	-11.329*	-4.145*	-14.802*
	KPSS	1.241**	0.309 (5%)	0.262**	0.081 (5%)
CMR	ADF	-2.73	-7.861*	-2.732	-7.805*
	PP	-2.82	-8.925*	-2.822	-8.853*
	KPSS	0.126 (5%)	-	0.129**	0.049 (5%)
GE	ADF	2.501	-0.698	-0.239	-3.881*
	PP	-5.605*	-	-8.639*	-
	KPSS	1.183**	0.226 (5%)	0.167**	0.095 (5%)
TR	ADF	2.062	-1.456	-1.527	-2.563
	PP	-6.033*	-	-8.236*	-
	KPSS	1.286**	0.212 (5%)	0.160**	0.092 (5%)

Note: “*, ** and *** denotes the rejection of null hypothesis against an alternative at 1, 5 and 10% level of significance. C and C+T refer to two alternative specifications denoting constant only & constant and a linear trend respectively. ADF is Augmented Dickey-Fuller test (Dickey and Fuller, 1979), PP represents the Philips-Perron test (Philips and Perron, 1988) and KPSS denotes the Kwiatkowski et al. (1992a) stationarity test. Schwarz information criteria (SIC) is applied to choose the appropriate lag length for ADF test and Newey-West automatic selection procedure is used to choose the bandwidths for PP and KPSS tests”.

Table 2-4: NG-Perron (2001) Unit Root Test

<i>Test-Statistic</i>		<i>MZ_α</i>	<i>MZ_t</i>	<i>MSB</i>	<i>MPT</i>	<i>Result</i>
Constant						
<i>Variables / Level</i>	<i>Lags</i>					
GR	0	-38.96*	-4.406*	0.113	0.649	I(0)
CON	4	0.423	0.174	0.411*	16.199*	I(1)
PI	3	2.172	1.914	0.881*	68.286*	I(1)
GDP	4	2.018	1.836	0.910*	70.598*	I(1)
CMR	0	-12.77**	-2.518**	0.197	1.952	I(0)
GE	4	6.364	10.912	1.715*	409.69*	I(1)
TR	2	-2.723	-0.582	0.214*	7.430*	I(1)
First Difference						
d(CON)	1	-21.625*	-3.254*	0.151	1.249	I(0)
d(PI)	0	-36.948*	-4.127*	0.111	0.149	I(0)
d(GDP)	2	-12.629**	-2.467**	0.195	2.121	I(0)
d(GE)	1	-98.288*	-6.993*	0.071	0.282	I(0)
d(TR)	1	-125.753*	-7.907*	0.063	0.234	I(0)
Critical values		-13.800	-2.580	0.174	1.780	1%
		-8.100	-1.980	0.233	3.170	5%
		-5.700	-1.620	0.275	4.450	10%
Constant and Trend						
<i>Level</i>	<i>Lags</i>					
GR	0	-38.970	-4.412	0.113	2.352	I(0)
CON	3	-4.489	-1.254	0.279*	18.509*	I(1)
PI	0	0.421	0.243	0.577*	79.135*	I(1)
GDP	4	-2.479	-0.858	0.346*	27.665*	I(1)
CMR	1	-15.64***	-2.79***	0.178	5.856	I(0)
GE	3	2.921	7.682	2.630*	1853.84*	I(1)
TR	3	3.544	6.771	1.910*	1049.99*	I(1)
First Difference						
D(CON)	0	-37.187*	-4.311*	0.125	2.454	I(0)
D(PI)	0	-38.994*	-4.366*	0.111	2.604	I(0)
D(GDP)	1	-323.039*	-12.708*	0.039	0.284	I(0)
D(GE)	1	-97.014*	-6.952*	0.072	0.988	I(0)
D(TR)	1	-116.154*	-7.605*	0.065	0.841	I(0)
Critical values		-23.800	-3.420	0.143	4.030	1%
		-17.300	-2.910	0.168	5.480	5%
		-14.200	-2.620	0.185	6.670	10%

Note: “*, ** and *** denotes the rejection of null hypothesis against an alternative at 1, 5 and 10% level of significance”.

Table 2-5 Seasonal Unit Root Test-HEGY:

Variables	GR	CON	PI	GDP	CMR	GE	TR
Constant & Seasonal dummy							
Null							
Nonseasonal unit root (Zero frequency)	- 4.29***	4.70	2.98	2.55	-2.65***	3.07	1.98
Seasonal unit root (2 quarters per cycle)	-5.09**	-5.53**	-5.66**	-2.35	-6.51**	0.85	2.34
Constant, Trend and Seasonal dummy							
Null							
Nonseasonal unit root (Zero frequency)	-4.29***	1.04	-1.65	-1.62	-2.04***	-1.66	-1.42
Seasonal unit root (2 quarters per cycle)	-5.09**	-5.15**	-5.68**	-2.38	- 5.15**	0.69	1.46
Seasonal unit root (4 quarters per cycle)	13.63*	19.20*	31.92*	1.48	19.20*	1.93	1.84
Result	I(0)	I(1)	I(1)	I(1)	I(0)	I(1)	I(1)

Note: “*, ** and *** denotes the rejection of null hypothesis against an alternative at 1, 5 and 10% level of significance. HEGY represents Hylleberg et al. (1990) seasonal unit root test. Lag length is chosen on the basis of Schwarz information criteria (SIC) and 1000 Monte-Carlo simulations were conducted to simulate the critical values”.

The unit root analysis highlights that we have a blend of I (1) and I (0) variables and none of them is integrated of order greater than one, therefore, the application of NARDL is vindicated. Before proceeding for asymmetric analysis, and following the studies like Yadav et al. (2012); Ilzetzki et al. (2013); Goyal & Sharma (2015, 2018), we deseasonalize the data wherever required by applying the *Census X13 algorithm* of Census Bureau of US³⁹. The summary statistics of the normal and de-seasonalized variables is documented in Table 2.6.

³⁹ The deseasonalization of the variables like GE, TR & GDP is mandated by the much noted “March Rush” or the “end of season” situations observed at the end of a financial year in case of India (Goyal & Sharma (2018)).

Table 2-6: Descriptive Statistics

	CMR	CONS	GDP	GE	GR	PI	TR
Mean	6.75	9985.42	10564.27	4935.48	1.66	5305.90	2121.43
Median	6.85	7390.81	10187.54	3660.24	1.85	4699.93	1897.26
Skewness	-0.21	0.81	0.31	0.76	0.23	0.38	0.86
Kurtosis	2.37	2.34	1.80	2.38	3.94	1.78	2.90
Jarque-Bera	1.90	10.19	6.07	9.03	3.61	6.89	9.89
Probability	0.39	0.01	0.05	0.01	0.16	0.03	0.01
Observations	80	80	80	80	80	80	80

Note: “Descriptive Statistics of de-seasonalized data are reported. The variables are taken in absolute numbers. Later to overcome scale and size effect and to avoid the problems associated with the distributional properties of data series, natural logarithms of all variables except the rates and percentages are taken in order to arrive at the more appropriate and consistent estimators”.

2.5.2 Asymmetry Analysis:

To overcome scale and size effect and to do away with the issues related to the distributional properties of the data series, natural logarithms of all variables except the rates and percentages are taken in order to arrive at more appropriate and consistent estimators. The log forms of the corresponding variables will now be represented like LPI, LCON, LGE, LTR and LGDP respectively and the GR and CMR will remain as it is. The asymmetric analysis begins with the reaction of output growth to the hikes and cuts in government expenditure and taxes along with the private investment and interest rate. The results of asymmetric ARDL model in its *ECM* specification 2.1 are reported in Table 2.7. We followed a general to specific approach for a reliable model specification. Initially a lag length of $\max p = q = 2$ is chosen according to the “*Akaike’s Information Criteria (AIC)*” and the *Schwartz-Bayesian Criteria (SBC)*” and subsequently most of the insignificant lags are dropped in order to ensure precision in the statistical results by avoiding the noise into the trajectories of dynamic multipliers.

To account for the possibility of cointegration in model 2.1, null of no cointegration i.e. ($\gamma = 0$) according to Banerjee et al. (1998) and ($\gamma = \delta^+ = \delta^- = 0$) by Pesaran et al. (2001) is tested against an alternative of the presence of cointegration. The Panel B of Table 2.7 establishes the evidence in favour of long-run association because both the test statistic t_{BDM} and F_{PSS} are statistically significant. For the reliability and stability of the estimated model, Panel C of the Table 2.7 mentions the diagnostic tests. The χ^2_{Sc}

reports the absence of *autocorrelation*, χ^2_{BPG} confirms the *homoscedasticity* of error variance, *Ramsey F – test* ratifies the *structural specification* of the estimated model & finally, the *normality* requirement is proved by χ^2_{NOR} respectively.

Having established the existence of a long-run association, we now proceed to test whether this relationship is symmetrical (linear) or whether some asymmetry is portrayed. For this purpose, Wald's test with a null of symmetrical association is tested against an alternative of an asymmetrical one. The results of both short-run (W_{SR}) and long-run (W_{LR}) tests are reported in lower part of Panel A of Table 2.7. It is seen from the results that the null of long-run symmetrical association is rejected in all the observed cases at 1%, 5% and 10% level of significance and therefore, the evidence of the existence of long-run asymmetrical association is established between GR & LPI, GR & LGE, GR & LTR and GR & CMR respectively. Similarly, except for GR & CMR, the null of short-run symmetry is rejected between the GR & LPI, GR & LGE and GR & LTR against an alternative of asymmetric relationship at the 10% level of significance. Thus, unlike the studies based on a linear and symmetric framework, we find that the relationship between positive and negative changes in the government spending and taxes with the GR is asymmetric in both short and long-run. The confirmation of both short and long-run asymmetries vindicates our complete asymmetric specification for NARDL model.

The positive and negative changes in the LGE & LTR affect the output growth of India asymmetrically as the associated coefficients are different in sign, size and statistical significance. Coming to the long-run impacts, Panel A of Table 2.7 reports that the response of output growth to the positive change in LPI is found to be positive and statistically significant, however, the response to the negative change in LPI is relatively muted and statistically insignificant.

Table 2-7: long & Short-run Asymmetry Results (Model 2.1)

A. Asymmetry Results		Long-Run Effect [+]		Long-Run Effect [-]		
Variables	Coef.	F- stat	P- value	Coef.	F- stat	P- value
LPI	5.371	5.985	0.017**	5.145	0.138	0.712
LGE	6.945	2.833	0.098***	2.453	0.212	0.647
LTR	-5.317	4.965	0.030**	0.519	2.028	0.091***
CMR	-0.335	14.23	0.000*	0.062	4.030	0.042***
Long-run Asymmetry			Short-run Asymmetry			
W_{LR}			W_{SR}			
	F- stat	P- value		F- stat	P- value	
LPI	7.537	0.009*		3.750	0.058***	
LGE	5.646	0.021**		2.991	0.089***	
LTR	5.507	0.022**		2.391	0.099***	
CMR	4.019	0.050***		0.110	0.741	
B. Cointegration Test		F_{PSS}		t_{BDM}		
		10.395**		-9.392**		
C. Model Diagnostics		Test Statistics		P-value		
χ^2_{Sc}		43.30		0.187		
χ^2_{BPG}		0.035		0.850		
χ^2_{NOR}		0.768		0.680		
Ramsey F-test		0.303		0.823		

Growth Equation (2.1): $GR = f(LPI, LGE, LTR, CMR)$. Note: " F_{PSS} and t_{BDM} are the long-run cointegration test statistics. *, ** & *** denote the 1, 5 and 10% significance levels respectively. χ^2_{Sc} represent the portmanteau serial correlation test, χ^2_{BPG} denote the Breusch-Pagan-Godfrey heteroskedasticity test, Ramsey F is the RESET test and finally the Jarque-Bera normality test is denoted by χ^2_{NOR} . General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$. The relevant 5% and 10% upper bound critical values of t_{BDM} for $k=4$ (without taking partial decomposition into consideration) are -3.99 & -3.66 and for $k=8$ (when partial sum decompositions are independently treated as regressors) are -4.72 & -4.40. Similarly for the F_{PSS} test the relevant 5% and 10% upper bound critical values for $k=4$ are 4.01 & 3.52 and for $k=8$ are 3.39 & 3.06 respectively" (Pesaran et al. 2001).

Similarly, the impact of an increase in LGE is found to be significantly positive and that of decrease in it affects the output growth insignificantly⁴⁰. The multiplier value attached to the increase in the government expenditure is favourable to enhance the

⁴⁰ Although, we did not distinguish between the recessions and expansions explicitly, however our result of spending multiplier being higher for increases in LGE than the one associated with the decreases in it and the latter one being statistically insignificant is also reported in Riera-Crichton et al. (2015). Moreover, the large cumulative multiplier values are also reported in Jha et al. (2014) for India even after discounting their present values; Bose and Bhanumurthy (2015) for India; Riera-Crichton et al. (2015) in case of OECD economies and Jones et al. (2015) for UK and US. Thus, a symmetrical multiplier value may underestimate relative to the estimates in an asymmetrical framework (Riera-Crichton et al. 2015).

growth performance of India and thereby follows the Keynesian multiplier theory. The Keynesian effect of spending changes associated with the increase in government expenditure are in line with the results of Tagkalakis (2008); Auerbach and Gorodnichenko (2012); Thomakos (2012); Yadav et al. (2012); Bose and Bhanumurthy (2015); Caggiano et al. (2015); Qazizada and Stockhammer (2015); Arin et al. (2015); Auerbach and Gorodnichenko (2017)⁴¹. The implication of this result is that government expenditure changes are more effective in mitigating the economic downturns than muting the booms (Tagkalakis, 2008).

Though it is beyond the scope of present study to provide an explanation to this asymmetric response of economic growth to positive and negative changes in government spending, however a likely theoretical reason may be stated as follows. The asymmetric impact of government spending changes on the economic growth of a country may arise due to its asymmetric impact on the aggregate demand through its components like consumption and investment inflexibility and the existence of liquidity constraints (Tagkalakis, 2008; Bhat and Sharma 2018). Due to limited access to credit markets in a recessionary period, liquidity constraints may be binding across a wider range of households and firms and therefore, any increase in government spending would enhance the liquidity position of constrained economic agents and thereby enhance the aggregate demand more substantially⁴². Likewise, due to the presence of less developed credit markets and large fraction of liquidity constrained individuals, the negative wealth effect due to an hike in LGE as reported in the RBC theories, will be weaker and hence a spending expansion would enhance the aggregate demand more appreciably and amplify the public spending effects on output growth.

On the contrary, any fall in the government spending leads to a relatively smaller fall in aggregate demand due to the resistance from people to lower the consumption levels (Ratchet effect) and investment irreversibility. Hence, the effect of spending expansion is more pronounced than its contraction. The outcome of this result is more relevant for a developing country like India, where the access to the credit is limited and where the

⁴¹ However, unlike these studies, we also examined the impact of a decrease in LGE as is resorted during the economic upturns to mark any asymmetric impacts.

⁴² Because the liquidity constrained individuals consume all the disposable income change caused by increased public spending without any regard to the future implications of contemporary spending and tax decisions (Tagkalakis, 2008).

purchasing power of the large part of population is very low. Thus, the status quo of Indian economy affirms with the finding of Brinca et al. (2016), who maintain that besides the country characteristics, the value of fiscal multiplier is highly sensitive to the fraction of population facing tight liquidity and also depends on the level of average wealth in the economy.

As regards to tax changes, we found that tax hikes retard the growth while tax cuts improve it. Both the coefficients are statistically significant and follow the Keynesian theoretical contours, however, the effect of tax hikes is more pronounced than tax cuts. Unlike some earlier studies, after allowing for asymmetric effects, we observe that the taxes hikes & cuts produce different results. In contrast to the impact of spending changes, tax changes are more effective in muting booms and are little effective to avoid economic downturn. The results are more or less similar to those of Jones et al. (2015) and Hussain and Malik (2016) relating to the response to tax cut, however, unlike them we also found a statistically significant coefficient for a tax hike. The factors like the differential response of macroeconomic variables like consumption, investment, output growth to different tax shocks, difference in magnitude of private & public debt, difference in centralization of taxation and the overall monetary environment may provide some insights about the possible asymmetries⁴³. Even the behaviour of aggregate demand components also add to the observation of asymmetric response to tax changes.

From the above analysis it can be inferred that the effects of fiscal policy changes on the output growth of India is asymmetric, with spending hikes more effective than spending cuts and tax hikes more effective than tax cuts. On a comparative note between spending and tax changes, our results indicate that spending hikes are more effective than the tax cuts when an expansionary policy stance is needed during bad times and tax hikes are more effective than spending cuts when a contractionary policy action is needed during boom. The results are broadly consistent with those of Jha et al. (2014) & Arin et al. (2015), however, neither of them adopted an asymmetric framework for analysis.

⁴³ For a detailed discussion about these factors refer to Jones et al. (2015).

Relatively, greater effectiveness of spending hikes versus tax cuts could be given the following theoretical reasoning. The government in case of spending hikes, is directly involved in the direct procurement of goods and services including the expenditures on public works and infrastructure and therefore has an immediate and more pronounced effect on aggregate demand by enhancing the purchasing power of credit constrained population. On the contrary, the impact of tax cuts is less direct and less pronounced because the effectiveness of tax cuts depends on the willingness of economic agents (firms and households) to spend the additional purchasing power deriving from the tax cuts (Jha et al. 2014). In India, the relative effectiveness of spending hikes is a plausible owing to the distorted credit allocation and prevalence of inequalities. Therefore, the role of government to stimulate the demand conditions through expenditure hikes is quite imperative (Jha et al. 2014).

Again the consumption downward inflexibility and investment irreversibility following a spending cut usually during an upturn makes it less effective than tax hikes. The effect of spending cuts could be avoided by reducing savings or inventories, however, the tax hike acts as a potent instrument to lower the demand conditions. Even the confidence building for financial markets in case of spending cuts and failure to do so through the tax hikes will ensure a lesser output decline due to a spending cut than a tax hike during an expansion (Jha et al. 2014; Kasselaki and Tagkalakis 2016).

Finally, the GR is found to respond asymmetrically to the monetary policy actions as well. A contractionary policy action in the form of a hike in CMR is found to reduce the GR whereas an expansionary stance improves it. Both the coefficients are statistically significant, however, the impact of rate hike is more pronounced than the rate cut. This implies that tight monetary policy slows the economic growth more than easy monetary policy action stimulates it. Theoretical reasoning for this monetary policy asymmetry can be attributed to the changing outlooks of firms and consumers, the binding liquidity constraints and the downward price rigidity (Morgan 1993; Barnichon et al. 2017).

The changing outlook of firms and consumers could result in the asymmetric impacts, if the magnitude of pessimism is relatively high during economic downturns than they are optimistic during expansions, or if the business and consumer confidence matters

more during recessionary conditions⁴⁴. As related to the credit constraints, tight monetary policy would be more effective than an easy one if the former makes banks less willing to lend to some riskier borrowers. A tight monetary policy executed during an expansion raises the market rates and thereby increase the bank's cost of funds coupled with higher risk of default on part of borrowers. As a result, banks become choosy in lending to the riskier borrowers, leaving them credit constrained. In a growing economy like India with appreciable demand for credit, credit constraints lower the spending levels by these borrowers substantially. Thus, the binding credit constraints magnifies the effect of tight policy stance and lead to a stronger decline in borrowing and spending than would be possible from the interest rate hikes alone (Morgan 1993). On the contrary, a cut in the interest rates through an easy policy action eliminate the credit constraints. However, if the demand for credit is lacking during an economic downturn, slacking the liquidity position may not necessarily augment the borrowings and higher spending. Thus, a stronger demand contraction following a tight policy stance and a relatively lower stimulation of it following an easy policy action make the response of output growth more skewed towards contraction than expansion.

Finally, the asymmetric price transmission or the "*Rockets and Feathers*" hypothesis⁴⁵ provides another illustration for the asymmetric response of output growth to the monetary policy changes through the lower downward price flexibility. Output growth would respond more negatively to the interest rate hikes than positively to the rate cuts if the prices are less flexible in the downward direction than otherwise. The tight monetary policy action will lead to substantial fall in output and a small fall in prices in prices, whereas an easy policy action will lead to small increase in output and an appreciable hike in the prices⁴⁶. From empirical point of view, this result implies than

⁴⁴ Due to the higher pessimism during the recessionary periods, lower interest rates may not boost consumer spending and investments whereas the higher interest rates during booms lowers them by increasing their costs, however the optimism during the boom should not overweigh the pessimism during recession (Morgan 1993).

⁴⁵ According to "Rocket and Feathers" hypothesis developed by Bacon (1991) prices rise like rockets and fall like feathers and thus portray the asymmetric price movements. Increasing the prices, say for instance due to increasing costs, is preferred to decreasing the prices when the costs fall.

⁴⁶ In response to lower spending as a result of tight policy action, instead of cutting prices the firms prefer to reduce output and in response to spending augmentation following an easy policy action together with the trending inflation, firms wish to increase prices rather than output (Morgan 1993).

monetary policy actions could serve as a better tool like tax hikes to mute the boom or excess demand pressures in the economy.

Table 2-8 Nonlinear ARDL error correction model 2.1.

<i>Variables</i>	<i>Coefficient</i>	<i>t-statistic</i>	<i>P-value</i>
Dependent variable: ΔGR			
GR_{t-1}	-0.321	-9.390	0.000
LPI_{t-1}^+	9.031	2.360	0.022
LPI_{t-1}^-	-8.649	-0.370	0.711
LGE_{t-1}^+	11.676	1.680	0.099
LGE_{t-1}^-	-4.125	-0.460	0.649
LTR_{t-1}^+	-8.939	-2.160	0.035
LTR_{t-1}^-	-0.872	-0.210	0.832
CMR_{t-1}^+	-0.563	-3.620	0.001
CMR_{t-1}^-	-0.104	-0.650	0.520
ΔGR_{t-1}	0.509	4.370	0.000
ΔLPI_t^-	-5.634	-1.940	0.058
ΔLGE_t^+	14.786	2.450	0.017
ΔLGE_{t-1}^+	3.906	1.980	0.076
ΔLGE_{t-1}^-	-8.362	-0.740	0.464
ΔLTR_{t-1}^-	9.411	1.550	0.097
ΔCMR_t^-	0.293	0.940	0.351
ΔCMR_t^-	0.115	0.350	0.728
Constant	2.701	4.590	0.000

Note: "General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$ and most of the insignificant lags are eliminated out to ensure the precision in cumulative dynamic multipliers".

The response of economic growth to the fiscal policy changes in the short-run follows the Keynesian paradigm, wherein an expansionary fiscal stance (increase in spending or decrease in taxes) stimulates the economic growth and a contractionary one lowers it. The results are reported in Table 2.8. The short-run impact of an increase in government expenditure on the economic growth is found to be significantly positive and that of decrease in it is statistically insignificant. Similarly for the tax instrument, positive change affects the economic growth negatively and negative change improves it, however, only the second one is statistically significant. The short-run impact of LPI and CMR, it is in accordance with the theory, but it is statistically insignificant and therefore are left undiscussed.

2.5.3 Extensions:

To ensure the robustness of the above documented results, we extended our analysis to investigate the impact of various explanatory variables on the private consumption & private investment. For the private consumption response, the results are reported in Table 2.9.

Here again with an initial lag structure of $\max p = q = 2$ as suggested by *AIC* and *SBC* criteria, we followed a general to specific approach for a reliable analysis. Part A establishes a long-run cointegration relationship among the variables of model 2.2 since both F_{PSS} & t_{BDM} are statistically significant at 5% significance level. In the short-run, null of symmetrical association against an alternative of asymmetrical one is rejected between LCON & LGE, LCON & LTR and LCON & CMR and accepted between LCON & LGDP. On the other hand, null of long-run symmetry is rejected against an alternative of asymmetry between LCON and all the explanatory variables included in the model 2.2 as shown in lower part of panel A Table 2.9. Panel C of establish the diagnostic requirements of the estimated model 2.2.

Upper part of panel A of the Table 2.9 shows that private consumption mimics the response of output growth to the changes in LGE & LTR. The impact of increase in government spending is reported to be positive and statistically significant whereas the impact of negative change in spending is insignificant. This corroborates the above finding that when economic agents have limited access to the credit during recessions and thereby liquidity constraints may be binding across large section of households, the

response of consumption would be more to positive spending changes. Hence, the response of private consumption to an expansionary fiscal stance would be positive (Keynesian) in the economic downturns, magnifying the impact of positive public spending shocks on the output (Tagkalakis, 2008).

Table 2-9: Long & Short-run Asymmetry Results (Model 2.2)

A. Asymmetry Results	Long-Run Effect [+]			Long-Run Effect [-]		
Variables	Coef.	F- stat	P- value	Coef.	F- stat	P- value
LGDP	0.325	3.627	0.062***	3.724	0.687	0.410
LGE	0.457	14.48	0.000*	0.012	0.005	0.943
LTR	-0.182	3.731	0.058**	0.229	7.309	0.009*
CMR	0.016	20.94	0.005*	-0.007	7.763	0.007*
	Long-run Asymmetry			Short-run Asymmetry		
	W_{LR}			W_{SR}		
	F- stat	P- value		F- stat	P- value	
LGDP	4.248	0.044**		1.447	0.234	
LGE	10.45	0.002*		5.205	0.026**	
LTR	3.327	0.059***		5.541	0.022**	
CMR	4.299	0.042**		5.516	0.022**	
B. Cointegration Test	F_{PSS}		t_{BDM}			
	5.265**		-4.757**			
C. Model Diagnostics	Test Statistics		P-value			
χ^2_{Sc}	41.46		0.282			
χ^2_{BPG}	0.186		0.667			
χ^2_{NOR}	0.240		0.879			
Ramsey F-test	1.002		0.400			

Consumption Equation (2.2): $LCON = f(LGDP, LGE, LTR, CMR)$. Note: “ F_{PSS} and t_{BDM} are the long-run cointegration test statistics. *, ** & *** denote the 1, 5 and 10% significance levels respectively. χ^2_{Sc} represent the portmanteau serial correlation test, χ^2_{BPG} denote the Breusch-Pagan-Godfrey heteroskedasticity test, Ramsey F is the RESET test and finally the Jarque-Bera normality test is denoted by χ^2_{NOR} . General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$. The relevant 5% and 10% upper bound critical values of t_{BDM} for $k=4$ (without taking partial decomposition into consideration) are -3.99 & -3.66 and for $k=8$ (when partial sum decompositions are independently treated as regressors) are -4.72 & -4.40. Similarly for the F_{PSS} test the relevant 5% and 10% upper bound critical values for $k=4$ are 4.01 & 3.52 and for $k=8$ are 3.39 & 3.06 respectively” (Pesaran et al. 2001).

Similarly, a hike in taxes lowers consumption and a cut augments it. Both coefficients are statistically significant and well according to theory. The smaller response of consumption to the tax hikes provides an illustration of the downward less flexibility of consumption owing to asymmetric adjustment costs arising from the non-

psychological factors such as the pre-commitment to contemporary consumption standards like housing, insurance, phone contracts, education etc. (Hussain and Malik 2016). On the contrary, a tax cut relaxes the tight liquidity position by improving purchasing power of households.

Similarly, the impact of increase in income is seen to be significantly positive according to Keynesian psychological law and that of decrease in income affects consumption insignificantly due to the operation of consumption ratchet effect. Finally, the response of private consumption to the monetary policy actions explains the behaviour of a typical household as a saver. The increase in interest rate improves the wealth position of savers and thereby incentivizes them to increase the spending, on the contrary, a fall in the interest rates may tempt a household to substitute current consumption for the future in order to maintain the target income from savings. Again, it may be noted that consumption downward inflexibility is reported in this case as well and thus validate the consistency of our results.

The results related to the dynamics of private investment as represented by model 2.3 are reported in Table 2.10. Again a lag length of $\max p = q = 2$ is chosen according to *AIC* and *SBC* criteria and a general to specific approach is followed to ensure accuracy and reliability in dynamic multipliers. Panel B confirms the existence of a long-run association, whereas lower part of panel A establish the evidence of short-run asymmetrical association between LPI & LGDP and LPI & LTR and long-run asymmetrical association between LPI and all the explanatory variables and finally, panel C validates the reliability of estimated model 2.3.

The reaction of private investment to the increase in public spending follows the substitutability hypothesis and therefore later crowds out the former. However, the response of spending decreases is statistically insignificant may be due to the investment irreversibility (Pindyck 1993). The displacement of private investment due to spending hikes in India appears to be plausible because the relative proportion of current expenditure as a percentage of GDP has substantially outplayed the proportion of its counterpart i.e. capital expenditure and the relative proportion of current expenditure as a percentage of total government expenditure has also exceeded to the

capital expenditure, as shown in Figures 2.1 and 2.2 (Jha et al. 2014)⁴⁷. Moreover, the other reasons which displaced the private investment as a result of public spending include declined infrastructural investments, increasing cost of capital through market borrowings and increase in price levels following the monetization of deficits from central bank (Krishnamurthy 2002).

Table 2-10: Long & Short-run Asymmetry Results (Model 2.3)

A. Asymmetry Results		Long-Run Effect [+]			Long-Run Effect [-]		
<i>Variables</i>	<i>Coef.</i>	<i>F- stat</i>	<i>P- value</i>	<i>Coef.</i>	<i>F- stat</i>	<i>P- value</i>	
LGDP	6.368	15.02	0.000*	-8.917	2.256	0.099***	
LGE	-0.610	2.809	0.099***	-0.167	0.121	0.729	
LTR	-0.304	3.850	0.085***	0.142	4.253	0.064***	
CMR	-0.039	5.171	0.027**	0.001	0.001	0.908	
Long-run Asymmetry				Short-run Asymmetry			
		W_{LR}		W_{SR}			
		F- stat	P- value	F- stat	P- value		
LGDP		5.198	0.021**	9.714	0.003*		
LGE		3.314	0.074***	1.324	0.255		
LTR		3.382	0.069***	3.646	0.061***		
CMR		3.974	0.051**	0.051	0.821		
B. Cointegration Test		F_{PSS}		t_{BDM}			
		5.112**		-4.425**			
C. Model Diagnostics		Test Statistics		P-value			
χ^2_{SC}		36.82		0.477			
χ^2_{BPG}		0.636		0.570			
χ^2_{NOR}		2.859		0.239			
Ramsey F-test		0.243		0.876			

*Investment Equation (2.3): $LPI = f(LGDP, LGE, LTR, CMR)$. Note: “ F_{PSS} and t_{BDM} are the long-run cointegration test statistics. *, ** & *** denote the 1, 5 and 10% significance levels respectively. χ^2_{SC} represent the portmanteau serial correlation test, χ^2_{BPG} denote the Breusch-Pagan-Godfrey heteroskedasticity test, Ramsey F is the RESET test and finally the Jarque-Bera normality test is denoted by χ^2_{NOR} . General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$. The relevant 5% and 10% upper bound critical values of t_{BDM} for $k=4$ (without taking partial decomposition into consideration) are -3.99 & -3.66 and for $k=8$ (when partial sum decompositions are independently treated as regressors) are -4.72 & -4.40. Similarly for the F_{PSS} test the relevant 5% and 10% upper bound critical values for $k=4$ are 4.01 & 3.52 and for $k=8$ are 3.39 & 3.06 respectively” (Pesaran et al. 2001).*

⁴⁷ The study has used the annual observations of current, capital and total expenditures in Figures 2.1 and 2.2, since the data at the quarterly frequency for the segregated tax and spending components is not available consistently.

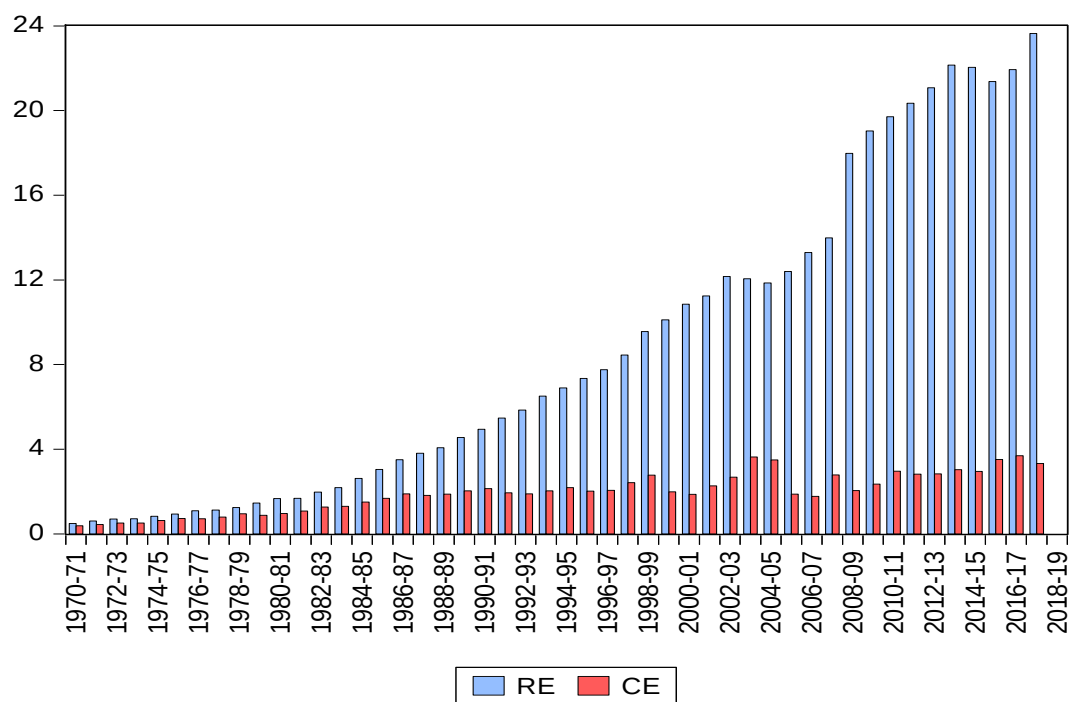


Figure 2.1: Revenue and Capital Expenditure as a percentage of GDP

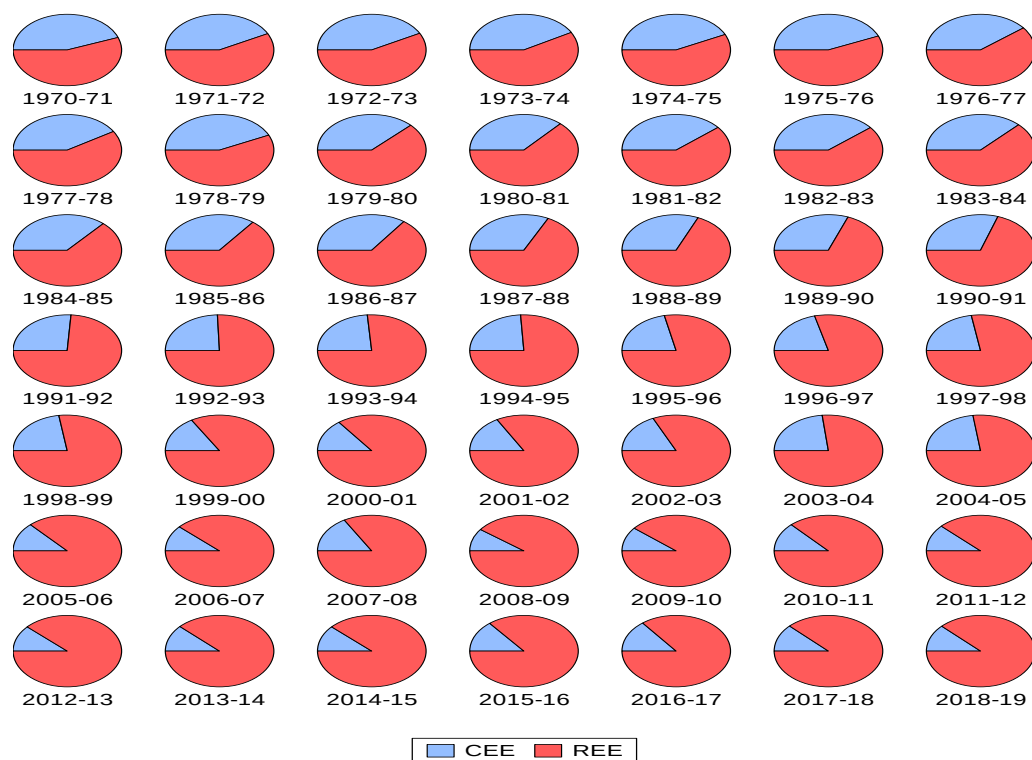


Figure 2.2: Revenue and Capital Expenditure as a percentage of Total Expenditure

The impact of tax changes on private investment follows the Keynesian framework, wherein the tax hikes reduce the private investment and tax cuts increase it, although the impact of a tax hike is greater than a tax cut. The hike in taxes reduces the profitability position of the investors and induce them to cut down the investment levels appreciably whereas a tax cut may not incentivise the private investors to increase the investment spending when the economic conditions are recessionary or when the risks related to the success of investment are low.

The response of private investment to the increase and decrease in income follows the notion of accelerator principle and both the coefficients are statistically significant. However, the magnitude of accelerator coefficient associated with a positive change in income is lower than the one reported for a negative change. Finally, the contractionary monetary policy action is found to decrease the private investment and the response to an easy policy shock is found to be statistically insignificant. This asymmetric response may again be explained through the channels mentioned above like the economic outlook, restricted bank lending to riskier borrowers and the less downward price flexibility.

It may further be noted that even in case of private consumption and private investment, tax hikes are more effective than spending cuts when a contractionary policy action is needed during good times. However, spending hikes are more effective to stimulate private consumption and tax cuts are more effective to stimulate private investment during an economic downturn. The short-run reaction of private consumption & private investment to spending & tax changes along with the change in income level and the interest rate are well according to theory. The results are reported in Tables 2.11 & 2.12 shown in appendix 2-I, however an intuitive look can be taken from the cumulative dynamic multiplier graphs given below.

2.5.4 Cumulative Dynamic Multipliers:

To start with, the dynamic multipliers, portraying the traverse from any deviation in the short-run to a new equilibrium position in the long-run, for the model 2.1 are shown in Figure 2.3. The blue line indicates the line of asymmetry and the value of this line at any given point measures the extent of asymmetry at that point. Figure 2.3 replicates all the results reported in Table 2.7, thus confirming the validity of above discussions. We found the presence of short-run asymmetry in all the cases except between GR &

CMR. In the long-run, the asymmetry is reported in all four parts of the Figure 2.3. However, between GR & LPI and GR and LGE, it is operative in terms of only positive changes and between GR & LTR and GR & CMR, the long-run asymmetry persists in terms of both positive and negative changes, although the impact of positive change is reported to be higher than that of negative change. Moreover, it takes around five quarters on average to reach to new equilibrium position following any short-run disturbance.

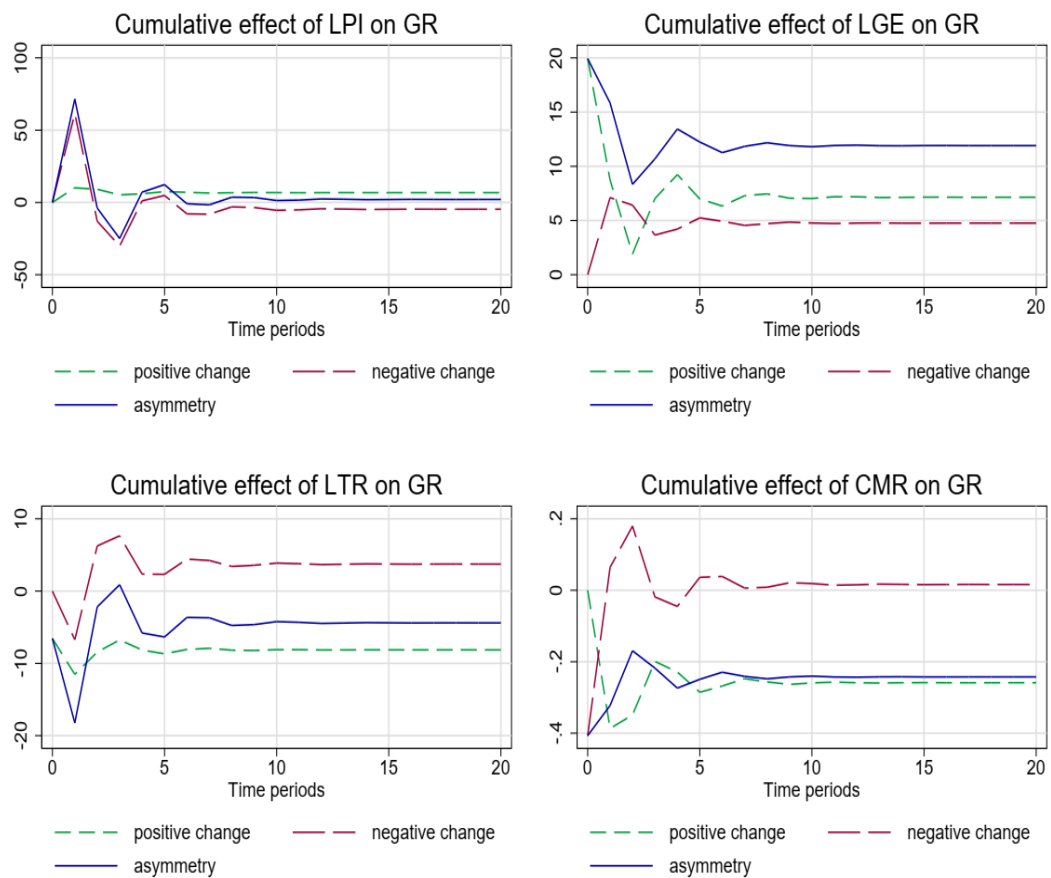


Figure 2.3: Cumulative Dynamic Multipliers for Model 2.1

Similarly according to Figure 2.4, portraying the dynamics of model 2.2, that except for LCON & LGDP, short-run asymmetry is reported in all the remaining parts of the figure. In the long-run, asymmetry is found in all the cases with asymmetry being significant only from positive change in case of LGDP and LGE, whereas in the remaining cases the asymmetry is significant with respect to both the positive and negative changes in LTR and CMR. However, the impact of negative change is more

substantial than the positive change in case of LTR and the opposite holds in case of CMR. In this case, it takes around 2 to 3 quarters on average to converge towards the long-run equilibrium position following any short-run disturbance.

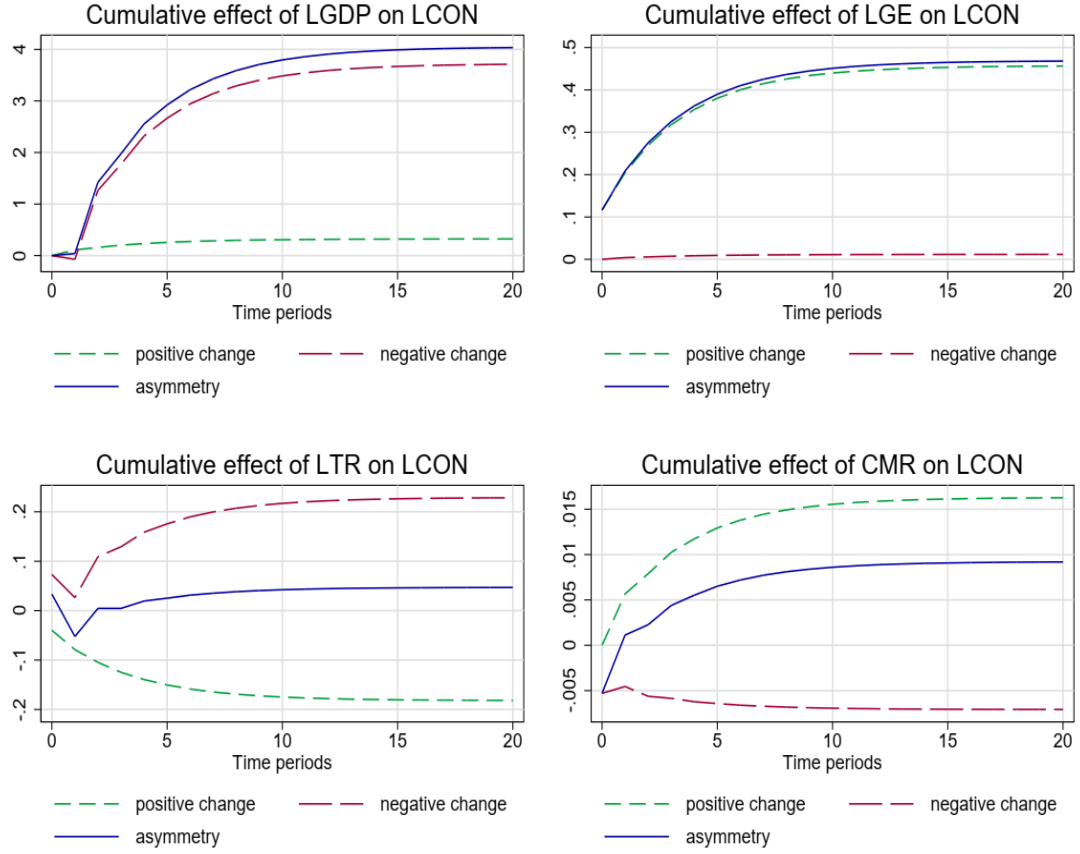


Figure 2.4: Cumulative Dynamic Multipliers for Model 2.2

Finally, Figure 2.5 portrays the dynamics responses of private investment to the positive and negative changes in the variables of model 2.3. The short-run asymmetry is reported between LPI & LGDP and LPI & LTR and a symmetric impact on LPI is found in case of LGE and CMR. However, the long-run asymmetry is reported in all the parts of Figure 2.5 like in Table 2.10. The impact of positive change is found to be higher than the corresponding negative change in all the cases except LGDP where the opposite holds. Further, in case of LGE and CMR asymmetry is significant from positive change only. The convergence towards a new stable long-run equilibrium following any short-run disturbance takes around 2 to 3 quarters like in case of Figure 2.4.

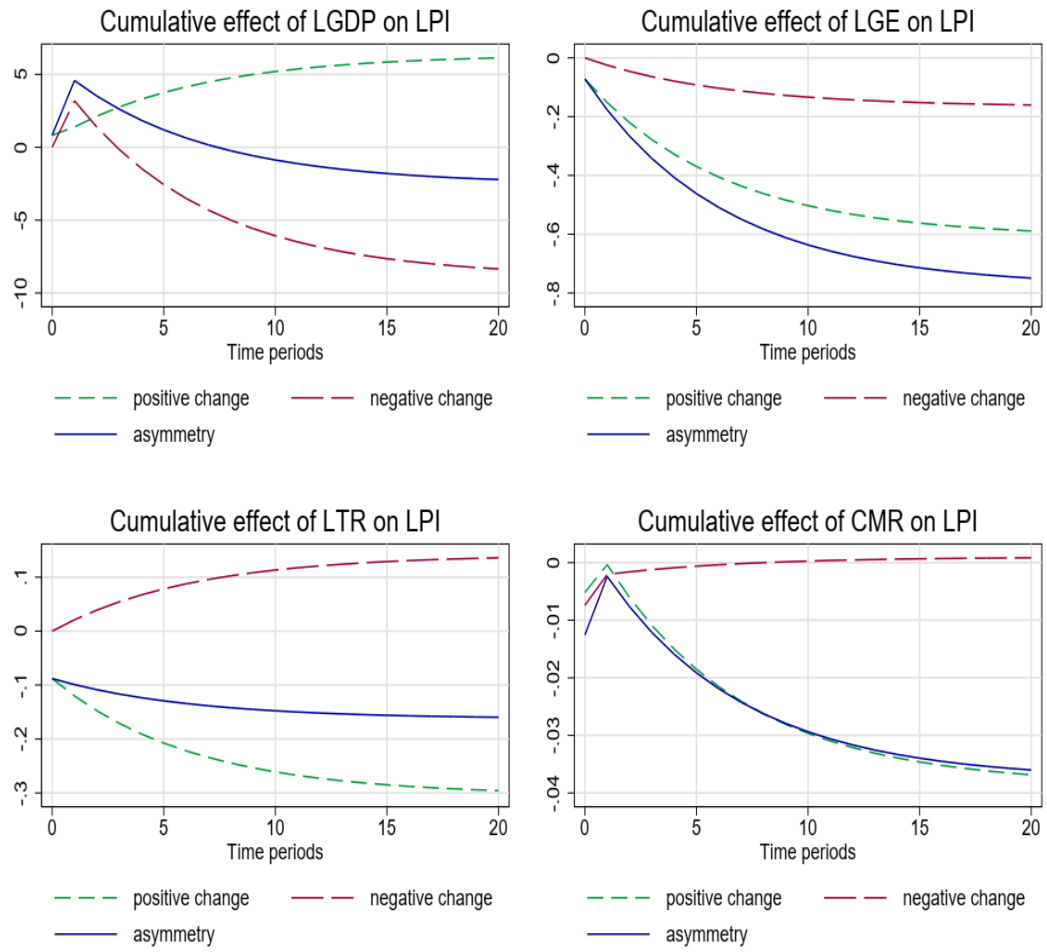


Figure 2.5: Cumulative Dynamic Multipliers for Model 2.3

2.6 Conclusion:

Despite the questions raised against the fiscal policy potency as a stabilization tool during 1970s and 1980s, the onset of global financial crisis led to a renewed interest to explore the impact of fiscal policy changes on the major macroeconomic variables. Although, large number of studies have been conducted in both developed and emerging economies, however, these studies have largely adopted a symmetric framework and the possibility of asymmetric responses of macroeconomic variables to the positive and negative changes in the fiscal policy tools have been only rarely undertaken. To account for the possibility of an asymmetric relationship between the fiscal policy instruments and the key macroeconomic variables, we applied an asymmetric cointegration framework proposed by Shin et al. (2014) to a quarterly data set from 1998-99q1 to 2017-18q4 in case of an emerging economy namely India. The results reported here indicate existence of an asymmetric cointegration relationship among output growth, government spending and tax changes in both the short and long-run. The response of output growth to the fiscal policy changes follows the Keynesian paradigm, wherein an expansionary fiscal stance (spending hikes or taxes cuts) stimulates it and a contractionary one (spending cuts and tax hikes) lowers it, however, the impact of spending cuts is found to be statistically insignificant.

It is seen that the impact of a hike in public spending is found to be significantly positive and that of decrease in it affects the economic growth insignificantly. The asymmetric impact of government spending changes on the economic growth of a country may arise due to its asymmetric impact on the aggregate demand through its components like consumption and investment inflexibility and the existence of liquidity constraints (Tagkalakis, 2008). Similarly, the effect of tax hikes is more pronounced than the effect of tax cuts and this could be due to differential response to different types of tax shocks, difference in the volume of private & public debt, difference in centralization of taxation and the overall monetary environment.

On a comparative note between spending and tax changes, our results indicate that spending hikes are more effective than the tax cuts and tax hikes are more effective than spending cuts. Finally, the response of output growth to the monetary policy changes is also found to be asymmetric with contractionary policy actions being more effective than the corresponding expansionary ones. Theoretically, the asymmetric impact of monetary policy actions can be attributed to the changing outlooks of firms and

consumers, the binding liquidity constraints and the downward price rigidity (Morgan 1993; Barnichon et al. 2017).

We also extended our analysis to scrutinize the impacts of fiscal policy changes on the private consumption & private investment asymmetrically. Regarding the private consumption dynamics, again the null of symmetrical association is rejected against an alternative of an asymmetrical one among private consumption, government spending and tax changes in both the short and long-run. From the results it appears that private consumption mimics the response of output growth to government spending and tax changes. The response of private consumption to the monetary policy actions, however, explains the behaviour of a typical household as a saver. The interest rate hike improves the wealth position of savers and thereby incentivizes them to increase the spending. On the contrary, a fall in the interest rate may tempt a household to substitute current consumption for the future in order to maintain the target income from savings.

Finally, regarding the private investment, short-run asymmetry is reported in case of tax changes and private investment only and in the long-run the asymmetrical relationship is established among both private investment, government spending and tax changes. The response of private investment to the increase in public spending follows the substitutability hypothesis and therefore the latter crowds out the former. However, the final impact of an increase in spending on the output growth is reported to be positive. The response of spending cuts is statistically insignificant due to investment irreversibility. The impact of tax changes on private investment follows the Keynesian framework, wherein the tax hikes reduce the private investment and tax cuts increase it, although the impact of a tax hike is greater than a tax cut. Finally, the contractionary monetary policy action is found to decrease the private investment and the response to an easy policy shock is found to be statistically insignificant. It may further be noted that even in case of private consumption and private investment, tax hikes are more effective than spending cuts. However, spending hikes are more effective to stimulate private consumption and tax cuts are more effective to stimulate private investment.

Appendix 2-I

Table 2-11: Nonlinear ARDL error correction model 2.2.

<i>Variables</i>	<i>Coefficient</i>	<i>t-statistic</i>	<i>P-value</i>
Dependent variable: $\Delta LCON$			
$LCON_{t-1}$	-0.347	-4.230	0.000
$LGDP_{t-1}^+$	0.113	0.870	0.386
$LGDP_{t-1}^-$	-1.229	-1.600	0.114
LGE_{t-1}^+	0.159	2.680	0.009
LGE_{t-1}^-	0.004	0.070	0.942
LTR_{t-1}^+	-0.063	-1.930	0.059
LTR_{t-1}^-	0.079	2.290	0.025
CMR_{t-1}^+	0.005	2.830	0.006
CMR_{t-1}^-	-0.002	-2.230	0.029
$\Delta LCON_{t-1}$	0.260	2.630	0.011
$\Delta LGDP_{t-1}^-$	1.366	1.200	0.234
ΔLGE_t^+	0.116	2.280	0.026
ΔLTR_t^+	-0.039	-2.040	0.041
ΔLTR_t^-	0.073	1.900	0.062
ΔLTR_{t-1}^-	0.081	2.260	0.027
ΔCMR_t^-	-0.005	-2.350	0.022
Constant	1.193	4.260	0.000

Note: "General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$ and most of the insignificant lags are eliminated out to ensure the precision in cumulative dynamic multipliers".

Table 2-12: Nonlinear ARDL error correction model 2.3.

<i>Variables</i>	<i>Coefficient</i>	<i>t-statistic</i>	<i>P-value</i>
Dependent variable: ΔLPI			
LPI_{t-1}	-0.148	-2.420	0.018
$LGDP_{t-1}^+$	0.946	3.030	0.004
$LGDP_{t-1}^-$	1.325	1.550	0.128
LGE_{t-1}^+	-0.091	-1.400	0.168
LGE_{t-1}^-	0.025	0.340	0.734
LTR_{t-1}^+	-0.045	-2.070	0.035
LTR_{t-1}^-	0.021	0.540	0.593
CMR_{t-1}^+	-0.005	-3.030	0.004
CMR_{t-1}^-	-0.000	-0.120	0.908
$\Delta LGDP_t^+$	0.825	2.810	0.007
$\Delta LGDP_{t-1}^+$	-0.257	-0.800	0.427
$\Delta LGDP_{t-1}^-$	-4.510	-3.080	0.003
ΔLGE_t^+	-0.072	-1.150	0.255
ΔLTR_t^+	-0.088	-1.910	0.061
ΔCMR_t^+	-0.005	-1.710	0.092
ΔCMR_{t-1}^+	-0.009	-2.880	0.006
ΔCMR_t^-	0.007	2.270	0.027
ΔCMR_{t-1}^-	-0.004	-1.350	0.183
Constant	0.452	2.440	0.018

Note: “General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$ and most of the insignificant lags are eliminated out to ensure the precision in cumulative dynamic multipliers”.

CHAPTER 3

3 Identifying Fiscal Inflation

3.1 Introduction:

Higher inflation has been considered a growth retarding factor and a means of reducing the welfare standards of common masses. Therefore, maintaining a stable price level featured by low inflation rate has remained a priority objective of macroeconomic management of various economies including India. Among the many factors fueling the inflationary tendencies in an economy like monetary shocks, structural shocks, demand shocks, external shocks and demographic changes, the issue of inflation has also been found related to fiscal policy decisions of the government. The “*fiscal theory of price level* (Leeper 1991; Sims 1994 and Woodford 2001)” and “*the seminal work of Sargent and Wallace (1981)*” developed the theoretical contours for the establishment of an interaction between inflationary pressures in an economy and the government budgetary imbalances. The former talks about the complementarity between monetary and fiscal policies for the price level determination; and on policy plane, the theory suggests sustainability of government finances to ensure the stable price level. The latter highlights the role of relative dominance of monetary/fiscal authorities in determination of the price level. In a monetary dominance regime, fiscal authorities abide with the decisions of independently determined monetary policy and are constrained to follow a fiscal discipline strategy to avoid the inflationary pressures in the economy. On the contrary in a fiscal dominance regime, the fiscal authorities determine the level of current and future fiscal imbalances and thereby constrain the monetary authority for the demand of government bonds. This leads to excess money creation through debt monetization and hence inflationary tendencies emerge⁴⁸. The deficit could be financed either through imposition of higher taxes or domestic or external borrowings. However, developing countries quite often financed their deficit by debt monetization due to the high costs associated with higher tax rates, political

⁴⁸ “Governments running persistent deficits have sooner or later to finance those deficits with money creation (seigniorage), and thus producing inflation”, Sargent and Wallace (1981).

instability and market borrowings. As a result, fiscal view of inflation is more often reported in the developing countries than in the developed countries which are seen to have efficient tax collection system and considerable access to external borrowings (Catao and Terrones 2005).

The present study attempts to investigate the impact of fiscal deficit on the inflationary tendencies in Indian economy. Though several studies have been conducted to make an analysis of these two variables in the Indian context, the deficit-inflation nexus has not been evaluated exhaustively and the evidence reported by earlier studies remains inconclusive. India is chosen as a candidate for analysis due to its vibrant inflation dynamics and its observed downward inflexibility of deficit financing. The deficit financing has always been considered a viable instrument to avoid any recessionary tendencies in the economy. However, recognizing the adverse impacts of excess deficit, the government followed the fiscal consolidation program through FRBM Act⁴⁹ (2003-04) and finalized the pro-growth targets for fiscal imbalances. The recent fiscal response to the global crisis after the suspension of fiscal targets not only enabled India to avoid the crisis at home but also to continue along its growth trajectory as well. The move, however, represented a deviation from the fiscal discipline path. Even though the efforts have been made to curtail the deficit figures appreciably, the economy is still plagued with persistent deficit figures of 3.52% of GDP in 2016-17⁵⁰. In light of swelling deficit figures and vibrant inflationary phenomenon in the economy, it would, therefore, be important to examine the possible interaction between these two variables. Though the inflationary pressures in India have been theoretically ascribed to both domestic and foreign factors and to both supply and demand shocks, however, the

⁴⁹ The Government of India brought the Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) since the Indian policy makers felt the need to improve the fiscal positions and ameliorate the macroeconomic management in order to move towards a nearly balanced budget regime featured with strengthened fiscal prudence. The Act aimed at elimination of revenue deficit completely and reduction of fiscal deficit to a manageable level of 3% of GDP by 2007. However, due to the International financial crisis (2007-08), the targets of the Act were initially postponed and later suspended in 2009.

⁵⁰ Even recently, for the relevance of fiscal consolidation process, the N.K. Singh panel (2017) was setup to review the fiscal discipline strategy in India. The Committee advocated that a rule based fiscal policy by limiting government debt, fiscal deficit and revenue deficits to certain targets is good for fiscal consolidation in India. The panel recommended the fiscal deficit target of 2.5% of GDP by the financial year 2022-23. Unlike the FRBM Act, the report recommended a glide path to the fiscal targets i.e. a steady progress towards them and also suggested that there be some flexibility in the deficit targets strictly according to the needs of economy and that too within an acceptable deviation from the main targets.

empirical evidence reported remains inadequate (Mohanty and John; 2015). The possible reason for such an inadequacy could be the changes in determinants of inflation over the period of time (Mohanty and John; 2015). Therefore, the study is an attempt to analyze the inflationary phenomenon in India from the viewpoint of fiscal deficit in order to sort out the likely role of latter in explaining the overall inflation. The study adopts a broader analytical framework to include all the potential determinants of inflation in addition to fiscal deficit. Data for the period 1970-2016 has been examined to provide an evaluation of Indian inflationary problem with some recent evidence. The contribution of this study to the existing literature possibly includes the following. Firstly, Taking note of dynamic nature of the relationship between these two variables, the study will examine the deficit inflation nexus in a dynamic and asymmetric framework. The novelty of the study is ensured by the very nature of it is the first study in case of India to identify the fiscal inflation in an asymmetric configuration. We will apply a NARDL model, given by Shin et al. (2014) to examine the existence, if any, of cointegrating relationship in an asymmetric paradigm. Secondly, the nature of causality between fiscal deficit and inflation will be examined in a time domain and frequency domain framework in order to portray precisely the casual interactions between these two variables in the short-run and long run.

3.2 Theoretical Debate:

The impact of fiscal deficits on inflation has been discussed in the celebrated work of Sargent and Wallace (1981) in a framework of “monetary dominance” and “fiscal dominance” regimes. The deficit is financed either through bond sales to the public or through the seigniorage created by monetary authority or by a combination of both. In the case of an independent monetary authority framework, fiscal authority is constrained in the formulation of its policy. In this regime of monetary dominance, money supply is regulated and fiscal deficit would tend to be non-inflationary. On the contrary in a fiscal dominance regime, the regulation of money supply by the monetary authorities becomes less effective and fiscal authorities satisfy the inter-temporal budget constraints through the excess money creation, in the process leading to inflation. While the monetarists ascribe the tag of the monetary phenomenon to inflation, Fisher and Easterly (1990) regarded the inflationary tendencies as being a fiscal phenomenon. In reality, fiscal authorities have often preferred seigniorage to finance the fiscal imbalances, thereby triggering the inflationary pressures.

There is yet another recent theoretical premise arguing for the nature of the relationship between fiscal deficits and inflation, namely the “*fiscal theory of price level (FTPL)*”⁵¹. According to *FTPL*, the price level in an economy is not determined individually by monetary authorities alone, but complementarity of both monetary and fiscal policies is operative.. In *FTPL*, fiscal authorities are permitted to choose the surplus or deficit figures, not necessarily conducive for fiscal solvency. Thus, due to the exogenous character of fiscal actions, endogenous movement of the price level is required to achieve fiscal solvency⁵². The fiscal policy thus, becomes a leader and monetary policy a follower, controls only the timing of inflation and with the result, fiscal deficits tend to be inflationary. Minford and Peel (2002) therefore asserted that price level and fiscal policy are linked through the present value of the corresponding budget constraint. The Keynesians also provide another channel for a direct association between fiscal deficit and inflation like those of Elmendorf and Mankiw (1999)⁵³ through aggregate demand augmentation.

It may be noted that the association between deficit and inflation is a dynamic one (“Sargent and Wallace (1981); Catao and Terrones (2005); Lin and Chu (2013)”). In a fiscal dominance regime, fiscal deficit provides an estimate of future and not the current money creation (seigniorage) required for their financing and hence do not lead to current inflation. This is due to the fact that borrowing enables fiscal authorities to allocate the seigniorage inter-temporally and thus, they refute the existence of any contemporaneous association. In addition, the short-run association between the two variables can be multiplex (Dornbusch et al. 1990; Calvo and Vegh 1999), can involve a possible feedback of inflation on fiscal deficit (Catao and Terrones 2005) and hence its direction and strength may not be accommodative to theoretical analogies.

⁵¹ Given by “Woodford 1994, 1995, 2001; McCallum 2001; Cochrane 2001, 2005; Leeper and Yun 2006”.

⁵² According to *FTPL*, “Specifically, price level in the economy is determined by the nominal debt to present value of future surpluses. When the fiscal authorities make an adjustment to the present value of its future surpluses, the price level will rise to lower the real value of debt.” Maitra (2016).

⁵³ In the case of Keynesians, an increased fiscal deficit necessitated by an increase in public expenditure or tax cut leads to an increase in aggregate demand and hence exerts an upward pressure on price level in an economy (in case economy is operating above full employment level) or enhances the level of both output and price level (in case economy is operating on upward sloping aggregate supply curve). However, in case of Elmendorf and Mankiw (1999), a rise in debt would result in increased price levels by creating a positive wealth effect on households.

Therefore, the empirical examination between these two variables would be analyzed from a long-term perspective.

With a view to scrutinize the inflation-deficit nexus in India, the study adopts a broader analytical framework to take cognizance of other important determinants of inflation as well. So far as the influence of money supply is concerned, inflation is impacted positively and proportionally by money supply in case of classicals, positively and non-proportionally according to Keynesians and Monetarists postulate a direct long-run association between inflation and money supply. Regarding the effect of other monetary policy instruments, inflation responds negatively to interest rate⁵⁴ and positively to exchange rate. To take account of possible influence of structural factors⁵⁵, we include real GDP growth rate to act as a surrogate for output fluctuations in the economy. The increasing integration of Indian economy with the rest of world and increasing dependence on oil imports makes it imperative to include the oil prices⁵⁶ and exchange rate fluctuations into the domain of empirical analysis. Lastly, trade-openness is also included in the inflation determination equation so as to test the validity of Romer (1993) hypothesis in case of India. The hypothesis argues for a negative association between openness and inflation due to the time inconsistency of monetary policy in case of more open economies. Thus a combination of factors related to monetary policy, fiscal policy, supply shocks and external factors are included in empirical exercise⁵⁷.

⁵⁴ “The importance of interest in the monetary policy transmission has increased because the RBI from May 2011 has modified the operating procedure of monetary policy in order to move towards a single policy repo rate, with average call money rate being explicitly recognized as an operating target” (Mohanty and John 2015).

⁵⁵ According to the Structuralist view, the inflationary pressures in the economy are ascribed to the structural maladjustments, bottlenecks & rigidities of the economy (Maitra 2016)

⁵⁶ Barsky and Killian 2004; Hamilton and Herrera 2004; Catao and Terrones 2005; Lin and Chu 2013, Mohanty and John 2015 have also included impact of oil prices into account.

⁵⁷ The unavailability of time series data on the age structure wise population numbers, the influence of demographic factors has not been evaluated in the study.

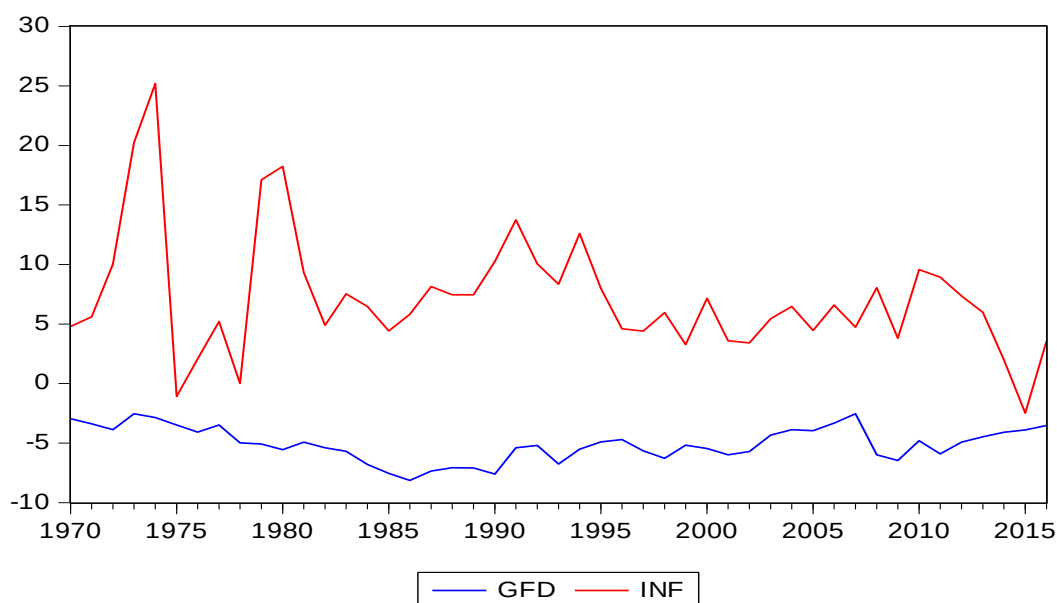


Figure 3.1: Inflation rate and Fiscal Deficit as a percentage of GDP

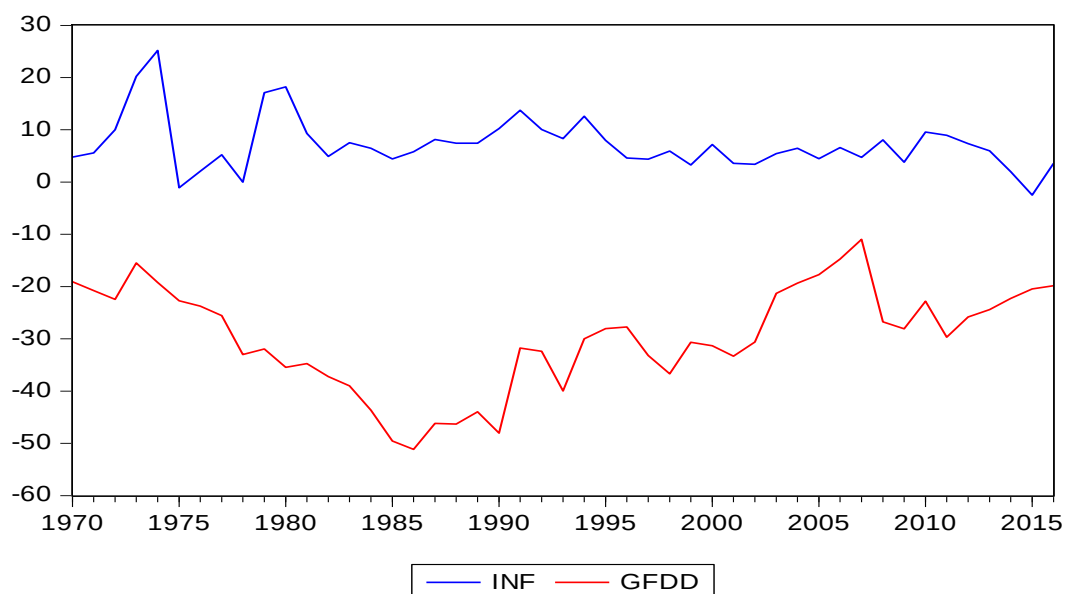


Figure 3.2: Inflation rate and Fiscal Deficit as a percentage of Narrow Money

3.3 Empirical Review:

3.3.1 General Literature:

The issue of inflation has always been at the core of theoretical and empirical debates. Scholars have analyzed the inflationary tendencies in various countries with different datasets, different determinants and different econometric methodologies. So far as the impact of fiscal deficit on the inflation is concerned, Hamburger and Zwick (1981) found the inflationary nature of budget deficit while analyzing the United States data

for a period 1954-1976. The authors also found budget deficit more inflationary in the Keynesian regime (1961-1974). However, Dwyer (1982) failed to document any evidence in favor of influence of debt on the money supply and overall price level in the economy. On the contrary, Ahking and Miller (1985) reported the evidence of deficit-inflation relationship only in some specific periods. Similarly, Darrat (1985) found money growth and fiscal deficit as the significant determinants of increased price levels. Applying a neo-classical framework, King and Plosser (1985) reported the existence of weak deficit-inflation relationship. Moreover, King and Plosser (1985) failed to uncover any such relationship while examining a mix of 12 developed and developing countries.

Examining the data from 10 developed countries, Giannaros and Kolluri (1986) found the absence of any kind of relationship between among the examined variables like fiscal deficit, money supply & inflation. Similarly, using the data over the period 1952-1987, Protopapadakis and Siegel (1987) also reported the existence of a feeble association between these two variables in another set of 10 developed economies. In addition, inflation is not found to respond debt growth strongly. In another study on 7 industrial economies, Barnhart and Darrat (1988) found the absence of any unidirectional or feedback Granger causality between these two variables.

In case of 17 developing countries and for a time period from 1961 to 1985, De Haan and Zelhorst (1990) found the absence of any evidence in favor of “*fiscal dominance hypothesis*” and reported that inflation reacts to deficit only during high inflation episodes. Metin (1998) documented the positive impact of deficit on the inflation in case of Turkey. However, analyzing the data on 3 transition economies, Komulainen and Pirttila (2002) reported the neutrality of fiscal deficit in explaining the inflationary tendencies in these economies. Similarly, Loungani & Swagel (2001) found puny association between fiscal balance and inflation in case of 53 developing countries. However, the relationship becomes stronger in case of economies with higher average inflation. The authors further reported the non- linear influence of fiscal imbalances on inflation and found that the former affects the latter significantly only when the magnitude of former is above 5%. Domac and Yucel (2005) while applying pooled probit estimation in case of 15 emerging economies document the inflationary role of fiscal deficit. Recently, Nguyen (2015) also reported the evidence of fiscal inflation in case of eight selected economies of Asia.

Some scholars were interested to examine the deficit-inflation nexus in case of a mix of developed and developing countries together in a panel setting and reported diversity of results. For instance, Karras (1994) found absence of any impact of deficits on inflation in case of a panel of 32 developed and developing countries. Similarly, examining a panel of 90 countries, Click (1998) reported the absence of any impact of domestic debt on inflation over the period 1971-1990. However, Cottarelli et al. (1998) found the inflationary nature of deficit along with inflation persistence in case of a mixed panel of 47 countries. Similarly, Laasch et al. (2002) found the evidence in favor of fiscal inflation by examining a mixed panel of 94 economies. The study further reported the significant role of fiscal deficit in determining the seigniorage and inflation in case of high inflation periods and in case of countries with high average inflation. Catao and Terrones (2005) examined a data set comprising of 109 countries over a period of 1960-2001 to investigate the dynamic nature of interactions between these two variables. The study documented the evidence of inflationary nature of deficit figures in case of transition economies and in the economies featured with high episodes of inflation but not in case of advanced economies and those experiencing lower inflation levels. Similarly, examining the larger data set over the period 1962-2004 for a mixed panel of 71 countries, Kwon et al. (2009) found the positive and appreciable impact of debt growth on the inflation in case of countries plagued with massive debts but, however, the impact is low in remaining cross sections of panel. Lin and Chu (2013) while analyzing the data on 91 countries for a period 1960-2006, found the results more or less similar to that of Catao and Terrones (2005). More recently, Tran (2018) investigated the asymmetric impact of fiscal balance on the variables like inflation, interest rate & exchange rate in case of four emerging economies like BRICs for the period 1999-2000. The study found the long run association between fiscal balance and monetary variables in case of countries like Brazil and India, whereas no such association is found for China and Russia.

3.3.2 Studies specific to India:

The deficit inflation interaction has also been examined in the case of Indian economy. Sarma (1982), Jadhav (1994) and Rangarajan & Mohanty (1998) have found the existence of a perennial interaction between fiscal deficit and inflation in both forward and feedback directions. In addition, these studies have reported the fiscal deficit among the important determinants of inflation in India. The outcome of these studies is relevant

to the prevailing conditions of that time. With the permanent blockade of ad hoc treasury bills in 1996-97, market borrowings used to finance deficit ceased as an option and mode of monetization was resorted. However, even after accounting for monetization period of deficit financing in an extended data set analysis, Ashra et al. (2004) reported the absence of long-run association between Reserve Bank credit & fiscal deficit and between money & Reserve Bank credit to the government. The study, therefore, recommended the scrapping of fiscal deficit as a stabilization tool. Using a more recent data set and an updated methodology, Khundrakhpam and Goyal (2009) reported the significant contribution of fiscal deficit in the incremental reserve money creation and overall money expansion, which finally leads to inflation in the economy. Similarly, Khundrakhpam and Pattanaik (2010) found the inflationary role of fiscal imbalances. RBI (2012), also reported evidence in favor of the fiscal inflation in India. Mohanty & John (2015) applied the time-varying structural VAR procedure to analyze the time-varying impact of various determinants of Inflation in India. This study also reported the inflationary impact of fiscal deficit. More recently, Ramu and Gayithri (2017) found the inflationary impact of fiscal deficit in India. Through a SVAR approach the authors have documented the evidence of three transmission channels like “*consumption expenditure channel, money supply channel and import channel*” to portray the traverse of the impact of fiscal deficit on inflation. However, no evidence in favor of interest rate channel is observed.

The above literature survey highlighted the fact that on average deficits are less inflationary in advanced and low inflation countries characterized by sound and credible monetary authorities and less fiscal dominance. However, the deficits are found to be inflationary in developing countries and in countries with higher inflation rates and high inflation periods. So far as India, in particular, is concerned, the deficit-inflation nexus has not been evaluated at length and the evidence reported by earlier studies remains inconclusive. The present study, therefore, is an attempt to analyze the inflationary impact of fiscal deficit in a new methodological setup and with an updated and extended dataset in case of India. Taking note of dynamic nature of the relationship between these two variables, the study will examine the deficit inflation nexus in a dynamic and asymmetric framework. The novelty of the study is ensured by the very nature of it is the first study in case of India to identify the fiscal inflation in an

asymmetric framework and as well to examine the causality between the two variables in both short-run and long-run.

3.4 Data Description and Empirical Methodology:

3.4.1 Data Description:

The selection of the variables for empirical analysis is guided by the prevalent theoretical prepositions and the existing empirical evidence. The data set is of annual frequency covering the period 1970 to 2016. The variables include Inflation (INF), Gross fiscal deficit (GFD), Money (NM), Gross domestic product (GDP), real GDP growth rate (GDPFC), interest rate (CMR), Trade-openness (TO), exchange rate (EXR) and oil price Inflation (OPI). The data on all the variables (except OPI) has been taken from “*Reserve Bank of India website*”, whereas for OPI we resorted to “*International Financial Statistics (IFS) from International Monetary Fund*”.

INF is expressed as the percentage annual variation in the Wholesale Price Index⁵⁸ (WPI). GFD is expressed as a percentage of GDP and following Catao and Terrones (2005) and Lin and Chu (2013), GFDD is also scaled by narrow money (NM) for robustness purposes. GDPFC is the annual change in gross domestic product at constant prices. NM is represented by the narrow money measure. TO is proxied by the sum of exports and imports both expressed as a percentage of GDP⁵⁹. Average of three oil price measures in the foreign currency is first converted into rupee terms by multiplying the nominal exchange rate ($EXR = ₹/\$$) of India with the respective oil price figures. Finally, OPI is calculated as the percentage annual variation in oil prices expressed in local currency. The inclusion of OPI in the analysis will portray the effect of oil price dynamism and exchange rate movements simultaneously. The definitions of various

⁵⁸ “Inflation measure in India has been usually provided by WPI because of the absence of a nation-wide representative Consumer Price Index (CPI)” (Maitra 2016).

⁵⁹ “Openness does not have any universally accepted definition. Its different aspects make construction of one index difficult. Common ‘single indices’ only measure economic dimension of openness like trade openness, the IMF’s restrictions measurement, Chinn-Ito index, etc. ‘Synthetic indices’ measure economic, social, political and environmental dimensions of openness like A.T. Kearney/Foreign Policy Globalization (KFP), KOF, Maastricht Globalization Index, New globalization index etc. There are various shortcomings of each group of indexes but the most robust obstacle is a lack of data (Goldberg and Pavcnik 2007). In this study, we are looking at the economic dimension of openness thus, we choose trade ratio as a measure of openness. This index for measuring trade openness is the ratio of trade (sum of export and import) to the Gross Domestic Product (GDP) of the country. The trade openness of countries depends on trade policy (restriction on trade) as well as the geographical and economic characteristics of a country” (Ajaz et al. 2016).

variables are given below in Table 3.1 and the descriptive statistics are reported in Table 3.2.

Table 3-1: Variable Description

Variables	Symbol	Description	Units	Source
Inflation	INF	percentage annual variation in the Wholesale Price Index	Percentage terms	RBI
Gross Fiscal Deficit	GFD	Difference between the total expenditure and total revenue (excluding the market borrowings).	Percentage of GDP	RBI
Gross Fiscal Deficit	GFDD	Difference between the total expenditure and total revenue (excluding the market borrowings).	Percentage of NM	RBI
Gross Domestic Product	GDPFC	Annual change in gross domestic product at constant prices	Percentage terms	RBI
Call Money Rate	CMR	Weighted Average Call Money Rates	Percent per annum	RBI
Trade Openness	TO	Sum of exports and imports both expressed as a percentage of real Gross Domestic Product	Percentage of GDP	RBI
Oil Price Inflation	OPI	Simple average of three spot prices; UK Brent, West Texas Intermediate and the Dubai Fateh.	percentage annual variation in oil prices expressed in local currency	IMF

Note- “RBI= Database on Indian Economy-Reserve Bank of India, IMF= International Financial Statistics, International Monetary Fund”.

Table 3-2: Descriptive statistics

<i>Statistics</i>	<i>INF</i>	<i>GFD</i>	<i>GFDD</i>	<i>GDPEC</i>	<i>CMR</i>	<i>TO</i>	<i>OPI</i>
Mean	7.209	-5.080	-29.771	5.631	8.668	9.776	2.322
Median	6.471	-5.080	29.699	6.053	8.220	8.9	5.914
Std. Dev	5.162	1.421	9.834	2.945	3.244	5.94	7.333
Skewness	1.333	-0.149	-0.409	-1.231	1.389	0.751	-1.716
Kurtosis	5.620	2.304	2.475	5.386	5.481	2.363	6.886
JB- stat	27.369	1.125	1.852	23.021	27.183	5.223	52.65
P-value of JB-stat.	0.000	0.569	0.396	0.000	0.000	0.073	0.000
Observation	47	47	47	47	47	47	47

3.4.2 Empirical Methodology:

3.4.2.1 Causality examination:

3.4.2.1.1 Time-Domain Causality:

To examine the time domain causality, the study employs the well-known Toda-Yamamoto (1995) test, henceforth (TY) test. In the usual procedure of conventional Granger causality test, the lagged coefficients obtained through underlying VAR model are set equal to zero according to Wald's principle. However, Lutkepohl (2004) cautions about nonstandard limiting distributions of Wald's test statistic due to the co-integration properties of VAR model. These nonstandard asymptotic properties follow from the singularity of asymptotic distributions. To do away with the singularity nuisance, the TY test, supplemented the original VAR model with the maximum order of integration of variables. Moreover, the test performs better in case the variables are integrated and possibly cointegrated and the data is used in levels rather than in first differences⁶⁰.

The TY test is performed using the specifications 3.1 and 3.2. It is to be noted that the standard Granger causality is based on VAR(k) model, wherein k is the appropriate length of lags of various variables reported by different lag selection criteria, in TY procedure, VAR (k + d_{max}) model is estimated. Here d_{max} denote the maximum order

⁶⁰ For a detailed description of the test refer to Toda-Yamamoto (1995).

of integration of the variables suspected in the process. If we set lag length k equal to p and d is reported as the highest order of integration, we proceed as:

$$M_t = \theta_0 + \theta_i \sum_{i=1}^p M_{t-i} + \theta_d M_{t-d} + \vartheta_j \sum_{j=1}^p N_{t-j} + \vartheta_d N_{t-d} + \varepsilon_t \quad 3.1.$$

$$N_t = \theta'_0 + \theta'_i \sum_{i=1}^p M_{t-i} + \theta'_d M_{t-d} + \vartheta'_j \sum_{j=1}^p N_{t-j} + \vartheta'_d N_{t-d} + \epsilon_t \quad 3.2.$$

M and N constitute the set of variables to be examined for analysis. Here zero restrictions are put to first p parameters in order to test the null of no causality against an alternative one where the causality is supposed to exist. The test statistic is usually referred as modified Wald (MWALD) follows a χ^2 distribution having a degree of freedom equal to p and supposed to be independent of the unit roots and cointegration.

3.4.2.1.2 Frequency Domain Causality:

With a view to examine the issue of causality in the short and long-run, we employ frequency domain analysis. Statistically, frequency domain (FD) refers to a domain for the examination of mathematical functions or signals at various frequencies instead of time, wherein a given stationary process is decomposed into a “*weighted sum of sinusoidal components with a certain frequency (Ω)*”. Though the nature of the definition of causality remains same for both time and frequency domains, the framework of examination is different. *Change of a signal over time is represented by a time domain graph, whereas the magnitude of a signal within each frequency band over a range of frequencies is connoted by FD graph.* More simply, time denotes the happening of a variation and frequency measures the strength of that variation. Though there are many approaches⁶¹ available in the literature to conduct the Granger causality in frequency domain analysis, we however, employed the recently developed framework of Breitung and Candelon (2006), hereafter (BC). This approach has the advantage of being applicable to either *a stationary set of variables or integrated but not cointegrated* (data used in first differences) or *both integrated and cointegrated* (data is used in levels). In addition, FD analysis eliminates seasonal variations in case

⁶¹ These include Partial Directed Coherence (PDC) and other approaches like those of Geweke (1982) and more recently by Breitung and Candelon (2006).

the data series used for analysis is short and the methodology accounts for non-linearities and causality cycles i.e. causality analysis at low and high frequencies.

Breitung and Candelon (2006) test between the two variables M and N can be performed through a VAR derived framework as⁶²:

Let $V_t = [M_t, N_t]$ be a two dimensional vector of time series obtained at $t = 1, \dots, T$ with a finite-order VAR representation given by:

$$\Theta(L)V_t = \mu_t \quad 3.3.$$

Where $\Theta(L) = 1 - \Theta_1 L - \dots - \Theta_p L^p$ is a 2×2 lag polynomial with is $L^k V_t = V_{t-k}$. μ_t is assumed to be a white noise process with the usual properties. Let H be the lower triangular matrix of the Cholesky decomposition $H'H = \sigma^{-1}$, such that $E(\epsilon_t \epsilon_t') = I$ and $\epsilon_t = H\mu_t$. In case of a stationary system, the MA representation is given as:

$$V_t = \Phi(L)\mu_t = \begin{bmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{bmatrix} \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \end{bmatrix} \quad 3.4.$$

$$= \varphi(L)\mu_t = \begin{bmatrix} \varphi_{11}(L) & \varphi_{12}(L) \\ \varphi_{21}(L) & \varphi_{22}(L) \end{bmatrix} \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{bmatrix} \quad 3.5.$$

Here also $\Phi(L) = \Theta(L)^{-1}$ and $\varphi(L) = \Phi(L)H^{-1}$. This representation can be applied to derive the spectral density of M_t as:

$$f_M(\Omega) = \frac{1}{2\pi} \{ |\varphi_{11}(e^{-i\Omega})|^2 + |\varphi_{12}(e^{-i\Omega})|^2 \} \quad 3.6.$$

The causality measure advocated by Geweke (1982) is defined as:

$$G_{N \rightarrow M}(\Omega) = \log \left[\frac{2\pi f_M(\Omega)}{|\varphi_{11}(e^{-i\Omega})|^2} \right] \quad 3.7.$$

$$= \log \left| 1 + \frac{|\varphi_{12}(e^{-i\Omega})|}{|\varphi_{11}(e^{-i\Omega})|} \right| \quad 3.8.$$

If $|\varphi_{12}(e^{-i\Omega})|^2 = 0$, then there is absence of causality from N to M at frequency Ω . In case we have the elements of V_t as integrated and possibly cointegrated, then frequency

⁶² For a detailed account of test refer to Breitung and Candelon (2006).

domain causality measure can be represented through an orthogonalized MA specification:

$$\Delta V_t = \varphi'(L)\mu_t = \varphi'(L)\mu_t \quad 3.9.$$

Here $\varphi'(L) = \varphi'(L)H^{-1}$. It may be noted that in a two-variable co-integrated system $\delta'\varphi'(1) = 0$, δ is a cointegration vector and $\delta'V_t$ is a stationary process (Engle and Granger; 1987). Here again the associated causality measure is given by:

$$G_{N \rightarrow M}(\Omega) = \log \left| 1 + \frac{|\varphi'_{12}(e^{-i\Omega})|}{|\varphi'_{11}(e^{-i\Omega})|} \right| \quad 3.10.$$

We test the null of $G_{N \rightarrow M}(\Omega) = 0$ to check whether N causes M or not at any frequency Ω .

Breitung and Candelon (2006) provided a modified frequency domain causality test by using the following reformulated VAR specification.

$$M_t = \omega_1 M_{t-1} + \dots + \omega_p M_{t-p} + \partial_1 N_{t-1} + \dots + \partial_p N_{t-p} + \Phi_t \quad 3.11.$$

The null hypothesis used in Geweke (1982), $G_{N \rightarrow M}(\Omega) = 0$, has been reformulated by BC into, $H_0: R(\Omega)\omega = 0$. Where ω constitutes a vector of coefficients of N and

$$R(\Omega) = \begin{bmatrix} \cos(\Omega) & \cos(2\Omega) & \dots & \cos(p\Omega) \\ \sin(\Omega) & \sin(2\Omega) & \dots & \sin(p\Omega) \end{bmatrix} \quad 3.12.$$

The *F statistic* related to Equation 3.12 follows $F(2, T-2p)$ for $\Omega \in (0, \pi)$. It is to be noted that the causality between the two variables at the low frequency denotes the long-run causality and the short-run causality is represented at high frequency. If the variables are cointegrated then causality at zero frequency connotes long-run causality and in case of stationary variables there exists no such thing like long-run causality, instead the low frequency causality implies the explanatory variable is able to predict the low frequency component of dependent variable one period ahead.

3.4.2.2 Asymmetric cointegration:

Primarily the study examines the nature of relationship between fiscal deficit and inflation in the economy. Doing away with linearities and taking cognizance of possible asymmetries, we applied an asymmetric ARDL model by Shin, et al. (2014) for empirical analysis. The detailed description about the adopted methodology has been

reported in chapter 1, however, so far as the variables involved in the empirical analysis are concerned, the following nonlinear error correction models based on the model in equation 1.8.4 is estimated.

$$\begin{aligned}
\Delta INF_t = & c + \lambda INF_{t-1} + \pi_1^+ GFD_{t-1}^+ + \pi_1^- GFD_{t-1}^- + \pi_2^+ CMR_{t-1}^+ + \pi_2^- CMR_{t-1}^- \\
& + \pi_3^+ GDPFC_{t-1}^+ + \pi_3^- GDPFC_{t-1}^- + \pi_4^+ TO_{t-1}^+ + \pi_4^- TO_{t-1}^- + \pi_4^+ OPI_{t-1}^+ \\
& + \pi_4^- OPI_{t-1}^- + \sum_{i=1}^{p-1} \mu_i \Delta INF_{t-i} + \sum_{i=0}^q \Omega_{1,i}^+ \Delta GFD_{t-i}^+ \\
& + \sum_{i=0}^q \Omega_{1,i}^- \Delta GFD_{t-i}^- + \sum_{i=0}^q \Omega_{2,i}^+ \Delta CMR_{t-i}^+ + \sum_{i=0}^q \Omega_{2,i}^- \Delta CMR_{t-i}^- \\
& + \sum_{i=0}^q \Omega_{3,i}^+ \Delta GDPFC_{t-i}^+ + \sum_{i=0}^q \Omega_{3,i}^- \Delta GDPFC_{t-i}^- + \sum_{i=0}^q \Omega_{4,i}^+ \Delta TO_{t-i}^+ \\
& + \sum_{i=0}^q \Omega_{4,i}^- \Delta TO_{t-i}^- + \sum_{i=0}^q \Omega_{4,i}^+ \Delta OPI_{t-i}^+ + \sum_{i=0}^q \Omega_{4,i}^- \Delta OPI_{t-i}^- \\
& + \epsilon_{1,t}
\end{aligned} \tag{3.13}$$

$$\begin{aligned}
\Delta INF_t = & d + \rho INF_{t-1} + \pi_1^+ GFDD_{t-1}^+ + \pi_1^- GFDD_{t-1}^- + \pi_2^+ CMR_{t-1}^+ + \pi_2^- CMR_{t-1}^- \\
& + \pi_3^+ GDPFC_{t-1}^+ + \pi_3^- GDPFC_{t-1}^- + \pi_4^+ TO_{t-1}^+ + \pi_4^- TO_{t-1}^- + \pi_4^+ OPI_{t-1}^+ \\
& + \pi_4^- OPI_{t-1}^- + \sum_{i=1}^{p-1} \mu_i \Delta INF_{t-i} + \sum_{i=0}^q \Omega_{1,i}^+ \Delta GFDD_{t-i}^+ \\
& + \sum_{i=0}^q \Omega_{1,i}^- \Delta GFDD_{t-i}^- + \sum_{i=0}^q \Omega_{2,i}^+ \Delta CMR_{t-i}^+ + \sum_{i=0}^q \Omega_{2,i}^- \Delta CMR_{t-i}^- \\
& + \sum_{i=0}^q \Omega_{3,i}^+ \Delta GDPFC_{t-i}^+ + \sum_{i=0}^q \Omega_{3,i}^- \Delta GDPFC_{t-i}^- + \sum_{i=0}^q \Omega_{4,i}^+ \Delta TO_{t-i}^+ \\
& + \sum_{i=0}^q \Omega_{4,i}^- \Delta TO_{t-i}^- + \sum_{i=0}^q \Omega_{4,i}^+ \Delta OPI_{t-i}^+ + \sum_{i=0}^q \Omega_{4,i}^- \Delta OPI_{t-i}^- \\
& + \epsilon_{2,t}
\end{aligned} \tag{3.14}$$

As usual, c and d constitute constants, λ and ρ denote the AR coefficients, π_i^+ , π_i^- and Ω_i^+ , Ω_i^- were $i=1,2,3,4$, are the long-run and short-run asymmetric coefficients and finally, $\epsilon_{i,t} \sim iid(0, \sigma_{\epsilon_{i,t}}^2)$ respectively. The definition of various variables is given in

Table 3.1. Equation 3.13 estimates the asymmetric response of inflation when fiscal deficit is expressed as a percentage of GDP and equation 3.14 measures the asymmetric response of inflation when fiscal deficit is expressed as a percentage of narrow money. Again, we applied a full asymmetry model and the motivation for choosing such a specification is provided by the various theoretical contours arguing for the existence of asymmetric linkages.

3.5 Empirical Results and Discussion:

3.5.1 Unit Root Analysis:

We start with the examination of integration properties of the variables to be used in the analysis by applying the well-known ADF test and PP test. To supplement the result outcomes of these two tests, KPSS test is also applied. Using the appropriate specifications for each variable in each of the tests mentioned, the results shown in Table 3.3 report a mixture of I(0) & I(1) variables. INF, CMR, GDPFC, and OPI are found I(0) and GFD, GFDD and TO are found to be I(1) at level and I(0) at first differences.

3.5.2 Cointegration and Causality Analysis:

Prior to the causality evaluation, we first check whether the variables of prime interest i.e. INF & GFD and INF & GFDD have any cointegration relationship or not. With no variable having an integration order greater than one, “*Autoregressive distributed lag model or Bounds F-test*” as given by Pesaran & Shin (1998) and Pesaran et al (2001), would be an appropriate option to apply. As reported in panel A of Table 3.4, the null of no cointegration is rejected between INF and GFD expressed as a percentage of GDP. As related to GFD expressed as a percentage of NM, results are akin to those reported in the first case. With the confirmation of the cointegration between the two variables, causality analysis in a time domain framework is examined through TY test. Literature has highlighted that the direction of causality is not only from fiscal deficit to inflation through the various transmission channels, but a feedback causality is also possible. Inflation can both increase and decrease the fiscal deficit. According to Aghevli and Khan (1978) Hypothesis, higher price level in the economy lowers the real value of government revenue and thereby necessitates it to enhance the borrowings to meet the growing expenditure requirements.

Table 3-3: Unit Root Tests

Variables	Test	C		C+T	
		Levels	First difference	Level	First difference
INF	ADF	-4.580*	-	-5.586*	-
	PP	-4.515*	-	-5.017*	-
	KPSS	0.389 (5%)	-	0.087 (5%)	-
CMR	ADF	-3.381**	-	-3.577**	-
	PP	-3.280**	-	-3.502***	-
	KPSS	0.267 (5%)	-	0.161 (1%)	-
GDPFC	ADF	-5.956*	-	-8.164*	-
	PP	-6.096*	-	-8.209*	-
	KPSS	0.604 (1%)	-	0.064 (5%)	-
GFD	ADF	-2.565	-6.718*	-2.465	-6.895*
	PP	-2.435	-7.709*	-2.428	-7.907*
	KPSS	0.804**	0.215 (5%)	0.173**	0.071 (5%)
GFDD	ADF	-1.874	-7.455*	-2.152	-7.554*
	PP	-1.829	-7.536*	-2.021	-7.677*
	KPSS	0.934*	0.229 (5%)	0.167**	0.058 (5%)
TO	ADF	-1.046	-5.443*	-1.479	-5.414*
	PP	-1.123	-5.484*	-1.924	-5.459*
	KPSS	0.785*	0.104 (5%)	0.178**	0.105 (5%)
OPI	ADF	-6.344*	-	-6.452*	-
	PP	-6.327*	-	-6.450*	-
	KPSS	0.153 (5%)	-	0.085 (5%)	-

Note: “*, ** and *** denotes the rejection of null hypothesis against an alternative at 1, 5 and 10% level of significance. C and C+T refer to two alternative specifications denoting constant only & constant and a linear trend respectively. ADF is Augmented Dickey-Fuller test (Dickey and Fuller, 1979), PP represents the Philips-Perron test (Philips and Perron, 1988) and KPSS denotes the Kwiatkowski et al. (1992a) stationarity test. Schwarz information criteria (SIC) is applied to choose the appropriate lag length for ADF test and Newey-West automatic selection procedure is used to choose the bandwidths for PP and KPSS tests”.

With the result deficit rises and is known as inflation-induced fiscal deficit (Heller 1980). Similarly, excessive inflationary pressures mandate a contractionary policy stance on part of monetary authorities to control it. Higher nominal interest rates (Fisher effect) increase the debt interest payments of the already accumulated debt of

government and thereby trigger further the deficit level. Likewise, Olivera-Tanzi effect also illustrates the case of causality running from inflation to fiscal deficit⁶³.

Table 3-4: Cointegration and Time domain causality.

Cointegration Test		
Variables	Lag structure (AIC, SBC)	Bounds Value
INF and GFD	1,0	10.675*
INF and GFDD	1,0	10.473*
Time- Domain Causality		
Variables	χ^2_S	p-value
GFD causes INF	19.443	0.035*
INF causes GFD	2.5017	0.990
GFDD causes INF	22.014	0.037*
INF causes GFDD	6.1367	0.909

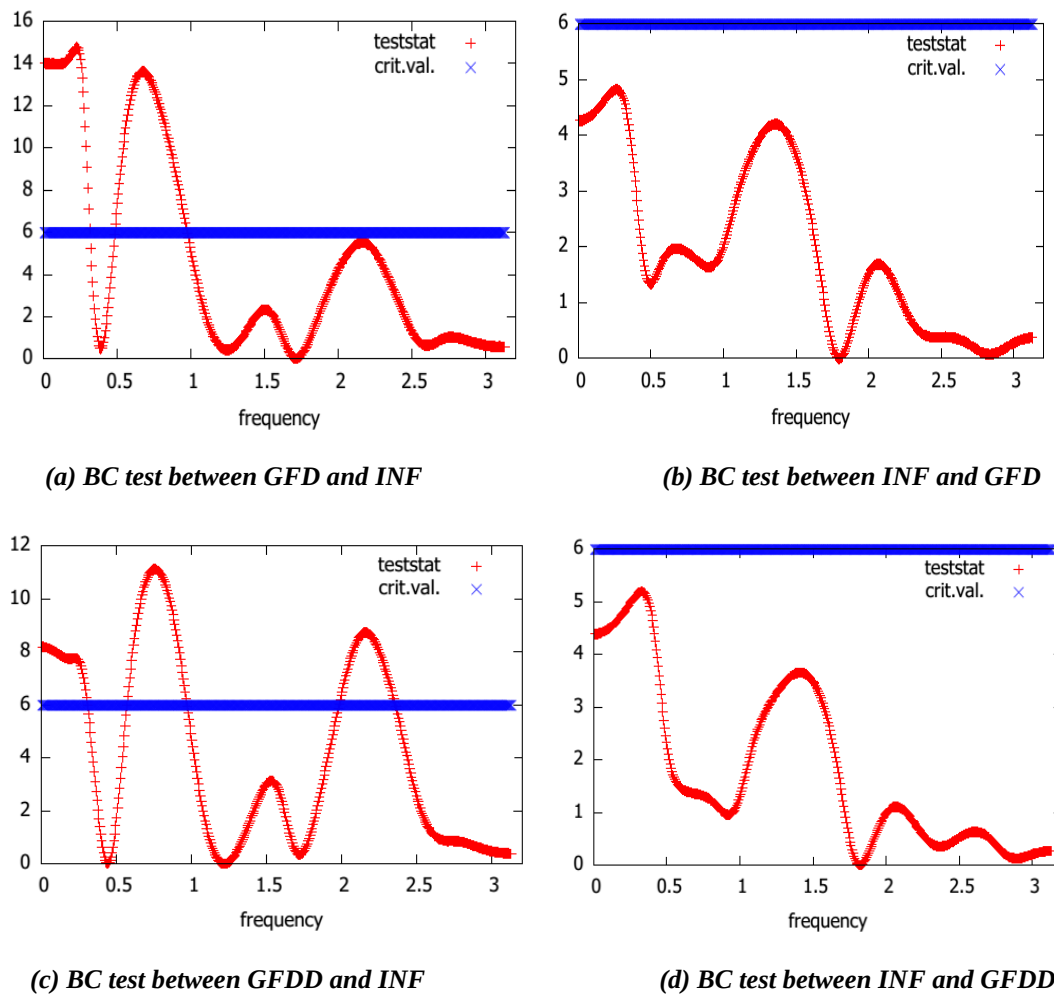
Note: “ indicates statistical significance at 1% significance level and the corresponding lower and upper bound critical values are 6.84 and 7.84 for ARDL Bounds test respectively. For the Time Domain Causality, Toda-Yamamoto test is applied. For the appropriate lag selection, AIC & SBC criteria’s are used”.*

Thus, due to deteriorated revenue position, deficit increases. Besides the positive association, the inflation and budget deficit also move in reverse direction under certain circumstances. Inflation tax would be a type of tax revenue that leads to a fall in deficit. Similarly, if the borrowing is not indexed to the inflation, any hike in the later will lower the real value of former through borrowing shocks.

⁶³ “Higher inflation pressures can also lead to decline in the volume of tax collection and a deterioration of real tax proceeds being collected by the government due to time elapsed between the taxable event occurs and the collection of the tax becomes effective (collection lags). The collection delays are less important in the no or low inflation episodes. However, when there is high inflation, the real value of the payment received by the government is low compared with the value it would have if it had been made immediately right after the taxable event. Thus, collection lag has an important bearing in the valuation of tax revenue during the periods of high inflation” (Olivera 1967; Tanzi 1977)

The lower panel of Table 3.4 clearly provides an indication that fiscal deficit granger causes inflation in India but feedback causality is absent. The presence of unidirectional causality and cointegration highlights the inflationary influence of deficits in India. The establishment of the unidirectional causality from fiscal deficit to inflation is in accordance with the results of Ramu and Gayithri (2017).

Figure 3.3: Frequency domain causality (Breitung-Candelon test)



The four parts of Figure 3.3 (a, b, c & d) portray the causality analysis in a frequency domain framework using BC test. The part “a” of the figure shows that fiscal deficit causes inflation only at lower frequencies or higher time periods. At the higher frequencies (short-run), deficit is not found to cause the inflation in India. Part “b” again

provides an illustration of the absence of feedback causality from inflation to fiscal deficit in India at all frequencies. Thus, BC test documents that fiscal deficit need not be inflationary in the short-run since the government can temporarily resort to other sources of deficit financing instead of excess money creation in short-run (Sargent and Wallace (1981); Lin and Chu (2013)). The outcome of this result also validates the intrinsically dynamic nature of the relationship between these two variables. The parts “c” and “d” of the figure provides the results for robustness. The two parts again support the results reported earlier.

3.5.3 Asymmetry Analysis:

With a view to provide some insights about the possible asymmetry, if any, exists between the variables, the study applies *NARDL* model. We include INF, GFD, CMR, GDPFC, TO and OPI variables into the *NARDL* error correction specification 3.13. Since none of the variables is integrated to more than one, the application of *NARDL* is justified. In addition, the adopted methodology would also take note of dynamic nature of the relationship since the specification permits the lags of both dependent and independent variables to influence the dependent variable and also allows for intrinsic dynamic adjustment⁶⁴.

In this case, as well, the null of no cointegration is rejected like in the case of *linear Bounds F-test*, since both the t_{BDM} and F_{pss} tests, as reported at panel B of Table 3.5, are found to be statistically significant at 5% significance level. The presence of a long-run cointegration relationship in an asymmetric framework provides an indication of the inflationary role of fiscal deficits. We followed a general to a specific approach for the estimation of asymmetric *ARDL* error correction model⁶⁵. We started with $max\ p = q = 2$ as decided by *AIC* & *SBC* criteria's, and zero restrictions are assigned to most of the insignificant lags to ensure precision and avoidance of noise into the dynamic multipliers. The panel C of Table 3.5 reports the necessary diagnostic tests of the estimated model. Absence of *autocorrelation* is accepted in case of the *Portmanteau serial correlation test* χ^2_{SC} , *heteroskedasticity* in case of *Breusch-Pagan-Godfrey test*

⁶⁴ “The asymmetric *ARDL* model combines a nonlinear long-run relationship with nonlinear error correction by use of carefully constructed partial sum decompositions” Shin et al. (2014).

⁶⁵ The results are is reported in Table 3.7 in the Appendix 3-I.

χ^2_{BPG} , Ramsey RESET test (Ramsey F-test) validates the structural specification of model and finally, presence of normality is accepted in the Jarque-Bera test of normality χ^2_{NOR} . Therefore, the stability conditions of estimated model are fulfilled.

With the detection of long-run association, the study proceeds to examine whether it is symmetrical or some asymmetry is involved. Wald's test with a null of asymmetry is tested against an alternative of asymmetry. The (WLR) and (WSR) test statistics are shown in lower part of panel A of Table 3.5. The results document the presence of an asymmetrical long-run association between INF & GFD, INF & CMR, INF & GDPFC and INF & TO; however, the null of symmetrical association cannot be rejected between INF and OPI. The short-run asymmetry is also reported among the same pairs of variables and the null of asymmetric impact cannot be rejected again in case of oil price inflation as the WSR is found to be statistically insignificant.

The long-run coefficients of the inhabited relationship of various variables with the inflation are shown in upper part of panel A of Table 3.5. In case of fiscal deficits, $GFD^+ = 4.710$ and $GFD^- = -0.071$. The establishment of a long-run direct association between the two variables provides an empirical support to the projections of Khundrakpam and Pattanaik (2010) and are in line with the findings of Rangarajan et al. (1989); Ramu and Gayithri (2017); Tran 2018. Surge in money supply (due to increased fiscal deficit and capital inflows) and the narrowing down of negative demand gaps in the economy provide a manifestation of inflationary role of fiscal deficits in India (Khundrakpam and Pattanaik, 2010). The positive impact of fiscal deficit on the inflation of India can be attributed to the theoretical arguments of Keynesians, Neo-Classicals and Monetarists. In fact, Ramu and Gayithri (2017) have tracked some of the transmission channels of the impact of fiscal deficit on inflation in case of India. In addition, the inflationary role of fiscal deficit is in line with the observation of Tran (2018). In case of emerging countries like India, featured with high fiscal deficit and public debt stocks are more exposed to inflationary pressures. Therefore, owing to their less fiscal space as may be needed for sustainability, these economies are vulnerable to higher default risks.

The signs of positive and negative coefficients are according to theory and both are statistically significant. However, increases in fiscal deficit is found to be more

inflationary and the decrease in fiscal deficit is found to affect the inflation with a lower magnitude. In other words, the impact of fiscal position deterioration on inflation is more

Table 3-5: Long & Short-run Asymmetry Results (Model 3.13)

A. Asymmetry Results	Long-Run Effect [+]			Long-Run Effect [-]		
Variables	Coef.	F- stat	P- value	Coef.	F- stat	P- value
GFD	4.710	7.792	0.011*	-0.071	4.236	0.049**
CMR	-1.968	23.80	0.000*	0.522	4.466	0.046**
GDPFC	-1.605	20.41	0.000*	1.911	22.06	0.000*
TO	-0.389	2.012	0.170	-0.723	3.542	0.073***
OPI	0.065	2.063	0.165	-0.048	0.805	0.379
		Long-run Asymmetry		Short-run Asymmetry		
		W_{LR}		W_{SR}		
		F- stat	P- value	F- stat	P- value	
GFD		4.706	0.041**	3.114	0.091***	
CMR		18.64	0.000*	8.085	0.009*	
GDPFC		4.516	0.045**	4.584	0.044**	
TO		5.751	0.025**	3.044	0.095***	
OPI		0.346	0.562	2.754	0.111	
B. Cointegration Test		F_{PSS}		t_{BDM}		
		4.450**		-5.759**		
C. Model Diagnostics		Test Statistics		P-value		
χ^2_{Sc}		16.88		0.660		
χ^2_{BPG}		0.315		0.574		
χ^2_{NOR}		2.381		0.304		
Ramsey F-test		1.309		0.330		

$INF = f(GFD, CMR, GDPFC, TO, OPI)$. Note: “ F_{PSS} and t_{BDM} are the long-run cointegration test statistics. *, ** & *** denote the 1, 5 and 10% significance levels respectively. χ^2_{Sc} represent the portmanteau serial correlation test, χ^2_{BPG} denote the Breusch-Pagan-Godfrey heteroskedasticity test, Ramsey F is the RESET test and finally the Jarque-Bera normality test is denoted by χ^2_{NOR} . General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$. The relevant 5% and 10% upper bound critical values of t_{BDM} for $k=5$ (without taking partial decomposition into consideration) are -4.19 & -3.86 and for $k=10$ (when partial sum decompositions are independently treated as regressors) are -5.03 & -4.69. Similarly for the F_{PSS} test the relevant 5% and 10% upper bound critical values for $k=5$ are 3.79 & 3.35 and for $k=10$ are 3.24 & 2.94 respectively” Pesaran et al. (2001).

pronouncing and that of any fiscal improvement is milder or sluggish. Though it is not within the scope of present study to provide the underlying reasons of the asymmetric response of inflation to positive and negative changes in fiscal deficit, however, the relevant theoretical underpinnings are worth mentioning. The possible asymmetry of fiscal deficit on inflation can be explained through the existence of liquidity constraints,

consumption-investment downward inflexibility and the downward price stickiness. Due to the existence of liquidity constraints as reflected through less developed credit markets, any increase in fiscal deficit would lead to an exacerbated increase in aggregate demand because of additional purchasing power with the individuals with limited liquidity hitherto and also enable individuals without constraints feel wealthier. Hence, impact on inflation would be relatively higher. In case the deficit is reduced, people find it difficult to lower the consumption levels (Ratchet effect) drastically, leading only to a marginal decline in demand conditions and hence a lower effect on inflation is observed. The lower impact of reduced fiscal deficit on inflation can also be explained through downward price stickiness. Producers are usually hesitant to price and wage reductions in order to avoid the worker-employ conflicts, secure the worker morale and secure some degree of price setting power even in a supply constrained economy (Mohanty and John, 2015; Barnichon et al. 2017). Thus, the effect of contractionary fiscal action in-terms of a decline in deficit spending has a lower effect on inflation.

Coming to the impact of monetary policy shocks as surrogated through call money rate of interest, we found that the inflation and interest rate are negatively related wherein a contractionary policy shock lowers it and an expansionary one raises it. The established negative association can operate through the conventional aggregate demand channel. However, contractionary policy stance is found to be more effective than the expansionary one, signifying the asymmetric influence of monetary policy actions on the inflation of India. The reason for this asymmetry can be ascribed to the behavior of demand conditions due to changing outlook of firms and consumers, the binding liquidity constraints and the downward price stickiness under alternative monetary policy stances (Morgan 1993; Barnichon et al. 2017)⁶⁶. The substantial reduction of inflation due to interest rate hike can also be explicated through the money supply channel. An increase in interest rate by the central bank leads to a rise in prime lending rate, a decline in credit supply, a fall in money supply via money multiplier process and finally to a lower level of the price level. On the other hand, a decrease in the interest rate during the retarded economic conditions will not necessarily lead to borrowing and

⁶⁶ The proper explanation of these factors leading to monetary policy asymmetry is given in Chapter 1, when the effects of contractionary and expansionary monetary policy actions on the economic growth was discussed.

spending augmentation of all economic agents in the economy, the effect of expansionary policy stance on inflation will, therefore, be relatively lower⁶⁷ (Barnichon et al. 2017).

The impact of output growth and decline as represented by the positive and negative sum components of GDPFC is according to the theoretical contours, but an asymmetry is reported. A negative growth in output is found to increase the inflation relatively by a higher magnitude than the positive growth is found to reduce it. A decline in the output indicates the presence of supply constraints and given the demand conditions (if not increasing) the impact on price level will be higher. On the contrary, an increase in output growth cannot decrease the prices drastically due to the presence of producer's price-setting power to some extent. Thus in a supply constrained economy, downward price rigidity leads to the asymmetric impact of output growth and output decline on inflation.

As regard to the trade-openness, although an asymmetry is reported, the signs refute the validation of Romer (1993) hypothesis in case of India. Specifically, the coefficient of TO^+ is -0.389 and that of TO^- is -0.723. The former is statistically insignificant and the latter is significant. The insignificance of TO^+ may be due to its ex-post measurement of openness only and lacks the ex-ante measurement. The negative component is significant, however, and the sign establishes a direct association between these two variables. The direct link in case of India is in line with inflationary impact of outward –orientation for developing countries (Evans 2007; Jalil et al. 2014, Ajaz et al. 2016). The asymmetries observed above again highlight the presence of price stickiness in the inflationary phenomenon of the economy.

Finally, as for the impact of oil price inflation, though the signs are theoretically correct, yet both the positive and negative coefficients are weak and statistically insignificant. The possible explanation for such insignificance at the segregated asymmetric level is that the global oil prices have been converted to domestic oil prices by multiplying the

⁶⁷ During a contractionary policy stance, business investment and consumer expenditure on durable goods and housing are substantially more sensitive than other expenditures, however, on the contrary the response of output and inflation to the expansionary policy stance is either negligible or generally insignificantly different from zero (Tenreyro and Thwaites 2015). An increase in interest rate during an expansion leads to a reduced expansion due to increased costs, but the lower interest rates may not necessarily lead to increasing investments in a downturn.

former with the nominal exchange rate of the country concerned. The movements of the two variables, global oil prices, and exchange rates may not always be reinforcing but some counter movements are also possible. There may be a fall in global oil prices, but due to the increased demand from the country at a lower global price, its exchange rate depreciates and the initial effect of declining oil prices will now get negated through increasing exchange rates and thus the overall influence may be insignificant. In case of India, the depreciation of rupee more than offsets the favorable effect of the marginal decline in global commodity prices on domestic inflation (RBI 2013).

The results documented above justified the application of non-linear ARDL into the empirical exercise. Thus instead of assuming the linear nature of model specification (with associated possibility of inappropriate policy conclusions), we proceed with a well behaved and theoretically supported non-linear specification to take cognizance of dynamic nature of the relationship and that of observed asymmetries on the other.

3.5.4 Cumulative Dynamic Multipliers:

The graphical examination of dynamic effects of independent variables on the inflation can be further portrayed through dynamic multipliers, as shown in Figure 3.4. The graphs plot the dynamic effects of positive and negative changes in fiscal deficit, interest rates, output growth, trade openness and oil price inflation on the inflation of India. In case of fiscal deficit, asymmetry is stronger from the positive change and asymmetry persistence is observed even in the long-run. As to the interest rate shocks, contractionary policy stance is more influential than the expansionary stance. Similarly, expansion in output growth declines inflation relatively by a lower magnitude than the increase in inflation is caused by output decline. Finally, in case of oil price inflation and trade openness, we found the same phenomenon as reported in Table 3.5. However, the coefficients associated with positive change in trade openness and with both positive and negative changes in case of oil price inflation are statistically insignificant. Moreover, it takes around more than a year on average to reach to new equilibrium position following any short-run disturbance.

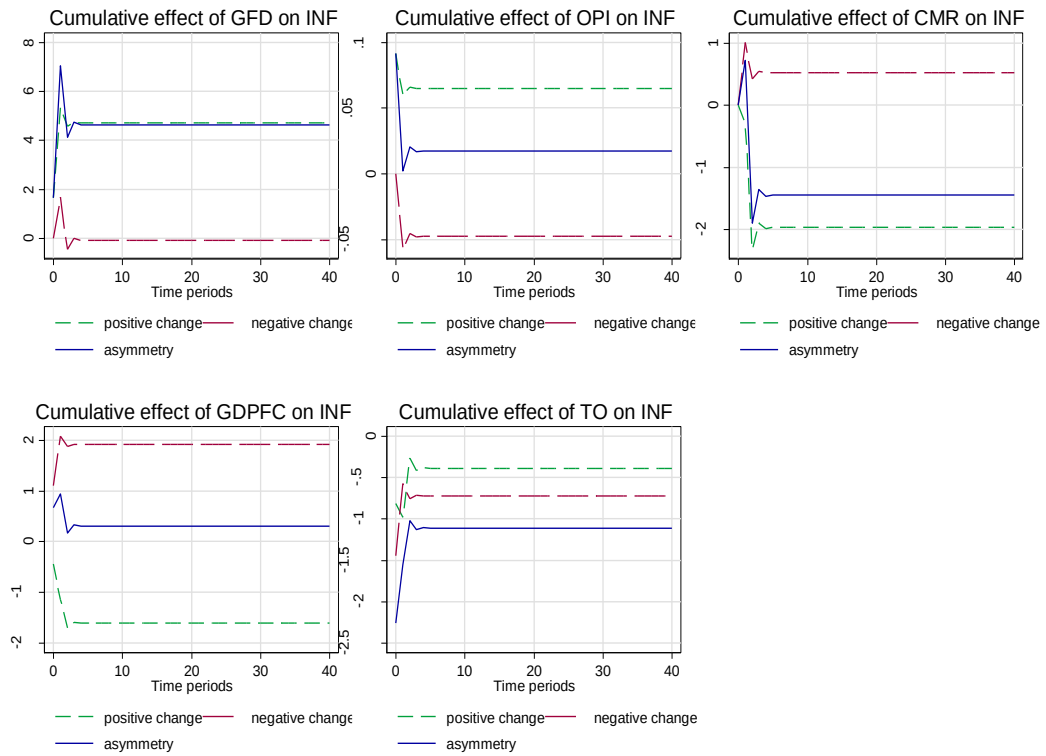


Figure 3.4: Cumulative Dynamic Multipliers for Model 3.13

3.5.5 Extensions:

The robustness of results is provided by using fiscal deficit as a percentage of narrow money in an economy as the key variable of analysis. Table 3.6 and Figure 3.5 reflect almost a mirror image of Table 3.5 & Figure 3.4 and therefore prove the robustness of results⁶⁸.

⁶⁸ Relative to Table 3.5, we found the additional insignificance of negative component of fiscal deficit and absence of long-run asymmetry in case of output growth. Again the error correction results for the model 3.14 are reported in Table 3.8 in the Appendix 3-I

Table 3-6: Long & Short-run Asymmetry Results (Model 3.14)

A. Asymmetry Results		Long-Run Effect [+]		Long-Run Effect [-]		
Variables	Coef.	F- stat	P- value	Coef.	F- stat	P- value
GFDD	0.671	8.812	0.007*	0.320	2.019	0.169
CMR	-2.231	21.51	0.000*	0.657	6.137	0.021**
GDPFC	-1.663	19.13	0.000*	1.841	17.89	0.000*
TO	-0.363	2.362	0.139	-0.656	3.670	0.064***
OPI	0.016	0.079	0.780	0.000	0.300	0.998
		Long-run Asymmetry		Short-run Asymmetry		
		W_{LR}		W_{SR}		
		F- stat	P- value	F- stat	P- value	
GFDD		6.153	0.021**	3.269	0.084***	
CMR		17.81	0.000*	9.697	0.005*	
GDPFC		1.132	0.299	8.00	0.010**	
TO		5.833	0.024**	6.908	0.015**	
OPI		0.236	0.632	0.098	0.756	
B. Cointegration Test		F_{PSS}		t_{BDM}		
		4.721**		-5.551**		
C. Model Diagnostics		Test Statistics		P-value		
χ^2_{SC}		15.31		0.758		
χ^2_{BPG}		0.364		0.546		
χ^2_{NOR}		0.296		0.862		
Ramsey F-test		0.607		0.163		

$INF = f(GFDD, CMR, GDPFC, TO, OPI)$. Note: " F_{PSS} and t_{BDM} are the long-run cointegration test statistics. *, ** & *** denote the 1, 5 and 10% significance levels respectively. χ^2_{SC} represent the portmanteau serial correlation test, χ^2_{BPG} denote the Breusch-Pagan-Godfrey heteroskedasticity test, Ramsey F is the RESET test and finally the Jarque-Bera normality test is denoted by χ^2_{NOR} . General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$. The relevant 5% and 10% upper bound critical values of t_{BDM} for $k=5$ (without taking partial decomposition into consideration) are -4.19 & -3.86 and for $k=10$ (when partial sum decompositions are independently treated as regressors) are -5.03 & -4.69. Similarly for the F_{PSS} test the relevant 5% and 10% upper bound critical values for $k=5$ are 3.79 & 3.35 and for $k=10$ are 3.24 & 2.94 respectively" Pesaran et al. (2001).

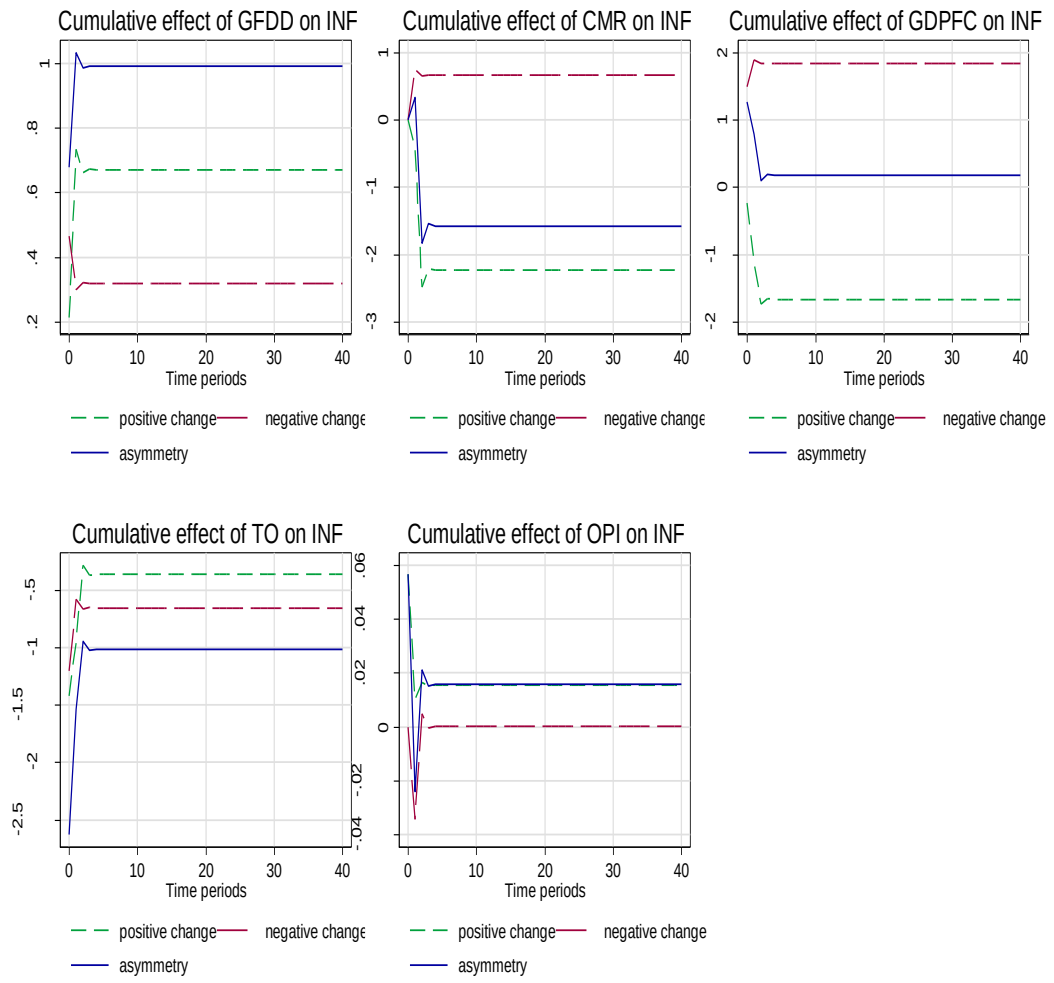


Figure 3.5: Cumulative Dynamic Multipliers for Model 3.14

3.6 Conclusion:

Higher inflation has always been considered as a growth retarding factor and a means of reducing the welfare standards of common masses. Therefore, maintaining a stable price level featuring a low inflation rate has remained a high priority objective of macroeconomic management of various economies including India. Among the many factors fuelling the inflationary tendencies in an economy like monetary shocks, structural shocks, demand shocks, external shocks and demographic changes, the issue of inflation has also been found to be related to fiscal policy decisions of the government. The study attempts to evaluate the inflationary tendencies in India particularly from the fiscal point of view. We examined the causality between fiscal deficit and inflation in a time domain and frequency domain framework. We found a unidirectional causality running from fiscal deficit to inflation in case of time domain analysis and no feedback causality is reported. However, in case of frequency domain design, causality from fiscal deficit to inflation is found at low frequencies only, i.e. no short-run causality is established and hence dynamic nature of the relationship between the two variables is justified. Using NARDL model, we examined the nature of association in an asymmetric framework. The results document the existence of an asymmetric long-run association between fiscal deficit and inflation. However, the expansionary fiscal stance is found to be more inflationary and the decreases in fiscal deficit are found to affect the inflation with a lower magnitude. The possible asymmetry of fiscal deficit on inflation can be explained through the existence of liquidity constraints and the downward price stickiness.

The other control variables used in the empirical exercise also reported the theoretically plausible results. Contractionary monetary policy stance is found to be more effective than the expansionary policy stance, signifying the asymmetric influence of monetary policy on the inflation of India. Similarly, in a supply-constrained economy with downward price rigidity, we found an asymmetric impact of output growth and output decline on inflation. As regard to the trade-openness, although an asymmetry is reported, the signs refute the validation of Romer (1993) hypothesis in case of India. Finally, the impact of oil price inflation on the inflationary pressures is according to theory but the coefficients are devoid of statistical significance.

Appendix 3-I

Table 3-7: Nonlinear ARDL error correction model 3.13.

<i>Variables</i>	<i>coefficient</i>	<i>t-statistic</i>	<i>p-value</i>
Dependent variable: ΔINF			
INF_{t-1}	-0.864	-5.760	0.000
GFD_{t-1}^+	5.693	2.920	0.008
GFD_{t-1}^-	0.086	0.070	0.942
CMR_{t-1}^+	-2.379	-5.090	0.000
CMR_{t-1}^-	-0.631	-1.130	0.250
$GDPFC_{t-1}^+$	-1.941	-4.290	0.000
$GDPFC_{t-1}^-$	2.309	4.380	0.000
TO_{t-1}^+	-0.471	-1.470	0.156
TO_{t-1}^-	-0.874	-1.930	0.066
OPI_{t-1}^+	0.078	1.340	0.195
OPI_{t-1}^-	0.057	0.850	0.403
ΔGFD_t^+	1.649	1.210	0.240
ΔGFD_{t-1}^-	-1.776	-1.090	0.287
ΔCMR_{t-1}^+	-2.086	-3.010	0.006
ΔCMR_{t-1}^-	-0.382	-1.200	0.242
$\Delta GDPFC_t^+$	-0.434	-1.210	0.240
$\Delta GDPFC_{t-1}^+$	-0.711	-2.090	0.048
$\Delta GDPFC_t^-$	0.101	2.950	0.007
ΔTO_t^+	-0.813	-1.350	0.192
ΔTO_{t-1}^+	-0.679	-1.140	0.268
ΔTO_t^-	1.441	1.690	0.105
ΔOPI_t^+	0.091	1.660	0.111
Constant	2.650	0.910	0.370

Note: "General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$ and most of the insignificant lags are eliminated out to ensure the precision in cumulative dynamic multipliers"

Table 3-8: Nonlinear ARDL error correction model 3.14.

<i>Variables</i>	<i>coefficient</i>	<i>t-statistic</i>	<i>p-value</i>
Dependent variable: ΔINF			
INF_{t-1}	-0.734	-5.550	0.000
$GFDD_{t-1}^+$	0.761	3.010	0.006
$GFDD_{t-1}^-$	-0.363	-1.380	0.181
CMR_{t-1}^+	-2.530	-4.800	0.000
CMR_{t-1}^-	-0.745	-0.540	0.760
$GDPFC_{t-1}^+$	-1.887	-4.360	0.000
$GDPFC_{t-1}^-$	1.976	4.180	0.000
TO_{t-1}^+	-0.412	-1.560	0.133
TO_{t-1}^-	0.744	1.720	0.100
OPI_{t-1}^+	0.017	0.280	0.785
OPI_{t-1}^-	-0.000	0.000	0.998
$\Delta GFDD_t^+$	0.214	1.070	0.295
$\Delta GFDD_t^-$	-0.464	-1.730	0.097
ΔCMR_{t-1}^+	-2.117	-3.110	0.005
$\Delta GDPFC_t^+$	-0.235	-0.630	0.534
$\Delta GDPFC_{t-1}^+$	0.756	0.200	0.740
$\Delta GDPFC_t^-$	0.496	3.960	0.001
ΔTO_t^+	-1.423	-1.160	0.042
ΔTO_{t-1}^+	-0.731	-1.163	0.116
ΔTO_t^-	1.205	1.940	0.065
ΔOPI_t^+	0.057	1.070	0.298
ΔOPI_{t-1}^-	0.034	0.670	0.512
Constant	3.759	1.290	0.209

Note: "General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$ and most of the insignificant lags are eliminated out to ensure the precision in cumulative dynamic multipliers".

CHAPTER 4

4 Interest Rates and Fiscal Policy

4.1 Introduction:

The importance of interest rates in affecting and/or managing the macro economy of a country, particularly in the arena of improved financial integration could not be undervalued. Interest rates are usually the principal regulatory instruments available with the central banks of countries having a centralized banking system. Any changes in the interest rates are usually decided by the country's monetary authority taking into account the growth, liquidity, external competitiveness and overall stability conditions of an economy. Apart from being determined exogenously by the banking authorities, interest rates are also influenced by various other economic variables through many theoretical transmission channels. Thus, instead of being exclusively administered, interest rates are also market determined. The behavior of interest rates could be determined by the simple Fisher equation in case of a fully closed economy (domestic influence only) or by an interest parity condition in case of fully open economy (external factors only) or more usually by a combination of both internal and external influences (Edwards and Khan 1985).

In addition, the effect of government fiscal imbalance on interest rates has been a matter of continuous discussion since the times of Barro (1974, 1976). Although the nature of relationship between the fiscal deficit and interest rates has been examined by various theories, however, the empirical analysis remained largely confined to developed countries, with only a limited studies are conducted related to developing countries. The issue of examining the interest rate response to fiscal deficit is primarily motivated by certain important reasons. First, interest rate is a primary determinant of investments in an economy and therefore, any change in the former due to changes in fiscal imbalance will result in a change in the magnitude of later. Second, in a financially integrated world, any impact of fiscal deficit on interest rates will spillover to other economies. And finally, response of interest rates to fiscal deficit changes will link the

two crucial policies i.e. both monetary and fiscal for the sound management of the economy⁶⁹.

In India the investigation of the nature of association between fiscal deficit and interest rates occupies an important place particularly in the contemporary context wherein the Indian fiscal and financial sectors have undergone appreciable reforms in terms of external integration and deregulations. Starting with 1980s interest rate liberalization, the Indian financial sector was diversified with many financial instruments like “*certificates of deposits*” (CD’s) in June 1989 and “*commercial papers*” (CP’s) in January 1990. The nature of interest rates from being completely administered has changed gradually till 1992, with most important rates now being market determined⁷⁰. The move of deregulation was aimed at to improve the allocative efficiency and thereby, enhance the growth and stability of economy. In order to diversify the risk and supplement the government funds, Reserve Bank of India (RBI) introduced “*364-day treasury bills and 5-year and 10-year Government bonds*” in mid-1992. The terms like *liberalization, privatization and globalization* (LPG) were introduced through 1991 reforms wherein the nature of economy was changed from both domestic and foreign fronts. From a fixed exchange rate regime till 1992, it shifted to a dual exchange rate system up to February 1993 and finally, from March 1993 India adopted a unified freely floating exchange rate regime. The Indian rupee has been made *fully convertible* on current account since August 1994. However, the efforts for capital account convertibility are still underway. The shares of foreign direct investment and foreign portfolio investment have increased manifold since the *Make in India* program launched in September 2014. Many new sectors including the strategic ones like defense, airlines, chemicals etc. have been brought within the domain of foreign investments with enhanced percentages. Even the routes of transfer have been shifted from government route to automatic route in majority of sectors.

The behavior of fiscal policy has also varied over the time. From a conservative policy featured with higher taxes and lower deficit, the nature of fiscal policy got changed in 1980s with reduced taxes and increased fiscal deficit. The 1991 balance of payment

⁶⁹ In many economies, actually fiscal imbalances hinder the monetary policy actions in managing the interest rate behavior. Thus for a sound economic performance, both monetary and fiscal policies should be linked within a complete framework of stable fiscal balances (Correia et al. 1995).

⁷⁰ All deposit rates except the saving bank deposit rates and all lending rates are market determined**.

crisis necessitated for a reduction in deficit but these continued to increase in following periods. The relative proportion of financing the budget deficit has increased through market and external borrowings and monetized deficit has reduced considerably (Goyal 2004). By 2003 “*Fiscal Responsibility and Budget management act (FRBM)*” was introduced for *fiscal discipline* & strengthening the *fiscal prudence*. However, due to the financial crisis of 2007-09, fiscal policy responded with tax cuts and increased deficit in order to counteract the recessionary tendencies (De. S, 2017). Even the recent move towards “*Demonetization*” in November 2016 and introduction of “*Goods and Services tax*” (GST) from July 2017, Indian economy has struggled in terms of a fall in consumer demand and unfavorable growth figures. For the purpose of economic revival government has again started to increase the fiscal deficit by suspending the FRBM targets.

In this changing paradigm it is certainly interesting to make an examination of likely association between fiscal deficit and interest rates. Though, the issue has been taken initially in a theoretical discussion between Patnaik (2001) and Khatkhate & Villanueva (2001), later some scholars attempted to make an empirical evaluation as well. However, the scholars reported the substantial disagreements. The present study will therefore, revisit the relational status between the two variables in a dynamic, deregulated and highly integrated Indian economy. There are many reasons to account for. The available empirical literature is inconclusive. The associated data problems and the methodologies issues like endogeneity, structural breaks and were not taken care. To address some of these caveats, the study hopes to contribute to existing literature along several important dimensions. Two different data sets with different frequencies will be employed to examine the transitory and permanent impact of fiscal shocks. Quarterly data set with a short-term interest rate is used to explore the short-term version of relationship between interest rates and fiscal deficit and an annual data set together with a long-term interest rate is employed to highlight the long-term attributes. Unlike the previous studies, we employed an *IS-LM* and extended *open economy loanable fund* model specifications for the analytical framework. Moreover, to improve along the econometric methodology in order to avoid some of the earlier issues, the study has employed an “*Auto regressive distributed lag model (ARDL)*” given by Pesaran et al. (1998; 2001) to conduct the empirical exercise. To address the issue of causality, Toda-Yamamoto (1995) test has been used. Finally, appropriate dummies are

included in the analysis wherever required to take care of structural breaks or outliers observable in the data.

4.2 Theoretical Debate:

Primarily three schools assert for the nature of relationship between fiscal deficit and interest rate. First, the Keynesian's mention that a rise in government budgetary imbalance lead to a rise in interest rate, however, it will incentivize the private savings and lead to enhanced capital formation. Second, neo-Classical school also advocated a direct association between fiscal deficit and rate of interest, however, contrary to Keynesians, the rise in interest rate will lead to substitution of private investment and a lower level of capital stock in the economy. Finally, the third view advocated by Barro (1974, 1976) and popularly known as Ricardian equivalence hypothesis⁷¹ assumes a neutrality between the two variables. The rationale for such a neutrality has been provided along the reasoning that a rise in deficit or a tax cut has no impact on aggregate demand. The policy action is assumed to be a postponement of future higher taxes by rational economic agents and in order to pay-off the current higher deficit or finance the current tax cuts in future, private savings increase. Thus, any dissaving by the public sector leads to a corresponding rise in private savings, leaving the total national savings unchanged and hence no change in rate of interest.

4.3 Empirical Review:

4.3.1 General Literature:

The genesis of literature starts with David Ricardo's exploration itself in chapter XVII, "Taxes on Other Commodities Than Raw Produce" of his celebrated "*The Principles of Political Economy and Taxation*" (Apr 1891). However first elucidation has been provided by Barro (1974, 1976) while examining the budgetary deficit impact on U.S economy. Subsequently, many scholars started the working on it and disagreement both at the theoretical and empirical stands were reported. Studies were conducted more extensively for developed countries, however, in developing countries only a limited number of studies were reported. Moreover, the body of literature involves individual country analysis, cross country examinations and panel evaluations. The empirical exercise conducted so far can be sub-categorized according to three theoretical

⁷¹ The argument was originally introduced by Ricardo (1817).

paradigms. Some scholars found no association between fiscal deficit and interest rates as claimed by *Ricardian School*. These include Evans (1985), Tanzi (1985), Dalmagas (1987), Darrat (1989), Swamy et al. (1990), Findlay (1991), Gupta K L (1992) and Ahamad (1996). Whereas Wachtel and Young (1987), Viren. M (1988), Cebula (1990), Gochoco (1991) Cohen and Garnier (1991), Elmendorf (1993), Correia et al. (1995), Ostrosky (1979), Easterly et al. (1993), Cebula (1997), Canzoneri (2002), Gale and Orszag (2003), Frankel et al. (2004), Neumeyer and Perri (2005), Faini (2006), Barnes (2008), Herbert et al (2010), Yu. H (2010), Hauner and Kumar (2011), Caporale et al. (2013, 2015), Aisen and Hauner (2013) reported the evidence of direct co-movement of two variables like those argued by Keynesians and neo-Classical school.

The studies documented above were heterogeneous in terms of countries examined, the nature and definitions of the variables examined, the coverage and frequency of data periods analyzed, the analytical paradigms incorporated and lastly the econometric methodologies adopted. The studies reported a neutrality between interest rate and fiscal deficit highlighted the role of increasing financial openness, improved financial depth, increasing deficit monetization and the perfect foresight of optimizing economic agents as the primary reasons for non-response of interest rates to changes in fiscal deficit. However the neo-classical and Keynesian school argued that increased fiscal deficit created an imbalance between supply and demand for available funds in the economy. This imbalance thus puts an upward pressure on the rate of interest. In addition low financial openness, a plagued financial depth, increasing market borrowings, higher debt figures, interest rate deregulations and overall growth of the economy are also found be factors for such a positive association.

4.3.2 Studies Specific to India:

So far as India in particular is concerned, only a few studies are associated with the examination of the response of interest rates to fiscal deficit changes. Initially scholars like Sundararajan and Thakur (1980) and Pradhan et al. (1990) argue indirectly for a rise in interest rate due to higher fiscal deficit while analyzing the impact of public spending on the private investment. Subsequently, a fierce theoretical discussion started between Patnaik (2001) and Khatkhate et al. (2001) related to impact of fiscal deficit on interest rates in the economy. Advocating many theoretical outlines, the former

pointed out the absence of any direct impact of deficit on interest rates⁷² and later reported the possibility of a positive association⁷³. However the debate proved inconclusive and to polish the theoretical insights again, Bhattacharya (2009) asserted that there is likely no relationship between fiscal deficit and interest rates⁷⁴. As for as empirical evaluations are concerned, Rao (2000) employed static and dynamic frameworks to establish a relationship between budget deficit, debt monetization and market borrowings. The main outcome of the study is that interest rate targeting and inflation control will only be possible through an optimal combination of market borrowings and monetization to finance a given deficit figure. Moreover the study cautioned that unless about 40% of deficit is monetized, the interest rate and inflation rates will tend to be higher than what actually should be. Chakraborty (2002) analyzed the impact of fiscal deficit on the rate of interest in a financially deregulated and increasingly market borrowings regime. Using an asymmetric VAR, the author reported the absence of any impact of former on the later however, the causality is found to run from rate of interest to fiscal deficits. Dua and Pandit (2002) while analyzing the potential determinants of interest rates in India found a significant cointegration relationship between real interest rates its determinants. The study reported the role of both domestic and foreign factors in explaining the interest rate changes. Das (2004) scrutinized the impact of fiscal deficit on the interest rates of India and many other countries. Using the correlation and regression analysis, the author found the absence of any apparent impact of former on the later. Goyal (2004) also examined the nature of relationship between rate of interest and fiscal deficit. Though the author tried to improve on the data employed previously and to extend VAR analysis from simple two-variable case to multi-variable case, however, the results were not in favor of a direct link between the two variables. But unlike Chakraborty (2002), feedback causality is reported. Chakraborty (2007) tried to test the possibility of physical and financial

⁷² “The preposition that the size of fiscal deficits affect the level of interest rates is theoretically completely erroneous, which in turn makes the budgetary strategy fundamentally flawed”, (Patnaik 2001).

⁷³ “The factual evidence also shows that interest rates can remain higher with a fiscal surplus, depending on other economic variables, than in situation with fiscal deficits”, (Khatkhate et al. 2001).

⁷⁴ “There is no reason why larger borrowing by Government need raise interest rates in the economy. It is a case of prejudice in favor of small Government that is the reason for continued currency of this view? Or even if the expressed view is due to desire to keep the foreign institutional investors happy, should it not be better to control speculative capital directly instead of recommending deflationary fiscal policies in the midst of a recession?”, (Bhattacharya 2009).

crowding out in case of India. However, the results reported the absence of either of two substitutability cases. Similarly, Chakraborty (2012) tried to examine the issue of financial crowding out in India. Using the monthly data for the period Apr 2006 to Apr 2011 in a multi-variable asymmetric VAR framework, the rates of interest were not found responsive to changes in deficit figures both in short run and long-run. However the other control variables like reserve monetary changes, expected inflation and capital inflows were found to affect the rate of interest as per theoretical expectations.

The above mentioned literature survey highlights many important points. First, there is inconclusiveness about theoretical contours of the issue. As far as empirics is concerned, though there is ample literature available related to developed countries, but only a few studies have been conducted for developing world, especially in case of India. Lack of unanimity can be observed from the above discussion both generally and India in particular. The possible econometric issues like of endogeneity, multicollinearity and specification bias were not addressed properly in the earlier studies. Since these studies either employed VARs or instrumental variables techniques and both of them have their respective shortcomings⁷⁵. Because of the lack of appropriate data, particularly related to market determined interest rates, not much has been done about the nature of link between fiscal deficit and interest rates in India.

Given the premise the present study will try to re-examine the relational status between fiscal deficit and interest rates in case of Indian economy. With a view to take cognizance of the impact of transitory shocks and the impact on fundamental factors, we have employed two different sets of data with a different frequency. Quarterly data with a short term interest rate is used to explore the short-term versions of relation and an annual series data along with a long term rate is employed to highlight the long-term attributes of the relationship. The choice of different sets of data is further motivated to check for the possibility of any financial and/or direct crowding out⁷⁶. Unlike the

⁷⁵ VARs are sensitive to ordering of variables and are not feasible for multiplicative relationship modelling. The instrumental variables tend to suffer from problem of weak instruments and thereby render the estimation procedure unreliable.

⁷⁶ Buiter (1990) has differentiated between two forms of crowding out-physical and financial. The physical or direct crowding out refers to decline in private investments (real capital) as a result of an increase in public spending and not through any change in prices or interest rates. However indirect or financial crowding out refers to the reduction in private capital formation due to rise in rate of interest. It is due to the changes in public actions which will alter the behavior of private agents either through manipulation of budget constraints or affecting the prices like rates of interest.

previous studies we have employed an extended open economy loanable fund and *IS-LM* derived model specifications for the analytical framework. In order to improve along the econometric methodology to avoid some of the earlier issues, the study has employed an ARDL model to conduct the empirical exercise. For causality examination, Toda-Yamamoto (1995) test has been applied. Finally, appropriate dummies are included in the analysis wherever required to take care of structural breaks or outliers observable in the data.

4.4 Analytical framework:

To check whether the two variables share any relationship in short or long term, the available literature provides two theoretical specifications to deal with such an examination.

4.4.1 IS-LM framework:

A static *IS-LM* model adopted earlier by Evans (1985, 1987a and b), Viren (1988) and Cebula & Belton (1992) expresses a positive association between these two variables. The positive relationship is due to the fact that as fiscal deficit increases, disposable income increases due to the rightward shift in *IS curve*. The increased income stimulates the domestic private consumption and hence a rise in demand for real money stock. With a fixed money supply in the economy, the only way to bring the money market back in equilibrium is that the short-term nominal interest rate should rise (Evans 1987b). For the empirical application, the *IS-LM* framework assumes three additional variables besides the fiscal deficit which are supposed to affect the short-term interest rate and thereby to arrive at the following estimable specification:

$$CMR_t = \beta_0 + \beta_{1(+)}GCE_t + \beta_{2(+)}FD_t + \beta_{3(-/+)}M_t + \beta_{4(+)}INF_t + \beta_{5(+)}EXR_t \quad 4.1.$$

The dependent variable CMR_t denotes the nominal short term interest rate, whereas GCE_t , FD_t , M_t , INF_t and EXR_t represent government consumption expenditure, fiscal deficit, money stock, expected inflation and exchange rate respectively. The signs in the parenthesis of equation 4.1 represent the expected theoretical relationships between the variables.

An increase in government consumption expenditure is expected to increase the rate of interest via an increase in aggregate demand coupled with a fixed monetary stock. So

for as impact of money supply is concerned, scholars have failed to arrive at a common consensus⁷⁷, both at theoretical and empirical level. Theoretically, there are five effects through which the relationship has been visualized. The *unanticipated monetary announcement effect* (Girton and Nattress 1985) expects a positive impact of increased money supply on the rate of interest due to a rise in expected inflation through an inflation premium. *Keynesian liquidity effect*, however, highlights a negative impact on the short term interest rate because of increased liquidity experienced in the money market⁷⁸. The *financial effect* like the *Keynesian effect* also expects a negative impact of increased money supply via open market operations, raising the bond prices and resulting in lower short term interest rates⁷⁹. *Income effect* mentions that a rise in income leads to an increase in demand for money which in turn leads to fall in real balance of the economy and finally, a higher interest rate. As for as *price expectation effect* is concerned an increase in money supply results in a higher nominal rate of interest⁸⁰. It is important to note that all the five effects will have some relevance at one or the other point of time and the severity and span of any effect is subjective and thus, need to be empirically evaluated. Empirical evidence about the relationship between rate of interest and monetary expansion has been reported as dubious. Mishkin (1982) documented the evidence of a direct association, Makin (1983) reported a negative one⁸¹ and Grier et al. (1993) found a positive impact of lagged money shocks on short term interest rates.

The impact of expected inflation on the short term rate of interest has been elucidated through the well-known *Fisher effect*. It states that there is a one to one⁸² direct

⁷⁷ For an exhaustive review of unsettled relationship refer to Nachane et al. (1997).

⁷⁸ Keynesians assume a sluggish adjustment of income and prices to changes in money supply and thus with an unchanged nominal income and excess money supply in the money market, rates of interest ought to decline.

⁷⁹ As money supply increases, the reserves with the banks increase and to do away with them bank started demanding short term securities. This expansion in demand leads to a rise in their prices and hence a fall in interest rates.

⁸⁰ According to this effect, an augmentation of money supply in the economy exerts a positive effect on expected inflation and therefore, a higher nominal interest rate.

⁸¹ Makin (1983) explained the differences in empirical results in terms of different interest rate measures employed in the analysis.

⁸² The empirical support for one to one relationship interest is very limited and the unit coefficient would mean a contradiction to super neutrality hypothesis wherein a rise in inflation will not affect the interest rates in the long-run. Thus from Irving Fisher's equation onwards most of the studies have found a

association between expected inflation and nominal interest rate and hence any upward augmentation in inflation expectations will lead to a rise in rate of interest. Finally, in order to account for the nature of India as an open economy and to explain the impact of capital inflows in short period, we have incorporated one additional variable, namely, exchange rate into the equation 4.1. The impact of expected depreciation (an increase in exchange rate) on the rate of interest is theoretically positive. A higher expected depreciation would mean an increase in demand for foreign bonds relative to domestic ones. The prices of domestic bonds fall and the interest rate rises.

4.4.2 Loanable funds model:

The *loanable funds model* to study the response of long-term interest rate to the changes in fiscal deficit or debt has been incorporated initially in a closed economy framework by Hoelscher (1986). Later on the model has been employed for empirical analysis in subsequent periods and finally, Cebula (2003) extended it for an open economy analysis by including the impact of capital inflows into the supply side of Loanable funds.

In order to derive an estimable equation we proceed as follows. According to *Loanable funds model*, the prime determinants for demand and supply of loanable funds are given as:

$$D_t = d(LIR, INFF, RGDP, GFD) \quad 4.2.$$

$$S_t = s(LIR, SRI, INFF, NCI) \quad 4.3.$$

Equation 4.2 simply asserts that the demand for loanable funds (D_t) is directly related to expected inflation (INFF), real Gross domestic product growth (RGDP) and gross fiscal deficit (GFD) and inversely to long term interest rate (LIR). Similarly, equation 4.3 mentions that the supply of loanable funds (S_t) is related positively to LIR & net capital inflows (NCI) and negatively to SRI and INFF. Simultaneously solving both the equations 4.2 and 4.3 for the equilibrium condition, we get the following function for long term rate of interest (LIR) as:

$$LIR = f(SRI, INFF, RGDP, GFD, NCI) \quad 4.4.$$

coefficient of less than one and hence would mean an effect of inflation on the rates of interest even in the long –run.

Expressing 4.4 in the linear estimable form we get:

$$LIR_t = \delta_0 + \delta_{1(+)}GFD_t + \delta_{2(+)}SRI_t + \delta_{3(+)}RGDP_t + \delta_{4(+)}INFF_t + \delta_{5(-)}NCI_t \quad 4.5.$$

Like earlier, the signs in the parenthesis represent the expected theoretical relationships between dependent variable and respective independent variables. Here again fiscal deficit is expected to affect the long term interest rate positively. An increase in fiscal deficit means an increase in government dis-savings, substituting the share of private sector in the available pool of funds in the economy and hence exerts an upward pressure on interest rates. The short term interest rate is expected to affect the long term interest rate positively according to “*expectation theory of term structure of interest rates*”. Similarly, a higher growth rate of an economy is expected to affect the interest rate directly due to accelerator effects of the GDP growth on investment⁸³ (Correia-Nunes and Stemitsiotis 1995). The direct association between the expected inflation and long-term nominal interest rate could again be explained through *Fisher hypothesis*⁸⁴. Lastly, the open economy version of *loanable funds model* expects a negative relationship between net capital inflows and rate of interest. An increase in net capital inflow would mean a surge in domestic availability of funds and therefore, a fall in rate of interest.

It is worth to mention that the *IS-LM* framework explores only the short-term versions of the relationship between fiscal deficit and interest rates and implies no long-term inferences. A long-term evaluation framework, however, has been provided by *Loanable funds model* based on the equilibrium condition between domestic savings and investment flows. Thus, the equation (4.1) enables to examine the possibility of *indirect or financial crowding out* wherein the private capital formation is affected by changing the interest rates. The equation (4.5) on the other hand provides an opportunity to check the possibility of *direct crowding* wherein the private capital formation is substituted directly by the public spending, as the latter is taking a share of former from

⁸³ Demand for loanable funds by the private investors swells in a growing economy, thus interest rates increase (Hoelscher 1986 and Cebula 1995).

⁸⁴ Other things being equal, any hike in the expected inflationary tendency lowers the real interest rate and an augmentation of private investment demand. This later increase leads to a rise in money demand and therefore, a rise in nominal interest rate.

the available pool of funds in the economy. This finally leads to a persistent rise in interest rates and a fall in private sector investment in the subsequent periods. Thus, long term interest analysis is the traverse through which budget deficit influences the real side of economy.

4.5 Data Description and Empirical Methodology:

4.5.1 Data Description:

The study employs two data sets of different frequency to facilitate the empirical analysis of the possible relationship in the short and long-term versions. The description of various variables incorporated into the analysis is given in Table 4.1. For the short-term analysis a quarterly data set covering the period 1996q2 to 2016q2 has been used. The variables include call money rate (CMR) as dependent variable and government consumption expenditure (GCE), expected inflation (INF), gross fiscal deficit (FD), broad money (M) and nominal expected exchange rate (EXR) as independent variables. Data on nominal weighted average CMR expressed as percent per annum, FD expressed as a percentage of gross domestic product (GDP), INF measured as percentage annual variation in wholesale price index (WPI) and EXR defined as units of rupee per dollar has been taken from “*Reserve Bank of India (RBI-DBIE) website*”. The data on GCE expressed as a percentage of GDP and Broad money (M) expressed as logarithm of real money supply has been taken from “*Federal Reserve Bank of St. Louis*”. The period of analysis is decided by the data availability related to the economy.

As for as expectations related to INF and EXR are concerned, there are three popular approaches available in the literature - *actual future expectations*, *estimations of expectations using autoregressive and moving average process (ARMA) and taking current values equivalent to future expectations by assuming the rational expectations behavior or perfect foresight*. We will adopt the third approach⁸⁵ wherein expectations related to the variables are believed to equal current actuals. This approach means an econometric specification of a *random walk* without a drift or a model of *adoptive expectations* where the current actuals are given the weights equal to one.⁸⁶ This approach is adopted on the consideration that actual expectations data is not available

⁸⁵ The studies like those of Bai and Perron (2003), Driffill and Snell (2003), Caporale and Grier (2005) followed this approach.

⁸⁶ As Garcia and Perron (1996) assume that economic agents use all the available information optimally.

in case of India and since our frequency of data is quarterly, it is quite intuitive that current and future expected values of a variable would be highly correlated in such a short time horizon. In addition using an ARMA strategy to generate adaptive expectations, results in huge consistency loss than our simple approach.

Table 4-1 Variable Description

Variables	Symbol	Description	Units	Source
Short-Term Interest Rate	CMR/SRI	Weighted Average Call Money Rates	Percent Terms	RBI
Government Consumption Expenditure	GCE	Government Revenue expenditure	Percentage of GDP	FRB
Gross Fiscal Deficit	FD	Difference between the total expenditure and total revenue (excluding the market borrowings).	Percentage of GDP	RBI
Broad Money	M	Sum of currency, demand deposits and time deposits.	Log form	FRB
Exchange Rate	EXR	Units of rupee per dollar	Rate	RBI
Long-Term Interest Rate	LIR	Minimum general lending rate	Percent Terms	RBI
Gross Fiscal Deficit	GFD	Difference between the total expenditure and total revenue (excluding the market borrowings).	Percentage of GDP	RBI
Output Growth	RGDP	Percentage annual variation of real Gross domestic product	Percentage terms	RBI
Inflation	INF/INFF	Percentage annual variation in wholesale price Index	Percentage terms	RBI
Capital Inflows	NCI	Net capital account balance	Log form	RBI

Note: “FRB= Federal Reserve Bank of St. Louis, RBI=Database on Indian Economy, Reserve Bank of India”.

To facilitate the long term-analysis, we have used a data set of annual frequency covering the period 1970 to 2016. we have incorporated long term lending rate (LIR) as the dependent variable and gross fiscal deficit (GFD), call money rate (SRI), real

gross domestic product (RGDP) growth rate, expected inflation (INFF) and net capital inflow (NCI) are included as explanatory variables. Data on LIR expressed as minimum general lending rate, GFD expressed as a percentage of GDP, SRI expressed as percent per annum, RGDP defined as percent annual growth rate of gross domestic product, INF expressed as percentage annual variation in WPI and NCI expressed as log form of capital account balance have been taken from “*Reserve Bank of India (RBI-DBIE) website*”. As before actual inflation is again taken as a measure of expected inflation due to reasons mentioned earlier.

4.5.2 Empirical Methodology:

4.5.2.1 Unit Root Analysis:

In order to conduct an efficient empirical exercise and to avoid any spurious kind of relationships, it is important to know whether the variables under study are stationary or not. To serve the purpose there are a number of tests available in the econometric literature, each with its pros and cons. Because of their popularity and simplicity we applied ADF and KPSS tests to know the order of integration. As far as our period of analysis is concerned (both short and long period), various events took place around the world and in India particularly. These will lead to possible structural breaks in the time series data to be analyzed and therefore, render the conventional unit root tests like ADF and KPSS inappropriate⁸⁷ as these tests do not take such breaks in their specifications. To avoid the probable error and for a robust examination, we employed the unit roots tests of Zivot-Andrews (ZA 1992) test and Perron (1997) test. These two tests take the effect of unknown structural breaks into account and endogenously determine the break dates⁸⁸.

4.5.2.2 Cointegration Approach:

We proceed to check for the presence of a long-run cointegration relationship among variables under study. There are different approaches to proceed with. Either with a

⁸⁷ “Failure to allow for an existing break leads to a bias that reduces the ability to reject a false unit root null hypothesis” Perron (1989).

⁸⁸ Whereas ZA (1992) test allows a structural break in series X_t only in the alternate hypothesis and assumes a non-stationary time series without structural break under null. The Perron (1997) allows for a structural break under both null and alternate hypothesis.

single equation residual based test like Engle-Yoo (1987) and Philips-Ouliaris (1990) or a system cointegration approach like Johansen (1988) and Johansen-Juselius (1990). A modified single equation approach has also been developed by Pesaran & Shin (1998) and Pesaran et al. (2001), popularly known as “*Autoregressive distribute lag model (ARDL) or Bounds test*” to examine the existence of any long-run co-movement among variables. The present study applies the *ARDL* approach because of its potential advantages over the conventional approaches⁸⁹. The model can be employed even in a situation where some of the variables are integrated of order zero and some others of order one, and that none of the variables is integrated of order two. Being a single equation approach, it is easy to execute and interpret. Further, the model is flexible enough in choosing the different lags for different variables included in the specification, thus avoids any loss of long-run information. It also provides a solution to weak endogeneity problem. Unlike the conventional error correction approaches, the coefficients of lagged level variables are not restricted in modified error correction mechanism (*ECM*)⁹⁰.

This approach follows a two-step procedure. The existence of a long-run cointegration relationship is tested in step first. If the cointegration is detected, short-run and long-run coefficients along with the *speed of adjustment* from any short-run distortion towards the long-run association are calculated in step two by employing a basic *ARDL* specification and error correction models.

The general form of an *ARDL* model is given by:

$$Z_t = \gamma_0 + \sum_{i=1}^p \gamma_i Z_{t-i} + \sum_{j=0}^q \theta_j S_{t-i} + \mu_t \quad 4.6.$$

where Z_t denotes the dependent variable, Z_{t-i} are the lagged values of dependent variable with γ_i associated coefficients. S_{t-i} represent the set of independent variables to be included in the analysis with θ_j denoting the respective coefficients. Lags of

⁸⁹ The segregation of the dummy variable into the positive and negative sums components does not appear to be valid. Therefore, to incorporate the influence of structural dummies on the nature of relationship among the variables incorporated into the empirical specifications, linear *ARDL* is adopted. Further, when tested for the presence of asymmetric relationships, the results appeared to be in favour of symmetry.

⁹⁰ This is the reason the modified *ECM* is called as “*unrestricted ECM* or an *unconstrained ECM*”. However Pesaran et al (2001) name it as “*conditional ECM*”.

dependent variable are running from 1 to p , and that of independent variables from 0 to q . Finally, μ_t is assumed to be a white noise error term.

To check whether a long-run association exists between dependent variable and all other variables, we used *ARDL Bounds test based on F-statistic*. For checking the cointegration, the *ECM* specifications of equations 4.1 and 4.5 are given as:

$$\begin{aligned}
\Delta CMR = & \theta_0 + \theta_1 CMR_{t-1} + \theta_2 GCE_{t-1} + \theta_3 FD_{t-1} + \theta_4 M_{t-1} + \theta_5 INF_{t-1} \\
& + \theta_6 EXR_{t-1} \\
& + \sum_{j=1}^m \rho_j \Delta CMR_{t-j} + \sum_{i=0}^n \phi_i \Delta GCE_{t-i} \\
& + \sum_{i=0}^n \sigma_i \Delta FD_{t-i} + \sum_{i=0}^n \omega_i \Delta M_{t-i} \\
& + \sum_{i=0}^n \varphi_i \Delta INF_{t-i} + \sum_{i=0}^n \delta_i \Delta EXR_{t-i} \\
& + \epsilon_t
\end{aligned} \tag{4.7}$$

$$\begin{aligned}
\Delta LIR_t = & \theta_0 + \theta_1 LIR_{t-1} + \theta_2 GFD_{t-1} + \theta_3 SRI_{t-1} + \theta_4 RGDP_{t-1} + \theta_5 INFF_{t-1} \\
& + \theta_6 NCI_{t-1} \\
& + \sum_{j=1}^m \rho_j \Delta LIR_{t-j} + \sum_{i=0}^n \phi_i \Delta GFD_{t-i} \\
& + \sum_{i=0}^n \sigma_i \Delta SRI_{t-i} + \sum_{i=0}^n \omega_i \Delta RGDP_{t-i} \\
& + \sum_{i=0}^n \varphi_i \Delta INFF_{t-i} + \sum_{i=0}^n \delta_i \Delta NCI_{t-i} \\
& + \epsilon_t
\end{aligned} \tag{4.8}$$

The part of equations 4.7 and 4.8 carrying the coefficients from θ_1 to θ_6 represent the long-run association and the part with the coefficients $\rho_i, \phi_i, \sigma_i, \omega_i, \varphi_i$ and δ_i constitute the short-run dynamics. The other terms in the equation are variables of short version

(4.1) and long version (4.5) analytical framework defined in the section 4.4.1 and 4.4.2 respectively. $\epsilon_t \sim iid(0, \sigma^2)$.

The null hypothesis for the *Bounds test* is framed in terms of joint insignificance of lagged level coefficients. Such that:

$$H_0; \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = 0$$

Against the Alternative:

$$H_1; \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \neq \theta_6 \neq 0$$

Pesaran et al. (2001) provided the *bounds of critical values* for various models with different number of explanatory variables. The lower bound assumes the stationarity of all variables and the upper bound assumes that all variables are non-stationary. If the calculated *F-statistic* lies below the lower bound, it means the acceptance of null hypothesis of no cointegration and if the test statistic is greater than upper bound value, it is an evidence of cointegration among the variables under study. Finally, if the value of test statistic lies in between the lower and upper bounds, then we are not sure about the presence or absence of cointegration.

As per the structure of model and because of the fact that some economic variables respond after some lags, we resort to information criteria's like *AIC* or *SBC* to select the appropriate lags. Moreover, if the cointegration is detected, we proceed to check for the direction of causality between fiscal deficit and interest rates. For that purpose, Toda-Yamamoto (1995) test is applied. This test has the advantage over simple Granger causality as it performs better in case the variables are integrated and possibility cointegrated and instead of differencing we use the data in levels.

4.6 Empirical Results and Discussion:

4.6.1 Structural Break Test:

The empirical exercise starts with the testing of *structural breaks* in the data. We have used the Bai-Perron (2003) test⁹¹. Table 4.2 clearly shows the existence of a single structural break in case of annual data series and two breaks in case of quarterly data series. The break dates detected like 2008-09 and 2003q1 and 2009q1 tally with the

⁹¹ In this test, multiple structural breaks can be detected endogenously from the data.

recent *global financial crisis* and the introduction of *FRBM act 2003* in case of Indian economy. To account for the influence of *structural breaks*, we incorporated two dummies d1 and d2 in our analysis.

Table 4-2: Bai-Perron (2003) multiple Structural Breaks Test.

Break test	f-stat (scaled)	Critical value	Break date
<u>Annual</u>			
0 vs. 1*	106.36	20.08	-
1 vs. 2	18.862	22.11	2008-09
<u>Quarterly</u>			
0 vs. 1*	25.879	18.23	-
1 vs. 2*	20.378	19.91	-
2 vs. 3	14.699	20.99	2001q1 & 2009q1 (Sequential) 2003q1 & 2009q1 (Seperation)

4.6.2 Unit Root Analysis:

Table 4.3 shows that the unit root tests report different results except in case of FD and M where the results are similar. Because of the presence of structural breaks we have considered the results of ZA (1992) and Perron (1997) unit root tests and in case these two are divergent then the results of Perron (1997) will be taken as final⁹². Perron and ZA tests declared CMR as I(0), GFD as I(1) and M as I(1) and because of difference in results between ZA and Perron tests, we would consider GCE as I(1), INF as I(1) and EXR as I(1) on the basis of Perron outcomes.

⁹² This is because of potential advantage of Perron (1997) over ZA (1992), as the later considers the structural break only in alternate hypothesis and assumes a non-stationary time series without a break. However, later considers possible breaks under both the hypothesis. Moreover unlike ZA, Perron allows for two different of breaks through additive outlier and innovative outlier models.

Table 4-3: Unit Root Analysis of short-term interest rate model variables.

<i>Test</i>	<i>CMR</i>	<i>GCE</i>	<i>FD</i>	<i>INF</i>	<i>M</i>	<i>EXR</i>
ADF	-4.903	-1.023	-2.386	-4.205	-2.616	-0.835
P-Value	(0.007)	(0.934)	(0.384)	(0.006)	(0.275)	(0.957)
KPSS	0.168	0.284	0.223	0.156	0.128	0.200
5% C.V	(0.146)	(0.146)	(0.146)	(0.146)	(0.146)	(0.146)
Z-A	-6.144	-3.531	-4.978	-5.219	-2.125	-3.492
P-Value	(0.126)	(0.000)	(2.144)	(0.000)	(0.672)	(0.023)
Lags	0	3	3	4	4	1
Break Date	2001Q2	2008Q4	2008Q4	2010Q4	2012Q4	2006Q4
Perron	-6.14	-3.501	-4.775	-5.189	-2.088	-3.026
5% C.V	(-5.59)	(-5.59)	(-5.59)	(-5.59)	(-5.59)	(-5.59)
LAGS	0	3	3	4	4	0
Break Date	2001Q2	2008Q3	2008Q3	2010Q3	2013Q2	2009Q1
Order	I(0)	I(1)	I(1)	I(1)	I(1)	I(1)

Table 4-4: Unit Root Analysis of long-term interest rate variables.

TEST	LIR	RGDP	GFD	SRI	INFF	NCI
ADF	-4.345	-7.416	-2.470	-3.580	-5.464	-5.985
P-Value	(0.006)	(0.000)	(0.340)	(0.042)	(0.000)	(0.000)
KPSS	0.162	0.080	0.173	0.160	0.080	0.133
5% C.V	(0.146)	(0.146)	(0.146)	(0.146)	(0.146)	(0.146)
Z-A	-3.930	-8.711	-4.799	-5.245	-5.670	-7.497
P-Value	(0.206)	(0.024)	(0.080)	(0.000)	(0.256)	(0.011)
Lags	1	0	0	0	3	0
Break Date	1993	2005	1991	1996	1997	1983
Perron	-4.953	-8.952	-4.736	-5.068	-5.663	-7.616
5% C.V	-5.59	-5.59	-5.59	-5.59	-5.59	-5.59
Lags	0	0	0	0	0	0
Break Date	2009	1979	1990	1991	1978	1983
Order	I(1)	I(0)	I(1)	I(1)	I(0)	I(0)

Similarly, Table 4.4 shows that the results portrayed by unit root tests without structural break are completely divergent to those with structural breaks with the exception of RGDP and NCI where the two show similar results. The Perron and ZA test have declared LIR as $I(1)$, RGDP as $I(0)$, GFD as $I(1)$, NCI as $I(0)$. As for as INFF and SRI are concerned we will take former as $I(0)$ and later as $I(1)$ due to rejection of unit root null in case of INFF and acceptance of null of unit root in case of CMRR by Perron test. None of the variables were found $I(2)$, thus render the application of *ARDL* model technically feasible.

The *structural breaks* associated with the variables show coincidence with severe drought coupled with declining industrial production, insignificant rain fall, steep hike in oil prices and increased inflationary pressures during 1978-79, the balance of payments crisis of 1980s, the economic reforms of 1990s, the seasonal monetary tightening due to fall in domestic liquidity in the face of foreign exchange market uncertainty in 2000s, the introduction of *FRBM* in 2003 and more recently the global financial crisis of 2007-09.

4.6.3 Cointegration Analysis:

4.6.3.1 Short term interest rate analysis, *IS-LM* framework:

With the premise of different order of integration of the variables and none of them is $I(2)$, we proceeded for *non-standard Bounds test* to check whether the variables are cointegrated or not. Since the two variables CMR and FD are of prime concern, we started with the specification of these two variables only to test whether the duo share any long-run co-movement or whether other variables influence the nature of their relationship. As can be seen from Table 4.5, there is the clear evidence of a long-run relationship between fiscal deficit and interest rate, since the *Bounds F-stat* is higher than the upper bound critical value at 1, 5 and 10% levels of significance. Similarly if we incorporate other variables like GCE, INF, M and EXR into the specification, the null of no cointegration is rejected again as the calculated *F-stat* is higher than upper bound critical value. Likewise the inclusion of *structural breaks* in the form of a dummy

variable $d1^{93}$ into the equation does not lead to the rejection of the existence of cointegration relation among the variables under study.

Table 4-5: ARDL Bounds Test- (Model 4.1)

<i>Specification</i>	<i>Lag structure</i>	<i>Bounds value</i>	<i>1%</i>	<i>5%</i>	<i>10%</i>
<i>M0 (CMR,FD)</i>	1,0	13.27	7.8	5.7	4.8
<i>M1(CMR,GCE,FD,INF,M,EXR)</i>	1,0,1,0,0,1	6.539	4.7	3.8	3.4
<i>M2(CMR,GCE,FD,INF,d1)</i>	1,0,1,0,0	8.100	5.1	4.0	3.5
<i>M3(CMR, GCE, FD,INF,M,d1)</i>	1,0,1,0,1,0	7.341	4.2	3.3	2.9
<i>M4(CMR,GCE,FD,INF,EXR,d1)</i>	1,0,1,0,1,0	7.154	4.2	3.3	2.9

After confirming the existence of a long-run association we proceeded to check the direction of causality between interest rate and fiscal deficit with Toda-Yamamoto test in a multivariate VAR framework, wherein the all variables except FD are set exogenous. Upper panel A of Table 4.6 reveals the evidence of a one sided causality between fiscal deficit and interest rate and causality is running from fiscal deficit to CMR. This means that swelling fiscal imbalances are affecting the rates of interest in India and the converse is not true as for as short version relationship between fiscal deficit and interest rates is concerned. This result is in conformity with the behavior of Indian economy, since it started to finance the deficits with increasing proportions of market and external borrowings and thereby pushing an upward pressure on interest rates.

As a next step, we estimated the long-run coefficients to see how the different variables are affecting the short-term interest rate. The optimal lag for each variable and for each different specification has been decided by both *AIC* and *SBC* criteria as can be seen from column second of Table 4.5. A synoptic view at the left hand side of Table 4.7 clearly reveals that various variables affect the interest rate (CMR) according to expected theoretical signs.

⁹³ Wherein the break values are set equal to one and all other observations are set equal to zero. Moreover the Chow-test has been employed for robustness and to know the length of the break.

Table 4-6: Toda-Yamamoto (1995) causality test

Short-term causality		
	Chi-square statistic	P-value
<i>FD granger causes CMR</i>	12.21*	0.015
<i>CMR granger causes FD</i>	1.349	0.852
Long-term causality		
<i>GFD granger causes LIR</i>	14.51*	0.002
<i>LIR granger causes GFD</i>	12.54*	0.005

Model M1 highlights that fiscal deficit and Interest rates are directly related and any increase in former raises the later by a magnitude of 1.053. The outcome of this result is contrary to the projections of equivalence hypothesis of Ricardo concerning the nature of relationship between fiscal deficit and interest rates. Thus, the *IS-LM* channel, wherein increased deficits lead to a rise in interest rates by augmenting the aggregate demand, could be considered a possible explanation for the direct association. The positive impact of fiscal deficit on the rate of interest can also be taken as an evidence of financial crowding because interest rates are increased via an increase in aggregate demand and not by any substitution of private investment by the public sector.

Similarly the impact of increased government expenditure is positive and statistically significant. Whenever GCE increases, other things remaining constant, there occurs a rise in aggregate demand via a rightward shift of *IS curve* in case of *IS-LM* model. With the result, the money demand in the economy rises and in order for money market to be in equilibrium, interest rate increases. The positive impact of expected inflation INF, proxied by actual inflation can be explained in terms of *Fischer hypothesis*. The coefficient of 0.247 indicates the gradual incorporation of inflation into the interest rates.

Table 4-7: Short term Interest Rate Results (Model 4.1)

Variable	Dependent variable-d(CMR)								
	M1	M2	M3	M4	Lags	S1	S2	S3	S4
GCE	0.328 (0.04)	0.188 (0.04)	0.141 (0.01)	0.064 (0.09)	d(GCE)	0.192 (0.05)	0.114 (0.03)	0.086 (0.19)	0.604 (0.01)
FD	1.053 (0.02)	0.769 (0.06)	0.689 (0.08)	0.946 (0.04)	d(FD)	0.267 (0.08)	0.21 (0.15)	0.177 (0.23)	0.195 (0.22)
INF	0.247 (0.06)	0.337 (0.00)	0.336 (0.00)	0.44 (0.00)	d(INF)	0.145 (0.07)	0.204 (0.00)	0.205 (0.00)	0.244 (0.00)
M	-1.516 (0.06)		0.446 (0.02)		d(M)	-0.886 (0.07)		0.338 (0.09)	
EXR	0.091 (0.29)			0.134 (0.00)	d(EXR)	0.351 (0.01)			0.291 (0.03)
d1		-2.33 (0.00)	-2.78 (0.00)	-1.816 (0.02)					
C	14.33 (0.01)	5.322 (0.0)			ECT1	-0.58 (0.00)	-0.6 (0.00)	-0.6 (0.00)	-0.55 (0.00)
LM-STAT	0.827 (0.44)	0.306 (0.74)	0.179 (0.84)	0.73 (0.49)					
BPG	1.215 (0.30)	0.755 (0.61)	1.124 (0.36)	1.134 (0.35)					

Note: "Numbers in parenthesis are associated p-values".

The increase in money supply is found to affect the CMR negatively. In case of the Indian economy the negative effect of money supply on the short term rate of interest is explained either through a Keynesian liquidity effect or financial effect. An alternate reason for the negative impact on interest rate operates through the fact that excess money will be demanded only when interest rate falls.

To take note of the effect of external influences, the behavior of nominal exchange rate is examined. A positive, though very small, coefficient associated with it is according to the theory but is insignificant in long-run. This may be due to using current actuals for the exchange rate expectations and hence, do not capture any effect of expected depreciation on interest rates. As economic agents expect a depreciation of local currency, demand for foreign bonds increases and that of domestic bonds decreases. With the result the prices of domestic bonds fall and interest rate rises.

Next we incorporated dummy d1 into different model specifications. In all the cases the value of d1 is statistically significant, indicating the presence of structural break. The

sign of all the independent variables, except the money supply has remained same. Thus, including structural break into the analysis has enabled to know whether the nature of relationship between variables has changed or remained constant. Several interesting points need to be made here. Firstly, the magnitude of GCE and GFD on the rate of interest has declined relative to the model without structural break. This highlights the impact of introducing fiscal discipline measures aimed at to cut down the unproductive consumption expenditures and also to reduce the size of deficit so as to strengthen the fiscal prudence. The impact of WPI and EXR has increased and moreover, the coefficient on EXR has become statistically significant. The increased impact of WPI can be explained in terms of higher headline inflation episodes, which in turn pushes up the overall inflation rate in the economy and therefore, the impact on CMR magnifies. In addition, the inclusion of structural break enabled the adaptive expectation proxy of exchange rate expectations to exert an appreciable and statistically significant effect on interest rate. The shifting of nature of relationship from inverse to direct in case of money supply is explained via unanticipated monetary announcement effect or price expectation effect. It means an increase in money supply triggers an upward revision of inflation expectations and therefore, a rise in nominal rate of interest CMR.

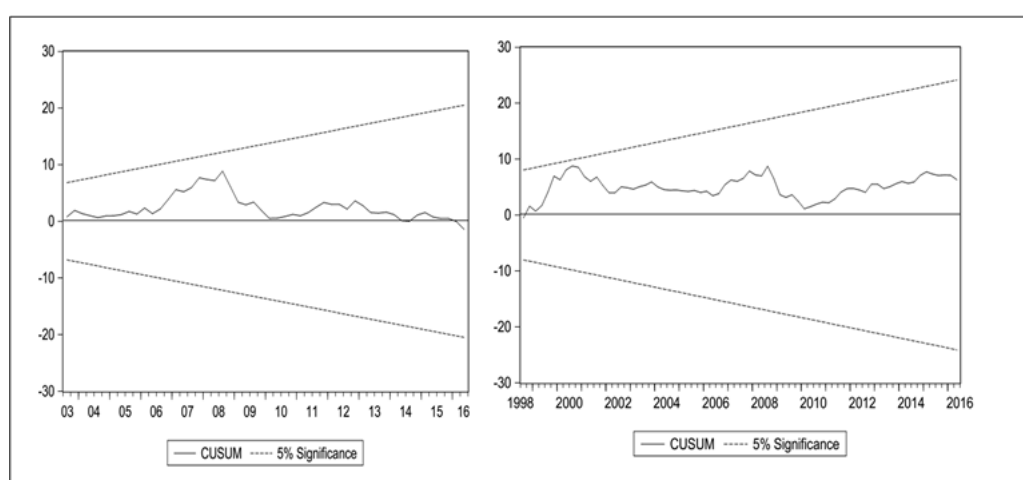


Figure 4.1: CUSUM test (A) with a structural Break and (B) Without a structural Break

Now coming to short-run dynamics, the independent variables affect the interest rate in the same way they affected it in long-run, of course not with a similar magnitude. The insignificance of GCE and FD is due to the declining trends of these two variables since

the introduction of FRBM act in 2003, the influence of which is captured by dummy incorporated into the analysis. Moreover the short-run *Fischer effect* is lower than the long-run effect. The impact of exchange rate depreciation is again positive and statistically significant. The value of “*error correction term (ECT)*”, measuring the *speed of adjustment* towards long-run cointegration, is nearly around 60% in almost all the model specifications. It carries the required *negative sign* and is statistically significant. Lastly, to validate the model specifications, we conducted the relevant diagnostic tests to check whether the residuals are *serially uncorrelated*⁹⁴ and whether they are *homoscedastic*. The results reported on the left lower part of Table 4.4 report that *no autocorrelation* and *no heteroskedasticity* is found. Moreover, Figures 4.1 (A & B) reported the *CUSUM test* for dynamic stability of the model specifications with and without a structural break.

4.6.3.2 Long-term interest rate analysis, Loanable funds model:

Like the short-term interest rate analysis, we started with the testing of existence of a long-run relationship among the variables primarily used for analysis like long-run lending interest rate (LIR) and gross fiscal deficit (GFD).

Table 4-8: ARDL Bounds Test. (Model 4.5)

Specification	Lag structure	Bounds value	1%	5%	10%
<i>M1 (LIR,GFD)</i>	1,0	11.29	7.8	5.7	4.8
<i>M2(LIR,GFD,SRI)</i>	1,1,1	10.12	6.4	4.9	4.1
<i>M3(LIR,GFD,SRI,RGDP)</i>	1,2,1,0	7.539	4.8	3.6	3.1
<i>M4(LIR,GFD,SRI,RGDP,INFF)</i>	1,2,1,1,0	9.390	4.4	3.5	3.0
<i>M5(LIR,GFD,SRI,RGDP,INFF,NCI)</i>	1,0,0,1,3,4	3.995	4.2	3.3	2.9
<i>M6(LIR,GFD,SRI,d2)</i>	1,0,1,1	45.84	5.6	4.4	3.8
<i>M7(LIR,GFD,SRI,RGDP,d2)</i>	1,0,1,1,1	15.53	4.4	3.5	3.0
<i>M8(LIR,GFD,SRI,RGDP,INFF,d2)</i>	1,0,1,1,0,1	14.96	4.2	3.3	2.9
<i>M9(LIR,GFD,SRI,RGDP,INFF,NCI,d2)</i>	1,0,1,1,0,0,1	12.81	4.1	3.2	2.9

Table 4.8 clearly reveals the existence of a cointegration among the variables either when only two of them are tested, or when many other variables are also included in

⁹⁴ The ARDL model is based in fact on the assumption of uncorrelated residuals.

specifications or more importantly when the structural dummy (d2) is also involved into analysis. In each case the *non-standard Bounds F-statistic* is higher than the upper bound value and therefore, leads to the rejection of null hypothesis assuming no cointegration among variables. Having established the existence of cointegration, we tested for the causality between long term interest rate and fiscal deficit using again the Toda-Yamamoto (1995) test. We found feedback causality between the two variables as the probability value of accepting the null of no causality has been rejected by the test (lower part B of Table 4.6). There is a strong reason for the existence of bi-directional causality in the long term analysis of the interest rate-deficit nexus. Higher fiscal deficit lead to substitution of the share of private sector funds from the available pool of funds in the economy and this competition between private and public sector leads to a rise in interest rates. The increased interest rates in turn lead to more debt obligations to be paid swelling deficit figures accordingly. Thus, the Indian economy is faced with the problem of *debt-deficit spiral*.

Table 4.9 reports the nature and magnitude of the long-run cointegration relationship among the variables incorporated in the long-term analysis. We have followed specific to general approach in assessing the nature of relationship. We started with the basic specification involving two variables like LIR and GFD and then we proceeded with additional regressors. Finally, we incorporated the structural break variable in the form of a dummy (d2) to examine the nature of relationship even in presence of structural breaks. The optimal lag for each variable and for each different specification has been decided by both *AIC* and *SBC* criteria as can be seen from column second of Table 4.8.

Again the impact of various variables on the rate of interest is according to expected theoretical signs. LIR and GFD are found to be directly related. The magnitude of the statistically significant coefficient attached to GFD varies from 0.531 to 1.276 in case of models without a structural dummy and 0.497 to 0.961 in case of models with a structural dummy. This positive influence of fiscal imbalance on the rate of interest, again leads to the refutation of *Ricardian equivalence hypothesis* and is in conformity with the neo-classical school rather than Keynesian. This is because the of the substitution of private sector funds by public sector leads to upward movement in lending interest rates. Higher interest rates would increase the borrowing costs for private investors and thereby reduce private capital formation.

Table 4-9: Long-Term Interest rate Analysis (Model 4.5)

Variable s	Dependent Variable-LIR								
	M1	M2	M3	M4	M5	M6	M7	M8	M9
GFD	1.197 (0.00)	0.959 (0.02)	0.738 (0.05)	0.531 (0.11)	1.276 (0.00)	0.497 (0.00)	0.961 (0.00)	0.869 (0.00)	0.877 (0.00)
SRI		0.334 (0.07)	0.783 (0.00)	0.631 (0.00)	0.011 (0.95)	0.446 (0.00)	0.739 (0.00)	0.632 (0.00)	0.629 (0.00)
RGDP			0.427 (0.01)	0.663 (0.00)	0.876 (0.00)		0.353 (0.02)	0.434 (0.00)	0.459 (0.03)
INFF				0.206 (0.01)	0.632 (0.00)			0.142 (0.03)	0.144 (0.66)
NCI					-0.402 (0.08)				-0.309 (0.09)
C	7.359 (0.00)	5.667 (0.01)				7.225 (0.00)			
d2						-3.397 (0.00)	-3.119 (0.00)	-2.671 (0.01)	-2.524 (0.05)
LM-STAT	0.485 (0.62)	1.464 (0.24)	1.574 (0.22)	0.573 (0.57)	1.017 (0.37)	1.267 (0.20)	2.467 (0.09)	1.558 (0.26)	1.892 (0.18)
BPG	1.375 (0.26)	1.184 (0.33)	1.276 (0.32)	2.245 (0.01)	0.671 (0.71)	1.208 (0.32)	1.116 (0.36)	1.775 (0.18)	2.157 (0.14)

Note: "Numbers in parenthesis are associated p-values".

The positive impact of short term interest rate denoted by SRI on long-term interest rate is the evidence of “*expectation theory of term structure of interest rates*”. Output growth (RGDP) in the economy is found to affect the LIR positively. This result is in conformity with the operation of accelerator principle in India whereby output growth leads to a rise in investment demand and hence results in higher interest rate. INF affects the LIR positively according to the *Fischer hypothesis*. However, the magnitude of impact is relatively lower in long-term case. To take note of the open economy nature of India, the behavior of net capital inflows is examined. We found the negative response of lending rate to any increase in capital inflows into the economy. This result is again theoretically plausible since any increase in capital inflows would lead to a rise in domestic availability of loanable funds and therefore, interest rate declines. Finally, the statistical significance of dummy d2 provides evidence of structural break in the

data. However there is no change in nature of relationship reported with and without break variable.

Table 4-10: Short-run dynamics of long term interest rate

<i>Lags</i>	<i>Dependent Variable- d(LIR)</i>								
	<i>S1</i>	<i>S2</i>	<i>S3</i>	<i>S4</i>	<i>S5</i>	<i>S6</i>	<i>S7</i>	<i>S8</i>	<i>S9</i>
d(GFD)	0.922 (0.01)	0.822 (0.08)	1.150 (0.01)	1.061 (0.01)	1.010 (0.00)	0.435 (0.01)	0.703 (0.00)	0.709 (0.00)	0.719 (0.00)
d(GFD(-1))			1.498 (0.00)	1.682 (0.00)					
d(SRI)		0.07 (0.66)	0.357 (0.03)	0.178 (0.29)	0.009 (0.95)	0.278 (0.00)	0.357 (0.00)	0.254 (0.03)	0.249 (0.04)
d(RGDP)			0.329 (0.02)	0.382 (0.01)	0.123 (0.50)		0.125 (0.16)	0.166 (0.06)	0.178 (0.13)
d(INFF)				0.196 (0.02)	0.201 (0.03)			0.116 (0.04)	0.118 (0.05)
d(NCI)					-0.836 (0.17)				-0.032 (0.87)
ECT2	-0.771 (0.00)	-0.837 (0.00)	-0.771 (0.00)	-0.949 (0.00)	-0.792 (0.00)	-0.873 (0.00)	-0.731 (0.00)	-0.816 (0.00)	-0.82 (0.00)

Note: "Numbers in parenthesis are associated p-values".

Finally the short-run dynamics associated with the long-term interest rate analysis is shown in Table 4.10. The signs of coefficients attached to various independent variables are according to theory and are statistically significant at various levels of significance with few exceptions. Here again the short-run *Fisher effect* is higher than the long-run. The “*error correction terms (ECT2)*” are again statistically significant and carry the *negative sign* required for convergence towards the long-run association. It is further to be noted that in loanable fund models, the *speed of convergence* from any short-run distortion is relatively higher than in the *IS-LM* models. The diagnostic stability tests portray the absence of *autocorrelation* and *heteroskedasticity* and *CUSUM test* shown in Figures 4.2 (A & B) reflect the dynamic stability of econometric models with and without structural break.

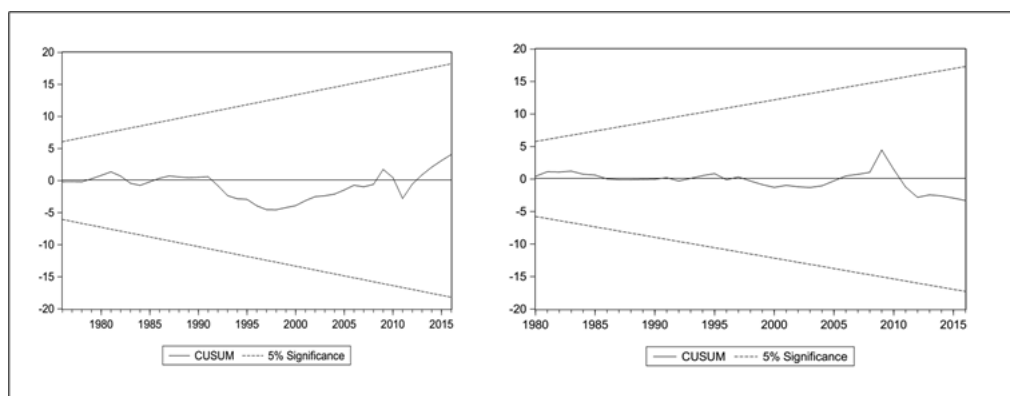


Figure 4.2: CUSUM test (A) with a structural break and (B) without a structural break

4.7 Conclusion:

The importance of interest rates in affecting and/or managing the macroeconomy of a country particularly in the arena of improved financial integration could not be undervalued. Apart from being exogenously determined by a country's monetary authority, its behavior is also market determined. It is influenced by either domestic or foreign or a combination of both the factors, depending upon the degree of openness of an economy. The impact of fiscal deficit on the rate of interest has always been an unsettled debate and even in the Indian case no consensus either theoretically or empirically is reported. The present study is an attempt to address the issues in a more economically integrated and financially deregulated economy, namely, India in order to establish any recent evidence.

Two different data sets with different frequencies will be employed to examine the transitory and permanent impact of fiscal shocks. Quarterly data set with a short-term interest rate is used to explore the short-term version of relationship between interest rates and fiscal deficit and an annual data set together with a long-term interest rate is employed to highlight the long-term attributes. Unlike the previous studies, we employed an *IS-LM* and extended *open economy loanable fund* model specifications for the analytical framework. Moreover, to improve along the econometric methodology in order to avoid some of the earlier issues, the study has employed an “*Auto regressive distributed lag model (ARDL)*” given by Pesaran et al. (1998; 2001) to conduct the empirical exercise. To address the issue of causality, Toda-Yamamoto

(1995) test has been used. Finally, appropriate dummies are included in the analysis wherever required to take care of structural breaks or outliers observable in the data.

The study reported the existence of cointegration relationship between short-run interest rate and fiscal deficit on the one hand and between long-term interest rate and fiscal deficit on the other. The existence of cointegration between the variables of interest clearly rejects the Ricardian equivalence proposition which otherwise predicts a neutrality between the two variables. The direct association operates through an augmented aggregate demand channel in short-period and the substitutability of private sector funds through increased market borrowings from the available pool of funds in the long-period analysis. The former channel establishes the evidence of financial or indirect crowding out, whereas later one implicitly supports the direct crowding out of private investment. Other variables affecting the interest rate were found to behave according to expected theoretical signs. Government consumption expenditure, inflation and exchange rate depreciation were found to affect short-term interest rate positively. Money supply affects it negatively in case the structural breaks are not included and positively when the breaks are incorporated into analysis. The former impact is illustrated through the *Keynesian liquidity* and *financial effect*, whereas later one is explained through *unanticipated monetary announcement effect* and *price expectation effect*. The long-term interest has been affected positively by short-term interest rate, real GDP growth and inflation, however the net capital inflows are found to affect it negatively. The short-run dynamics related to both short and long-term interest rate analysis also portrays the theoretically plausible results. Finally, the *error correction terms* were found *negative* and statistically significant. However, the *speed of adjustment* from any short-run distortion is relatively high in case of long-term interest rate analysis.

CHAPTER 5

5 Twin-Deficit Hypothesis

5.1 Introduction:

The size of government activity in influencing the macroeconomic scenario of an economy has increased considerably over the years, as is clear from the swelling fiscal deficit figures or large public expenditures, reported in annual budget documents. The stated objectives usually suggest that it should boost the investment and capital formation, raise the rate of savings, curtail the unproductive consumption, re-allocate the resources from unproductive uses to most desirable channels and keep a check on sectoral or regional imbalances. The success of these objectives obviously relies on the response of various macro variables at which the fiscal policy shocks are targeted, the nature of economy involved and more particularly the nature of government activity itself. If for instance, government increases the level of current expenditure, then empirics highlights the case of crowding out of private investment and therefore, a lower level of economic growth. Contrary to this, a rise in capital expenditure complements the private investment.

In addition to increased fiscal deficit, economies have also witnessed bulged current account deficit. The persistence of these two deficits is a policy concern as the two are regarded as barometers of the internal and external position of an economy. The large fiscal deficit is viewed to oppress the growth performance of an economy and large current account deficit hinders the international competitiveness, cause a drain of wealth, a reduction in forex reserves and may even switch on a currency crisis. Researchers have, over the years, tried to see the link, any of the fiscal policy changes (fiscal deficit) and external balance of a country. The standard Keynesian macroeconomics expects a direct association between the two deficits. Whereas Ricardian equivalence hypothesis of Barro (1976, 1989) postulates neutrality between them and more recently, Kim and Roubini (2008) support a negative association, “Twin Divergence” hypothesis.

In this study, we try to revisit the relational status between two deficits in case of a growing and dynamically open economy, India. We test the null of Ricardian

equivalence against an alternative of twin-deficit hypothesis. India has been witnessing high fiscal deficit coupled with high current account deficit over the years. As can be seen from the Figure 5.1, almost in every year there is a deficit either in internal or external balance except for certain years like 1972-73, 1975-76, 1976-77, 2001-02 and 2002-03 where there was a surplus in external account. The fiscal deficit increased progressively from 1970-71 (-2.96 percent of GDP) to 1986-87 (-8.13 percent of GDP) particularly to meet the local expenditures and move the economy out of the low level of development impasse. Thereafter, there occurs a reverse trend till the global financial crises 2008-09 due to the introduction of fiscal management initiatives from time to time. But to overcome the negative effects of global meltdown, the government of India injected higher doses of stimulative packages and deficit swallowed again along with current account imbalance.

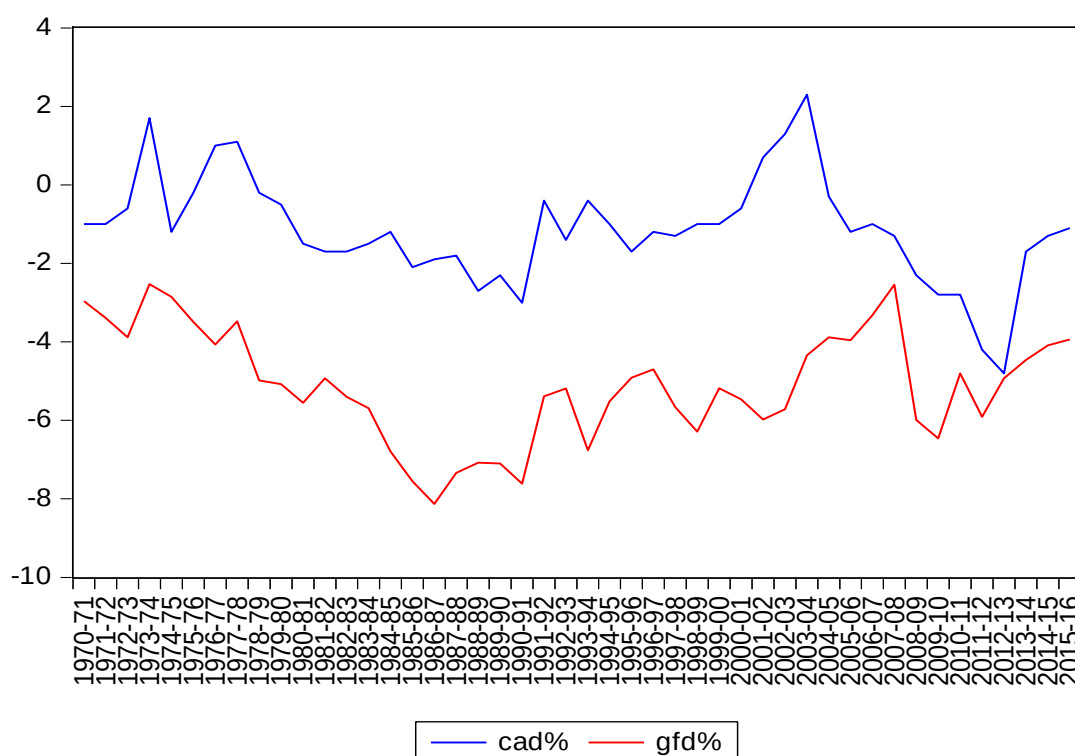


Figure 5.1: Gross fiscal Deficit and Current Account Deficit as a Percentage of GDP

Even after the implementation of FRBM Act 2003 aiming at improving the fiscal positions, Indian economy continued to struggle with fiscal imbalances even in the recent years. Moreover, the openness of the economy to the outside world has also shown an increased trajectory due to increased volumes of trade and other financial

transactions with the rest of world. For the year 2015-16 the figures reported are -3.54% and -1.25% for the fiscal deficit and external deficit respectively.

Work reported in the present study is motivated by lack of adequate literature so far as India is concerned and mixed evidence reported in general literature on the twin deficit hypothesis. The studies related to twin deficit hypothesis, so far conducted, have primarily based their analysis within a linear or symmetrical framework and have ignored the possibility of asymmetric nature of the association between the two deficits⁹⁵. The asymmetric impact of fiscal deficit on the current account balance of a developing country like India will be an important case to examine, given the presence of liquidity constraints and the operation of the downward inflexibility of consumption levels (Ratchet effect). The credit market in the India is less developed and the credit allocations are heavily concentrated in big business houses and other services sector big corporations. However, the other priority sectors like agriculture, small-scale industries, education, housing etc. have been given only a peripheral attention. Although many initiatives⁹⁶ were taken by the Indian policymakers to create a balance in the credit allocations to various sectors in the economy and enhance the liquidity position of rural and other hitherto neglected sectors, the performance is not found to be satisfactory (RBI report 2007)⁹⁷. The choice of an emerging economy, India, for the asymmetric investigation of fiscal twin deficit hypothesis is, thus, motivated by the prevalence of liquidity constraints among a large section of population together with persistent inequalities (Mazumdar et al. 2017). The lack of purchasing power, liquidity tightening, a distorted credit allocation system as prevalent in India and the presence of other stickiness and rigidities in the economic phenomenon makes it possible that the response of the current account balance to the fiscal deficit changes may not be symmetric. In a scenario of bulged fiscal and current account imbalances, the study will try to revisit the relational status between the two deficits in the realm of credit constraints and excessive inequality, in order to take cognizance of possible

⁹⁵ Trachanas and Katrakilidis (2013) have analyzed the twin deficit hypothesis in a nonlinear framework. But being a panel study, it lacks the applicability to an individual developing economy like India.

⁹⁶ Like bank nationalization in 1969, Self-help Groups (SHG) under micro-finance in 1992, Kisan credit card (KCC) in 1998, and General credit cards (GCC) in 2005.

⁹⁷ <https://www.rbi.org.in/SCRIPTs/PublicationReportDetails.aspx?UrlPage=ReportonCurrencyandFinance&ID=502>.

asymmetric/nonlinear effects of fiscal policy stances on the current account balance in both the short-run and the long-run. Our study will, therefore, enrich the existing literature along the lines of asymmetric linkages.

A Non-linear Autoregressive Distributed Lag (NARDL) model developed by Shin et al (2014) has been used to ascertain the existence, if any, of nonlinearities/asymmetries among the variables included.

5.2 Theoretical Debate:

There are primarily three opinions to deal with the nature of relationship between fiscal deficit and current account balance, namely *Keynesian or Mundell- Fleming, Ricardian and Kim & Roubini view* (Rosenweig and Tallman, 1993, p. 580; Khalid and Guan, 1999, p. 390). In cases of *Keynesian and Mundell-Flemming paradigms*, the two variables are assumed to be positively correlated (twin deficit hypothesis). Firstly, in *Keynesian absorption approach*, an increase in budget deficit due to an expansionary policy stance leads to an augmentation in domestic expenditure. It results in income enhancement of the people and amplification in demand for imports. Higher import demand, then, leads to an increase in current account deficit. The second transmission channel arguing for a direct association between the two deficits is provided by the *Mundell-Fleming approach*. In a flexible exchange rate system, and in a Mundell-Fleming type of economy featured with high capital mobility, an increase in fiscal deficit will lead to an expansion in demand and an increase in domestic interest rates. Higher interest rates lead to inflow of foreign capital in the economy and an appreciation of nation's currency. The stronger currency will make the exports expensive and imports cheaper and therefore, net exports decline and current account balance deteriorates⁹⁸. In addition to the above two transmission mechanisms, there is yet another channel reported in the literature supportive of direct co-movements of fiscal and current account deficits, which is opposite to what is popularly known as *Feldstein-Horioka Puzzle*⁹⁹ (1980). According to standard economic theory, with no

⁹⁸ In case the central bank of a country intervenes to prevent the currency appreciation by absorbing the excess supply of foreign money (say, in fixed exchange rate regime), there will be an upward surge in the prices on account of increase in money supply. Therefore, an ultimate appreciation of the real value of domestic currency is to be observed.

⁹⁹ Basically, Feldstein and Horioka (1980), maintain that if the perfect capital mobility is in fact present, then one should observe a low or zero correlation between domestic savings and investment. However,

regulations in the international financial markets, the savings would flow from the locations of low returns to highly profitable investment opportunities till the *interest-rate parity* is ensured. Therefore, in a world of perfect capital mobility, the domestic savings and investment would be independent of each other and that foreign capital is being used to finance the domestic investment demands. Hence, the internal budgetary and external current account balance move in a synchronous manner. To illustrate the notion, the following national income identity is employed:

$$X - M \equiv (T - G) + (S - I)$$

The symbols have the usual interpretations. The identity clearly highlights the direct co-movement of budgetary and external sectors, provided the saving-investment wedge remains constant.

Unlike the above theoretical contours, *Ricardian equivalence proposition* refutes any kind of link between internal and external balance. The reasoning advocated is that consumers will perceive the increased fiscal deficit as deferred higher future taxes. Thereby, any rise in fiscal deficit will make the rational economic agents to increase the savings so as to provide funds for future tax payments. Private savings thus increase, leaving the total savings of economy unchanged. Consumption, investment, and interest rates remain unaltered and hence there occurs no change in current account balance (Barro 1989). Therefore, due to the *non-myopic* behavior on part of optimizing economic agents, a substitution of debt for taxes that leads to a rise in budgetary imbalances would be financed by enhanced private savings and not by the foreign borrowing (external account deficit) (Rosenweig and Tallman, 1993, p.582).

As far as the third view is concerned, there is an inverse relationship between two deficits. Higher fiscal deficit leads to lower current account deficit i.e. a twin divergence. The reason for this divergence result could be provided through an endogenous movement of fiscal deficit and current account deficit caused by the output shocks. An economic recession (boom) leads to a decline (growth) in output levels and deterioration (improvement) in the fiscal account. On the external side of the economy we observe an improvement (fall) in the current account balance due to a relatively steep fall (rise) in the investment than the fall (rise) of savings following an negative

when the actual data is employed, the two scholars observed what appeared to be a puzzle, i.e. even when perfect capital mobility is present, the domestic savings and investment are still related to each other.

(positive) output shock. On the contrary, if there is an investment boom following a technological shock, current account balance deteriorates on the one hand, but the same boom will ameliorate the fiscal balance¹⁰⁰. The divergence result is also possible even after the business cycle or output fluctuations are controlled and fiscal shocks are treated as purely exogenous (Kim and Roubini 2007).

5.3 Empirical Review:

5.3.1 General Literature:

There is a lack of unanimity as far as the empirical literature on twin deficit hypothesis is concerned. Scholars have used a variety of modeling techniques to make the analysis of two deficits. The existing studies are based either on standard Keynesian paradigm or on real business cycle school or on GEEE (General equilibrium endowment economy) models. In addition to modeling approaches, there are several other attributes involved in making an evaluation of internal-external balance nexus. These include the definition of variables, model specification, econometric methodologies, nature of the economy, the period and frequency of data, to name a few!

In the early studies, the scholars conducted the analysis in a single equation framework and have primarily used OLS regressions to examine the link between the two deficits. The main argument advocated by the majority of them is that budget deficit contributes significantly and positively to current account deficit (Bernheim 1987, Darrat 1988, Salvatore 2006). Andersen (1990) however, documented a lack of such a connection.

Subsequent studies employed VAR models to look for an association between the twin deficits. These include Abell (1990), Bachman (1992), Enders and Lee (1990), Rosensweig and Tallman (1993), Normandin (1999), Corsetti and Muller (2006), Kim and Roubini (2008). Abell (1990), found a positive association, Enders and Lee 1990, study remained inconclusive. Corsetti and Muller (2006) and Kim and Roubini (2008) documented a negative relationship (twin divergence). Baharumshah et al. (2006)

¹⁰⁰ “Following a positive output shock, fiscal balance improves (due to the automatic-stabilizer role and the pro-cyclical behavior of government budget), current account balance deteriorates, real exchange rate appreciates and the real interest rate increases” (Kim and Roubini (2007). The counter-cyclical current account movement is consistent with both traditional and modern theories of the current account. An increased output following a positive output shock leads to a hike in the demand for foreign goods and magnify the current account imbalance according to traditional view and an output shock surrogating as a productivity shock incentivizes the increased investment and therefore a more selling current account imbalance.

applied the VAR and variance decomposition techniques to examine the existence of twin deficit hypothesis in case of ASEAN (Association of South East Asian Countries) countries. The study reported the presence of a long-run direct association between budget and current account deficits, although a unidirectional causality from budget deficit to current account deficit is reported in case of Thailand, a reverse one is found for Indonesia and bidirectional causality is found in case of Malaysia and the Philippines. Chihi and Normandin (2013) analyzed the issue of twin deficits hypothesis in case of several developing countries for a dataset from 1960 onwards. The study found the positive and statistically significant covariance between fiscal deficit and current account deficit. The results are consistent with predictions of modelling structure employed in the study and finally, the predicted covariance from the model is found to be convinced more strongly by internal shocks than the external ones. Algieri (2012) documented the evidence in favor of Ricardian equivalence hypothesis in case of five Euro countries popularly known as GIIPS¹⁰¹, by applying Granger and Toda-Yamamoto causality tests. Catik and Akseki (2014) applied a threshold VAR framework to examine the validity of twin deficit hypothesis in Turkey. The authors reported the nonlinearity of results, with twin deficit hypothesis valid in the regime when the economy is working above its potential level and when the economy is working below is potential, the two deficits are found be divergent. Ravinthirakumaran et al. (2015) examined the issue of twin deficit nexus in case of five SAARC (South Asian Association for Regional Cooperation) countries and reported mixed results. The study found the existence of causal relationship from budget deficit to current account deficit in case of Pakistan and Sri Lanka, whereas the causality in opposite direction is reported in case of India and Nepal and finally, a short-run causality from current account deficit to the budget deficit is found for Bangladesh.

Recently multitude of cointegration approaches has been incorporated into the analysis of twin deficit nexus¹⁰². These studies, using traditional cointegration techniques, reported less favorable evidence for twin deficit hypothesis. The lack of any kind of relationship between the two deficits can be attributed to the application of linear models only and disregard any non-linear or asymmetric aspects (Trachanas and

¹⁰¹ These include a group of five economically and financially lagging economies of Euro area. The group consists of Greece, Ireland, Italy, Portugal and Spain.

¹⁰² Kim (1995), Dibooglu (1997), Leachman and Francis (2002), Miller and Russek (1989).

Katrakilidis 2013). Marinho (2007), tested the twin deficit hypothesis in Egypt along with Feldstein-Horioka Puzzle. The study refuted the very existence of twin deficit hypothesis and reported the evidence of unidirectional causality running from current account deficit to fiscal deficit. The author also found the evidence of high capital mobility in case of Egypt. However, Neaime (2014) reported the unsustainability of debt and exchange rate policies in case of the Lebanese economy. The author further documented the evidence in favor of twin deficit hypothesis as well.

Some other researchers went a step further to incorporate more advanced cointegration approaches and thereby concluded more favorably for the validation of hypothesis. Bagnai (2006) evaluated the fiscal deficit and current account balance nexus in case of 22 OECD countries and incorporated the influence of structural breaks on the nature of the relationship between them. The author found the existence of a long-run and short-run association between the two deficit variables and reported the relationship between the current account and its determinants. Chowdhury and Saleh (2007) in an ARDL framework reported the validity of twin deficit hypothesis in case of Sri Lankan economy. Nickel and Vansteenkiste (2008) evaluated the nature of the relationship between fiscal deficit and current account balance in case of 22 industrialized countries in a dynamic panel threshold model framework. The direct association between the two variables is found in the countries with a debt to GDP ratio up to around 90%. In addition, the study reported the Ricardian behavior of households in case of countries burdened with high debts. Finally, the association between the two variables becomes statistically insignificant in case of 11 Euro countries featured with a debt to GDP ratio of above 80%. Daly and Siddiki (2009) applied a regime switching cointegration framework to test the validity of twin deficit hypothesis in case of 23 OECD (Organization for Economic Cooperation and Development) countries. With the incorporation of regime shifts, the study reported the existence of a direct association between current account deficit, budget deficit and interest rate in case of 13 out of 23 countries. However, when regime shifts are disregarded, the validity of twin deficit hypothesis is extensively declined. Rafiq (2010) applied a time-varying VAR methodology to investigate the nature and behavior of relationship between fiscal deficit, current account balance and real exchange rate in case of United States (US) and United Kingdom (UK). The study found the negative impact of fiscal deficit in case of US current account balance, whereas the opposite holds for the UK. In addition, the

impact of fiscal deficit has decreased over time in case of both countries and finally, in contrast to US, the fiscal deficit shocks are found to play a major role in explaining the current account and exchange rate fluctuations in case of UK. Holmes (2011) while analyzing the US data for a period 1947-2009 documented the evidence of a long-run cointegrating relationship between fiscal and current account deficit in a threshold cointegrating framework.

Trachanas and Katrakilidis (2013) while making an analysis of twin deficit hypothesis in case of five European economies found a direct long-run connection between the two deficits. The study further established the existence of asymmetric linkages with fiscal deficit fall being more effective in magnitude than the rise to influence the current account deficit. Ahmad et al. (2015) applied a threshold cointegration approach to examine the relationship between fiscal deficit and current account deficit in case of nine African countries. The authors documented the existence of a long-run direct association between the two deficits in case of six out of nine countries examined and a twin- divergence is reported in case of other three. Recently, Farhi and Tirole (2016) provided a theoretical paradigm for feedback loops between Sovereign debt forgiveness and banking insolvency. The paradigm developed by study argued for sovereign debt re-nationalization, regulation for macroeconomic stability and the mergers of banks.

5.3.2 Studies specific to India:

In the case of India, the issue of twin deficit hypothesis has not been examined at length. Some of the studies related to the Indian economy, in particular, are reported here. Initially, Anorno and Ramchander (1998), tested the existence of twin deficit hypothesis in case of five Asian economies, of which India was also included. Using the data period from 1957 to 1993, the study reported the case of unidirectional causality from fiscal deficit to trade deficit in case of Malaysia only and not in other countries. However, causality from trade deficit to the fiscal deficit is found in the entire panel. Moreover, other control variables like inflation, GDP and interest rate were also found to Granger cause trade deficit in India only and not in other countries. Basu and Datta (2005), generated the quarterly dataset of variables like the gross fiscal deficit, the rate of return on 10-year treasury bills, real effective exchange rate, GDP at factor cost and narrow money (M1) to examine the validity of twin deficit nexus in case of India. The authors, however, found the absence of cointegration between fiscal deficit and trade deficit and refuted the twin deficit hypothesis in India. Using the same

econometric methodology and analyzing the data from 1970-71 to 1999-00, Parikh and Rao (2006) documented a direct association between fiscal deficit and current account deficit in India. The study also found the direct impact of exchange rate appreciation on the external balance. Mitra and Khan (2014) also validated the twin deficit hypothesis in India while analyzing the data in post-liberalization period, April 1994-95 to July 2013-14. Tiwari (2014) used VAR and SVAR approaches to analyze the impact of fiscal stimulus on external balance in the Indian context. The author reported a positive linkage between the two and thereby validated the twin deficit hypothesis. Ravinthirakumaran et al. (2015) investigated the nature of the association between internal budgetary imbalance and external account balance in case of five, South Asian Association for Regional Cooperation (SAARC) countries in a vector autoregression (VAR) framework. The budget deficit is found to Granger cause current account deficit in the case of Pakistan and Sri Lanka and the reverse is true in the case of India and Nepal. However, for Bangladesh, the authors reported a causal connection from current account deficit to fiscal deficit only in the short-run. Suresh and Gautam (2015) documented the refutation of twin deficit hypothesis in case of India, though a short run association is found along with bi-directional causality, whereas Rajasekar and Deo (2016) in their analysis confirmed twin movements in the long-run and the causality between two deficits. Recently, Garg and Prabheesh (2017) while analyzing the drivers of India's current account deficit in a linear ARDL framework reported the confirmation of twin deficit hypothesis and refutation of Feldstein-Horioka hypothesis. Similarly, MR (2017) analyzed the issue of twin deficit hypothesis in case of Indian economy for a period 1980-81 to 2012-13 in a Structural VAR framework. The results reported in the study confirm the refutation of Ricardian equivalence hypothesis and variables are found to work according to Keynesian absorption theory and Mundell-Fleming model.

To conclude, it is quite evident from the above that the evidence is not uniform generally. As far as India is concerned, the literature is very meager on the one hand and on the other there is no study conducted so far in the Indian context which has analyzed the two deficits in a nonlinear framework. We will be using a well-articulated nonlinear asymmetric technique to examine the relationship between two deficits when asymmetry is incorporated. Our article will, therefore, enrich the existing literature along the lines of asymmetric linkages.

5.4 Data description and Empirical Methodology:

5.4.1 Data Description:

Table 5-1: Variable Description

Variables	Symbol	Description	Units	Source
Current Account Deficit	<i>cad</i>	Difference between receipts and payments in the current account of BOP account.	Percentage of GDP	RBI
Output Growth	<i>gdp</i>	Growth rate of real Gross Domestic Product.	Percentage Terms	RBI
Gross Fiscal Deficit	<i>gfd</i>	Expressed as a difference between the total expenditure and total revenue (excluding the market borrowings).	Percentage of GDP	RBI
Trade-openness	<i>to</i>	Sum of exports & imports	Percentage of GDP	RBI

Note: "RBI= Reserve Bank of India"

The data for the present analysis constitutes a set of four variables, covering a period from 1970-71 to 2015-16 and is obtained from the Reserve Bank of India (RBI) website. The variables to be examined include current account deficit (*cad*) and gross fiscal deficit (*gfd*) both as a percentage of GDP. The other variables are real GDP growth rate as a proxy for output growth (*gdp*), and sum of exports & imports (both as a percentage of GDP) as a surrogate for trade openness (*to*). The variable details and descriptive statistics are given in Tables 5.1 & 5.2 respectively.

Table 5-2: Descriptive statistics

Statistics	<i>cad</i>	<i>gfd</i>	<i>gdp</i>	<i>to</i>
Mean	-1.148	-5.114	5.469	8.391
Median	-1.200	-5.130	5.535	7.950
Std. Dev	1.366	1.417	2.938	4.280
Skewness	0.074	-0.112	-1.074	0.635
Kurtosis	3.959	2.334	5.015	2.133
JB- stat	1.807	0.944	16.64	4.533
P-value of JB-stat.	0.405	0.623	0.000	0.103
Observations	46	46	46	46

5.4.2 Empirical Methodology:

The prime concern of the study is to trace out whether the current account deficit responds to the changes in gross fiscal deficit. We applied a non-linear ARDL model developed by Shin et al. (2014) to ascertain the existence, if any, of nonlinearities among the variables, included. This method has been applied due to its potential merits over the other conventional linear approaches as explained in section 1.8 of chapter 1. However, concerning the variables incorporated in the study, we estimate the following nonlinear error correction model based on the model in equation 1.8.4 as:

$$\begin{aligned}
&\Delta cad_t \\
&= c + \gamma cad_{t-1} + \delta_1^+ gfd_{t-1}^+ + \delta_1^- gfd_{t-1}^- + \delta_2^+ gdp_{t-1}^+ + \delta_2^- gdp_{t-1}^- + \delta_3^+ to_{t-1}^+ \\
&+ \delta_3^- to_{t-1}^- + \sum_{i=1}^{p-1} \pi_i \Delta cad_{t-i} + \sum_{i=0}^q \beta_{1,i}^+ \Delta gfd_{t-i}^+ + \sum_{i=0}^q \beta_{1,i}^- \Delta gfd_{t-i}^- \\
&+ \sum_{i=0}^q \beta_{2,i}^+ \Delta gdp_{t-i}^+ + \sum_{i=0}^q \beta_{2,i}^- \Delta gdp_{t-i}^- + \sum_{i=0}^q \beta_{3,i}^+ \Delta to_{t-i}^+ + \sum_{i=0}^q \beta_{3,i}^- \Delta to_{t-i}^- \\
&+ \epsilon_t
\end{aligned} \tag{5.1}$$

Here δ^+ and δ^- are long-run parameters, β^+ and β^- are short-run coefficients, γ is the auto-regressive term and ϵ_t is a white noise error term. As mentioned in the theoretical part, fiscal deficit and current account deficit are expected to be either directly or

inversely or neutrally related to each other. The study tries to test the validity of *Ricardian equivalence hypothesis* in India against the alternative of *twin deficit hypothesis*. So far as the other control variables are concerned, the impact of real *gdp* growth on the current account is expected to be positive according to “*stages of development*” thesis of balance of payments ((Hoffmaister and Roldos 1997, 2001). Enhancement in the growth performance of an economy enables it to improve along the competition dimensions, expand its basket of exports and negate down the dependence on imports. The trade openness is expected to be inversely related with current account deficit (Edwards 2004). The increased trade openness leads to an augmentation in foreign exchange earnings through the adoption of export promotion and import substitution and therefore affects the current account balance favorably.

5.5 Empirical Results and Discussion:

5.5.1 Unit Root Analysis:

Table 5-3: Unit Root Tests

	<i>Intercept</i>		<i>Intercept and trend</i>	
Level	ADF	PP	ADF	PP
<i>cad</i>	-2.929 (0.049)	-2.900 (0.053)	-3.076 (0.124)	-3.061 (0.127)
<i>gfd</i>	-2.636 (0.093)	-2.513 (0.119)	-2.512 (0.321)	-2.481 (0.335)
<i>gdp</i>	-6.060 (0.000)	-6.187 (0.000)	-7.574 (0.000)	-7.570 (0.000)
<i>to</i>	-0.873 (0.787)	-0.921 (0.775)	-1.761 (0.702)	-1.957 (0.614)
First Difference				
<i>cad</i>	-7.940 (0.000)	-8.129 (0.000)	-7.845 (0.000)	-8.023 (0.000)
<i>gfd</i>	-6.697 (0.000)	-7.661 (0.00)	-6.827 (0.000)	-7.821 (0.000)
<i>to</i>	-5.168 (0.000)	-5.143 (0.00)	-5.059 (0.000)	-5.043 (0.000)

Note: “ADF is Augmented Dickey-Fuller test (Dickey and Fuller, 1979) and PP represents the Philips-Perron test (Philips and Perron, 1988). Schwarz information criteria (SIC) is applied to choose the appropriate lag length for ADF test and Newey-West automatic selection procedure is used to choose the bandwidths for PP test. Numbers in the parenthesis are associated p-values”.

The nonlinear ARDL method can be used in the analysis without any test of whether the variables are stationary or not, provided none of them is integrated of order two. Therefore, to check that none of the variables under study is I (2), we have employed ADF and PP unit root tests to serve the purpose. Table 5.3 shows that current account deficit (*cad*), the gross fiscal deficit (*gfd*) and trade openness (*to*) are all I (1) at levels and stationary at first differences, whereas real GDP growth rate (*gdp*) is I (0) at levels. Therefore we have a mix of stationary and non-stationary variables but none of the variables is integrated of order more than one.

5.5.2 Asymmetry Analysis:

In order to check for the existence of cointegration in model 5.1, the null hypothesis that the impact of the lagged variables on the dependent variable is zero is tested against an alternative that they do influence it. The test statistics like F_{PSS} and t_{BDM} so obtained are greater than the upper critical values at 1% significance level¹⁰³, as reported in Panel B of Table 5.4. The outcome of this result clearly points to a refutation of Ricardian equivalence hypothesis in India, suggesting the presence of long-run relationship and thus validating the “twin deficit” hypothesis. The result reported here is similar to Parikh and Rao (2006), Tiwari (2014), Garg and Prabheesh (2017) and MR (2017). However, it is contradictory to Basu and Dutta (2005) and Suresh and Gautam (2015). The affirmation with some studies and contradiction with others may be due to the time period considered and the econometric methodology adopted for the analysis. Refutation of Ricardian equivalence hypothesis and acceptance of twin deficit hypothesis seems logical in a developing country like India as the requirements of former in terms of assumptions of rational foresight of economic agents, the absence of liquidity constraints, infinite horizons, lump-sum tax, income certainty etc. are very unlikely fulfilled. The direct co-movement of two deficits thus could be operative either through Keynesian or Mundell-Fleming channels¹⁰⁴.

The asymmetric ARDL error correction results are outlined in Table 5.5. We followed a general to a specific approach for the correct model specification. Initially, a specification of $\max p = \max q = 4$, is chosen according to *AIC* & *SBC* criteria's and

¹⁰³ The results are reported in Panel B of Table 5.4. The values of cointegration test statistics are found to be, $F_{PSS} = 9.8892$ and $t_{BDM} = -6.188$. The reported values are statistically significant at 1% significance level.

¹⁰⁴ In fact in an interesting study by MR (2017), both the channels of transmission are found operative.

subsequently, most of the insignificant lags are omitted to ensure reliability in results and avoidance of noise problem into the dynamic multipliers. The Panel C Table 5.4 reports the necessary diagnostic tests of the estimated model. The *portmanteau test* (χ^2_{SC}) accepts the null of no *autocorrelation*, *Breusch-Pagan-Godfrey* (χ^2_{BPG}) test confirms the absence of *heteroskedasticity*, *Ramsey RESET*¹⁰⁵ test (*Ramsey F – test*) validates the *structural specification of model* and finally, *Jarque-Bera* (χ^2_{NOR}) test confirms the *normality* requirement of the estimated model.

In presence of a long-run cointegration association, we now proceed to check whether this association is symmetrical (linear) in character or whether there is some asymmetry inhabited. To serve the purpose we have used Wald's test with a null of the symmetrical relationship against an alternative of asymmetrical one. Both the long-run (W_{LR}) and short-run (W_{SR}) results are documented in the lower part of Panel A of Table 5.4. The analysis portrays the presence of long-run asymmetry between *cad* and *gfd*, whereas the null of symmetrical association cannot be rejected between *cad* and *gdp* & *cad* and *to*.

As is clear from upper part of panel A of Table 5.4, the estimated long-run coefficients are, $gfd^+ = 1.930$ and $gfd^- = -0.368$ and only the first one is statistically significant. Therefore a 1% hike in *gfd* results in 1.930% rise in *cad*, whereas 1% drop in *gfd* results in a decline of *cad* by 0.368%. Thus it is clear that fiscal deficit increases leave a more pronounced effect on current account deficit. The asymmetric impact of fiscal deficit on the current account balance of a country may arise due to its asymmetric impact on aggregate demand through consumption inflexibility (ratchet effect) and the existence of liquidity constraints. Due to the existence of liquidity constraints in a developing country like India, any increase in fiscal deficit will add to the purchasing power of people, who are usually liquidity constrained, and also makes the liquidity unconstrained people feel relatively better off. As a result, the aggregate demand in the economy is enhanced both horizontally and vertically; leading to an increase in demand for more imports and therefore current account deteriorates more drastically (Tagkalakis 2008). On the contrary any decrease in deficit financing on part of government will not lead to a corresponding fall in demand conditions due to resistance

¹⁰⁵ Ramsey Regression Equation Specification Error Test.

from people to lower the consumption levels (the Ratchet effect) and hence current account balance improves only marginally or insignificantly. The positive link established above can be explained along the lines of Keynesian or Mundell-Fleming theoretical contours.

Table 5-4: Long and Short-run Asymmetric Results (Model 5.1)

A. Asymmetry results		Long-Run Effect [+]			Long-Run Effect [-]		
Variables	Coef.	F- stat	P- value	Coef.	F- stat	P- value	
gfd	1.930	44.93	0.000*	-0.368	1.629	0.221	
gdp	-0.358	9.904	0.007*	0.339	6.577	0.022**	
to	-1.474	24.08	0.000*	1.423	6.740	0.020**	
Long-run Asymmetry				Short-run Asymmetry			
W_{LR}				W_{SR}			
	F- stat	P- value		F- stat	P- value		
gfd	16.21	0.001*		9.960	0.007*		
gdp	0.166	0.689		10.81	0.005*		
to	0.016	0.899		12.22	0.003*		
B. Cointegration Test		F_{PSS}	t_{BDM}				
		9.889*	-6.188*				
C. Model Diagnostics		Test Statistics	P-value				
χ^2_{Sc}		20.00	0.394				
χ^2_{BPG}		1.434	0.421				
χ^2_{NOR}		1.393	0.498				
Ramsey F-test		1.965	0.261				

Equation (5.1); $cad = f(gfd, gdp, to)$. Note: “ F_{PSS} and t_{BDM} are the long-run cointegration test statistics. *, ** & *** denote the 1, 5 and 10% significance levels respectively. χ^2_{Sc} represent the portmanteau serial correlation test, χ^2_{BPG} denote the Breusch-Pagan-Godfrey heteroskedasticity test, Ramsey F is the RESET test and finally the Jarque-Bera normality test is denoted by χ^2_{NOR} . General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$. The relevant 1%, 5% and 10% upper bound critical values of t_{BDM} for $k=3$ (without taking partial decomposition into consideration) are -4.10, -3.78 & -3.46 and for $k=6$ (when partial sum decompositions are independently treated as regressors) are -4.99, -4.38 & -4.04. Similarly for the F_{PSS} test the relevant 1%, 5% and 10% upper bound critical values for $k=3$ are 5.61, 4.35 & 3.77 and for $k=6$ are 4.43, 3.61 & 3.23 respectively” (Pesaran et al. 2001).

So far as gdp and to are concerned, all the coefficients are significant at conventional 5% significance level and impact the dependent variable according to theoretical rationale. As far as gdp coefficients are concerned, the positive coefficient has a value of -0.358 and the negative one equals to 0.339. This represents almost a case of a

symmetrical association, confirming the earlier acceptance of null of a long-run symmetrical impact of the two components of *gdp* on *cad*. The positive influence of real *gdp* growth on the external balance confirms the "stages of development" theory of the balance of payments (Hoffmaister and Roldos 1997, 2001). India has reached a level of development wherein the quality of life has improved to a considerable extent. The investment structure of the economy, the financial services, the capital formation and infrastructural development have enhanced a lot and therefore, the dependence for development requirements has decreased considerably. The positive impact of real *gdp* growth on external balance is obvious from the point of increasing the potency of India to make more exports and demand less from others, thereby improving its current account position. Of course, a deterioration of external balance arise when there is a dearth of output domestically and an increased dependence on others to meet the local demands.

Regarding the trade openness (*to*), the estimated long-run coefficients are, $to^+ = -1.474$ and $to^- = 1.423$. Here again, the coefficients almost show a symmetrical impact on current account balance, and the signs are according to theory. The increased openness of Indian economy with the outside world has enabled it to increase the foreign exchange earnings through enhanced export promotion channels and propagation of import substitution measures. This has resulted in the reduction of current account deficits. The revision of FDI policy to make India more captivating investment destination, preference of Indian industry in procurement, trimming of excise and/or custom duties, enhancing ease of doing business, opening up of defense sector for private sector investment and defense exports, make in India program, creation of export promotion zones (EPZs), special economic zones (SEZs) and free trade zones (FTZs) are all intended to increase the global integration and hence to enhance the size of its exports and foreign exchange earnings so as to benefit from related positive spillovers and therefore to improve its external balance position.

Table 5-5: *Nonlinear ARDL error correction model 5.1.*

<i>Variables</i>	<i>coefficient</i>	<i>t-statistic</i>	<i>p-value</i>
Dependent variable: Δcad			
cad_{t-1}	-0.960	-6.190	0.000
gfd_{t-1}^+	1.852	5.480	0.000
gfd_{t-1}^-	0.353	1.230	0.230
gdp_{t-1}^+	-0.343	-3.120	0.007
gdp_{t-1}^-	-0.325	-2.490	0.025
to_{t-1}^+	-1.415	-4.960	0.000
to_{t-1}^-	-1.366	-2.960	0.010
Δcad_{t-2}	0.304	1.900	0.077
Δcad_{t-3}	0.186	1.200	0.248
Δgfd_{t-1}^+	-2.344	-6.320	0.000
Δgfd_{t-2}^+	-1.688	-3.840	0.002
Δgfd_{t-3}^+	-0.709	-1.680	0.113
Δgfd_{t-2}^-	-0.412	-1.140	0.271
Δgfd_{t-3}^-	-0.835	-2.140	0.050
Δgdp_t^+	0.188	1.810	0.090
Δgdp_{t-1}^+	0.151	2.340	0.034
Δgdp_{t-3}^+	0.191	2.980	0.009
Δgdp_t^-	-0.293	-3.500	0.003
Δgdp_{t-1}^-	0.229	2.110	0.052
Δgdp_{t-3}^-	-0.282	-2.940	0.010
Δto_t^+	-0.826	-2.310	0.035
Δto_{t-1}^+	1.996	5.070	0.000
Δto_{t-2}^+	1.734	3.780	0.002
Δto_{t-1}^-	1.885	3.120	0.007

<i>Variable</i>	<i>coefficient</i>	<i>t-statistic</i>	<i>p-value</i>
Δto_{t-2}^-	2.574	3.070	0.008
Δto_{t-3}^-	3.237	5.730	0.000
Constant	-2.140	-0.860	0.025

Note: “General to specific approach is followed, with an initial set up comprising $\max p = \max q = 2$ and most of the insignificant lags are eliminated out to ensure the precision in cumulative dynamic multipliers”.

After deliberations on long-run effects, we now switch over to short-run asymmetry. The results indicate that all the three variables showed the existence of asymmetry as W_{SR} is significant for each one of them (lower part of Panel A of Table 5.4), enabling us to do away with the null of symmetrical association and acceptance of a lopsided link between the current account balance and the respective independent variables.

5.5.3 Cumulative Dynamic Multipliers:

Finally, the impact of regressors on current account balance is lucidly connoted through dynamic multipliers. A synoptic view on Figure 5.2 replicates what has been discussed above, thus, confirms the robustness of our results. The short run asymmetry is reflected between *gfd* and *cad*, with positive changes being more effective than the negative changes. After a period of five-time horizons, long-run asymmetry persists but is operative only in terms of positive components. In case of *gdp* impact on *cad*, negative changes are more effective than the positive ones, displaying the short run asymmetry. But after six-time horizons, the asymmetry fades in long run and current account deficit responds to both positive and negative changes in almost equal magnitude. Finally, *to* also has an asymmetrical impact on current account deficit, again with negative changes having a more pronounced impact than the positive ones. However, like the *gdp*, *to* also switches to long run symmetrical association with current account balance.

It is tempting to note that assuming a linear association between internal budget balance and external account balance on the one hand and that of other control variables on the other would have directed one to wrong inferences and policy actions. The results clearly highlight that the oppositely signed components of *gfd* have a dissimilar and

distinctive impact on *cad* in both short-run and long-run. The policy makers should, therefore, make the policy architecture more incorporative of inward and outward dynamics. Self-sufficiency, export orientation and fiscal discipline are obviously instruments at hand to achieve a desired and growth enhancive external balance.

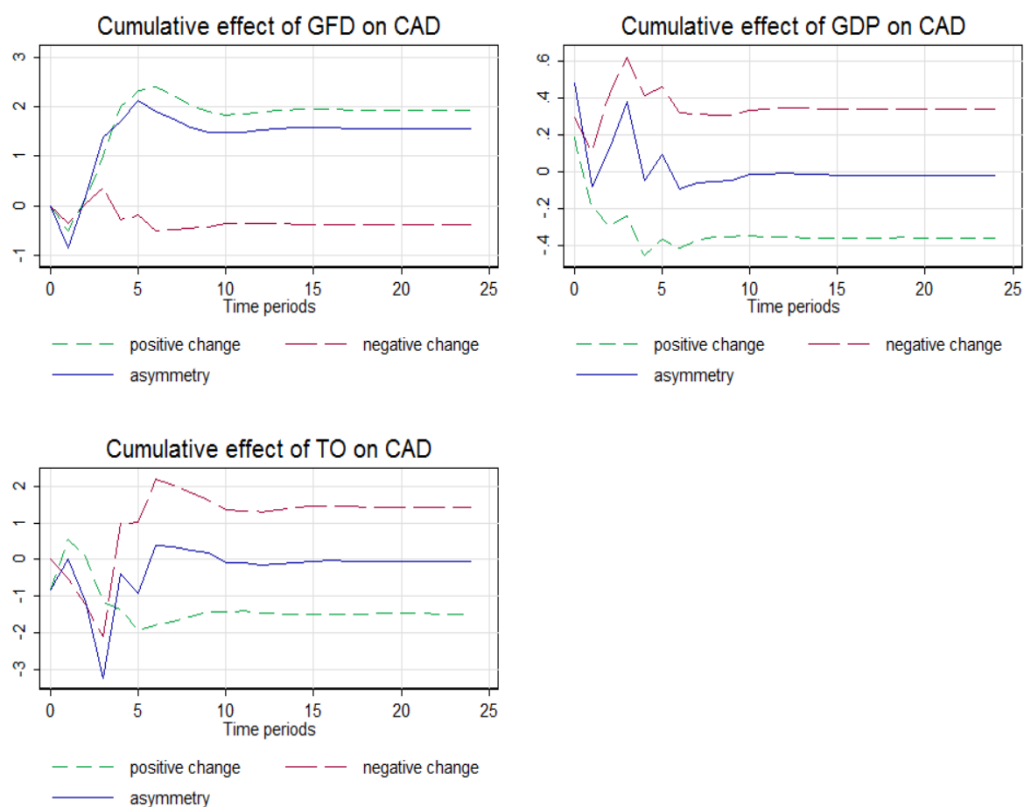


Figure 5.2: Cumulative Dynamic Multipliers for Model 5.1

5.6 Conclusion:

The study primarily analyses the internal budget balance and external account balance nexus in a dynamic and globally integrated economy, namely India, in a nonlinear model setting for a period of 1970-71 to 2015-16. The study confirms the long-run co-movements of two deficits and therefore, refutes the Ricardian equivalence proposition and validates the “twin-deficit” hypothesis. But instead of a linear relationship like examined in the previous studies, the two variables are found to share the asymmetric linkages both in the short-run and the long-run and fiscal deficit increases leave a more pronounced effect on current account deficit than the decreases do. The other control variables used in the study such as real GDP growth and trade openness are also found to have cointegration with the *cad*, but the relationship is symmetrical in the long-run even though asymmetrical in the short-run. The study finally employs the asymmetric cumulative dynamic multipliers to portray the route of asymmetries and adjustments over the course of time. The dynamic multipliers also confirm the results documented in the earlier part and therefore demonstrate their robustness.

6 Conclusion

6.1 A Prelude:

While the theoretical and empirical work in the field of fiscal policy has reached a well-established and advanced stage, however, no unanimity is reported. The dynamism in the economic discourse together with the external shocks or internal disturbances often warrant an examination beyond the conventional wisdom. The multitude of empirical observations not in accordance with the well-established theories makes it imperative to search for alternatives that would explain the contrary observations and thus, provide a suitable basis to devise the policy actions appropriately. After reviewing the relevant literature, we notice that on the whole, the empirical analysis about the fiscal policy effectiveness, particularly in the Indian context, has largely been conducted in the symmetric/linear frameworks and that the possibilities of asymmetric linkages have not been explored. However, assuming a symmetric association may lead to incorrect policy actions (Shin et al. 2014). To fill this gap, the study attempts to investigate the effectiveness of fiscal policy in an asymmetric framework in case of a dynamic and increasingly integrated economy namely, India.

Specifically, the questions of investigation include an asymmetric estimation of fiscal multipliers; validity of fiscal theory of price level; physical and/or financial crowding-out and the twin-deficit hypothesis respectively. The choice of an emerging economy, India, for the asymmetric investigation of fiscal policy changes is also motivated by the prevalence of liquidity constraints among a large section of population together with persistent inequalities (Mazumdar et al. 2017). A comprehensive examination of these issues would be imperative for a robust understanding and substantial effectiveness of fiscal policy actions.

To investigate the impact of various fiscal policy instruments and other control variables on the major macroeconomic variables, we have used secondary data sources. For the empirical analysis, we have used a *non-linear asymmetric cointegration* method developed by Shin et al. (2014). For the causality examination, in some of the empirical

exercises, well-known Toda-Yamamoto (1995) test for time domain and Breitung and Candelon (2006) test for frequency domain causality are applied.

6.2 Extensive Summary of Findings:

The study is comprised of six chapters; an introduction, four empirical chapters and a conclusion. Each empirical chapter has its own structure. Though the chapters enjoy some free-standing, however, the issues examined are substantially related to each other. An evaluation of some relevant issues of fiscal policy in the Indian context has been explored in each of the empirical chapters.

➤ Chapter 1

The study starts with the introduction chapter which provides an account of the relevance of stabilization policy (monetary and fiscal) in the alternative schools of macroeconomics under various economic circumstances. The research objectives, scope of study and the empirical methodology adopted in the analysis are also presented in this chapter.

➤ Chapter 2

In chapter 2, an attempt is made to estimate the fiscal multipliers from an asymmetric viewpoint in the Indian context. Specifically, the impact of positive and negative changes in government spending and taxes on the economic growth, private consumption and private investment has been examined. In addition, to control for the monetary policy influence, the interest rate is incorporated as a control variable in addition to the private investment.

The results reported the existence of an asymmetric cointegration relationship among output growth, government spending and tax changes in both the short and long-run. The response of output growth to the fiscal policy changes follows the Keynesian paradigm, wherein an expansionary fiscal stance (spending hikes or taxes cuts) stimulates it and a contractionary one (spending cuts and tax hikes) lowers it, however, the impact of spending cuts is found to be statistically insignificant. More importantly, the impact of a hike in public spending is found to be significantly positive and that of decrease in it affects the economic growth insignificantly. The implication of this result is that government expenditure changes are more effective in mitigating the economic downturns than muting the booms (Tagkalakis, 2008). The outcome of this result is

relevant for a developing country like India, where the access to credit is very limited and where the purchasing power of a large proportion of population is very low.

Similarly, the effect of tax hikes is found to be more pronounced than the effect of tax cuts, implying that tax changes are more effective in muting booms and are less effective in avoiding economic downturns. On a comparative note between spending and tax changes, our results indicate that spending hikes are more effective than the tax cuts when an expansionary policy stance is needed during bad times and tax hikes are more effective than spending cuts when a contractionary policy action is required during a boom. The response of output growth to the interest rate changes is also found to be asymmetric, with contractionary policy actions more effective than the corresponding expansionary ones. Theoretical reasoning for this monetary policy asymmetry can be attributed to the changing outlooks of firms and consumers, the binding liquidity constraints and the downward price rigidity (Morgan 1993; Barnichon et al. 2017). The asymmetric price transmission or the “Rockets and Feathers” hypothesis provides another illustration for the asymmetric response of output growth to the monetary policy changes through the lower downward price flexibility. Finally, the response of output growth to a positive change in private investment is found to be positive and statistically significant, whereas, the response to a negative change is relatively muted and statistically insignificant.

Regarding the private consumption dynamics, it appears from the results that private consumption mimics the response of output growth to government spending and tax changes. The response of private consumption to the monetary policy actions explains the behaviour of a typical household saver. The impact of increase in income is reported to be significantly positive according to Keynesian psychological law and that of decrease in income affects consumption insignificantly due to the operation of consumption downward rigidity.

Finally, regarding the private investment, short-run asymmetry is reported only in case of tax changes and private investment, whereas in the long-run the asymmetrical relationship is established among both private investment, government spending and tax changes. The response of private investment to the increase in public spending follows the substitutability hypothesis and therefore, later crowds out the former, however, the overall impact of an increase in spending on the output growth is reported to be positive. The response of spending cuts is statistically insignificant due to

investment irreversibility (Pindyck 1993). Likewise, tax hikes reduce the private investment and tax cuts increase it, although the impact of a tax hike is greater than that of a tax cut. A hike in taxes reduces the profitability position of the investors and induces them to cut down the investment levels appreciably whereas a tax cut may not incentivise the private investors to increase the investment spending when the economic conditions are recessionary or when the risks related to the success of investment are high. Finally, the contractionary monetary policy action is found to decrease the private investment and the response to an easy policy shock is found to be statistically insignificant and the asymmetric results could be attributed to the already discussed channels.

➤ **Chapter 3**

Chapter 3 aims at examining the impact of fiscal deficit on the inflationary tendencies in the Indian economy. The study adopts a broader analytical framework to include all the potential determinants of inflation in addition to fiscal deficits.

We found a unidirectional causality running from fiscal deficit to inflation in case of time domain analysis and no feedback causality is reported. However, in case of frequency domain design, causality from fiscal deficit to inflation is found at low frequencies only, i.e. no short-run causality is established and hence, dynamic nature of the relationship between the two variables is justified. Thus, frequency domain causality test shows that fiscal deficit need not be inflationary in the short-run since the government can temporarily resort to other sources of deficit financing instead of excess money creation in short-run (Sargent and Wallace (1981); Catao and Terrones (2005) and Lin and Chu (2013)).

The results show the existence of an asymmetric and direct long-run association between fiscal deficits and inflation. The outcome of this result is an indication of fiscal theory of price level in India. Surge in money supply (due to increased fiscal deficit) and the narrowing down of negative demand gaps in the economy provide a manifestation of inflationary role of fiscal deficit in India (Khundrakpam and Pattanaik, 2010). However, the expansionary fiscal stance is found to be more inflationary and the decreases in fiscal deficit is found to affect the inflation with a lower magnitude. The possible asymmetric impact of fiscal deficit on inflation can be explained through the

existence of liquidity constraints, consumption & investment downward inflexibility and the downward price stickiness.

As related to other control variables, contractionary monetary policy stance is found to be more effective than the expansionary policy stance and this asymmetric response may again be explained through the channels mentioned above like the changes in economic outlook, restricted bank lending to riskier borrowers and the less downward price flexibility. A negative growth in output is found to increase inflation relatively by a higher magnitude than a positive growth is found to reduce it. A decline in the output indicates the presence of supply constraints and given the demand conditions (if not increasing) the impact on price level will be higher. On the contrary, an increase in output growth cannot decrease the prices drastically due to the presence of producer's price-setting power to some extent. Thus, in a supply constrained economy, downward price rigidity leads to the asymmetric impact of output growth and output decline on inflation. As regard to the trade-openness, although an asymmetry is reported, the signs refute the validation of Romer (1993) hypothesis in case of India and the direct link in case of India is in line with inflationary impact of outward –orientation for developing countries (Ajaz et al. 2016). The asymmetries observed above again highlight the presence of price stickiness in the inflationary phenomenon of the economy. Finally, the impact of oil price inflation on the inflationary pressures is according to theory but the coefficients are not statistically significant.

➤ **Chapter 4**

Chapter 4, examines the impact of fiscal deficit and other control variables on the interest rates in an economically integrated and financially deregulated economy, India. Unlike the previous studies, we have employed an IS-LM and extended open economy loanable fund model specifications for the analytical framework. The study has used the Auto Regressive Distributed lag model (ARDL) (Pesaran et al. 1998, 2001) to conduct the empirical exercise. To address the issue of causality, Toda-Yamamoto (1995) test has been applied.

The study found the existence of direct long-run cointegration relationship between short-run interest rate and fiscal deficit on the one hand and between long-term interest rate and fiscal deficit on the other. The existence of cointegration between the variables of interest clearly rejects the Ricardian equivalence proposition which predicts a

neutrality between the two variables. The direct association operates through an augmented aggregate demand channel in short-period and the substitutability of private sector funds through increased market borrowings from the available pool of funds in the long-period analysis. The results indicate to a case of financial crowding out in India, implying possible displacement of private sector investment (as observed in Chapter 2 with respect to the relationship between public spending and private investment).

Government consumption expenditure, inflation and exchange rate depreciation were found to affect short-term interest rate positively. Money supply affects it negatively in case the structural breaks are not included and positively when the breaks are incorporated into analysis. In addition, the inclusion of structural break into the regression analysis highlighted that the magnitude of the impact of government consumption expenditure and fiscal deficit on the rate of interest is lower when compared to the model without structural break. This highlights the influence of introducing fiscal discipline measures aimed at cutting down unproductive consumption expenditures and also reducing size of deficit so as to strengthen the fiscal prudence.

The long-term interest is affected positively by short-term interest rate in accordance with the expectation theory of term structure of interest rates; by real GDP growth due to the operation of accelerator principle; and by inflation according to the Fischer hypothesis. However the net capital inflows are found to affect it negatively, indicating a rise in domestic availability of funds. The short-run dynamics related to both short and long-term interest rate analysis also portrays the theoretically plausible results. Finally, the error correction terms were found negative and statistically significant. The speed of adjustment from any short-run distortion is relatively high in case of long-term interest rate analysis.

As related to the causality examination, the results report an evidence of a one sided causality from fiscal deficit to short-term interest rate in the short-run. However, in the long-term version, we found feedback causality between the fiscal deficits and long-term interest rate. Thus, the Indian economy is faced with the problem of debt-deficit spiral.

➤ Chapter 5

In Chapter 5, the validity of twin-deficit hypothesis against the Ricardian equivalence hypothesis is examined in case of India. Annual data set from 1970- 2015 has been analysed in an asymmetric econometric framework to examine the impact of fiscal deficit on the current account balance coupled with the other control variables such as the output growth and trade-openness.

We found existence of a direct long-run association between fiscal deficit and current account balance, pointing to a refutation of Ricardian equivalence hypothesis in case of India and validating the “twin deficit” hypothesis. Further, instead of a symmetrical association, the results report the presence of long-run asymmetry between fiscal deficits and current account balance, whereas the null of symmetrical association cannot be rejected between current account deficit and output growth & current account deficit and trade-openness. However, in the short-run, null of symmetry against an alternative of asymmetry is rejected in all cases.

Fiscal deficit hikes are found to leave a more pronounced effect on current account deficit than the decreases do. The possible reason for such an asymmetric impact of fiscal policy stances on the current account balance of a developing country like India may be due to existence of liquidity constraints and downward inflexibility in consumption (Ratchet effect). So far as output growth & current account balance are concerned, all the coefficients are significant and the case of an indirect symmetrical association is indicated. The positive influence of real output growth on the external balance confirms the "stages of development" theory of the balance of payments (Hoffmaister and Roldos 1997, 2001). Similarly, for the trade-openness, an indirect symmetrical association is found in case of India. The increased openness of Indian economy with the outside world has enabled it to increase the foreign exchange earnings through enhanced export promotion channels and propagation of import substitution measures.

6.3 Policy Recommendations:

The study clearly points out that assuming a symmetrical association would lead to inappropriate policy actions. Therefore, one should check for the possibility of asymmetric or non-linear associations to ensure a reliable analysis. From the policy implication viewpoint, the asymmetric results obtained in the study provide a strong ground to devise policies adaptive to changing realms in domestic and external sectors.

The existing macroeconomic scenario of India demands a policy mix that should ensure a high and sustainable growth path coupled with the sound fiscal health in the economy. The results show favourable impact of expansion of spending on output growth, however, its impact on the other important macroeconomic variables like private investment, inflation, interest rate and current account deficit is detrimental. In view of this, we find that an expansion of spending warrants a disciplined fiscal strategy in order to ensure a desired (and growth conducive) external balance together with the domestic macroeconomic stability. To conduct a sound fiscal policy, the government needs to cut down unproductive consumption expenditures, raise tax revenues and pay an attention to distribution and trickle down effects in order to avoid the adversity of high inequality and liquidity constraints in the economy.

The sign and size of fiscal multipliers suggest that the government expenditure expansion should be shifted to the capital expenditure side. Spending hikes should be preferred to avoid recessions and tax hikes should be incorporated to mute the booms. The tax cuts once announced may be entrenched and prove difficult to get reversed or adjusted and the spending cuts may face rent seeking by business corporates. However, for consolidation plans, expenditure based austerity should be practised instead of tax based because the former appeared to have no negative impacts on economy whereas the latter one affects it unfavourably and through spending cuts during a boom fiscal space can be enhanced. Moreover, dis-incentivizing effects of higher taxes regarding the work and investment and its inability to enhance market confidence again renders the taxes as a less attractive option for consolidation than the cuts in spending, preferably not the public investment spending.

The complementary role of monetary policy is also required to ensure a success of fiscal policy actions. To avoid the relative dominance of fiscal authorities and the associated negative repercussions in the form of inflationary pressures, monetary authorities should possess credibility to manage the macroeconomic system and policy stances should be implemented according to requirements of the economy. With respect to the control variables, the results imply the requirement of output growth and increasing integration with the outside world. Likewise, export promotion & import substitution, exchange rate stability and appreciable capital inflow are seen as helpful in achieving the stability related to various macroeconomic indicators. Moreover, in order to ameliorate the current account balance, policies aimed at increasing the real

competitiveness through control of domestic price fluctuations and improvement in the quality of tradable goods and services (like productive investments and technological advancements) should be adopted.

6.4 Limitations of the study and scope for further research:

The study attempted to scrutinize some of the important aspects of macroeconomic dynamics in the domain of fiscal policy effectiveness. However, certain caveats to this investigation are warranted and an introspection into these caveats may provide a scope for further research in the area. To start with, a more structured analysis with robust theoretical underpinnings may enhance the understanding and findings of this study. Second, on the whole, unavailability of data for sufficiently longer periods of time acted both a challenge and hindrance for the exploration of a more comprehensive analysis. A segregated analysis of spending and tax shocks, alternate sources of financing deficit and an extended data set may be useful. Although, the asymmetries have been observed in the empirical exercise with respect to the reaction of various macroeconomic variables to fiscal policy changes and the probable theoretical reasons were advocated, however, an identification of exact transmission channels of asymmetry would enrich the analysis of fiscal policy effectiveness.

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